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Information technology — Object Management Group Business Process Model and Notation

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Foreword

ISO (the International Organization for Standardization) and IEC (the International Electrotechnical Commission) form the specialized system for worldwide standardization. National bodies that are members of ISO or IEC participate in the development of International Standards through technical committees established by the respective organization to deal with particular fields of technical activity. ISO and IEC technical committees collaborate in fields of mutual interest. Other international organizations, governmental and non-governmental, in liaison with ISO and IEC, also take part in the work. In the field of information technology, ISO and IEC have established a joint technical committee, ISO/IEC JTC 1.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of the joint technical committee is to prepare International Standards. Draft International Standards adopted by the joint technical committee are circulated to national bodies for voting. Publication as an International Standard requires approval by at least 75 % of the national bodies casting a vote.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO and IEC shall not be held responsible for identifying any or all such patent rights.

ISO/IEC 19510 was prepared by the Object Management Group (OMG), as the OMG Business Process Model and Notation (BPMN), version 2.0.1, and was adopted, under the PAS procedure, by Joint Technical Committee ISO/IEC JTC 1, *Information technology*, in parallel with its approval by national bodies of ISO and IEC.

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Introduction

The primary goal of BPMN is to provide a notation that is readily understandable by all business users, from the business analysts that create the initial drafts of the processes, to the technical developers responsible for implementing the technology that will perform those processes, and finally, to the business people who will manage and monitor those processes. Thus, BPMN creates a standardized bridge for the gap between the business process design and process implementation.

This specification represents the amalgamation of best practices within the business modeling community to define the notation and semantics of Collaboration diagrams, Process diagrams, and Choreography diagrams. The intent of BPMN is to standardize a business process model and notation in the face of many different modeling notations and viewpoints. In doing so, BPMN will provide a simple means of communicating process information to other business users, process implementers, customers, and suppliers.

The specification provided by this International Standard is identical to OMG BPMN 2.0.1.

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INTERNATIONAL STANDARD ISO/IEC 19510:2013(E)

Information technology - Object Management Group Business Process Model and Notation

1 Scope

1.1 General

The **Object Management Group** (OMG) has developed a standard **Business Process Model and Notation** (**BPMN**). The primary goal of **BPMN** is to provide a notation that is readily understandable by all business users, from the business analysts that create the initial drafts of the processes, to the technical developers responsible for implementing the technology that will perform those processes, and finally, to the business people who will manage and monitor those processes. Thus, **BPMN** creates a standardized bridge for the gap between the business process design and process implementation.

Another goal, but no less important, is to ensure that XML languages designed for the execution of business processes, such as **WSBPEL** (Web Services Business Process Execution Language), can be visualized with a business-oriented notation.

This International Standard represents the amalgamation of best practices within the business modeling community to define the notation and semantics of **Collaboration** diagrams, **Process** diagrams, and **Choreography** diagrams. The intent of **BPMN** is to standardize a business process model and notation in the face of many different modeling notations and viewpoints. In doing so, **BPMN** will provide a simple means of communicating process information to other business users, process implementers, customers, and suppliers.

The membership of the OMG has brought forth expertise and experience with many existing notations and has sought to consolidate the best ideas from these divergent notations into a single standard notation. Examples of other notations or methodologies that were reviewed are UML Activity Diagram, UML EDOC Business Processes, IDEF, ebXML BPSS, Activity-Decision Flow (ADF) Diagram, RosettaNet, LOVeM, and Event-Process Chains (EPCs).

2 Conformance

2.1 General

Software can claim compliance or conformance with **BPMN 2.0** if and only if the software fully matches the applicable compliance points as stated in the International Standard. Software developed only partially matching the applicable compliance points can claim only that the software was based on this International Standard, but cannot claim compliance or conformance with this International Standard. The International Standard defines four types of conformance namely **Process Modeling Conformance**, **Process Execution Conformance**, **BPEL Process Execution Conformance**, and **Choreography Modeling Conformance**.

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The implementation claiming conformance to **Process Modeling Conformance** type is NOT REQUIRED to support **Choreography Modeling Conformance** type and vice-versa. Similarly, the implementation claiming **Process Execution Conformance** type is NOT REQUIRED to be conformant to the **Process Modeling** and **Choreography Conformance** types.

The implementation claiming conformance to the **Process Modeling Conformance type** SHALL comply with all of the requirements set forth in sub clause 2.1. The implementation claiming conformance to the **Process Execution Conformance type** SHALL comply with all of the requirements set forth in sub clause 2.2. The implementation claiming conformance to the **BPEL Process Execution Semantics Conformance type** SHALL comply with all of the requirements set forth in sub clause 2.3. The implementation claiming conformance to the **Choreography Conformance type** SHALL comply with all of the requirements set forth in sub clause 2.4. The implementation is said to have **BPMN Complete Conformance** if it complies with all of the requirements stated in sub clauses 2.1, 2.2, 2.3, and 2.4.

2.2 Process Modeling Conformance

The next eight sub clauses describe **Process Modeling Conformance**.

2.2.1 BPMN Process Types

The implementations claiming **Process Modeling Conformance** MUST support the following **BPMN** packages:

- The **BPMN** core elements, which include those defined in the *Infrastructure*, *Foundation*, *Common*, and *Service* packages (see Clause 8).
- **Process** diagrams, which include the elements defined in the **Process**, **Activities**, *Data*, and *Human Interaction* packages (see Clause 10).
- **Collaboration** diagrams, which include **Pools** and **Message Flow** (see Clause 9).
- **Conversation** diagrams, which include **Pools**, **Conversations**, and **Conversation Links** (see Clause 9).

