



The Workflow Management Coalition Specification

Workflow Management Coalition Workflow Standard

Process Definition Interface -- XML Process Definition Language

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1. Change History

Version 2.10– Editor: Robert Shapiro (robert.shapiro@global360.com)

- Clean up Vendor Extensions to leverage XML Schema for validation.
- Numerous editing changes (based on Justin Brunt document).

Version 2.09– Editor: Robert Shapiro (robert.shapiro@global360.com)

- Minor Editing of Text.
- Specify ISO standards to improve interoperability of country, language, currency and date formats.
- Schema now supports DATE and TIME as separate BasicTypes in addition to the existing DATETIME.
- Added ‘InitialValue’ and ‘Required’ attributes to FormalParameters.
- Corrections to the XPD 2.0 schema on multi-instance loops as the BPMN specification calls for expressions that we have previously implemented as strings.
- Conformance Class extended to include several levels of BPMN conformance.
- Section on ExpressionType added.
- Schema changes associated with conformance and with page, nodegraphics, connectorgraphics and with expressiontype.
- Schema change DataField references in DataObject.

Version 2.08– Editor: Robert Shapiro (robert.shapiro@global360.com)

- ResultCompensation changed to TriggerResultCompensation.
- "IsForCompensation" attribute added to ‘Activity’ element.
- Figure 5.1 (Process interchange) edited.

Version 2.07– Editor: Robert Shapiro (robert.shapiro@global360.com)

- Update of the Acknowledgements.
- Minor editing
- In the Activity element, the choice of activity type is no longer optional; you must have one of the possible child elements: Route (Gateway), Implementation, BlockActivity (Embedded Sub-Flow) or Event.
- Fixed schemata for all elements that have names beginning with ‘TriggerResult’. Also cleaned up documentation for ‘Signal’ Event.
- Inserted example using signals to synchronize processes (milestones).
- The Multiple Intermediate Event MAY be used in Normal Flow.

Version 2.06– Editor: Robert Shapiro (robert.shapiro@global360.com)

- Update of the Acknowledgements.
- Minor editing
- Fixed TriggerMultiple, TriggerIntermediateMultiple and TriggerConditional. All references to TriggerRule deprecated.
- The occurrence of ‘Performer’ as a child element of ‘Activity’ has been deprecated. ‘Performers’ is the correct

child element.

- Changed definition of ‘Group’ to allow a list of Ids to designate the objects in the Group.
- Note that the deprecated schema is being used to handle changes from version 2.0 to version 2.1.

Version 2.05– Editor: Robert Shapiro (robert.shapiro@global360.com)

- Minor changes to individual schemata.
- In Group Element CategoryRef changed to Category and ObjectRef changed to Object.
- Added missing schema for ModificationDate.
- In Lane Element, LaneChildren replaced by NestedLane.
- TriggerResultSignal attribute ‘Name’ added to schema.
- DataField attributes ReadOnly, IsArray and Correlation all have type:xsd:Boolean and default ‘false’.

Version 2.04– Editor: Robert Shapiro (robert.shapiro@global360.com)

- Minor Editing of Text. Group Element Defined and Artifact has Group subelement.
- LoopCondition and MI_Condition can be either an attribute of type ‘string’ or an element of type ExpressionType.
- Full Schema Temporarily removed and changes accepted.
- Table and Figure legends updated.

Version 2.03– Editor: Robert Shapiro (robert.shapiro@global360.com)

- Updated Document to include ActivityCostStructure in SimulationInformation.
- LayoutInfo element added to PackageHeader to allow scaling of coordinate information in NodeGraphicsInfo and ConnectorGraphicsInfo.
- TestValue element added to DataMapping.
- ReadOnly attribute added to DataField and FormalParameter.
- Unique Object Id requirement stated.
- Added E-mail Voting Process Example.

Version 2.02– Editor: Robert Shapiro (robert.shapiro@global360.com)

- Updated Document to include BPMN 1.1 graphics and changes from BPMN 1.0
- Updated Document to include XPD L 2.1 proposals (not complete)

Version 2.01– Editor: Robert Shapiro (robert.shapiro@global360.com)

- Changed version, date and address information.
- Changed acknowledgements.
- Updated Event Section text, graphics and XML.

Version 2.0 – Editor: Robert Shapiro (robert.shapiro@global360.com)

- This version is the final approved version of XPDL 2.0.
- The following 3 edits were not performed on some public released copies of the specification.

Version 1.15 – Editor: Robert Shapiro (rshapiro@capevisions.com)

- Fixed minor errors in specification.

Version 1.14 – Editor: Robert Shapiro (rshapiro@capevisions.com)

- Backed out schema change that deprecated SubFlow element. SubFlow is the name of the element.
- Fixed minor errors in specification.

Version 1.13 – Editor: Robert Shapiro (rshapiro@capevisions.com)

- Updated the Specification to include discussion of new properties that determine starting ActivitySet and Activity.
- Fixed minor errors in schema. (NodeGraphicsInfos, ConnectorGraphicsInfos, starting ActivitySet and Activity properties.

