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Shared Data Model and Notation (SDMN)

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https://www.omg.org/spec/SDMN/20240210/SDMN-diagrams.zip

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Preface

OMG

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1 Scope

A Shared Data Model is a collection of **DataItems** and **ItemDefinitions** to be used (referenced) by the other BPM-Plus (**BPM+)** data elements:

- **BPMN** Data Objects, **CMMN** Case File Items, **DMN** Data Inputs, etc.
- The **DataItems** and **ItemDefinitions** can be created once and maintained in a single location and can then be distributed across multiple models
    - This eliminates the manual synchronization burden of working with the **BPM+** models without a Shared Data Model
- A Shared Data Model is a model because there are relationships between the **DataItems** and **ItemDefinitions** (e.g., parent-child)
    - Diagrams can be included to visualize the **DataItems** and their relationships or **ItemDefinitions** and their relationships

The primary goal of **SDMN** is to provide a set of structural elements that are common to other Object Management Group (OMG) specifications. **SDMN** has been structured to be dependent on the elements defined in Specification Common Elements (see the **SCE** specification for more information). Other Business Modeling and Integration (BMI) Task Force and Healthcare Domain Task Force (HDTF) specifications may also utilize the elements of **SCE** as they are updated in the future.

2 Conformance

2.1 General

Software can claim compliance or conformance with **SDMN 1.0** if and only if the software fully matches the applicable compliance points as stated in the specification. In addition, the structural elements provided by Specification Common Elements (**SCE 1.0**) are also required in a compliant or conformant software solution. Software developed only partially matching the applicable compliance points can claim only that the software was based on this specification but cannot claim compliance or conformance with this specification.

2.2 Shared Data Modeling Conformance

The implementation claiming conformance to the Shared Data Modeling Conformance SHALL comply with all of the requirements set forth in Clauses 8, 9, and 10; and it should be conformant with the Visual Notation Conformance in Clause 14. Conformant implementations SHALL fully support and interpret the exchange format specified in Clause 13.

This compliance point is intended to be used by **SDMN** modeling tools.

2.3 Visual Conformance

An implementation that creates and displays **SDMN** models SHALL conform to the specifications and restrictions with respect to diagrammatic relationships between graphical elements, as described in Clause 14. A key element of **SDMN** is the choice of shapes and icons used for the graphical elements identified in this specification. The intent is to create a standard visual language that all Shared Data modelers will recognize and understand. An implementation that creates and displays **SDMN** models SHALL use the graphical elements, shapes, markers and decorators illustrated in this specification.

There is flexibility in the size, color, line style, and text positions of the defined graphical elements, except where otherwise specified. In particular:

- **SDMN** elements MAY have labels (e.g., its name and/or other attributes) placed inside the shape, or above or below the shape, in any direction or location, depending on the preference of the modeler or modeling tool vendor.
- The fills that are used for the graphical elements MAY be white or clear. The notation MAY be extended to use other fill colors to suit the purpose of the modeler or tool (e.g., to highlight the value of an object attribute).
- Graphical elements, shapes, and decorators MAY be of any size that suits the purposes of the modeler or modeling tool with the condition that the additional graphical elements SHALL NOT conflict with any current **BPM+** Standard defined graphical element.
- The lines that are used to draw the graphical elements MAY be black.
    - The notation MAY be extended to use other line colors to suit the purpose of the modeler or tool (e.g., to highlight the value of an object attribute).
    - The notation MAY be extended to use other line styles to suit the purpose of the modeler or tool (e.g., to highlight the value of an object attribute) with the condition that the line style SHALL NOT conflict with any current BPM+ Standard defined line style.

The following extensions to a **SDMN** model are permitted:

- New decorators or indicators MAY be added to the specified graphical elements. These decorators or indicators could be used to highlight a specific attribute of a **SDMN** element or to represent a new subtype of the corresponding concept with the condition that the additional graphical elements SHALL NOT conflict with any current BPM+ Standard defined decorator or indicator.
- A new shape representing a kind of **DataItem** or **ItemDefinition** MAY be added to a model with the condition that the shape SHALL NOT conflict with the shape specified for any other BPM+ Standard element or decorator.
- Graphical elements MAY be colored, and the coloring MAY have specified semantics that extend the information conveyed by the element as specified in this standard.
- The line style of a graphical element MAY be changed, but that change SHALL NOT conflict with any other line style REQUIRED by this specification or the other BPM+ Standards.
- An extension SHALL NOT change the specified shape of a defined graphical element or decorator. (e.g., changing a square into a triangle, or changing rounded corners into squared corners, etc.).

This compliance point is intended to be used by entry-level **SDMN** tools.

3 References

3.1 Normative References

The following normative documents contain provisions which, through reference in this text, constitute provisions of this specification. For dated references, subsequent amendments to, or revisions of, any of these publications do not apply.

- Key words for use in RFCs to Indicate Requirement Levels, S. Bradner, IETF RFC 2119, March 1997 http://www.ietf.org/rfc/rfc2119.txt
- [BPMN] Business Process and Model Notation (BPMN™): https://www.omg.org/bpmn/
- [CMMN] Case Management Model and Model Notation (CMMN™): https://www.omg.org/spec/CMMN/
- [DD] Diagram Definition (DD™): https://www.omg.org/spec/DD/
- [DMN] Decision Model and Model Notation (DMN™): https://www.omg.org/spec/DMN/
- [SCE] Specification Core Elements (SCE): https://www.omg.org/spec/SCE/
- [UML] Unified Modeling Language ™ (UML®): http://www.omg.org/spec/UML
- [XMI] XML Metadata Interchange (XMI®) http://www.omg.org/spec/XMI

3.2 Non-normative References

The following normative documents does not contain any non-normative references.

4 Terms and Definitions

The table below presents a glossary for this specification:

Table 1. Glossary

Term	Definition
Case	A **CMMN** element that is a proceeding that involves actions taken regarding a subject in a particular situation to achieve a desired outcome.
DataItem	A **SDMN** DataItem represents a common definition and structure for the data handling elements of the other **BPM+** models.
Decision	A **DMN** element that is the act of determining an output value (the chosen option), from a number of input values, using logic defining how the output is determined from the inputs.
ItemDefinition	Defines the detailed structure, which can be simple or complex, of a DataItem.
Process	A **BPMN** element that describes a sequence or flow of Activities in an organization with the objective of carrying out work. The ProcessRef element provides a link to a Process in a **BPMN** document.

5 Symbols

There are no symbols defined in this specification.

6 Additional Information

6.1 Conventions

The section introduces the conventions used in this document. This includes (text) notational conventions and notations for schema components. Also included are designated namespace definitions.

6.2 Typographical and Linguistic Conventions and Style

This document incorporates the following conventions:

- The keywords “MUST,” “MUST NOT,” “REQUIRED,” “SHALL,” “SHALL NOT,” “SHOULD,” “SHOULD NOT,” “RECOMMENDED,” “MAY,” and “OPTIONAL” in this document are to be interpreted as described in RFC-2119.
- A **term** is a word or phrase that has a special meaning. When a term is defined, the term name is highlighted in **bold** typeface.
- A reference to another definition, section, or specification is highlighted with underlined typeface and provides a link to the relevant location in this specification.
- A reference to a graphical element is highlighted with a bold, capitalized word (e.g., **ProcessRef**).
- A reference to a non-graphical element or **SDMN** concept is highlighted by being italicized and (e.g., *Documentation*).
- A reference to an attribute or model association will be presented with the `Courier New` font (e.g., `Expression`).

- Non-normative examples are set off in boxes and accompanied by a brief explanation.
- XML and pseudo code is highlighted with `Courier New` typeface. Different font colors MAY be used to highlight the different components of the XML code.
- The cardinality of any content part is specified using the following operators:
  - [1] — exactly once
  - [0..1] — 0 or 1
  - [0..*] — 0 or more
  - [1..*] — 1 or more
- Attributes separated by | and grouped within { and } — alternative values
  - <value> — default value
  - <type> — the type of the attribute

6.3 Display of Metamodel Diagrams

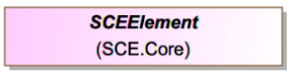
The metamodel presented in these sections utilizes the patterns and mechanisms that are used for the current **BPM+** specifications. **BPM+** specifications rarely display the entire metamodel of a technical specification in a single diagram. The entire metamodel would be very large, complicated, and hard to follow. Typically, a specification will present sub-sets of the overall metamodel as they apply to specific topics. For example, in the **BPMN** specification there are metamodel diagrams that show the elements relating to activities or data elements. This document will follow that pattern and present sub-sets of a larger metamodel.

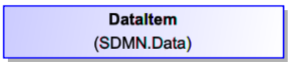
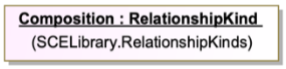
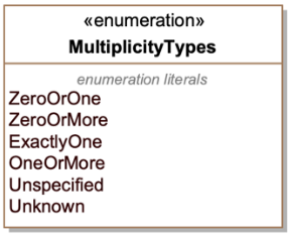
The metamodel diagrams are Unified Modeling Language (UML) structure diagrams. In addition to the metamodel, OMG specifications provide XML schemas which map to the metamodels. In general, it is through XML documents that **BPM+** models are stored and exchanged.

Further, some of the metamodel elements are references to elements from other specifications. To clarify the owner of the metamodel element, there is a parenthesized text that identifies the model owner of that element. In addition, colors are used to support the text identification of the owner-language of that element. The colors are used as an aid to distinguish the languages but does not represent a normative aspect of the metamodels nor do they add any semantic information about the metamodels.

The table below presents examples of elements used throughout the metamodel diagrams within this specification:

Table 2. SDMN Metamodel Color-Coding

Element	Description	Example Color
SCE Structural Class	Metamodel elements from the **SCE 1.0** specification [OMG doc number bmi-2021-12-09] are shown in **SDMN** metamodel diagrams when **SDMN** elements are dependent on a **SCE** element. These elements include the owner of the language (SCE) in parenthases below the element name and these elements are color-coded lavender (see figure to the right).	
SDMN General Class	These elements include the owner of the language (SDMN) in parenthases below the element name and these elements are color-coded purple and the border line color is purple (see figure to the right). These make up the majority of metamodel elements shown in this specification.	

SDMN General Class (focus of diagram)	These elements have the same naming and color, but the border line color is dark blue instead of light brown (see figure to the right). They are highlighted as the focus of the particular metamodel diagram. This is an informative depiction that does not add any semantic information about the particular metamodel diagram.	
DMN General Class	Metamodel elements from the **DMN** specification are shown in **SDMN** metamodel diagrams when **SDMN** elements are dependent on a **DMN** element. These elements include the owner of the language (DMN) in parenthases below the element name and these elements are color-coded yellowish (see figure to the right).	
External Class	Classes from specifications that are not specifically part of the BPM+ stack of standards can be included in metamodel diagrams and display the owner of the language in parenthases below the element name and these elements are color-coded light-gray. (see figure to the right).	
SDMN Class Instance	These elements elements include the owner of the language (SDMN) in parenthases below the element name and these elements are color-coded light-purple to identify **SDMN** class instances from the **SDMN** Library (see figure to the right).	
SCE Class Instance	These elements include the owner of the language (SCE) in parenthases below the element name and these elements are color-coded light-violet to identify **SCE** class instances from the **SCE** Library (see figure to the right).	
Enumerations	(see figure to the right).	

6.4 Use of Text, Color, Size, and Lines in a Diagram

- Diagram elements MAY have labels (e.g., its name and/or other attributes) placed inside the shape, or above or below the shape, in any direction or location, depending on the preference of the modeler or modeling tool vendor.
- The fills that are used for the graphical elements MAY be white or clear.
  - The notation MAY be extended to use other fill colors to suit the purpose of the modeler or tool (e.g., to highlight the value of an object attribute).
- Diagram elements and markers MAY be of any size that suits the purposes of the modeler or modeling tool.
- The lines that are used to draw the graphical elements MAY be black.
  - The notation MAY be extended to use other line colors to suit the purpose of the modeler or tool (e.g., to highlight the value of an object attribute).

- The notation MAY be extended to use other line styles to suit the purpose of the modeler or tool (e.g., to highlight the value of an object attribute) with the condition that the line style SHALL NOT conflict with any current defined line style of the diagram.

6.5 Abbreviations

The table below presents a list of acronyms, and their defintion, that are used in this specification:

Table 3. Acronyms

Acronym	Definition
BPM+	Business Process Management Plus
BPMN	Business Process Model and Notation
CMMN	Case Management Model and Notation
DC	Diagram Commons
DD	Diagram Definition
DI	Diagram Interchange
DMN	Decision Model and Notation
OMG	Object Management Group
SCE	Specification Common Elements
SDMN	Shared Data Model and Notation
URI	Uniform Resource Identifier
XMI	XML Metadata Interchange
XML	Extensible Markup Language

6.6 Structure of this Document

This document provides a brief introduction to **SDMN** and its purpose (see the section entitled “Overview”). The introduction is followed by normative clauses that define the elements of the specification and their properties and associations (see the sections entitled “SDMN Metamodel” (Clause 9); “SDMN Model Elements” (Clause 10); “Mapping to BPM+ Models” (Clause 11); and “SDMN Diagram Interchange” (Clause 14)).

6.7 Acknowledgements

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7 Overview

The focus of this document is to define the content and structure of the Shared Data Model and Notation (**SDMN**).