As an alternative to full **Process Modeling Conformance**, there are three conformance sub-classes defined:

- **Descriptive**
- **Analytic**
- **Common Executable**

Descriptive is concerned with visible elements and attributes used in high-level modeling. It should be comfortable for analysts who have used BPA flowcharting tools.

Analytic contains all of **Descriptive** and in total about half of the constructs in the full **Process Modeling Conformance** Class. It is based on experience gathered in BPMN training and an analysis of user-patterns in the Department of Defense Architecture Framework and planned standardization for that framework.

Both **Descriptive** and **Analytic** focus on visible elements and a minimal subset of supporting attributes/elements.

Common Executable focuses on what is needed for executable process models.

Elements and attributes not in these sub-classes are contained in the full **Process Modeling Conformance** class.

The elements for each sub-class are defined in the next sub clause.

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2.2.2 BPMN Process Elements

The **Process Modeling Conformance** type set consists of **Collaboration** and **Process** diagram elements, including all **Task** types, *embedded* **Sub-Processes**, **CallActivity**, all **Gateway** types, all **Event** types (**Start**, **Intermediate**, and **End**), **Lane**, *Participants*, **Data Object** (including **DataInput** and **DataOutput**), **Message**, **Group**, **Text Annotation**, **Sequence Flow** (including *conditional* and *default* flows), **Message Flow**, **Conversations** (limited to grouping **Message Flow**, and associating *correlations*), *Correlation*, and **Association** (including **Compensation Association**). The set also includes markers (**Loop**, **Multi-Instance**, **Transaction**, **Compensation**) for **Tasks** and *embedded* **Sub-Processes**).

NOTE: Implementations are not expected to support **Choreography** modeling elements such as **Choreography Task** and **Sub-Choreography**.

For a tool to claim support for a sub-class the following criteria MUST be satisfied:

- All the elements in the sub-class MUST be supported.
- For each element, all the listed attributes MUST be supported.
- In general, if the sub-class doesn't mention an attribute and it is NOT REQUIRED by the schema, then it is not in the subclass. Exceptions to this rule are noted.

Descriptive Conformance Sub-Class

The **Descriptive** conformance sub-class elements are shown in Table 2.1.

Table 2.1 – Descriptive Conformance Sub-Class Elements and Attributes

Element	Attributes
participant (pool)	id, name, processRef
laneSet	id, lane with name, childLaneSet, flowElementRef
sequenceFlow (unconditional)	id, name, sourceRef, targetRef
messageFlow	id, name, sourceRef, targetRef
exclusiveGateway	id, name
parallelGateway	id, name
task (None)	id, name
userTask	id, name
serviceTask	id, name
subProcess (expanded)	id, name, flowElement
subProcess (collapsed)	id, name, flowElement
CallActivity	id, name, calledElement
DataObject	id, name

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Table 2.1 – Descriptive Conformance Sub-Class Elements and Attributes

TextAnnotation	id, text
association/dataAssociation[a]	id, name, sourceRef, targetRef, associationDirection[b]
dataStoreReference	id, name, dataStoreRef
startEvent (None)	id, name
endEvent (None)	id, name
messageStartEvent	id, name, messageEventDefinition
messageEndEvent	id, name, messageEventDefinition
timerStartEvent	id, name, timerEventDefinition
terminateEndEvent	id, name, terminateEventDefinition
documentation[c]	text
Group	id, categoryRef

a. **Data Association** is ABSTRACT: **Data Input Association** and **Data Output Association** will appear in the XML serialization. These both have REQUIRED attributes [`sourceRef` and `targetRef`] which refer to `itemAwareElements`. To be consistent with the metamodel, this will require the following additional elements: `ioSpecification`, `inputSet`, `outputSet`, **Data Input**, **Data Output**. When a **BPMN** editor draws a **Data Association** to an **Activity** or **Event** it should generate this supporting invisible substructure. Otherwise, the metamodel would have to be changed to make `sourceRef` and `targetRef` optional or allow reference to non-`itemAwareElements`, e.g., **Activity** and **Event**.
b. `associationDirection` not specified for **Data Association**
c. `Documentation` is not a visible element. It is an attribute of most elements.

Analytic Conformance Sub-Class

The **Analytic** conformance sub-class contains all the elements of the **Descriptive** conformance sub-class plus the elements shown in Table 2.2.

Table 2.2 – Analytic Conformance Sub-Class Elements and Attributes

Element	Attributes
sequenceFlow (conditional)	id, name, sourceRef, targetRef, conditionExpression[a]
sequenceFlow (default)	id, name, sourceRef, targetRef, default[b]
sendTask	id, name
receiveTask	id, name
Looping Activity	standardLoopCharacteristics
MultiInstance Activity	multiInstanceLoopCharacteristics

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Table 2.2 – Analytic Conformance Sub-Class Elements and Attributes

exclusiveGateway	Add default attribute
inclusiveGateway	id, name, eventGatewayType
eventBasedGateway	id, name, eventGatewayType
Link catch/throw Intermediate Event	Id, name, linkEventDefinition
signalStartEvent	id, name, signalEventDefinition
signalEndEvent	id, name, signalEventDefinition
Catching message Intermediate Event	id, name, messageEventDefinition
Throwing message Intermediate Event	id, name, messageEventDefinition
Boundary message Intermediate Event	id, name, attachedToRef, messageEventDefinition
Non-interrupting Boundary message Intermediate Event	id, name, attachedToRef, cancelActivity=false, messageEventDefinition
Catching timer Intermediate Event	id, name, timerEventDefinition
Boundary timer Intermediate Event	id, name, attachedToRef, timerEventDefinition
Non-interrupting Boundary timer Intermediate Event	id, name, attachedToRef, cancelActivity=false, timerEventDefinition
Boundary error Intermediate Event	id, name, attachedToRef, errorEventDefinition
errorEndEvent	id, name, errorEventDefinition
Non-interrupting Boundary escalation Intermediate Event	id, name, attachedToRef, cancelActivity=false, escalationEventDefinition
Throwing escalation Intermediate Event	id, name, escalationEventDefinition
escalationEndEvent	id, name, escalationEventDefinition
Catching signal Intermediate Event	id, name, signalEventDefinition
Throwing signal Intermediate Event	id, name, signalEventDefinition
Boundary signal Intermediate Event	id, name, attachedToRef, signalEventDefinition
Non-interrupting Boundary signal Intermediate Event	id, name, attachedToRef, cancelActivity=false, signalEventDefinition
conditionalStartEvent	id, name, conditionalEventDefinition