1.1. Acknowledgements

XPDL2.1 was a collaborative effort with contributions from many individuals.

Robert Shapiro (Global 360) directed the effort and edited the specification.

Keith Swenson (Fujitsu Software) contributed key ideas and as chair of the WfMC Technical Committee helped locate other resources to get this job done.

Justin Brunt (TIBCO Software) organized other resources at TIBCO Software and identified the changes to BPMN introduced in BPMN 1.1.

Bruce Silver (Bruce Silver Associates) fixed a number of BPMN-related problems and helped focus the specification on BPMN diagram interchange. He developed the concept of BPMN Model Portability conformance classes.

Other members of the Global 360 team included Tom Lavery and Andy Adler. Tom did a lot of work on the schema and added referential integrity checking.

Other members of the TIBCO Software team included Tim Stephenson, Sid Allway, Ravikanth Somayaji and Kamlesh Upadhyaya.

Denis Gagné [dgagne@trisotech.com] and his team at Trisotech contributed a spreadsheet showing the differences between BPMN 1.0, BPMN1.1 and XPDL 2.0. They also suggested several enhancements to the schema.

Shane C. Gabie (UNISYS) contributed change proposals.

Brad Stone (Aspirin Software) helped improve the specification.

The BPMN 1.1 Draft with mark-up DTC-2007-06-02 provided detailed information, tables and figures for this specification. Much appreciation goes to the BPMN group in OMG, all of the individuals who participated and especially to Stephen White (IBM).

XPDL2.0 required many hours of work by individuals who had to find time to contribute while carrying out their normal duties for the companies that employ them.

Robert Shapiro (Global 360) and Mike Marin (FileNET) did the bulk of the work.

Justin Brunt, Wojciech Zurek, Tim Stephenson (TIBCO Software), Sasa Bojanic (Prozone) and Gangadhar Gouri (Fujitsu Software) made significant contributions.

Keith Swenson (Fujitsu Software) provided invaluable organizational support and encouragement.

2. Audience

The intended audience for this document is primarily vendor organizations who seek to implement the XML Process Definition Language (XPDL) of the Workflow Management Coalition (WfMC), or wish to use it as a file format for the Business Process Modeling Notation (BPMN) of the Business Process Management Initiative (BPMI) and the Object Management Group (OMG). It may also be of interest to those seeking to assess conformance claims made by vendors for their products. Comments should be addressed to the Workflow Management Coalition.

3. Purpose

XPDL version 2.1 is back compatible with XPDL version 2.0, and is intended to be used as a file format for BPMN 1.1. The original purpose of XPDL is maintained and enhanced by this second version of the specification. The XPDL and the BPMN specifications address the same modeling problem from different perspectives. XPDL provides an XML file format that can be used to interchange process models between tools. BPMN provides a graphical notation to facilitate human communication between business users and technical users, of complex business processes.

There are a number of elements that are present in BPMN version 1.1 that were not present in XPDL version 2.0. Those had been incorporated into this version of XPDL.

This document has been expanded to provide much more documentation from the BPMN perspective. It should be possible for BPMN users to draw diagrams and specify attributes for those diagrams based on the contents of this specification.

The WfMC has identified five functional interfaces to a process or workflow service as part of its standardization program. This specification forms part of the documentation relating to "Interface one" - supporting Process Definition Import and Export. This interface includes a common meta-model for describing the process definition (this specification) and also a companion XML schema for the interchange of process definitions.

4. Introduction

A variety of different tools may be used to analyse, model, describe and document a business process. The process definition interface defines a common interchange format, which supports the transfer of process definitions between separate products.

The interface also defines a formal separation between the development and run-time environments, enabling a process definition, generated by one modelling tool, to be used as input to a number of different run-time products.

A process definition, generated by a build-time tool, is capable of interpretation in different run-time products. Process definitions transferred between these products or stored in a separate repository are accessible via the XPDL common interchange format.

To provide a common method to access and describe process definitions, a process definition meta-data model has been established. This meta-data model identifies commonly used entities within a process definition. A variety of attributes describe the characteristics of this limited set of entities. Based on this model, vendor specific tools can transfer models via a common exchange format.

One of the key elements of XPDL is its extensibility to handle information used by a variety of different tools. XPDL may never be capable of supporting all additional information requirements in all tools. Based upon a limited number of entities that describe a process definition (the "Minimum Meta Model"), XPDL supports a number of differing approaches.

One of the most important elements of XPDL is a generic construct that supports vendor specific attributes for use within the common representation. We recommend that any missing attributes be proposed to the WfMC interface one workgroup for inclusion in future releases.

This document describes the meta-model, which is used to define the objects and attributes contained within a process definition. The XPDL grammar is directly related to these objects and attributes. This approach needs two operations to be provided by a vendor:

- Import a process definition from XPDL.
- Export a process definition from the vendor's internal representation to XPDL.

A vendor can use an XSL style sheet to accomplish these two operations.