A "Shared Data Model" (SDM) is a collection of data elements and item definitions that supports a set of BPM-Plus (BPM+) Models (see directly below) that are used together to address a particular business modeling topic. In particular, a Shared Data Model will provide a single source for the definition of the data elements that are used across those correlated **BPM+** models. Thus, the SDM provides a shared, scoped, and focused view that supports mutual interfaces between the models, as well as external data sources.

7.1 What Constitutes a BPM+ Model?

Three OMG standards – Business Process Model and Notation (**BPMN**); Case Management Model and Notation (**CMMN**); and Decision Model and Notation (**DMN**) – are often used together to model real-world business situations since they provide (for the most part) a good separation of concerns for Process, Case, and Decision. Thus, the three languages are often spoken about and written about in this context. The origins of the **BPM+** acronym was to reduce the burden of referring to all three specifications in speech and in print. A single acronym to refer to the three languages is just simpler.

The idea of **BPM+** has since expanded to be a business modeling language stack that will gain new standards as they are developed. The standards that fit into that stack will be languages that address additional areas of concerns and can interact with, in one way or another, with at least one of the other **BPM+** languages. **SDMN** is a modeling standard designed to fit into to the **BPM+** stack. In this context, a Shared Data Model is considered the “fourth pillar” of **BPM+**. The other three pillars being the **BPM+** standards for Process, Case, and Decision. Additionally, new standards are being developed to fit in the **BPM+** stack.

7.2 Why a Shared Data Model?

Based on experience with the current set of **BPM+** standards – **BPMN**, **CMMN**, and **DMN** – the need of a centralized collection of **DataItems** and **ItemDefinitions** was identified (see the use case described in Clause 14.1 as an illustration of the drivers of this need). For example, using **BPM+** models to address a large topic, such as the behaviors of a healthcare clinical guideline (e.g., for hypertension or kidney disease) may result in dozens of individual Process, Case, and Decision models. Specific data elements are frequently used by multiple models across the three classes of **BPM+** model types (Process, Case, and Decision). To continue the hypertension example, a data element for “blood pressure” may be used within a Process, Case, and/or Decision. To ensure consistency and accuracy across the models of these large topics, the detailed structures (names and types) of the data elements should be synchronized across all the models that use them.

Since the development of the models of these large topics are lengthy and iterative, the detailed structures of the shared data elements are likely to change over time. Experience has shown that synchronizing the changes to data

elements across multiple models, multiple times, is a burdensome maintenance requirement.

Thus, a need for a central data collection for the data elements of **BPM+** Models was identified. This collection would serve as a central source for the development of data elements that would be referenced by the other **BPM+** models. This collection should reflect the structure and capabilities of the current **BPM+** models data elements. The library should also include a diagram and modeling environment that is consistent with the data representations of the current **BPM+** modeling environments to ease the modeling experience as a modeler moves between the respective modeling tools.

In addition to **SDMN**, there is the Specification Core Elements (**SCE**), that provides a set of common modeling language elements, such as root element and basic packaging capabilities. Instead of defining these basic, non-language specific elements **SDMN** is built upon the structures provided by **SCE**. Other **BPM+** languages can also use **SCE**.

The following figure illustrates the relationships between the old and new **BPM+** standards.

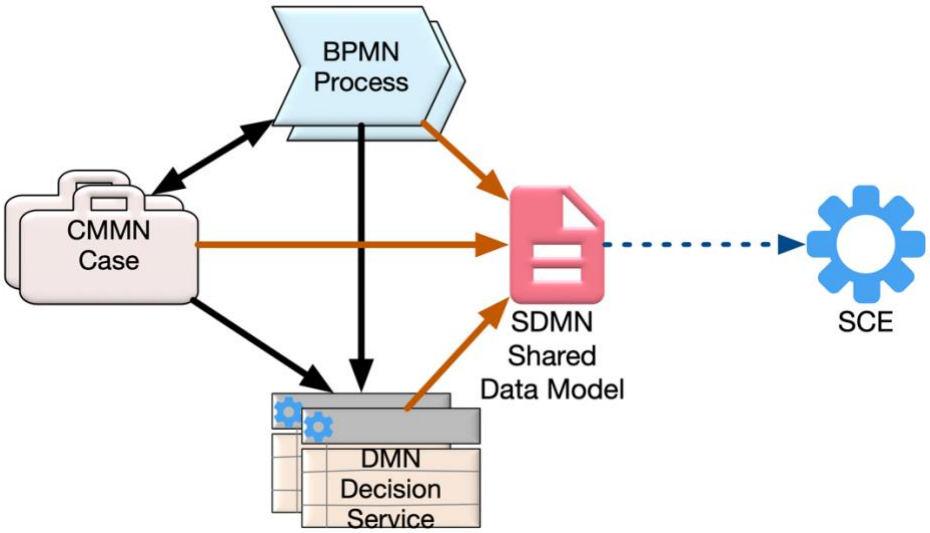


Figure 1 - Overview of SDMN in the Context of BPM+ Standards

7.2.1 Use Case: Hello Patient

The **BPM+** Health community has been defining Shareable Clinical Pathways by using the current **BPM+** standards to define formal and executable versions of current clinical guidelines (e.g., for hypertension, chronic kidney disease, etc.). Current clinical guidelines are usually found in printed or PDF documents and they contain vague and often confusing semantics leading to a great variability in how the guidelines are understood and performed.

This section describes a simple use case that was developed by the BPM+ Health community. At that time there was no concept of a Shared Data Model. The work on this and other use cases was instrumental in identifying the need and requirements for a Shared Data Model.

Organizing BPM+ Data Elements (A Shared Data Model)

Several elements in **BPM+** Models are intended to store or convey data required for the execution of those Models. **BPMN** has Data Objects, Data Inputs, Data Outputs, Data Stores, and Properties. **CMMN** has Case File Items. **DMN** has Information Items that are used for Data Inputs and Decisions. The Hello Patient use case employed many of these types of data elements within its **BPM+** models. The following table lists those data elements used within the set of **BPM+** models for the Hello Patient use case.

Table 4. List of Data Elements used by the BPM+ Models in the Hello Patient Use Case

Cases	Decision Services	Processes
1. Blood Pressure	**1. Blood Pressure**	**1. Blood Pressure**
2. Blood Pressure Goal	**2. Blood Pressure Goal**	**2. Blood Pressure Goal**
3. BMI Category	3. Blood Pressure Rating	3. Blood Pressure Rating
4. Encounter	**4. BMI Category**	**4. BMI Category**
5. Exam Data	5. Demographics	5. Demographics
6. Guideline Info	**6. Exam Data**	6. Encounter
7. Health Conditions	**7. Health Conditions**	**7. Exam Data**
8. Medication	**8. Medication**	**8. Health Conditions**
9. Medication Tolerances	**9. Medication Tolerances**	9. Loop Counter
10. Pathway Goals	10. Pathway Goals	**10. Medication**
11. Patient Health Record	11. Patient Complaints	**11. Medication Tolerances**
12. Referral	**12. Patient Health Record**	12. Pathway Goals
13. Treatment Plan	**13. Referral**	13. Patient Complaints
14. Vital Signs and Measurements	**14. Treatment Plan**	**14. Patient Health Record**
	15. Treatment Choice	**15. Referral**
15. Weight Counseling Referral	**16. Vital Signs and Measurements**	**16. Treatment Plan**
16. Weight Counseling Referral Choice	**17. Weight Counseling Referral**	17. Treatment Choice
	18. Weight Counseling Referral Choice	**18. Vital Signs and Measurements**
		19. Weight Counseling Referral

Note that the data elements listed in **bold** in the table are those that appear in all three types of **BPM**+ models. The other data elements appear in at least two of the model types.

The set of data elements listed in the above table reflect those data elements that are necessary for only the context of this use case (Hello Patient). They do not represent all the data elements that a doctor's office may require for all of its operations – let alone all the data elements required for the healthcare domain. The use case only specified the data elements that are shared across the models for its particular situation. Hence, we refer to sets of data elements used in this way as "Shared Data".

Since the use case employed all three different types of **BPM+** models (Process, Case, and Decision Service), the common data elements of the use case are shared and distributed across the three types of models. While there are some technical differences between how data is structured and used across the **BPM+** specifications, at the logical level, they all play the same role within the respective languages. This is evident when a specific conceptual data element (e.g., "Vital Signs and Measures") can be included in all three **BPM+** modeling languages (see figure below). That is, the same data element (and its values during runtime) can be passed from a **CMMN** Case to a **BPMN** Process and then be used in a **DMN** Decision.

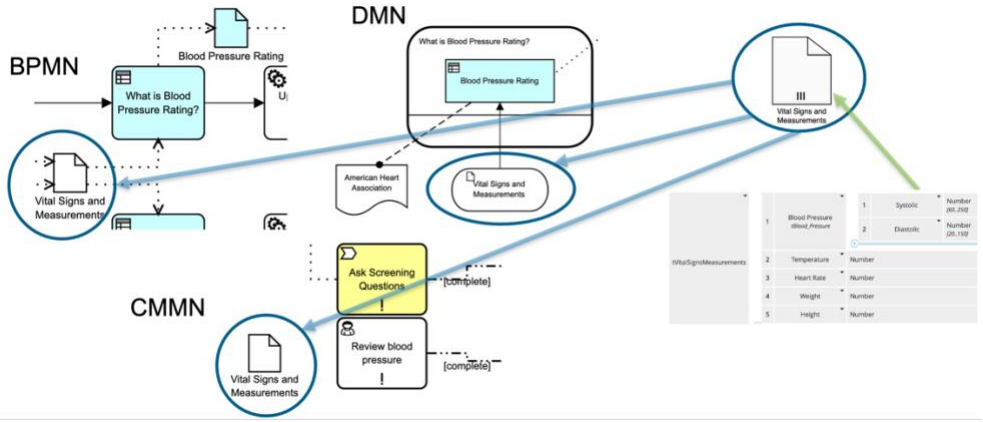


Figure 2 - Illustration of How Data Elements are Share Across BPM+ Models

Currently, the same data element has to be defined separately in the tools dedicated to each modeling language. There are no standard mechanisms for sharing data elements across the three types of **BPM+** models.

If there are a lot of data elements that are shared between the models of a set of BPM+ models, the development and maintenance burden for synchronizing the properties of the data elements will be problematic. All of the Hello Patient use date elements were used in at least two types of models. Each time any of the data elements were modified, which can happen frequently, there would be one or more modifications in the other types of **BPM+** models. It would be up to the modeler to ensure that the modifications were made and were consistent.

This maintenance burden was the driver for defining a Shared Data Model, which would be a collection of data elements that would readily be available for synchronization with the other **BPM+** models. That is, the **DataItems** and **ItemDefinitions** of the Shared Data Model should share the same characteristics as the data elements of the three **BPM+** model data elements. Further, the modeling experience should be very similar across all four models to ease burdens on the modeler.

The Shared Data Model would provide an environment where data elements can be defined and modified in a single location and the changes could be distributed to the other **BPM+** models without additional work and vigilance by the modeler. Modeling tools that implement **SDMN** should provide a diagramming capability that is consistent with how current **BPM+** modeling tools represent their data elements. Specifically, the notation for **BPMN** and **CMMN** data elements are consistent and should be used as the basis for a **SDMN** diagram. The following figure provides an example of how a **SDMN** Data Item Diagram could look.

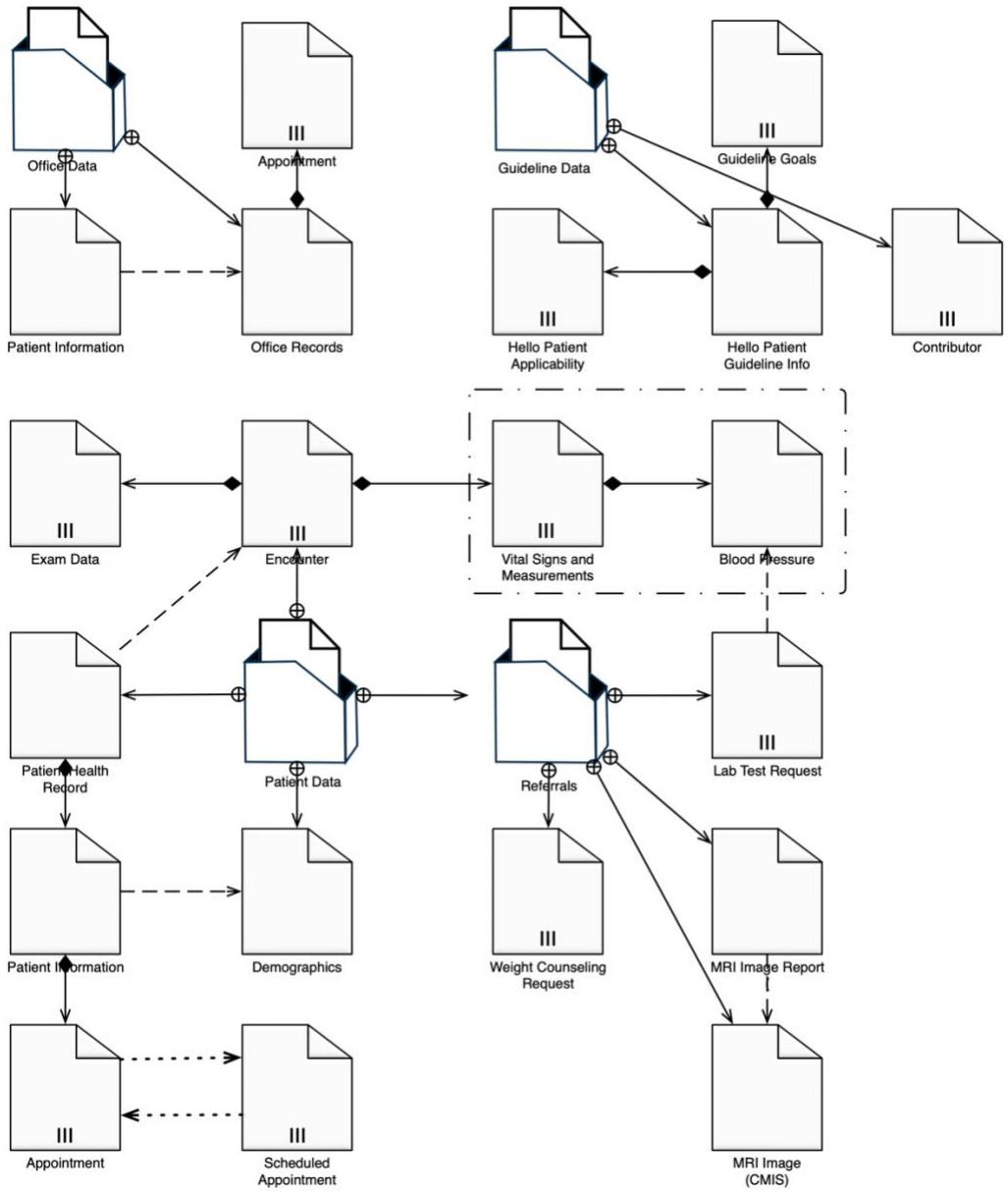


Figure 3 - An Example of How a SDMN DataItem Diagram

A Shared Data Model would then become another component of a BPM+ Knowledge Diagram (as shown in Figure 2 above).