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Table 2.2 – Analytic Conformance Sub-Class Elements and Attributes

Catching conditional Intermediate Event	id, name, conditionalEventDefinition
Boundary conditional Intermediate Event	id, name, conditionalEventDefinition
Non-interrupting Boundary conditional Intermediate Event	id, name, cancelActivity=false, conditionalEventDefinition
message[c]	id, name, add messageRef attribute to messageFlow

a. `ConditionExpression`, allowed only for **Sequence Flow** out of **Gateways**, MAY be null.
b. `Default` is an attribute of a `sourceRef` (exclusive or inclusive) **Gateway**.
c. Note that `messageRef`, an attribute of various message **Events**, is optional and not in the sub-class.

Common Executable Conformance Sub-Class

This conformance sub-class is intended for modeling tools that can emit executable models.

- Data type definition language MUST be XML Schema.
- Service Interface definition language MUST be WSDL.
- Data access language MUST be XPath.

The **Common Executable** conformance sub-class elements are shown in Table 2.3 and its supporting classes in Table 2.4.

Table 2.3 – Common Executable Conformance Sub-Class Elements and Attributes

Element	Attributes
sequenceFlow (unconditional)	id, (name), sourceRef[a], targetRef[b]
sequenceFlow (conditional)	id, name, sourceRef, targetRef, conditionExpression[c]
sequenceFlow (default)	id, name, sourceRef, targetRef, default[d]
subProcess (expanded)	id, name, flowElement, loopCharacteristics, boundaryEventRefs
exclusiveGateway	id, name, gatewayDirection (only converging and diverging), default
parallelGateway	id, name, gatewayDirection (only converging and diverging)
startEvent (None)	id, name
endEvent (None)	id, name
eventBasedGateway	id, name, gatewayDirection, eventGatewayType
userTask	id, name, renderings, implementation, resources, ioSpecification, dataInputAssociations, dataOutputAssociations, loopCharacteristics, boundaryEventRefs

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Table 2.3 – Common Executable Conformance Sub-Class Elements and Attributes

serviceTask	id, name, implementation, operationRef, ioSpecification, dataInputAssociations, dataOutputAssociations, loopCharacteristics, boundaryEventRefs
callActivity	id, name, calledElement, ioSpecification, dataInputAssociations, dataOutputAssociations, loopCharacteristics, boundaryEventRefs
dataObject	id, name, isCollection, itemSubjectRef
textAnnotation	id, text
dataAssociation	id, name, sourceRef, targetRef, assignment
messageStartEvent	id, name, messageEventDefinition (either ref or contained), dataOutput, dataOutputAssociations
messageEndEvent	id, name, messageEventDefinition, (either ref or contained), dataInput, dataInputAssociations
terminateEndEvent	(Terminating trigger in combination with one of the other end events)
Catching message Intermediate Event	id, name, messageEventDefinition (either ref or contained), dataOutput, dataOutputAssociations
Throwing message Intermediate Event	id, name, messageEventDefinition (either ref or contained), dataInput, dataInputAssociations
Catching timer Intermediate Event	id, name, timerEventDefinition (contained)
Boundary error Intermediate Event	id, name, attachedToRef, errorEventDefinition, (contained or referenced), dataOutput, dataOutputAssociations

a. Multiple outgoing connections are only allowed for converging **Gateways**.
b. Multiple outgoing connections are only allowed for diverging **Gateways**.
c. `ConditionExpression`, allowed only for **Sequence Flow** out of **Gateways**, MAY be null.
d. `Default` is an attribute of a `sourceRef` (exclusive or inclusive) **Gateway**.

Table 2.4 – Common Executable Conformance Sub-Class Supporting Classes

Element	**Attributes**
StandardLoopCharacteristics	id, loopCondition
MultiInstanceLoopCharacteristics	id, isSequential, loopDataInput, inputDataItem
Rendering	
Resource	id, name
ResourceRole	id, resourceRef, resourceAssignmentExpression
InputOutputSpecification	id, dataInputs, dataOutputs
DataInput	id, name, isCollection, itemSubjectRef

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Table 2.4 – Common Executable Conformance Sub-Class Supporting Classes

DataOutput	id, name, isCollection, itemSubjectRef
ItemDefinition	id, structure or import[a]
Operation	id, name, inMessageRef, outMessageRef, errorRefs
Message	id, name, structureRef
Error	id, structureRef
Assignment	id, from, to[b]
MessageEventDefinition	id, messageRef, operationRef
TerminateEventDefinition	id
TimerEventDefinition	id, timeDate

a. Structure MUST be defined by an XSD Complex Type
b. Structure MUST be defined by an XSD Complex Type

2.2.3 Visual Appearance

A key element of **BPMN** is the choice of shapes and icons used for the graphical elements identified in this International Standard. The intent is to create a standard visual language that all process modelers will recognize and understand. An implementation that creates and displays **BPMN Process** Diagrams SHALL use the graphical elements, shapes, and markers illustrated in this International Standard.