7.3 The Purpose and Use of a Shared Data Model

A **Shared Data Model** serves multiple purposes with a set of BPM+ models.

First, it provides a collection of **DataItems** and **ItemDefinitions** that serve as the source for the data elements of the **BPMN**, **CMMN**, and **DMN** models, including:

- **BPMN** Data Objects, Data Inputs, Data Outputs, and Messages
- **CMNN** Case File Items
- **DMN** Data Inputs and Decision Outputs

A Shared Data Model may also serve as a source for **BPMN** Data Object initialization at the start of a Process.

See the section “Pre-Assigning Values for DataItems,” below, for more information.

8 Specification Core Elements

The **SDMN** specification utilizes (is dependent on) structural elements defined in the Specification Core Elements (**SCE**) metamodel. This metamodel is defined in a separate specification [See the **SCE** specification] and contains a set of basic metamodel classes that are common to **SDMN** – and potentially other OMG specifications. Details about the elements of the **SCE** are maintained in a separate document.

As can be seen in the below, **SCE** defines elements that can be used by any modeling specification – that is, the elements are not specific to any particular area of concern, such a data, process, decision, etc. For example, the **SCE** *Documentation* element can be used (and is used) in any modeling specification since it is important to allow modelers to provide documentation about a semantic element they include in a model.

Because **SCE** defines these elements, **SDMN** does not have to duplicate them in this specification. **SDMN** can just create metamodel bindings to the elements in **SCE**. Thus, throughout this specification, **SCE** elements will be seen in metamodel diagrams and **SDMN** elements will be shown as being specializations of those **SCE** elements. The **SCE** and **SDMN** metamodel elements will be identified as described in Section 6.3.

The **SCE** high-level metamodel defines the basic infrastructure elements of a **BPM+** model (see figure below).

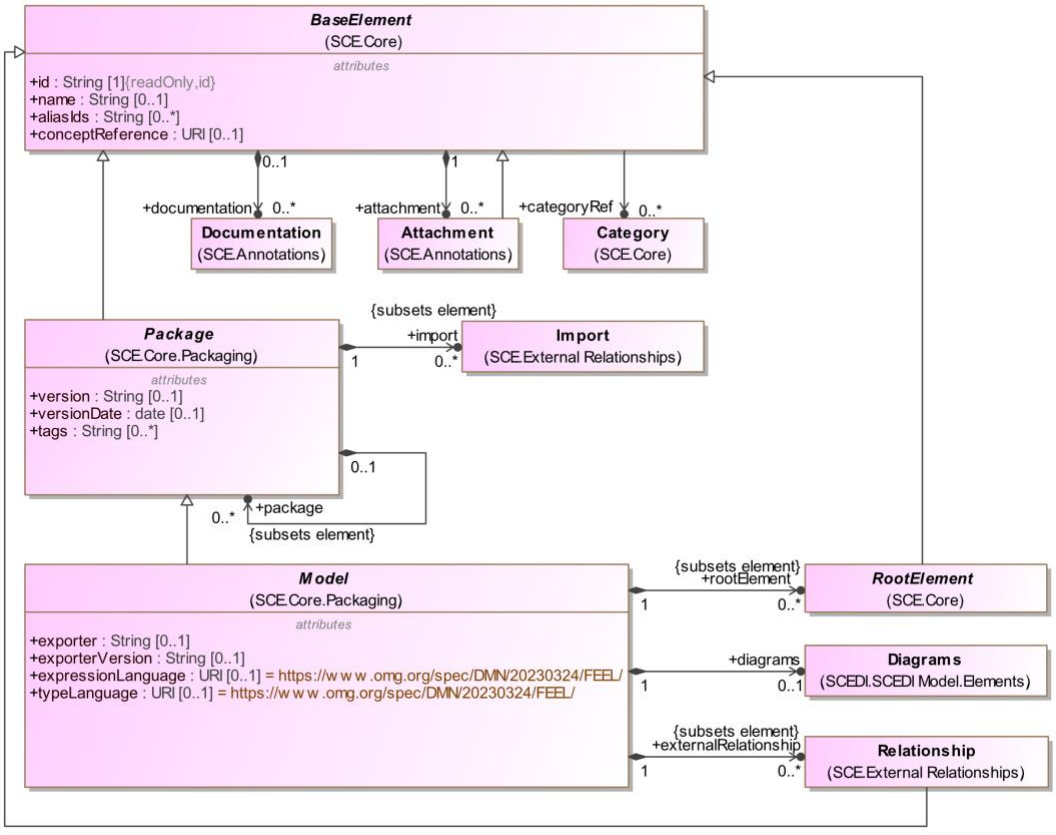


Figure 4 - The Specification Core Elements (SCE) Base Metamodel

9 SDMN Metamodel

The **SDMN** core metamodel defines the basic infrastructure elements of a **Shared Data Model**. As mentioned in the

previous section, **SDMN** is dependent on **SCE** [see the **SCE** specification]. This dependency is manifested in multiple **SDMN** metamodel relationships. For example, the *SharedDataModel* element directly specializes the **SCE** *SCEModel* element, thus inheriting all the properties and associations of that element.

The following figure shows the organization of the **SDMN** metamodel packages.

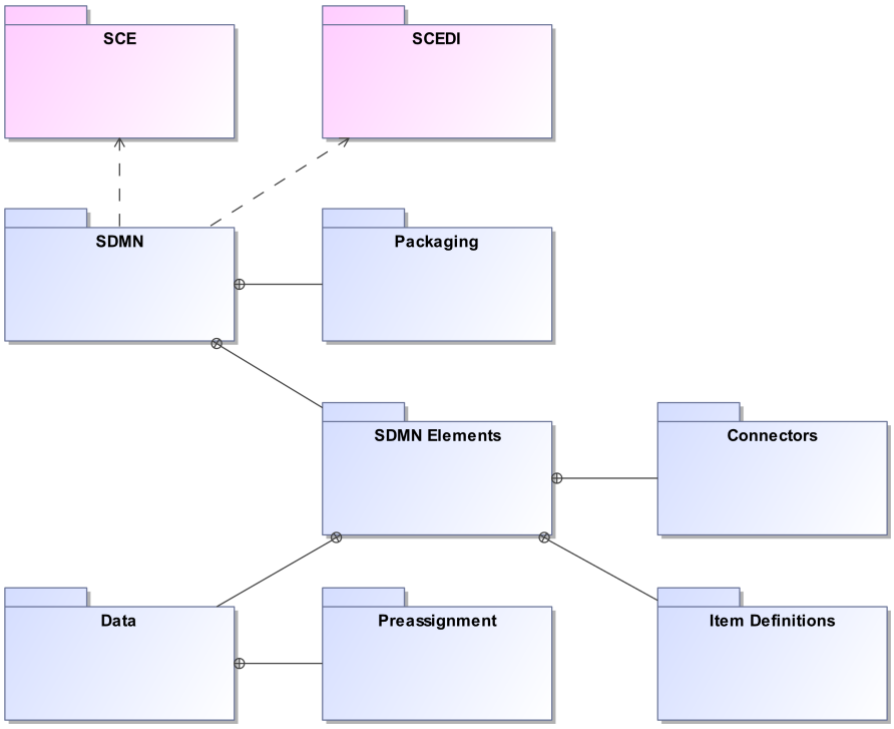


Figure 5 - SDMN Main Packages

Further, most of the other **SDMN** elements directly specialize the **SCE** *BaseElement* or **SCE** *RootElement*. These relationships can be seen in the metamodel diagrams in this chapter as well as being identified in the "Generalizations" subsections for the relevant **SDMN** classes defined in this chapter.

9.1 SharedDataModel

The *SharedDataModel* class is the outermost containing object for all **SDMN** elements. It defines the scope of visibility and the namespace for all contained elements. The interchange of **SDMN** files will always be through one or more *SharedDataModels*. Specifically, an XML file for a *SharedDataModel* usually would be appended with a ".sdmn" label.

The **ItemDefinition** element is directly contained in a *SharedDataModel*. Other **SDMN** elements, such as **DataItem** and **Connector**, are also included in a *SharedDataModel* since they subclass the **SCE** *RootElement*, which is contained in the **SCE** *Model* element. And thus, a *SharedDataModel* will contain any element that is based on **SCE** *RootElement*.

The following figure shows the *SharedDataModel* metamodel.

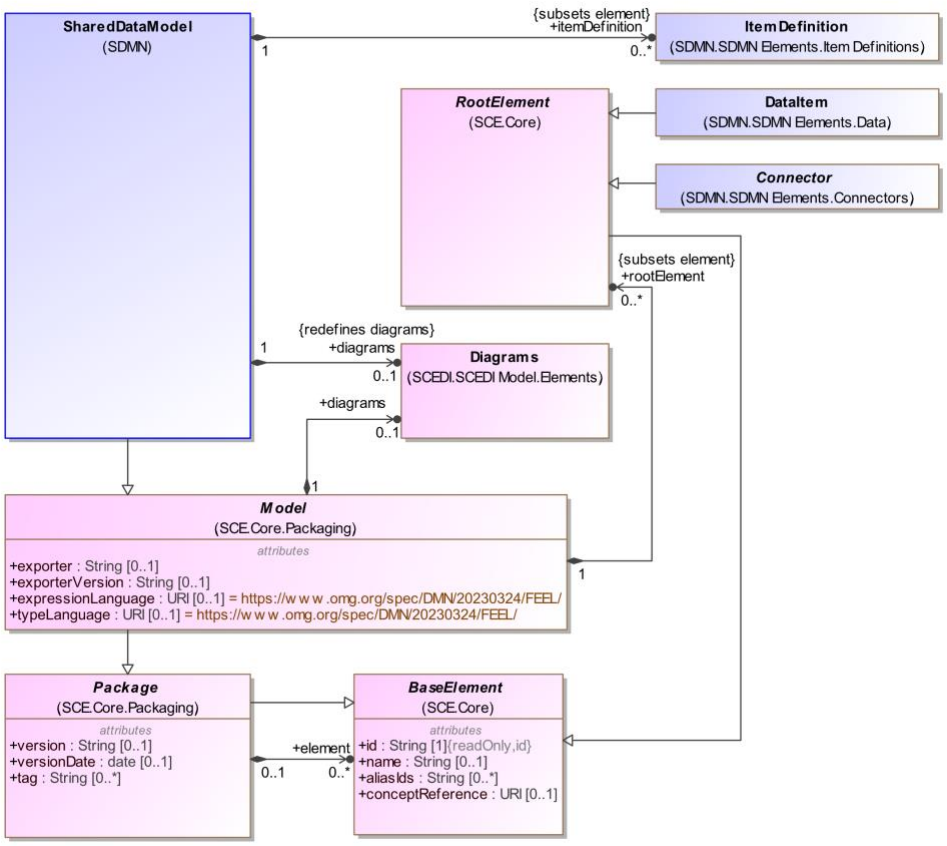


Figure 6 - The SharedDataModel Metamodel

Generalizations

The *SharedDataModel* element inherits the attributes and/or associations of:

- *SCEModel* (see the **SCE** Specification for more information).

Properties

The following table presents the additional attributes and/or associations for *SharedDataModel*:

Table 5. Table title

Property/Association	Description
itemDefinition : ItemDefinition [0..*]	This is a list of the **ItemDefinitions** that are included in the *SharedDataModel*. See the section entitled "Item Definitions," below, for more information about **ItemDefinitions**.
diagrams : SCE::Diagrams [0..1]	This attribute contains the Diagram Interchange information contained within this *SharedDataModel*. See the section entitled “SDMN Diagram Interchange” for more information.

10 SDMN Model Elements

This chapter defines **DataItem** and its related elements and **ItemDefinition** and its related elements.

10.1 DataItems

A **SDMN DataItem** represents a common definition and structure for the data handling elements of the other **BPM+** models.

A **DataItem** may represent a piece of information of any nature, ranging from unstructured to structured, and from simple to complex, which information can be defined based on any information modeling "language." A **DataItem** can be anything from a folder or document stored with CMIS, an entire folder hierarchy referring or containing other **DataItems**, or simply an XML document with a given structure. The structure, as well as the "language" (or format) to define the structure, is defined by the associated **ItemDefinition** (see below). This may include the definition of properties ("metadata") of a **DataItem**. If the internal content of the **DataItem** is known, an XML Schema, describing the **DataItem**, may be imported.

DataItems can be organized into arbitrary hierarchies either by containment or by composition.

The data structure these elements hold is specified using an associated **ItemDefinition**. A **DataItem** MAY be underspecified, meaning that the structure attribute of its **ItemDefinition** is optional if the modeler does not wish to define the structure of the associated data. The elements in the specification defined as item-aware elements are: Data Objects, Data Object References, Data Stores, Properties, DataInputs and DataOutputs.

The following figure shows the metamodel elements related to the **DataItem** element.

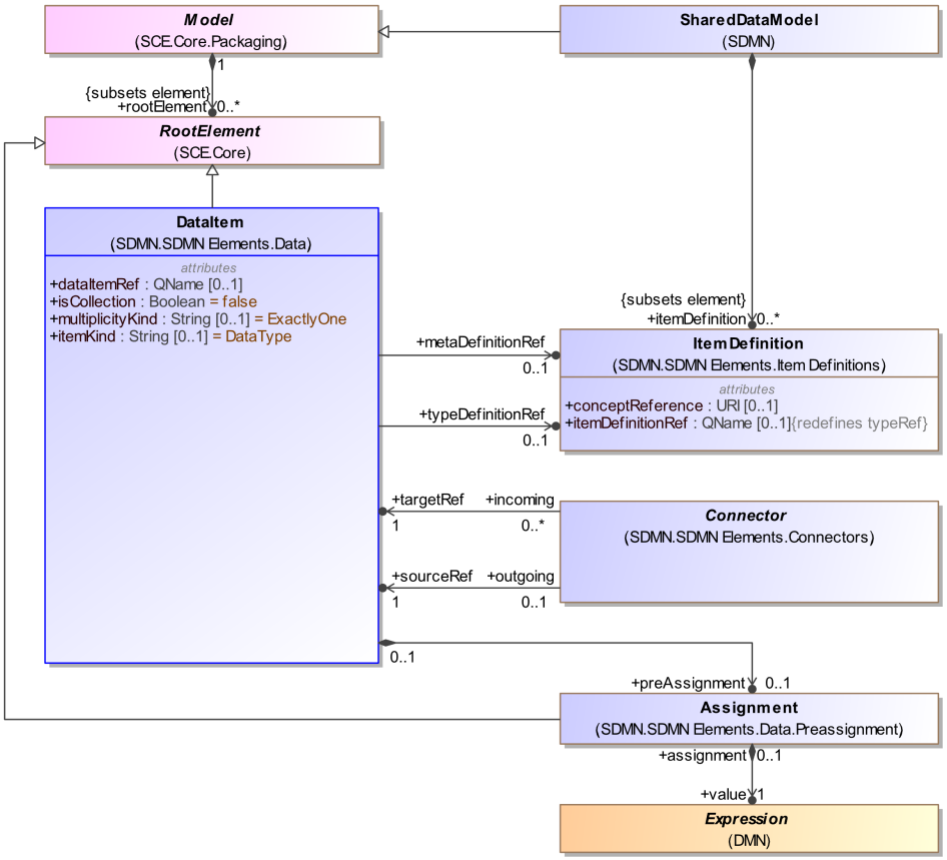


Figure 7 - The DataItem Metamodel

10.1.1 DataItem

A **SDMN DataItem** represents a common definition and structure for the data handling elements of the other **BPM+** models (as described above). It is contained within a *SharedDataModel*.

Notation

The following statements define the notation for a **DataItem**:

- A **DataItem** is a shape that SHALL be a document shape with folded upper right corner and drawn with a single line (see below).

The use of text, color, size, and lines for a **DataItem** SHALL follow the rules defined in the section entitled "Use of Text, Color, Size, and Lines in a Diagram" above.

The **DataItem** shape is a document with folded upper right corner (see figure below). This is the default notation for a **DataItem** and occurs when the `itemKind` property of the **DataItem** is set to anything other than `folder`, which has a different notation as shown below.

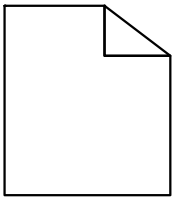


Figure 8 - A DataItem Object

The **DataItem** shape is a folder when the `itemKind` property of the **DataItem** is set to `folder`. (see figure below).

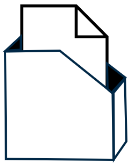


Figure 9 - A DataItem Object

Generalizations

The **DataItem** element inherits the attributes and/or associations of:

- **SCE** *RootElement* (see the **SCE** Specification for more information).

Properties

The following table presents the additional attributes and/or associations for **DataItem**:

Table 6. DataItem Attributes and/or Associations

Property/Association	Description
dataItemRef : QName [0..1]	A reference to an external **DataItem** that is imported into this Shared Data Model. The **DataItem** and its details can only be viewed in this model. Any changes to the original SHALL be carried out in the source Shared Data Model. A **DataItem** can have only one of `dataItemRef` or `ItemDefinitionRef` as a set attribute. Neither of them is required, though. If a `dataItemRef` is defined, then the graphical notation for the **DataItem** will include a locked icon.
isCollection : Boolean [0..1] = false	Defines if the **DataItem** represents a collection of elements. It is not needed when an `itemDefinition` is referenced. If an `itemDefinition` is referenced, then this attribute MUST have the same value as the `isCollection` attribute of the referenced `itemDefinition`. The default value for this attribute is *false*.
itemKind : String [0..1] default : Information	This defines the nature of the **DataItem**. Possible values are physical, information, conceptual, and others (see the table entitled "ItemKind Values") The default value is `Information`.
metaDefinitionRef : ItemDefinition [0..1]	A reference to an **itemDefinition** that defines the *Properties* of the **DataItem**. The `itemComponents` of the **ItemDefinition** structure map to the Properties of a **CMMN** Case File Item. Each of the `itemComponents` SHALL be a simple type.
multiplicityKind: String [0..1] default: ExactlyOne	This attribute sets the multipliciy of the **DataItem**. The default is `ExactlyOne`. See the table entitled "MultiplicityKind Values", below, for the entire set of values.
preAssignment : Assignment [0..1]	Specifies an optional pre-assignment **DMN** *Expression*. The expression will provide values for one or more of the simple type `itemComponents` of the **ItemDefinition** set for the **DataItem**.
typeDefinitionRef : ItemDefinition [0..1]	A reference to an **itemDefinition** that defines the detailed structure, which can be simple or complex, of the **DataItem**. A **DataItem** can have only one of `dataItemRef`, or `typeDefinitionRef` as a set attribute. None of them are required, though.

ItemKinds

The possible values of the `itemKind` attribute support the **BPMN**, **CMMN**, and possible future **BPM+** specifications. **DMN** does not include an `itemKind` attribute and thus it should be ignored by **DMN** models. See Sections 11.2 and 11.3 for mappings of the values presented below to the **BPMN** and **CMMN** specifications.

The following table presents a description for the possible values for *ItemKind*:

Table 1. ItemKind Values

Literal	Description
Conceptual	The type of the **DataItem** that doesn't represent data or physical items, but represents concepts in the minds of users that are important for tasks or decisions. For example, a preference for a particular type of procudure will influence a doctor's decision. While actual computations cannot be made with `Conceptual` **DataItem**, they are used to document aspects of the modeled behaviors.
Information	The type of the **DataItem**that fully utilizes the structural data capabilities inherent to **ItemDefinition**. If the **DataItem** has a `typeDefinitionRef` (to an ItemDefinition), then the value of `itemKind` MUST be `Information`.
Document	This represents a Data Object or Case File Item that is a type of `Document`. In **BPMN**, the document could be physical (e.g., printed) or electronic. In **CMMN**, it would represent a document in a Document Management System and is defined through the following URI: http://www.omg.org/spec/CMMN/DefinitionType/CMISDocument
Folder	This represents a **CMMN** Case File Item that is a `Folder`. A `Folder` can contain other `Folders` or `Documents`. Neither **BPMN** nor **DMN** have the concept of `Folder` as a data element. Thus, **DataItems** based that is a `Folder` would not map to **BPMN** or **DMN** data elements. The `Folder` is defined through the following URI: http://www.omg.org/spec/CMMN/DefinitionType/CMISFolder
Physical	The *ItemKind* is represents objects in a **BPMN** Process that are physical objects, such as printed documents or manufactured items. These types of **DataItems** are not currently relevant to **CMMN** or **DMN**.
Relationship	The *ItemKind* is defined through the following URI: http://www.omg.org/spec/CMMN/DefinitionType/ CMISRelationship
UMLClass	The *ItemKind* is represents a **UML** Class in a Class Diagram.
Unknown	The *ItemKind* is defined through the following URI: http://www.omg.org/spec/CMMN/DefinitionType/Unknown
Unspecified	The *ItemKind* is defined through the following URI: http://www.omg.org/spec/CMMN/DefinitionType/Unspecified
WSDLMessage	The *ItemKind* is represents a **WSDL** Message.
XSDComplexType	For *ItemKinds* of this type, the (**SCE**) *Import* class SHOULD be used to import an XML Schema definition into the **Shared Data Model**. The *ItemKind* is defined through the following URI: http://www.omg.org/spec/CMMN/DefinitionType/ XSDComplexType

XSDElement	For *ItemKinds* of this type, the (**SCE**) *Import* class SHOULD be used to import an XML Schema definition into the **Shared Data Model**. The *ItemKind* is defined through the following URI: http://www.omg.org/spec/CMMN/DefinitionType/XSDElement
XSDSimpleType	For *ItemKinds* of this type, the (**SCE**) *Import* class SHOULD be used to import an XML Schema definition into the **Shared Data Model**. The *ItemKind* is defined through the following URI: http://www.omg.org/spec/CMMN/DefinitionType/XSDSimpleType

MultiplicityKinds

The `MultiplicityKind` attribute is included in **SDMN** to support the `DefinitionType` attribute of **CMMN** *CaseFileItemDefinition* Elements. The values listed in the table below are the same values as defined by **CMMN**. The `MultiplicityKind` attribute does not map to any attribute of **BPMN** and **DMN** and thus, should be ignored by those types of models. **BPMN** and **DMN** both use an `isCollection` attribute to determine multiplicity.

The following table presents a description for the possible values for *MultiplicityKind*:

Table 7. MultiplicityKind Values

Literal	Description
ExactlyOne	There is one copy of this **DataItem**.
OneOrMore	There is at least one copy of this **DataItem**, but there may be more.
Unknown	The muliplicity is not known for this **DataItem**.
Unspecified	The muliplicity is not specified for this **DataItem**.
ZeroOrMore	There may be no copies of this **DataItem** or there may be multiple copies.
ZeroOrOne	There may be no copies of this **DataItem** or there may be one copy.

10.1.2 Pre-Assigning Values for DataItems

There are situations in the development of a collection of BPM+ models when the values of some of the **DataItem** properties are known. For example, in a healthcare scenario, certain medications are recommended for a particular condition. Each medication with have a representative **DataItem** in the **Shared Data Model** that will share the same *ItemDefintion*. The **ItemDefinition** will define the properties that are needed for prescribing the medication, such as medication name, codes, dosages, etc.

Assignment

An Assignment is contained within a **DataItem** or a **DataAssociation**.

Generalizations

The *Assignment* element inherits the attributes and/or associations of:

- **SCE** *RootElement* (see the **SCE** Specification for more information).

Properties

The following table presents the additional attributes and/or associations for *Assignment*:

Table 8. Assignment Attributes and/or Associations

Property/Association	Description
value : Expression [1]	The **DMN** *Expression* that evaluates the *Assignment*.

Pre-Assignment Example

The following example is a FEEL expression that preassigns values for a “medication” **DataItem**.

```
{
   "Metoprolol Tartrate 25" : {
      Id : "metoprololTartrate25Medication" ,
         Code: {
         Coding : {
            System : "http://www.nlm.nih.gov/research/umls/rxnorm" ,
            Code : "866426"
         },
         Text : "Metoprolol Tartrate 25 MG"
      },
      Form : {
         Coding : {
            System : "http://snomed.info/sct" ,
            Code : "385055001" ,
            Display : "Tablet dose form"
         },
         Text : "Tablet dose form"
      },
      Ingrediant : {
         Substance : {
            Id : "metoprololTartrate25Substance" ,
            Code : {
               Coding : {
                  System : "http://www.nlm.nih.gov/research/umls/rxnorm" ,
                  Code : "6918"
               }
               Text : "Metoprolol"
            }
         }
         Strength : {
            Numerator : {
               Value : "25" ,
               Unit : "mg"
            },
            Denominator : {
               Value : "1" ,
               Unit : "{tbl}"
            }
         }
      }
   }
}
```

10.2 Item Definitions

The **ItemDefinition** element is the mechanism for providing the data structure of **DataItems**.

The following figure shows the metamodel elements related to the **ItemDefinition** element.