NOTE: There is flexibility in the size, color, line style, and text positions of the defined graphical elements, except where otherwise specified (see page 41).

The following extensions to a **BPMN** Diagram are permitted:

- New markers or indicators MAY be added to the specified graphical elements. These markers or indicators could be used to highlight a specific attribute of a **BPMN** element or to represent a new subtype of the corresponding concept.
- A new shape representing a kind of **Artifact** MAY be added to a Diagram, but the new **Artifact** shape SHALL NOT conflict with the shape specified for any other **BPMN** element or marker.
- Graphical elements MAY be colored, and the coloring MAY have specified semantics that extend the information conveyed by the element as specified in this International 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 International Standard.
- An extension SHALL NOT change the specified shape of a defined graphical element or marker (e.g., changing a square into a triangle, or changing rounded corners into squared corners, etc.).

2.2.4 Structural Conformance

An implementation that creates and displays **BPMN** diagrams SHALL conform to the specifications and restrictions with respect to the connections and other diagrammatic relationships between graphical elements. Where permitted or requested connections are specified as conditional and based on attributes of the corresponding concepts, the implementation SHALL ensure the correspondence between the connections and the values of those attributes.

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NOTE: In general, these connections and relationships have specified semantic interpretations, which specify interactions among the process concepts represented by the graphical elements. Conditional relationships based on attributes represent specific variations in behavior. Structural conformance therefore guarantees the correct interpretation of the diagram as a specification of process, in terms of flows of control and information. Throughout the document, structural specifications will appear in paragraphs using a special shaped bullet: Example: ♦ A **TASK** MAY be a target for **Sequence Flow**; it can have multiple *incoming* Flows. An *incoming* Flow MAY be from an alternative path and/or parallel paths.

2.2.5 Process Semantics

This International Standard defines many semantic concepts used in defining **Processes**, and associates them with graphical elements, markers, and connections. To the extent that an implementation provides an interpretation of the **BPMN** diagram as a semantic specification of **Process**, the interpretation SHALL be consistent with the semantic interpretation herein specified. In other words, the implementation claiming **BPMN Process Modeling Conformance** has to support the semantics surrounding the diagram elements expressed in Clause 10.

NOTE: The implementations claiming **Process Modeling Conformance** are not expected to support the **BPMN** execution semantics described in Clause 13.

2.2.6 Attributes and Model Associations

This International Standard defines a number of attributes and properties of the semantic elements represented by the graphical elements, markers, and connections. Some of these attributes are purely representational and are so marked, and some have mandated representations. Some attributes are specified as mandatory, but have no representation or only optional representation. And some attributes are specified as optional. For every attribute or property that is specified as mandatory, a conforming implementation SHALL provide some mechanism by which values of that attribute or property can be created and displayed. This mechanism SHALL permit the user to create or view these values for each **BPMN** element specified to have that attribute or property. Where a graphical representation for that attribute or property is specified as REQUIRED, that graphical representation SHALL be used. Where a graphical representation for that attribute or property is specified as optional, the implementation MAY use either a graphical representation or some other mechanism. If a graphical representation is used, it SHALL be the representation specified. Where no graphical representation for that attribute or property is specified, the implementation MAY use either a graphical representation or some other mechanism. If a graphical representation is used, it SHALL NOT conflict with the specified graphical representation of any other **BPMN** element.

2.2.7 Extended and Optional Elements

A conforming implementation is NOT REQUIRED to support any element or attribute that is specified herein to be non-normative or informative. In each instance in which this International Standard defines a feature to be “optional,” it specifies whether the option is in:

- how the feature will be displayed,
- whether the feature will be displayed,
- whether the feature will be supported.

A conforming implementation is NOT REQUIRED to support any feature whose support is specified to be optional. If an implementation supports an optional feature, it SHALL support it as specified. A conforming implementation SHALL support any “optional” feature for which the option is only in whether or how it SHALL be displayed.

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2.2.8 Visual Interchange

One of the main goals of this International Standard is to provide an interchange format that can be used to exchange **BPMN** definitions (both domain model and diagram layout) between different tools. The implementation should support the metamodel for **Process** types specified in sub clause 13.1 to enable portability of process diagrams so that users can take business process definitions created in one vendor's environment and use them is another vendor's environment.

2.3 Process Execution Conformance

The next two sub clauses describe **Process Execution Conformance**.

2.3.1 Execution Semantics

The **BPMN** execution semantics have been fully formalized in this version of the International Standard. The tool claiming **BPMN Execution Conformance** type MUST fully support and interpret the operational semantics and **Activity** life-cycle specified in sub clause 14.2.2. Non-operational elements listed in Clause 14 MAY be ignored by implementations claiming **BPMN Execution Conformance** type. Conformant implementations MUST fully support and interpret the underlying metamodel.

NOTE: The tool claiming **Process Execution Conformance type** is not expected to support and interpret **Choreography** models. The tool claiming **Process Execution Conformance type** is not expected to support **Process Modeling Conformance**. More precisely, the tool is not required to support graphical syntax and semantics defined in this International Standard. It MAY use different graphical elements, shapes and markers, than those defined in this International Standard.

2.3.2 Import of Process Diagrams

The tool claiming **Process Execution Conformance type** MUST support import of **BPMN Process** diagram types including its definitional **Collaboration** (see Table 10.1).

2.4 BPEL Process Execution Conformance

Special type of Process Execution Conformance that supports the **BPMN** mapping to WS-BPEL as specified in sub clause 15.1 can claim **BPEL Process Execution Conformance**.