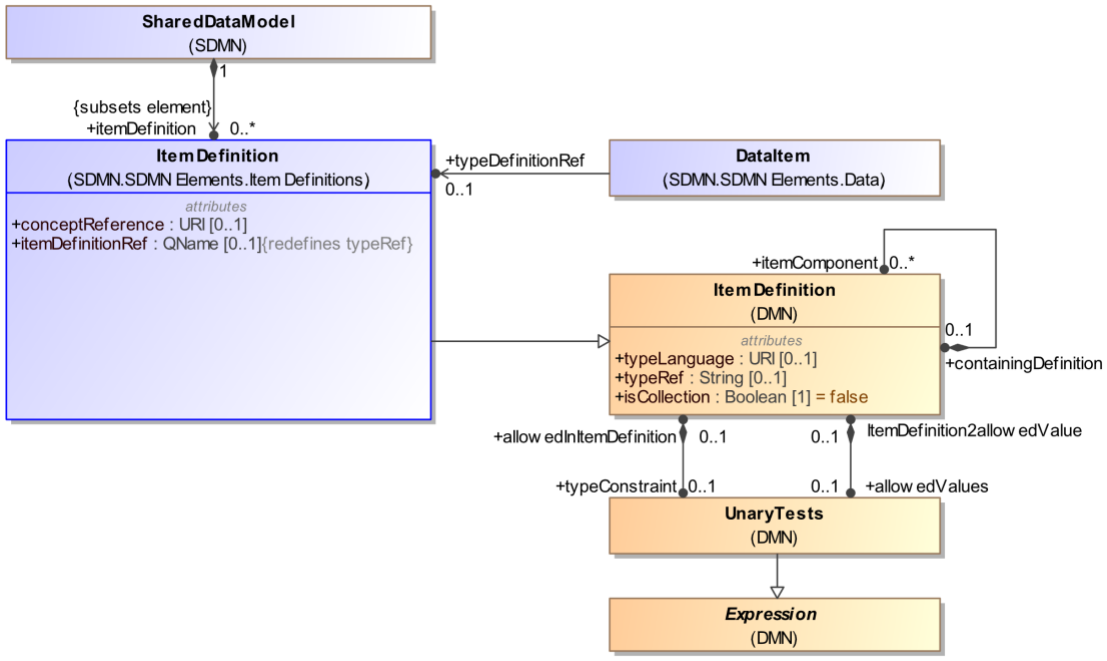


Figure 10 - The ItemDefinition Metamodel

10.2.1 ItemDefinition

The **ItemDefinition** element is the mechanism for providing the data structure of **DataItems**. It is contained within a *SharedDataModel*.

Notation

The following statements define the notation for an **ItemDefinition**:

- A **ItemDefinition** is a shape that SHALL be a boxes with two or more sections.
  - The top section will display the `name` of the **ItemDefinition**.
  - The bottom section(s) will display a `type` or a list of `types`.

The use of text, color, size, and lines for an **ItemDefinition** SHALL follow the rules defined in the section entitled "Use of Text, Color, Size, and Lines in a Diagram" above.

If the **ItemDefinition** is a simple `type` (e.g., has no `ItemComponent`), the **ItemDefinition** will be shown as in the following figure.

Label
typeRef allowedValues

Figure 11 - An ItemDefinition Object with no ItemComponent

If the **ItemDefinition** is a complex `type` (e.g., has one or more `ItemComponent`), the **ItemDefinition** will be shown as in the following figure. Additional paired sections will be added to the bottom of the shape for each `ItemComponent` that makes up the **ItemDefinition**.

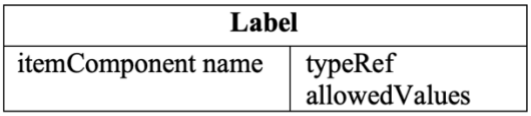


Figure 12 - An ItemDefinition Object with one or more ItemComponents

ItemDefinitions can be connected together through composition and reference relationships. The following figure displays an example of a composition indicator. It shares the line style of the **CompositionConnector** (see below) since it has the same basic semantic meaning.

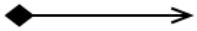


Figure 13 - An ItemDefinition Composition Indicator

The connection rules for a composition indicator are as follows:

- The source of a CompositionConnector SHALL be an ItemDefinition.
  - The source end of the **CompositionConnector** SHALL be attached to the right boundary of the `type` section of the sub-element for the source **ItemDefinition**.
- The target of a CompositionConnector SHALL be an ItemDefinition.
  - The target end of the **CompositionConnector** SHALL be attached to the top-level `name` section for the target **ItemDefinition**.

The following figure displays an example of a reference indicator. It shares the line style of the **ReferenceConnector** (see below) since it has the same basic semantic meaning.

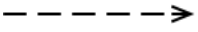


Figure 14 - A ItemDefinition Reference Indicator

The connection rules for a reference indicator are as follows:

- The source of a ReferenceConnector SHALL be an ItemDefinition.
  - The source end of the **ReferenceConnector** SHALL be attached to the right boundary of the `type` section of the sub-element for the source **ItemDefinition**.
- The target of a ReferenceConnector SHALL be an ItemDefinition.
  - The target end of the **ReferenceConnector** SHALL be attached to the top-level `name` section for the target **ItemDefinition**.

Generalizations

The **ItemDefinition** element inherits the attributes and/or associations of:

- **DMN** *ItemDefinition* (see the **DMN** specification for more information).

Properties

The following table presents the additional attributes and/or associations for **ItemDefinition**:

Table 9. ItemDefinition Attributes and/or Associations

Property/Association	Description
conceptReference : URI [0..1]	The specific context of the **BPM+** elements may result in different terminology or sub-sets of data representation elements within the normative domain models. To reduce any confusion due to terminology or data representation, the capability of linking model elements to the appropriate external sources of truth for their domain is provided (i.e., a `conceptReference`). Other **SDMN** elements receive this attribute by inheriting it from **SCE** *BaseElement*. However, since ItemDefinition derives from **DMN**, which does not have the attribute, it is added here. **It is expected that the value of the URI will be persistent.**
itemDefinitionRef : QName [0..1]	A reference to an external **ItemDefinition** that is imported into this **Shared Data Model**. The **ItemDefinition** and its details can only be viewed in this model. Any changes to the original SHALL be carried out in the source **Shared Data Model**. Other types of structures are not allowed for the **SDMN**. However, **BPMN** Data Objects and **CMMN** Case File Items have the capability of references other types of structures. These other types of structures would not be a part of the **SDMN Shared Data Model**.

10.3 Connectors

10.3.1 Connector

The Connector element is the abstract class that provides the common properties for the four concrete types of connectors (listed in the next four sections). It is contained in a **SharedDataModel**.

The following figure shows the metamodel elements related to the *Connectors* element.

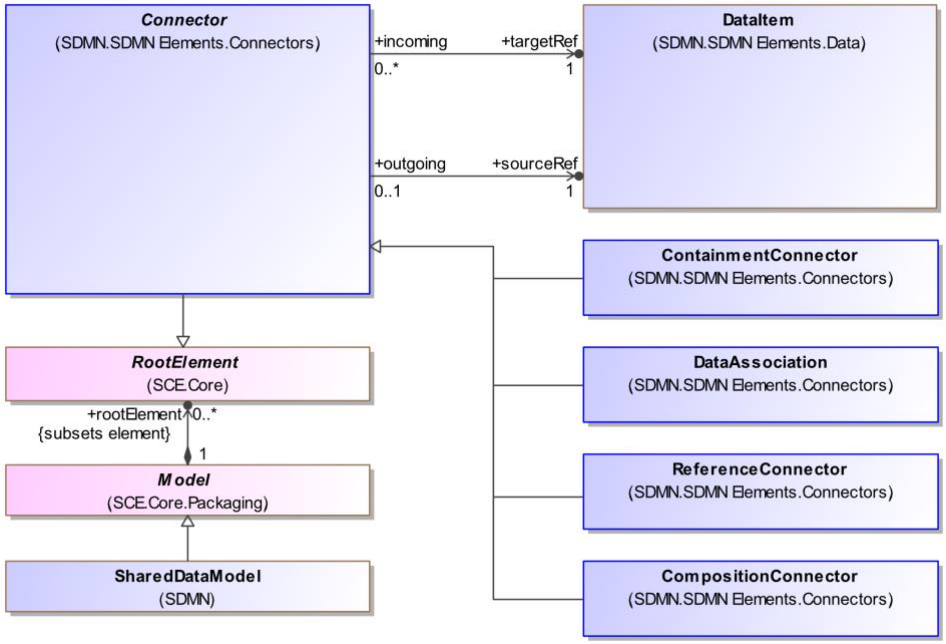


Figure 15 - The Connectors Metamodel

Generalizations

The *Connector* element inherits the attributes and/or associations of:

- **SCE** *RootElement* (see the **SCE** Specification for more information).

Properties

The following table presents the additional attributes and/or associations for *Connector*:

Table 10. Connector Attributes and/or Associations

Property/Association	Description
sourceRef : DataItem [1]	The **DataItem** that the *Connector* is connecting from.
targetRef : DataItem [1]	The **DataItem** that the *Connector* is connecting to.

10.3.2 CompositionConnector

A **CompositionConnector** is used to define a relationship between **DataItems**. It represents a part-of relationship between two **DataItems**. That is, one **DataItem** (the target) is part of another **DataItem** (the source). A Data Item of kind *folder* cannot be part of a composition relationship.

An example for **DataItem** composition can be found in healthcare scenarios: e.g., a patient record **DataItem** can be very complex and often only a portion of that **DataItem** is required for a **DMN** Decision. For example, creating a separate **DataItem** just for "demographics", which is part of a larger "health record" **DataItem**, will help focus the model for the context that is being addressed at that point.

CompositionConnectors are contained in a **SharedDataModel**.

The runtime consequences of creating a **CompositionConnector** between two **DataItems** include:

- If the source **DataItem** is deleted, then the target **DataItem** will also be deleted.
- If a source **DataItem** is moved or set within a container, then the target **DataItem** will also be moved.
- If a target **DataItem** within a source **DataItem** is updated (e.g., through a change in the value of a property), the source **DataItem** will also be updated. I.e., the source **DataItem** is aware of changes to target **DataItems**.

The **CompositionConnector** element does not have any additional attributes and/or associations.

Notation

The following statements define the notation for a **CompositionConnector**:

- A **CompositionConnector** is a line that SHALL be drawn with a single line (see below) with a filled diamond start and an angle 45° arrowhead end.
    - The use of text, color, size, and lines for a **CompositionConnector** SHALL follow the rules defined in the section entitled "Use of Text, Color, Size, and Lines in a Diagram" above.

The following figure displays an example of a **CompositionConnector**:

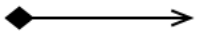


Figure 16 - A Composition Connector

Connection Rules

The following statements define connection rules for a **CompositionConnector**:

- The source of a **CompositionConnector** SHALL be a **DataItem**.
- The target of a **CompositionConnector** SHALL be a **DataItem**.

Generalizations

The **CompositionConnector** element inherits the attributes and/or associations of:

- *Connector* (see the section entitled "Connector" for more information).

Further, the *Connector* element inherits the attributes and/or associations of:

- **SCE** *RootElement* (see the **SCE** Specification for more information).

Properties

The **Composition Connector** element does not have any additional attributes and/or associations.

10.3.3 ContainmentConnector

A **ContainmentConnector** is used to define a relationship between **DataItems**. This relationship will specify that one **DataItem** is contained within another **DataItem**. Container **DataItems** must have their *ItemKind* set to either folder or physical. They are contained in a **SharedDataModel**.

The runtime consequences of creating a **ContainmentConnector** between two **DataItems** include:

- If a container is deleted, then the **DataItems** within the container will also be deleted.
- If a container is moved or set within another container, then the **DataItems** within the container will also be moved.
- If an element within a **DataItem** container is updated (e.g., through a change in the value of a property), the container will not be updated. I.e., the container is not aware of changes to existing contained **DataItems**.

Notation

The following statements define the notation for a **ContainmentConnector**:

- A **ContainmentConnector** is a line that SHALL be drawn with a single line (see below) with a cross-filled circle start and an angle 45° arrowhead end.
  - The use of text, color, size, and lines for a **CompositionConnector** SHALL follow the rules defined in the section entitled "Use of Text, Color, Size, and Lines in a Diagram" above.

The following figure displays an example of a **ContainmentConnector**:

Figure 17 - A Containment Connector

Connection Rules

The following statements define connection rules for a **ContainmentConnector**:

- The source of a **ContainmentConnector** SHALL be a **DataItem**.
  - The source **DataItem** MUST be assigned the *ItemKind* `folder` or `physical`.

- The target of a **ContainmentConnector** SHALL be a **DataItem**.

Generalizations

The **ContainmentConnector** element inherits the attributes and/or associations of:

- *Connector* (see the section entitled "Connector" for more information).

Further, the *Connector* element inherits the attributes and/or associations of:

- **SCE** *RootElement* (see the **SCE** Specification for more information).

Properties

The **ContainmentConnector** element does not have any additional attributes and/or associations.

10.3.4 DataAssociation

The **DataAssociation** class is a *Connector* and used to model how data is mapped between two **DataItems**. The source of the association is mapped to the target. The **ItemDefinition** from the souceRef and targetRef MUST have the same **ItemDefinition** or the **DataAssociation** MUST have a transformation *Expression* that transforms the source **ItemDefinition** into the target **ItemDefinition**. It is contained within a **SharedDataModel**.

The following figure shows the metamodel elements related to the **DataAssociation** element.

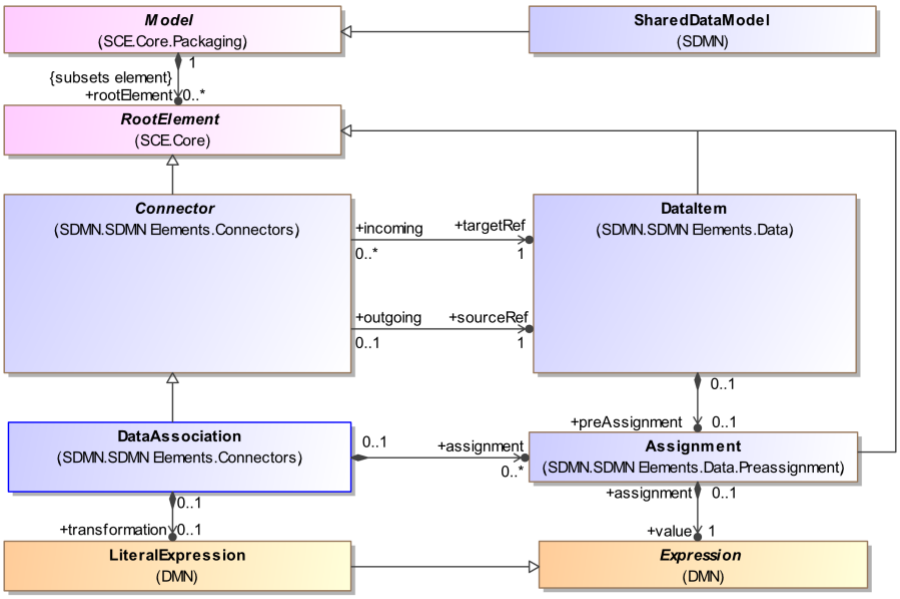


Figure 18 - The DataAssociation Metamodel

Notation

The following statements define the notation for a **DataAssociation**:

- A **DataAssociation** is a line that SHALL be drawn with a dotted single line (see below) with an angle 45° arrowhead end.
  - Note that the line style of the Data Association is the same as the **SCE** Model Artifact, **Association**. This graphical overlap was included in the **BPMN 2.0** specification and **SDMN** was designed to be consistent with other **BPM+** specifications. Thus, the same graphical overlap is being applied.

        - If a line that looks like an **Association** or a **DataAssociation** is connected between two **DataItems**, then the connector is assumed to be a **DataAssociation** (see the section entitled "Data Association Connection Rules," below). If the source or target of the line is not a **DataItem**, then the connector is assumed to be an **Association**.
    - The use of text, color, size, and lines for a **CompositionConnector** SHALL follow the rules defined in the section entitled "Use of Text, Color, Size, and Lines in a Diagram" above.
- The arrowhead of the connector is attached to the **DataItem** that is the target of the data mapping.

The following figure displays an example of a **DataAssociation**:

Figure 19 - A Data Association

Connection Rules

The following statements define connection rules for a **DataAssociation** connector:

- The source of a **DataAssociation** SHALL be a **DataItem**.
- The target of a **DataAssociation** SHALL be a **DataItem**.

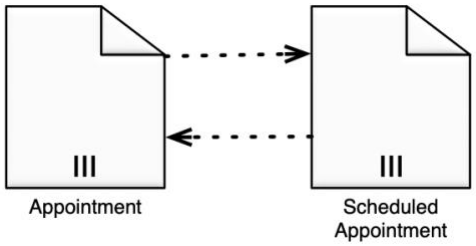


Figure 20 - Example of DataAssociations between two DataItems

Generalizations

The **DataAssociation** element inherits the attributes and/or associations of:

- *Connector* (see the section entitled "Connector" for more information).

Further, the *Connector* element inherits the attributes and/or associations of:

- **SCE** *RootElement* (see the **SCE** Specification for more information).

Properties

The following table presents the additional attributes and/or associations for **DataAssociation**:

Table 11. DataAssociation Attributes and/or Associations

Property/Association	Description
assignment : Assignment [0..*]	Specifies one or more data elements *Assignments*. By using an *Assignment*, single data structure elements can be assigned from the source structure to the target structure.
transformation : LiteralExpression [0..1]	Specifies an optional transformation *Expression*. The actual scope of accessible data for that *Expression* is defined by the source and target of the specific **DataAssociation** types.

10.3.5 ReferenceConnector

An *ReferenceRelationship* is used to define a relationship between **DataItems**. This relationship will specify that one **DataItem** is references another **DataItem**. This mechanism defines the technical structure of the **DataItem**. The referenced structure, shown as a separate **DataItem** in the diagram does extend the structure within the source **DataItem** but the referenced **DataItem** exists on its own and can be referenced by other **DataItems**.

They are contained in a **SharedDataModel**.

The runtime consequences of creating a **ReferenceConnector** between two **DataItems** include:

- If a **DataItem** that is referenced by another **DataItem** (either as a source or target) is deleted, then the referenced **DataItems** will not be deleted.
- If a **DataItem** is moved or set within another container, then the **DataItems** referenced by that **DataItem** will not be moved.
- If **DataItem** is updated (e.g., through a change in the value of a property), the **DataItems** referenced by that **DataItem** will not be updated. I.e., a **DataItem** is not aware of changes to any referenced **DataItems**.

Notation

The following statements define the notation for a **ReferencConnector**:

- A **ReferenceConnector** is a line that SHALL be drawn with a long dashed single line (see below) with an angle 45° arrowhead end.
    - The use of text, color, size, and lines for a **CompositionConnector** SHALL follow the rules defined in the section entitled “Use of Text, Color, Size, and Lines in a Diagram” above.

The following figure displays an example of a **ReferenceConnector**:

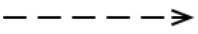


Figure 21 - A Reference Connector

Connection Rules

The following statements define connection rules for a **ReferenceConnector**:

- The source of a **ReferenceConnector** SHALL be a **DataItem**.
- The target of a **ReferenceConnector** SHALL be a **DataItem**.

Generalizations

The **ReferenceConnector** element inherits the attributes and/or associations of:

- *Connector* (see the section entitled “Connector” for more information).

Further, the *Connector* element inherits the attributes and/or associations of:

- **SCE** *RootElement* (see the **SCE** Specification for more information).

Properties

The **ReferenceConnector** element does not have any additional attributes and/or associations.

10.4 Model Artifacts

SDMN provides modelers with the capability of showing additional information about a **Shared Data Model** that is not directly related to the model elements through the capability provided by the *ModelArtifact* elements that are defined in the **SCE** specification. **SDMN** utilizes the three standard **SCE** *ModelArtifacts*: **Associations**, **Groups**, and **TextAnnotations**.

SDMN does not extend the capabilities of these *ModelArtifacts* but uses them as-is from the **SCE** specification. The following figure shows how the **SCE** *ModelArtifact* is included within **SDMN**. *ModelArtifacts* are contained within a **SharedDataModel**.

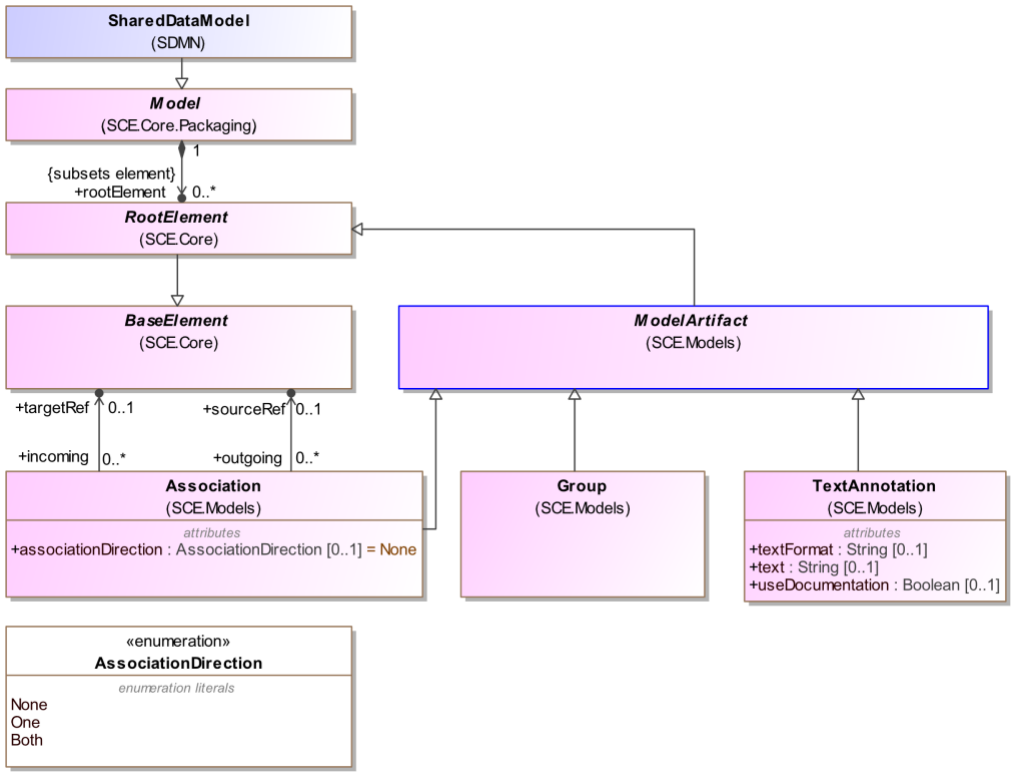


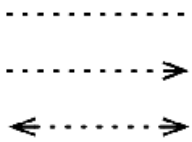
Figure 22 - The Use of SCE Artifacts in SDMN

A modeler or modeling tool MAY extend a **SDMN** Model and add new types of *ModelArtifacts*. Any new *ModelArtifacts* SHALL follow the connection rules (listed below). **Associations** can be used to link *ModelArtifacts* to other Model elements.

Notation

The table below displays the graphical elements of **SCE**'s Model Artifacts:

Table 12. Shared Data Model Graphical Elements

Element	Description	Notation
Association	An **Association** is used to associate Model Artifacts (often **Text Annotations**) or model elements to other model elements. The connection only specifies that there is some relationship between the two elements, but no model semantics are implied. An **Association** is line that is drawn with a dotted single line. An angle 30° arrowhead may optionally be added to either end of the line.	
Group	The **Group** object is a Model Artifact that provides a visual mechanism to group elements of a Model informally. **Groups** are often used to highlight certain sections of a Model without adding additional semantics. The highlighted (grouped) section of the Model can be separated for reporting and analysis purposes. A **Group** is a rounded corner rectangle that is drawn with a solid dashed and dotted line (see figure to the right).	
Text Annotation	**Text Annotations** are a mechanism for a modeler to provide additional information for the reader of a **SDMN** Model. An **Association** may be used to connect user-defined text (a **Text Annotation**) with a Model element. A **Text Annotation** is an open rectangle that is drawn with a solid single line (see figure to the right).	

Model Artifact Connection Rules

The following statements define connection rules for a *ModelArtifact*:

- A *ModelArtifact* SHALL NOT be a target for a **CompositionConnector**, a **ContainmentConnector**, a **DataAssociation**, or a **ReferenceConnector**.
- A *ModelArtifact* SHALL NOT be a source for a **CompositionConnector**, a **ContainmentConnector**, a **DataAssociation**, or a **ReferenceConnector**.

11 Mapping to BPM+ Models

The elements of **SDMN**, especially **DataItems** and *ItemDefintions*, are intended for use by **BPMN**, **CMMN**, and **DMN** models. There are differences between the way data is used and defined across these three types of models. Thus, if **SDMN** is going to support all of them, then the **SDMN** must in fact define data elements as a super-set of the capabilities of the other three models.

The following sub-sections define any mappings required for **SDMN** data elements to be imported into the other **BPM+** models.

11.1 Element Terminology Mapping to BPM+ Element Terminology

The following table defines the mapping for terms across the **BPM+** languages and **SDMN**:

Table 13. Mapping to BPMN

SDMN Element	BPMN Element	CMMN Element	DMN Element
Containment Connector	N/A	N/A	N/A
Composition Connector	N/A	N/A	N/A
Data Association	Data Association	N/A	N/A
DataItem	Item Aware Element (Data Object, Data Object Reference, Data Input, Data Output, Data Store, Data Store Reference, Property)	Case File Item	Information Item (Data Input, Decision Output)
ItemDefinition	ItemDefinition	CaseFileItemDefinition	ItemDefinition
ItemKind	ItemKind	definitionType	N/A
isCollection	isCollection	N/A	isCollection
Multiplicity	N/A	multiplicity	N/A
Pre-Assignment	N/A	N/A	N/A
Reference Connector	N/A	N/A	N/A
SharedDataModel	Definitions	Definitions	Definitions

11.2 BPMN

This section provides mapping from **SDMN** to **BPMN**.