NOTE: The tool claiming **BPEL Process Execution Conformance** MUST fully support **Process Execution Conformance**. The tool claiming **BPEL Process Execution Conformance** is not expected to support and interpret **Choreography** models. The tool claiming **BPEL Process Execution Conformance** is not expected to support **Process Modeling Conformance**.

2.5 Choreography Modeling Conformance

The next five sub clauses describe **Choreography Conformance**.

2.5.1 BPMN Choreography Types

The implementations claiming **Choreography Conformance** type MUST support the following **BPMN** packages:

- The **BPMN** core elements, which include those defined in the Infrastructure, Foundation, Common, and Service packages (see Clause 8).

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- **Choreography** diagrams, which includes the elements defined in the **Choreography**, and **Choreography** packages (see Clause 11).
- **Collaboration** diagrams, which include **Pools** and **Message Flow** (see Clause 9).

2.5.2 BPMN Choreography Elements

The **Choreography Conformance** set includes **Message, Choreography Task**, **Global Choreography Task**, **Sub-Choreography** (expanded and collapsed), certain types of **Start Events** (e.g., **None**, **Timer**, **Conditional**, **Signal**, and **Multiple**), certain types of **Intermediate Events** (**None**, **Message** attached to **Activity** boundary, **Timer** – normal as well as attached to **Activity** boundary, **Timer** used in **Event Gateways**, **Cancel** attached to an **Activity** boundary, **Conditional**, **Signal**, **Multiple**, **Link**, etc.) and certain types of **End Events** (**None** and **Terminate**), and **Gateways**. In addition, to enable **Choreography** within **Collaboration** it should support **Pools** and **Message Flow**.

2.5.3 Visual Appearance

An implementation that creates and displays **BPMN Choreography** Diagrams SHALL use the graphical elements, shapes, and markers as specified in the **BPMN** International Standard. The use of text, color, size and lines for **Choreography** diagram types are listed in sub clause 7.4.

2.5.4 Choreography Semantics

The tool claiming **Choreography Conformance** should fully support and interpret the graphical and execution semantics surrounding **Choreography** diagram elements and **Choreography** diagram types.

2.5.5 Visual Interchange

The implementation should support import/export of **Choreography** diagram types and **Collaboration** diagram types that depict **Choreography** within **collaboration** as specified in sub clause 9.4 to enable portability of **Choreography** definitions, so that users can take **BPMN** definitions created in one vendor's environment and use them is another vendor's environment.

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2.6 Summary of BPMN Conformance Types

Table 2.5 summarizes the requirements for **BPMN** Conformance.

Table 2.5 – Types of BPMN Conformance

Category	Process Modeling Conformance	Process Execution Conformance	BPEL Process Execution Conformance	Choreography Conformance
Visual representation of BPMN Diagram Types	Process diagram types and Collaboration diagram types depicting collaborations among Process diagram types.	N/A	N/A	Choreography diagram types and Collaboration diagram types depicting collaboration among Choreography diagram types.
BPMN Diagram Elements that need to be supported.	All Task types, embedded Sub-Process, Call Activity, all Event types, all Gateway types, Pool, Lane, Data Object (including DataInput and DataOutput), Message, Group, Artifacts, markers for Tasks and Sub-Processes, Sequence Flow, Associations, and Message Flow.	N/A	N/A	Message, Choreography Task, Global Choreography Task, Sub-Choreography (expanded and collapsed), certain types of Start, Intermediate, and End Events, Gateways, Pools and Message Flow.
Import/Export of diagram types	Yes for Process and Collaboration diagrams that depict Process within Collaboration.	Yes for Process diagrams	Yes for Process diagrams	Yes for Choreography and Collaboration diagrams depicting choreography within Collaboration.
Support for Graphical syntax and semantics	Process and Collaboration diagrams that depict Process within Collaboration.	N/A	N/A	Choreography and Collaboration diagrams depicting Choreography within Collaboration.
Support for Execution Semantics	N/A	Yes for Process diagrams	Yes for Process diagrams	Choreography execution semantics

3 Normative References

3.1 General

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

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3.2 Normative

OMG UML

- OMG Unified Modeling Language (OMG UML), Superstructure, V2.1.2 - http://www.omg.org/spec/UML/2.1.2/Superstructure

OMG MOF

- Object Management Group - Meta Object Facility (MOF) Core Specification, V2.0 http://www.omg.org/spec/MOF/2.0

RFC-2119

- Key words for use in RFCs to Indicate Requirement Levels, S. Bradner, IETF RFC 2119, March 1997 http://www.ietf.org/rfc/rfc2119.txt

3.3 Non-Normative

Activity Service

- Additional Structuring Mechanism for the OTS Specification, OMG, June 1999 http://www.omg.org
- J2EE Activity Service for Extended Transactions (JSR 95), JCP http://www.jcp.org/jsr/detail/95.jsp

BPEL4People

- WS-BPEL Extension for People (BPEL4People) Specification Version 1.1, Committee Specification, 17 August 2010 http://docs.oasis-open.org/bpel4people/bpel4people-1.1-spec-cs-01.html

Business Process Definition Metamodel

- OMG, May 2008, http://www.omg.org/docs/dtc/08-05-07.pdf

Business Process Modeling

- Jean-Jacques Dubray, “A Novel Approach for Modeling Business Process Definitions,” 2002 http://www.ebpml.org/ebpml2.2.doc

Business Transaction Protocol

- OASIS BTP Technical Committee, June, 2002 http://www.oasis-open.org/committees/download.php/1184/2002-06-03.BTP_cttee_spec_1.0.pdf

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Dublin Core Meta Data

- Dublin Core Metadata Element Set, Dublin Core Metadata Initiative
  http://dublincore.org/documents/dces/

ebXML BPSS

- Jean-Jacques Dubray, "A new model for ebXML BPSS Multi-party Collaborations and Web Services Choreography," 2002
  http://www.ebpml.org/ebpml.doc