ItemKind Mapping

The following table defines the mapping from **SDMN** *ItemKind* instances to **BPMN** itemKind literals:

Table 14. ItemKind Mapping

SDMN ItemKinds	BPMN itemKind Literals
Conceptual	Information (this is to allow a formal documentation of the characteristics of the `Conceptual` **DataItem**.)
Information	Information
Document	Information
Folder	Information
Physical	Physical
Relationship	Information
UMLClass	Information
Unknown	Information
Unspecified	Information

WSDLMessage	Information
XSDComplexType	Information
XSDElement	Information
XSDSimpleType	Information

Element Mapping

The following table defines the mapping from **SDMN** elements and attributes to **BPMN**:

Table 15. Mapping to BPMN

SDMN Element/Attribute	BPMN Element/Attribute
DataItem (not ItemKind Folder)	Data Object
DataItem (ItemKind Folder)	N/A
Item Definition	Item Definition If the *ItemDefinition* for a **DataItem** is of type `definitionRef`, then the *ItemDefinition* will mapped to a **BPMN** *ItemDefinition* for an Data Object. If the *ItemDefinition* for a **DataItem** is of type `metaDefinitionRef`, then the contents of the *ItemDefinition* will be ignored. There is no equivalent in **BPMN**. A separate *ItemDefinition* will not be created.
DataItem/preAssignment	N/A Although imlementations of **BPMN** could establish an activity at the beginning of the process that fills the output Data Object with the values listed in the pre-assignment.

11.3 CMMN

This section provides mapping from **SDMN** to **CMMN**.

ItemKind Mapping

The following table defines the mapping from **SDMN** *ItemKind* instances to the **CMMN** definitionType property:

Table 16. ItemKind Literals

SDMN itemKind Literals	CMMN itemKind Literals
Conceptual	Unknown
Information	Unspecified
Document	Document in CMIS
Folder	Folder in CMIS
Physical	Unspecified

Relationship	Relationship in CMIS
UMLClass	Unspecified
Unknown	Unknown
Unspecified	Unspecified
WSDLMessage	WSDLMessage
XSDComplexType	XML Schema Complex Type
XSDElement	XML-Schema Element
XSDSimpleType	XML Schema Simple Type

Element Mapping

The following table defines the mapping from **SDMN** elements and attributes to **CMMN**:

Table 17. Mapping to CMMN

SDMN Element/Attribute	CMMN Element/Attribute
DataItem (not ItemKind Folder)	CaseFileItem (not ItemKind Folder)
DataItem (ItemKind Folder)	CaseFileItem (ItemKind Folder)
Item Definition	CaseFileItemDefinition If the *ItemDefinition* for a **DataItem** is of type `definitionRef`, then the *ItemDefinition* will mapped to a **CMMN** *ItemDefinition* for an CaseFileItem. If the *ItemDefinition* for a **DataItem** is of type `metaDefinitionRef`, then the simple types of the *ItemDefinition* will mapped to **CMMN** properties for an CaseFileItem.
DataItem/preAssignment	N/A

11.4 DMN

This section provides mapping from **SDMN** to **DMN**.

Element Mapping

The following table defines the mapping from **SDMN** elements and attributes to **DMN**:

Table 18. Mapping to DMN

SDMN Element/Attribute	DMN Element/Attribute
DataItem (not ItemKind Folder)	InformationItem
DataItem (ItemKind Folder)	N/A

Item Definition	Item Definition If the *ItemDefinition* for a InformationItem is of type `definitionRef`, then the *ItemDefinition* will mapped to a **DMN** *ItemDefinition* for an InformationItem. If the *ItemDefinition* for a **DataItem** is of type `metaDefinitionRef`, then the contents of the *ItemDefinition* will be ignored. There is no equivalent in **DMN**. A separate *ItemDefinition* will not be created.
DataItem/ItemKind	N/A
DataItem/preAssignment	N/A

12 SDMN Examples

12.1 Hello Patient

The following figure provides an example of how a **SDMN** Data Item Diagram could look. It is based on a sample use case named “Hello Patient”, which is a visit to a doctor’s office (which is **BPM+** modeling technique for representing clinical guidelines). The **DataItems** in the model support the data elements of the Process, Case, and Decision models that define the behavioral components of the Knowledge Package.

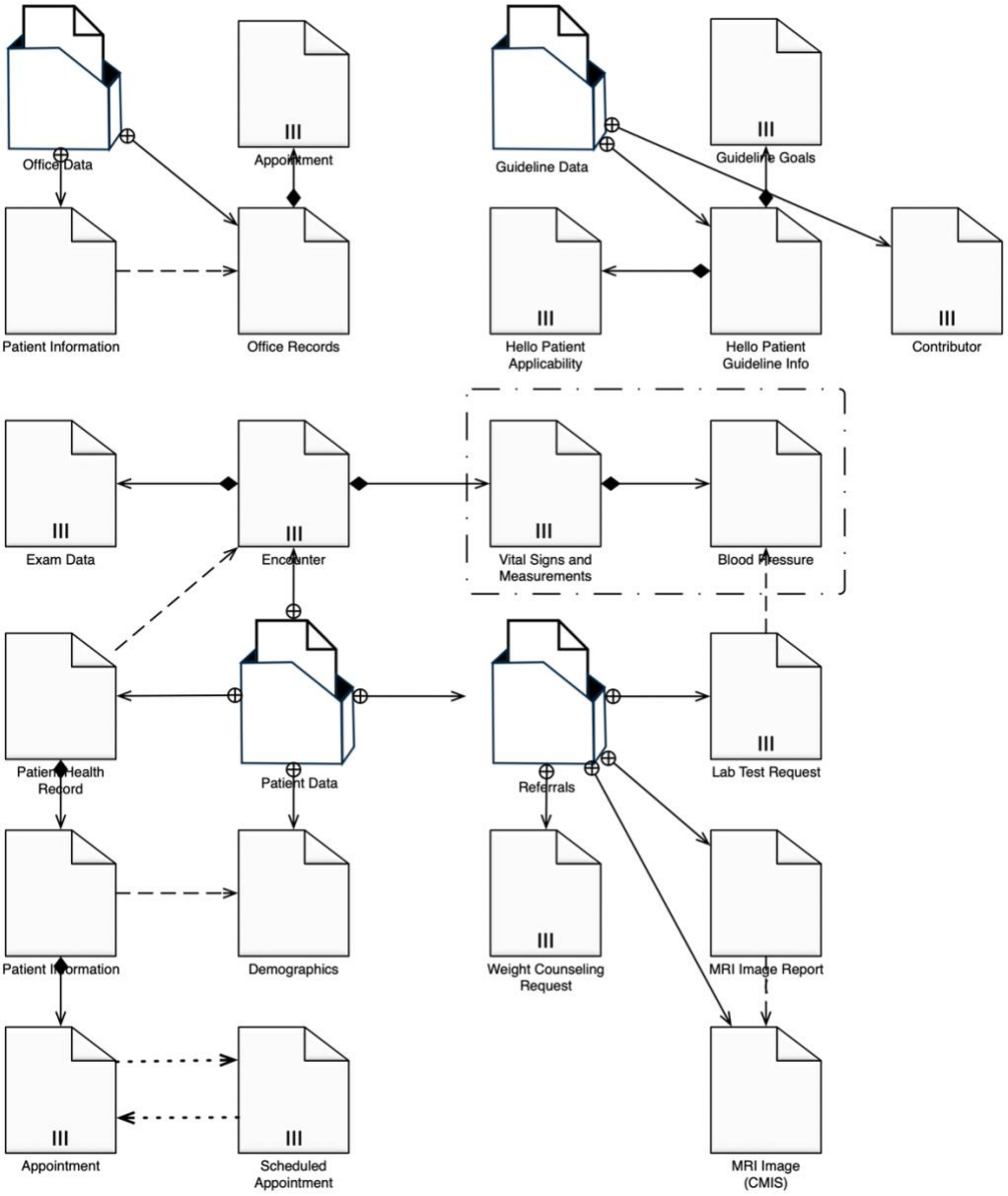


Figure 23 - An Example of How a SDMN DataItem Diagram

The following table lists the data elements used by the **BPM+** models.

Table 19. List of Data Elements used by the BPM+ Models in the Hello Patient Use Case

Cases	Decision Services	Processes
1. Appointment **2. Blood Pressure** 3. Blood Pressure Goal 4. BMI Category **5. Contributor** **6. Encounter** **7. Exam Data** **8. Guideline Goals** 9. Health Conditions **10. Hello Patient Applicable** **11. Lab Test Request** 12. Medication 13. Medication Tolerances **14. MRI Image** **15. MRI Image Report** **16. Office Data** **17. Office Records** 18. Pathway Goals **19. Patient Data** **20. Patient Health Record** **21. Patient Information** **22. Referrals** **23. Scheduled Appointment** 24. Treatment Plan **25. Vital Signs and Measurements** **26. Weight Counseling Request**	**1. Blood Pressure** 2. Blood Pressure Goal 3. Blood Pressure Rating 4. BMI Category **5. Demographics** **6. Exam Data** 7. Health Conditions 8. Medication 9. Medication Tolerances 10. Pathway Goals 11. Patient Complaints **12. Patient Health Record** 13. Referral 14. Treatment Plan 15. Treatment Choice **16. Vital Signs and Measurements** **17. Weight Counseling Request** 18. Weight Counseling Request Choice	**1. Appointment** **2. Blood Pressure** 3. Blood Pressure Goal 4. Blood Pressure Rating 5. BMI Category **6. Contributor** **7. Demographics** **8. Encounter** **9. Exam Data** 10. Health Conditions **11. Hello Patient Applicable** **12. Hello Patient Guideline Goals** **13. Lab Test Request** 14. Loop Counter 15. Medication 16. Medication Tolerances **17. MRI Image** **18. MRI Image Report** **19. Office Records** 20. Pathway Goals 21. Patient Complaints **22. Patient Health Record** **23. Patient Information** 24. Referral **25. Scheduled Appointment** 26. Treatment Plan 27. Treatment Choice **28. Vital Signs and Measurements** **29. Weight Counseling Request** 30. Weight Counseling Request Choice

Note that the data elements listed in **bold** in the table are those that appear in the **SDMN** model.

SDMN introduces a diagrammatic description of **ItemDefinitions** (types). **ItemDefinitions** are boxes with two or more sections. The top section will display the `name` of the **ItemDefinition**.

For simple type elements, a single section, below the `name`, will list `type` of the element and any defined `allowedValues` of that `type` (see "tEthinicity" in the figure below).

If the element is a structure with multiple sub-elements, then each sub-element will be listed in a divided section where the of the sub-element is on the left (the `name` section) and the `type` and `allowedValues` are on the right (the `type` section – see "tPatient_Health_Record", which has four sub-elements, in the figure below).

If the **ItemDefinition** has a sub-element where the `type` is a sub-structure through an `itemComponent`, the sub-structure will be defined in a separate **ItemDefinition** and there will be a composition relationship line from the `type` section of the sub-element to the top-level `name` section of the sub-structure **ItemDefinition** (see the connection between "tPatient_Health_Record" and "tPatient_Health_Record.Appointment" in the figure below). The sub-structure, although shown as a separate **ItemDefinition** in the diagram is fully contained within (is part of) the main element and cannot be re-used by other **ItemDefinitions** (e.g., as for "tPatient_Health_Record"). That is why the `type` section is empty since the contents of the `type` are displayed in a separate **ItemDefinition**.

If the **ItemDefinition** has a sub-element where the `type` is a referenced structure through a `typeRef`, the sub-structure will be defined in a separate **ItemDefinition** and there will be a reference relationship line from the `type` section of the sub-element to the top-level `name` section of the referenced structure **ItemDefinition** (see the connection between "tPatient_Health_Record" and "tDemographics" in the figure below). The referenced structure, shown as a separate **ItemDefinition** in the diagram does extend the structure within the main element (e.g., as for "tPatient_Health_Record") but the referenced **ItemDefinition** exists on its own and can be referenced by other **ItemDefinitions**. The `typeref` section for the sub-element of the source **ItemDefinition** will also display the `name` of the referenced **ItemDefinition**.

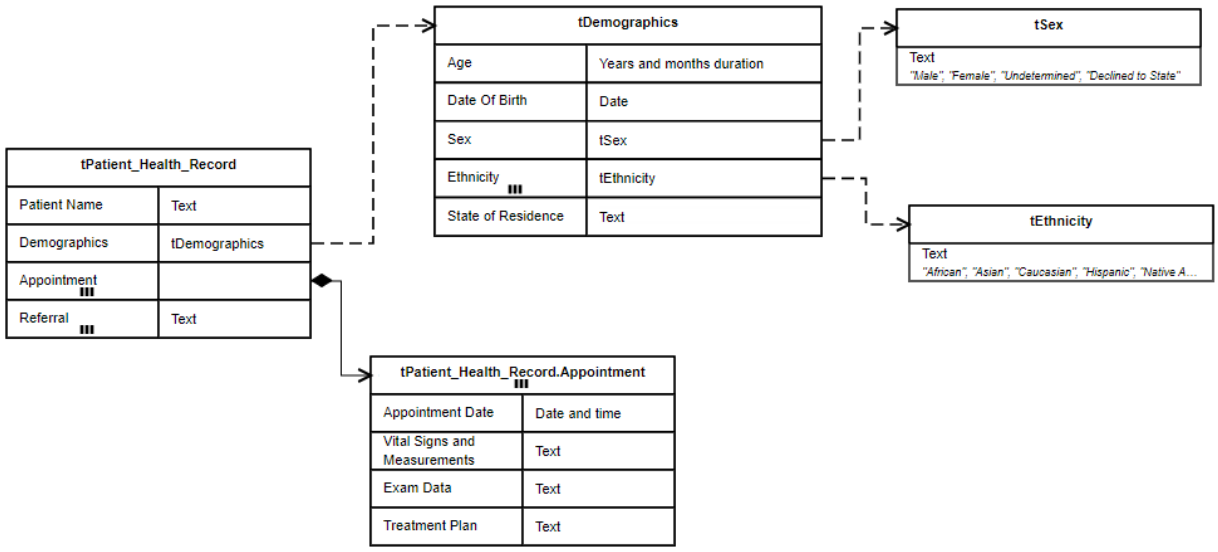


Figure 24 - ItemDefinition Diagram Example

13 Exchange Formats

13.1 Interchanging Incomplete Models

In practice, it is common for models to be interchanged before they are complete. This occurs frequently when doing iterative modeling, where one user (such as a subject matter expert or business person) first defines a high-level model, and then passes it on to another user to be completed and refined.

Such "incomplete" models are ones in which all of the mandatory attributes have not yet been filled in, or the cardinality lowerbound of attributes and associations has not been satisfied.

XMI allows for the interchange of such incomplete models. In **SDMN**, we extend this capability to interchange of XML files based on the **SDMN XSD**. In such XML files, implementers are expected to support this interchange by:

- Disregarding missing attributes that are marked as 'required' in the XSD.
- Reducing the lower bound of elements with 'minOccurs' greater than 0.

13.2 XSD

13.2.1 Document Structure

A domain-specific set of model elements is interchanged in one or more **SDMN** files. The root element of each file SHALL be `<sdmn:sharedDataModel>`. The set of files SHALL be self-contained, i.e., all definitions that are

used in a file SHALL be imported directly or indirectly using the `<sce:import>` element.

Each file SHALL declare a "`targetNamespace`" that MAY differ between multiple files of one model.

The XML namespace URI for SDMN 1.0 and backwards-compatible 1.x versions of SDMN is fixed at: https://www.omg.org/spec/SDMN/
In addition, SDMN XML files MUST use the mechanism for identifying and handling XML schema versions based on xsi:schemaLocation that is defined in the SCE specification.

13.2.2 References within the SDMN XSD

Many **SDMN** elements that may need to be referenced contain IDs and within the **SDMN** XSD, references to elements are expressed via these IDs. The XSD IDREF type is the traditional mechanism for referencing by IDs, however it can only reference an element within the same file. **SDMN** elements that inherit from **SCE** *RootElement* referencing by ID, across files, by utilizing QNames. A QName consists of two parts: an optional namespace prefix and a local part. When used to reference a SDMN element, the local part is expected to be the id of the referenced SDMN element.

Attribute typeRef references ItemDefinitions and built-in types by name not ID. In order to support imported types, typeRef uses the namespace-qualified name syntax [qualifier].[local-name], where qualifier is specified by the name attribute of the Import element for the imported type. If the referenced type is not imported, the prefix SHALL be omitted.

14 SDMN Diagram Interchange (SDMN DI)

14.1 Scope

This chapter specifies the meta-model and schema for **SDMN** Diagram Interchange (**SDMN DI**). The **SDMN DI** is meant to facilitate the interchange of **SDMN** diagrams between tools rather than being used for internal diagram representation by the tools. The simplest interchange approach to ensure the unambiguous rendering of a **SDMN** diagram was chosen for **SDMN DI**. This includes the direct re-use of **SCE DI** elements (see the **SCE** specification) without the need to create additional classes in **SDMN**. As such, **SDMN DI** does not aim to preserve or interchange any "tool smarts" between the source and target tools (e.g., layout smarts, efficient styling, etc.).

SDMN DI does not ascertain that the **SDMN** diagram is syntactically or semantically correct.

14.2 Diagram Definition and Interchange

The **SDMN DI** utilizes the **SCE DI** (see the **SCE 1.0** specification), which is harmonized with the OMG Diagram Definition (DD) standard version 1.1. The referenced DD contains two main parts: the Diagram Commons (DC) and the Diagram Interchange (DI). The DC defines common types like bounds and points, while the DI provides a framework for defining domain-specific diagram models.

The focus of **SDMN DI** is the interchange of laid out shapes and edges that constitute a **SDMN** diagram. Each shape and edge references a particular **SDMN** model element. The referenced **SDMN** model elements are all part of the actual **SDMN** model. As such, **SDMN DI** is meant to only contain information that is neither present nor derivable, from the **SDMN** model whenever possible. Simply put, to render a **SDMN** diagram both the **SDMN DI** instance(s) and the referenced **SDMN** model are REQUIRED.

From the **SDMN DI** perspective, a **SDMN** diagram is a particular snapshot of a **SDMN** model at a certain point in time. Multiple **SDMN** diagrams can be exchanged referencing model elements from the same **SDMN** model. Each diagram may provide an incomplete or partial depiction of the content of the **SDMN** model. As described in Clause 13, a **SDMN** model package consists of one or more files. Each file may contain any number of **SDMN** diagrams. The exporting tool is free to decide how many diagrams are exported and the importing tool is free to decide if and how to present the contained diagrams to the user.

14.3 SDMN Diagram Interchange Meta-Model

14.3.1 How to read this Chapter

Clause 14.3.4 describes in detail the meta-model used to keep the layout and the look of **SCE** Diagrams (as a basis for **SDMN** Diagrams). Clause 14.3.5 presents in tables a library of the **SCE** element depictions and an unambiguous resolution between a referenced **SDMN** model element and its depiction

14.3.2 Overview

The **SDMN DI**, which utilizes the **SCE DI**, is an instance of the OMG **DI** meta-model. The basic concept of **SDMN DI**, as with diagram interchange in general, is that serializing a diagram [*SCEDiagram*] for interchange requires the specification of a collection of shapes [*SCEShape*] and edges [*SCEEdge*].

The **SCE DI** classes only define the visual properties used for depiction. All other properties that are REQUIRED for the unambiguous depiction of the **SDMN** element are derived from the referenced **SDMN** element [*SCEDiagramElement*].

SDMN diagrams may be an incomplete or partial depiction of the content of the **SDMN** model. Some **SDMN** elements from a **SDMN** model may not be present in any of the diagram instances being interchanged.

SDMN DI does not directly provide for any containment concept. The *SCEDiagram* is an ordered collection of mixed *SCEShape*(s) and *SCEEdge*(s). The order of the *SCEShape*(s) and *SCEEdge*(s) inside a *SCEDiagram* determines their Z-order (i.e., what is in front of what). *SCEShape*(s) and *SCEEdge*(s) that are *SCEEdge*(s) MUST appear after them in the *SCEDiagram*. Thus, the exporting tool MUST order all *SCEShape*(s) and *SCEEdge*(s) such that the desired depiction can be rendered.

14.3.3 Measurement Unit

As per OMG DD, all coordinates and lengths defined by **SDMN DI** are assumed to be in user units, except when specified otherwise. A user unit is a value in the user coordinate system, which initially (before any transformation is applied) aligns with the device's coordinate system (for example, a pixel grid of a display). A user unit, therefore, represents a logical rather than physical measurement unit. Since some applications might specify a physical dimension for a diagram as well (mainly for printing purposes), a mapping from a user unit to a physical unit can be specified as a diagram's resolution. Inch is chosen in this specification to avoid variability, but tools can easily convert from/to other preferred physical units. Resolution specifies how many user units fit within one physical unit (for example, a resolution of 300 specifies that 300 user units fit within 1 inch on the device).

14.3.4 Elements

The following sections define the elements necessary for exchanging the diagrams from an **SDMN** modeling tool.

14.3.4.1 SDMN DI

SDMN DI doesn't have any defined elements, but uses the elements provided by **SCEDI** (see **Error! Reference source not found.** to see how **SCEDI** is structured in the overall **SDMN** metamodel). However, it should be noted that the use of the *SCEDiagramElement* class (see the figure below) should be restricted for **SDMN**. That is, the `elementRef` association for *SCEDiagramElement* should be restricted to include only the concrete sub-classes of *BaseElement* that are in the *SharedDataModel* (i.e., **SDMN** model elements, such as **DataItems**, etc.).

14.3.5 Notation

As a specification that contains notation, **SDMN** specifies the depiction for **SDMN** diagram elements, including **SCE** *DiagramArtifact* elements [OMG doc number bmi-2021-12-09].

Serializing a **SDMN** diagram for interchange requires the specification of a collection of *SCEShape*(s) and *SCEEdge*(s) in the *SCEDiagram* (see sections above). The *SCEShape*(s) and *SCEEdge*(s) attributes must be populated in such a way as to allow the unambiguous rendering of the **SDMN** diagram by the receiving party. More specifically, the *SCEShape*(s) and *SCEEdge*(s) MUST reference **SDMN** model elements. If no *BaseElement* is

referenced or if the reference is invalid, it is expected that this shape or edge should not be depicted.

When rendering a **SDMN** diagram, the correct depiction of a *SCEShape* or *SCEEdge* depends mainly on the referenced **SDMN** model element and its particular attributes and/or references. The purpose of this clause is to: provide a library of the **SDMN** element depictions, and to provide an unambiguous resolution between the referenced **SDMN** model element [*BaseElement*] and their depiction. Depiction resolution tables are provided below for both *SCEShape* and *SCEEdge*.

14.3.5.1 Labels

Both *SCEShape* and *SCEEdge* may have labels (its name attribute) placed on the shape/edge, or above or below the shape/edge, in any direction or location, depending on the preference of the modeler or modeling tool vendor.

Labels are optional for *SCEShape* and *SCEEdge*. When there is a label, the position of the label is specified by the bounds of the *SCELabel* of the *SCEShape* or *SCEEdge*. Simply put, label visibility is defined by the presence of the *SCELabel* element.

The bounds of the *SCELabel* are optional and always relative to the containing *SCEDiagram's* origin point. The depiction resolution tables provided below exemplify default label positions if no bounds are provided for the *SCELabel* (for *SCEShape* kinds and *SCEEdge* kinds (see sections above)).

When the *SCELabel* is contained in a *SCEShape*, the text to display is the name of the *BaseElement*.

14.3.5.2 SDMNShape Resolution

SCEShape can be used to represent a **DataItem** or an **ItemDefinition**.

DataItems

A **DataItem** is represented in a **SDMN** Diagram as one of two possible shapes.

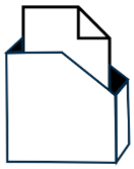
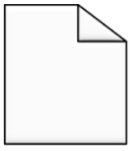
If the **DataItem**'s type is a Folder, then it is displayed with a folder shape (see table below, first row). These **DataItems** are will only be used within a **CMMN** diagram (outside of a **SDMN** diagram) although they will be displayed like any other CaseFileItem.

If the **DataItem**'s type is not a Folder (i.e., any other type of **DataItem**), then it is displayed with a document shape (see table below, second row). These type of **DataItems** can be used in **BPMN**, **CMMN**, and **DMN** diagrams. The **SDMN** shape for these **DataItems** match the shape used in **BPMN** and **CMMN**, but **DMN** uses a lozenge shape for its Data Inputs.

*Note that the **DataItem** type is determined by the **DataItem**'s associated ItemDefinition.*

The following table presents the depiction resolutions for **DataItems**:

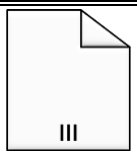
Table 20. Depiction Resolution of DataItems

SDMNElement	SDMNShape Attributes	Depiction
DataItem (Folder)	Shapes of **DataItem** that have itemKind=Folder	
DataItem (not Folder)	Shapes of **DataItem** that have itemKind!=Folder	

Multiplicity/Collection Decorator

The following table presents the depiction resolutions for the Multiplicity/Collection Decorator:

Table 21. Multiplicity/Collection Decorator Depiction

DataItem Attribute	Depiction
Multiplicity = ZeroOrMore or OneOrMore or isCollection = true	

ItemDefinitions

An **ItemDefinition** is represented in a **SDMN** Diagram as one of two possible shapes, depending on if the **ItemDefinition** has an `itemComponent` defined.

The following table presents the depiction resolutions for **Itemdefinitions**:

Table 22. Depiction Resolution of ItemDefinitions

SDMNElement	SDMNShape Attributes	Depiction
ItemDefinition	No **SDMNComponent** present	**Label** typeRef allowedValues
ItemDefinition	With 1 or more **itemComponent**	**Label** itemComponent name | typeRef allowedValues

14.3.5.3 SDMNEdge Resolution

SCEEdge can be used to represent an Ownership Connector, Parent-Child Connector, Relationship Connector, or a Data Association.

CompositionConnector

The following table presents the depiction resolutions for a **CompositionConnector**:

Table 23. Depiction Resolution of the CompositionConnector

SDMN Element	Depiction
CompositionConnector	

The following table presents the depiction resolutions for a **CompositionConnector**:

Table 24. Depiction Resolution of the itemComponent of an ItemDefinition

SDMN Element	Depiction
itemComponent with sub-components	

ContainmentConnector

The following table presents the depiction resolutions for a **ContainmentConnector** :

Table 25. Depiction Resolution of the ContainmentConnector

SDMN Element	Depiction
ContainmentConnector	

DataAssociation

The following table presents the depiction resolutions for a **DataAssociation**:

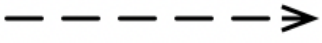
Table 26. Depiction Resolution of DataAssociation

SDMN Element	Depiction
DataAssociation	

ReferenceConnector

The following table presents the depiction resolutions for a **ReferenceConnector** between two **DataItems**:

Table 27. Depiction Resolution of the ReferenceConnector

SDMN Element	Depiction
ReferenceConnector	

The following table presents the depiction resolutions for a **ReferenceConnector** between two **ItemDefinitions**:

Table 28. Depiction Resolution of the typeRef attribute of an ItemComponent

SDMN Element	Depiction
itemComponent that contains a typeRef