Open Nested Transactions

- Concepts and Applications of Multilevel Transactions and Open Nested Transactions, Gerhard Weikum, Hans-J. Schek, 1992
  http://citeseer.nj.nec.com/weikum92concepts.html

RDF

- RDF Vocabulary Description Language 1.0: RDF Schema, W3C Working Draft
  http://www.w3.org/TR/rdf-schema/

SOAP 1.2

- SOAP Version 1.2 Part 1: Messaging Framework, W3C Working Draft
  http://www.w3.org/TR/soap12-part1/
- SOAP Version 1.2 Part21: Adjuncts, W3C Working Draft
  http://www.w3.org/TR/soap12-part2/

UDDI

- Universal Description, Discovery and Integration, Ariba, IBM and Microsoft, UDDI.org.
  http://www.uddi.org

URI

- Uniform Resource Identifiers (URI): Generic Syntax, T. Berners-Lee, R. Fielding, L. Masinter, IETF RFC 2396, August 1998
  http://www.ietf.org/rfc/rfc2396.txt

WfMC Glossary

- Workflow Management Coalition Terminology and Glossary
  http://www.wfmc.org/wfmc-standards-framework.html

Web Services Transaction

- (WS-Transaction) 1.1, OASIS, 12 July 2007,
  http://www.oasis-open.org/committees/ws-tx/

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Workflow Patterns

- Russell, N., ter Hofstede, A.H.M., van der Aalst W.M.P, & Mulyar, N. (2006). Workflow Control-Flow Patterns: A Revised View. BPM Center Report BPM-06-22, BPMcentre.org
http://www.workflowpatterns.com/

WSBPEL

- Web Services Business Process Execution Language (WSBPEL) 2.0, OASIS Standard, April 2007
http://docs.oasis-open.org/wsbpel/2.0/OS/wsbpel-v2.0-OS.html

WS-Coordination

- Web Services Coordination (WS-Coordination) 1.1, OASIS Standard, July 2007
http://www.oasis-open.org/committees/ws-tx/

WSDL

- Web Services Description Language (WSDL) 2.0, W3C Proposed Recommendation, June 2007
http://www.w3.org/TR/wsdl20/

WS-HumanTask

- Web Services Human Task (WS-HumanTask) 1.1, August 2010
http://docs.oasis-open.org/bpel4people/ws-humantask-1.1-spec-cs-01.html

XML 1.0 (Second Edition)

- Extensible Markup Language (XML) 1.0, Second Edition, Tim Bray et al., eds., W3C, 6 October 2000
http://www.w3.org/TR/REC-xml

XML-Namespaces

- Namespaces in XML, Tim Bray et al., eds., W3C, 14 January 1999
http://www.w3.org/TR/REC-xml-names

XML-Schema

- XML Schema Part 1: Structures, Henry S. Thompson, David Beech, Murray Maloney, Noah Mendelsohn, W3C, 2 May 2001
http://www.w3.org/TR/xmlschema-1//
- XML Schema Part 2: Datatypes, Paul V. Biron and Ashok Malhotra, eds., W3C, 2 May 2001
http://www.w3.org/TR/xmlschema-2/

XPath

- XML Path Language (XPath) 1.0, James Clark and Steve DeRose, eds., W3C, 16 November 1999
http://www.w3.org/TR/xpath

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XPDL

- Workflow Management Coalition XML Process Definition Language, version 2.0. http://www.wfmc.org/wfmc-standards-framework.html

4 Terms and Definitions

NOTE: See Annex C - Glossary.

5 Symbols

NOTE: There are no symbols defined.

6 Additional Information

6.1 Conventions

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

6.1.1 Typographical and Linguistic Conventions and Style

This International Standard incorporates the following conventions:

- The keywords “MUST,” “MUST NOT,” “REQUIRED,” “SHALL,” “MUST 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, sub clause, or specification is highlighted with underlined typeface and provides a link to the relevant location in this International Standard.
- A reference to a graphical element is highlighted with a bold, capitalized word and will be presented with the **Arial** font (e.g., **Sub-Process**).
- A reference to a non-graphical element or **BPMN** concept is highlighted by being italicized and will be presented with the Times New Roman font (e.g., *token*).
- A reference to an attribute or model association will be presented with the Courier New font (e.g., `Expression`).
- A reference to a WSBPEL element, attribute, or construct is highlighted with an italic lower-case word, usually preceded by the word “WSBPEL” and will be presented with the Courier New font (e.g., WSBPEL *`pick`*).
- Non-normative examples are set off in boxes and accompanied by a brief explanation.

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- XML and pseudo code is highlighted with `mono-spaced` 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:
  - <none> — 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

6.1.2 Abbreviations

The following abbreviations are used throughout:

This abbreviation	Refers to
WSBPEL	Web Services Business Process Execution Language (see WSBPEL). This abbreviation refers specifically to version 2.0 of this International Standard.
WSDL	Web Service Description Language (see WSDL). This abbreviation refers specifically to the W3C Technical Note, 15 March 2001, but is intended to support future versions of the WSDL specification.

6.2 Structure of this Document

Clause 1 discusses the scope of the document and provides a summary of the elements introduced in subsequent clauses of the document.

Clause 7 introduces the **BPMN** Core that includes basic **BPMN** elements needed for constructing various **Business Processes**, including **collaborations**, *orchestration* **Processes** and **Choreographies**.

Elements needed for modeling of **Collaborations**, *orchestration* **Processes**, **Conversations**, and **Choreographies** are introduced in Clauses 8, 9, 10 and 11, respectively.

Clause 13 introduces the **BPMN** visual diagram model. Clause 14 defines the execution semantics for **Process** *orchestrations* in **BPMN 2.0**. Clause 14 discusses a mapping of a **BPMN** model to WS-BPEL that is derived by analyzing the **BPMN** objects and the relationships between these objects. Exchange formats and an XSLT transformation between them are provided in Clause 15.

6.3 Acknowledgments

Submitting Organizations

The following companies are formal submitting members of OMG:

- Axway
- International Business Machines

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- MEGA International
- Oracle
- SAP AG
- Unisys

Supporting Organizations

The following organizations support this International Standard but are not formal submitters:

- Accenture
- Adaptive
- BizAgi
- Bruce Silver Associates
- Capgemini
- Enterprise Agility
- France Telecom
- IDS Scheer
- Intalio
- Metastorm
- Model Driven Solutions
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7 Overview

7.1 General

There has been much activity in the past few years in developing web service-based XML execution languages for Business Process Management (BPM) systems. Languages such as WSBPEL provide a formal mechanism for the definition of business processes. The key element of such languages is that they are optimized for the operation and inter-operation of BPM Systems. The optimization of these languages for software operations renders them less suited for direct use by humans to design, manage, and monitor **Business Processes**. WSBPEL has both graph and block structures and utilizes the principles of formal mathematical models, such as pi-calculus[1]. This technical underpinning provides the foundation for business process execution to handle the complex nature of both internal and B2B interactions and takes advantage of the benefits of Web services. Given the nature of WSBPEL, a complex **Business Process** could be organized in a potentially complex, disjointed, and unintuitive format that is handled very well by a software system (or a computer programmer), but would be hard to understand by the business analysts and managers tasked to develop, manage, and monitor the **Process**. Thus, there is a human level of "inter-operability" or "portability" that is not addressed by these web service-based XML execution languages.

Business people are very comfortable with visualizing **Business Processes** in a flow-chart format. There are thousands of business analysts studying the way companies work and defining **Business Processes** with simple flow charts. This creates a technical gap between the format of the initial design of **Business Processes** and the format of the languages, such as WSBPEL, that will execute these **Business Processes**. This gap needs to be bridged with a formal mechanism that maps the appropriate visualization of the **Business Processes** (a notation) to the appropriate execution format (a BPM execution language) for these **Business Processes**.

Inter-operation of **Business Processes** at the human level, rather than the software engine level, can be solved with standardization of the Business Process Model and Notation (**BPMN**). **BPMN** provides multiple diagrams, which are designed for use by the people who design and manage **Business Processes**. **BPMN** also provides a mapping to an execution language of BPM Systems (WSBPEL). Thus, **BPMN** would provide a standard visualization mechanism for **Business Processes** defined in an execution optimized business process language.

BPMN provides businesses with the capability of understanding their internal business procedures in a graphical notation and will give organizations the ability to communicate these procedures in a standard manner. Currently, there are scores of **Process** modeling tools and methodologies. Given that individuals will move from one company to another and that companies will merge and diverge, it is likely that business analysts need to understand multiple representations of **Business Processes**—potentially different representations of the same **Process** as it moves through its lifecycle of development, implementation, execution, monitoring, and analysis. Therefore, a standard graphical notation will facilitate the understanding of the performance **Collaborations** and business *transactions* within and between the organizations. This will ensure that businesses will understand themselves and participants in their business and will enable organizations to adjust to new internal and B2B business circumstances quickly. **BPMN** follows the tradition of flowcharting notations for readability and flexibility. In addition, the **BPMN** execution semantics is fully formalized. The OMG is using the experience of the business process notations that have preceded **BPMN** to create the next generation notation that combines readability, flexibility, and expandability.

1. See Milner, 1999, "Communicating and Mobile Systems: the –-Calculus," Cambridge University Press. ISBN 0 521 64320 1 (hc.) ISBN 0 521 65869 1 (pbk.)

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BPMN will also advance the capabilities of traditional business process notations by inherently handling B2B **Business Process** concepts, such as *public* and *private* **Processes** and **Choreographies**, as well as advanced modeling concepts, such as *exception handling*, *transactions*, and *compensation*.

7.2 BPMN Scope

This International Standard provides a notation and model for **Business Processes** and an interchange format that can be used to exchange **BPMN Process** definitions (both domain model and diagram layout) between different tools. The goal of the International Standard is to enable portability of **Process** definitions, so that users can take **Process** definitions created in one vendor's environment and use them in another vendor's environment.

The **BPMN 2.0.1** International Standard extends the scope and capabilities of the **BPMN 1.2** in several areas:

- Formalizes the execution semantics for all **BPMN** elements.
- Defines an extensibility mechanism for both **Process** model extensions and graphical extensions.
- Refines **Event** composition and correlation.
- Extends the definition of human interactions.
- Defines a **Choreography** model.

This International Standard also resolves known **BPMN 1.2** inconsistencies and ambiguities.

BPMN is constrained to support only the concepts of modeling that are applicable to **Business Processes**. This means that other types of modeling done by organizations for business purposes is out of scope for **BPMN**. Therefore, the following are aspects that are out of the scope of this International Standard:

- Definition of organizational models and resources,
- Modeling of functional breakdowns,
- Data and information models,
- Modeling of strategy,
- Business rules models.

Since these types of high-level modeling either directly or indirectly affects **Business Processes**, the relationships between **BPMN** and other high-level business modeling can be defined more formally as **BPMN** and other specifications are advanced.

While **BPMN** shows the flow of data (**Messages**), and the association of data artifacts to **Activities**, it is not a data flow language. In addition, operational simulation, monitoring, and deployment of **Business Processes** are out of scope of this International Standard.

BPMN 2.0.1 can be mapped to more than one platform dependent process modeling language, e.g., WS-BPEL 2.0. This International Standard includes a mapping of a subset of **BPMN** to WS-BPEL 2.0. Mappings to other emerging standards are considered to be separate efforts.

The International Standard utilizes other standards for defining data types, `Expressions`, and service operations. These standards are XML Schema, XPath, and WSDL, respectively.

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7.2.1 Uses of BPMN

Business Process modeling is used to communicate a wide variety of information to a wide variety of audiences. **BPMN** is designed to cover many types of modeling and allows the creation of end-to-end **Business Processes**. The structural elements of **BPMN** allow the viewer to be able to easily differentiate between sections of a **BPMN** Diagram. There are three basic types of sub-models within an end-to-end **BPMN** model:

1. **Processes** (*Orchestration*), including:
   - *Private non-executable* (internal) **Business Processes**
   - *Private executable* (internal) **Business Processes**
   - *Public* **Processes**
2. **Choreographies**
3. **Collaborations**, which can include **Processes** and/or **Choreographies**
   - A view of **Conversations**

Private (Internal) Business Processes

Private **Business Processes** are those internal to a specific organization. These **Processes** have been generally called workflow or BPM **Processes** (see Figure 10.4). Another synonym typically used in the Web services area is the *Orchestration* of services. There are two types of *private* **Processes**: *executable* and *non-executable*. An *executable* **Process** is a **Process** that has been modeled for the purpose of being executed according to the semantics defined in Clause 14. Of course, during the development cycle of the **Process**, there will be stages where the **Process** does not have enough detail to be "executable." A non-executable **Process** is a *private* **Process** that has been modeled for the purpose of documenting **Process** behavior at a modeler-defined level of detail. Thus, information needed for execution, such as formal condition `Expressions` are typically not included in a *non-executable* **Process**.

If a swimlanes-like notation is used (e.g., a **Collaboration**, see below) then a *private* **Business Process** will be contained within a single **Pool**. The **Process** flow is therefore contained within the **Pool** and cannot cross the boundaries of the **Pool**. The flow of **Messages** can cross the **Pool** boundary to show the interactions that exist between separate *private* **Business Processes**.

Figure 7.1 – Example of a *private* Business Process

Public Processes

A *public* **Process** represents the interactions between a *private* **Business Process** and another **Process** or *Participant* (see Figure 7.2). Only those **Activities** that are used to communicate to the other *Participant(s)* are included in the *public* **Process**. All other "internal" **Activities** of the *private* **Business Process** are not shown in the *public* **Process**. Thus, the *public* **Process** shows to the outside world the **Message Flows** and the order of those **Message Flows** that are needed to interact with that **Process**. *Public* **Processes** can be modeled separately or within a **Collaboration** to show the flow of **Messages** between the *public* **Process Activities** and other *Participants*. Note that the *public* type of **Process** was named "abstract" in **BPMN 1.2**.

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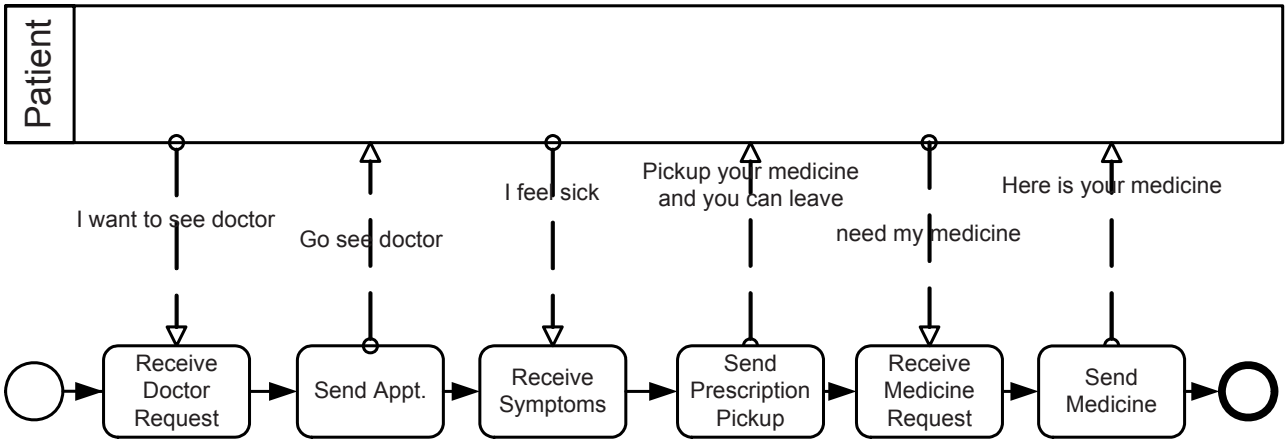

Figure 7.2 – Example of a *public* Process

Collaborations

A **Collaboration** depicts the interactions between two or more business entities. A **Collaboration** usually contains two or more **Pools**, representing the *Participants* in the **Collaboration**. The **Message** exchange between the *Participants* is shown by a **Message Flow** that connects two **Pools** (or the objects within the **Pools**). The **Messages** associated with the **Message Flows** can also be shown. The **Collaboration** can be shown as two or more *public* **Processes** communicating with each other (see Figure 7.3). With a *public* **Process**, the **Activities** for the **Collaboration** participants can be considered the "touch-points" between the participants. The corresponding internal (executable) **Processes** are likely to have much more **Activity** and detail than what is shown in the *public* **Processes**. Or a **Pool** MAY be empty, a "black box." **Choreographies** MAY be shown "in between" the **Pools** as they bisect the **Message Flows** between the **Pools**. All combinations of **Pools**, **Processes**, and a **Choreography** are allowed in a **Collaboration**.

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