All keywords and terms used within this specification are based upon the WfMC Glossary, or terminology used by BPMN.

For the purpose of this document, the terms process definition, business process model, and workflow model are all considered to represent the same concept, and therefore, they are used interchangeably.

4.1. Conformance

A vendor can not claim conformance to this or any other WfMC specification unless specifically authorised to make that claim by the WfMC. WfMC grants this permission only upon the verification of the particular vendor's implementation of the published specification, according to applicable test procedures defined by WfMC.

Conformance for process definition import / export is essentially based upon conformance to the XPDL grammar as defined by the XML schema (xsd). However, there is a mandatory minimum set of objects, as specified within this document, which must be supported within XPDL. But, given the wide variation of capabilities in modelling tools, it is reasonable to assume that an individual tool might conform to this specification but not be able to swap complete definitions with all other conforming products. A product that claims conformance must generate valid, syntactically correct XPDL, and must be able to read valid XPDL files. A valid, syntactically correct XPDL file must conform and validate against the XPDL schema.

In section 7.2.3 we discuss several aspects of conformance in detail, including the notion of BPMN Model Portability conformance classes.

4.2. XPDL Version 1.0 Compatibility

XPDL version 2.1 is compatible with XPDL version 1.0, with minor exceptions. The XPDL schema version 2.1 has a different namespace, and tools wishing to be compatible with XPDL version 1.0 need to understand XPDL 1.0, XPDL 2.0 and XPDL 2.1 namespaces.

The following XPDL version 1.0 elements were deprecated in version 2.0:

- Automatic element. Replaced by StartMode and FinishMode attributes of Activity.
- BlockId attribute of BlockActivity element. Replaced by ActivitySetId.
- DeadlineCondition element. Replaced with DeadlineDuration.
- Index attribute in FormalParameter element. Because FormalParameters must match the order in the declaration, and so there is no need for Index.
- Manual element. Replaced by StartMode and FinishMode attributes of Activity.
- Tool Element deprecated.
- Xpression element in Condition element. Replaced by Expression.
- The order in a WorkflowProcess changed from DataFields, Participants, and Applications to be Participants, Applications, and DataFields. This makes the order in Process and package consistent.

4.3. References

The following documents are associated with this document and should be used as a reference.

General background information:

WfMC, Terminology & Glossary (WfMC-TC-1011)

WfMC, Reference Model (WfMC-TC-1003)

WfMC, API specifications, which include process definition manipulation APIs:

WfMC, Client Application API Specifications (WAPI) (WfMC-TC-1009)

WfMC, Process Definition Interchange – Process Model (WfMC-TC-1016-P)

BPMI, Business Process Modeling Notation (BPMN), version 1.0 – May 3, 2004

OMG, Business Process Modeling Notation (BPMN) Final Adopted Specification dtc/06-02-01 Feb 2006

OMG, BPMN 1-1 Draft with mark-up DTC-2007-06-02.pdf – June 2, 2007

Process interoperability, used to support process invocation on a remote workflow service:

Workflow Interoperability - Abstract Specifications (WfMC-TC-1012)

Interoperability - Internet E-mail MIME Binding (WfMC-TC-1018)

Accompanying documents:

The Resource Model (Organizational Model: WfMC TC-1016-O)

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5. Overview of Process Definition Interchange

An XPD L package corresponds to a Business Process Diagram (BPD) in BPMN, and consists of a set of Process Definitions. The WfMC defines a process as:

The representation of a business process in a form that supports automated manipulation, such as modeling, or enactment by a workflow [or business] management system. The process definition consists of a network of activities and their relationships, criteria to indicate the start and termination of the process, and information about the individual activities, such as participants, associated IT applications and data, etc. (WfMC Glossary - WfMC-TC-1011)

The process definition provides an environment for a rich description of a process that can be used for the following,

- Act as a template for the creation and control of instances of that process during process enactment.
- For simulation and forecasting.
- As a basis to monitor and analyse enacted processes.
- For documentation, visualization, and knowledge management.

The process definition may contain references to subflows, separately defined, which make up part of the overall process definition.

An initial process definition will contain at least the minimal set of objects and attributes necessary to initiate and support process execution. Some of these objects and attributes will be inherited by each created instance of the process.

The WfMC Glossary also contains descriptions of, and common terminology for, the basic concepts embodied within a process definition such as activities, transitions, relevant data and participants, etc.

5.1. Approaches to Process Definition Interchange

This specification uses XML as the mechanism for process definition interchange. XPD L forms a common interchange standard that enables products to continue to support arbitrary internal representations of process definitions with an import/export function to map to/from the standard at the product boundary.

A variety of different mechanisms may be used to transfer process definition data between systems according to the

characteristics of the various business scenarios. In all cases the process definition must be expressed in a consistent form, which is derived from the common set of objects, relationships and attributes expressing its underlying concepts.

The principles of process definition interchange are illustrated in Figure 5.1: The Concept of the Process Definition Interchange.

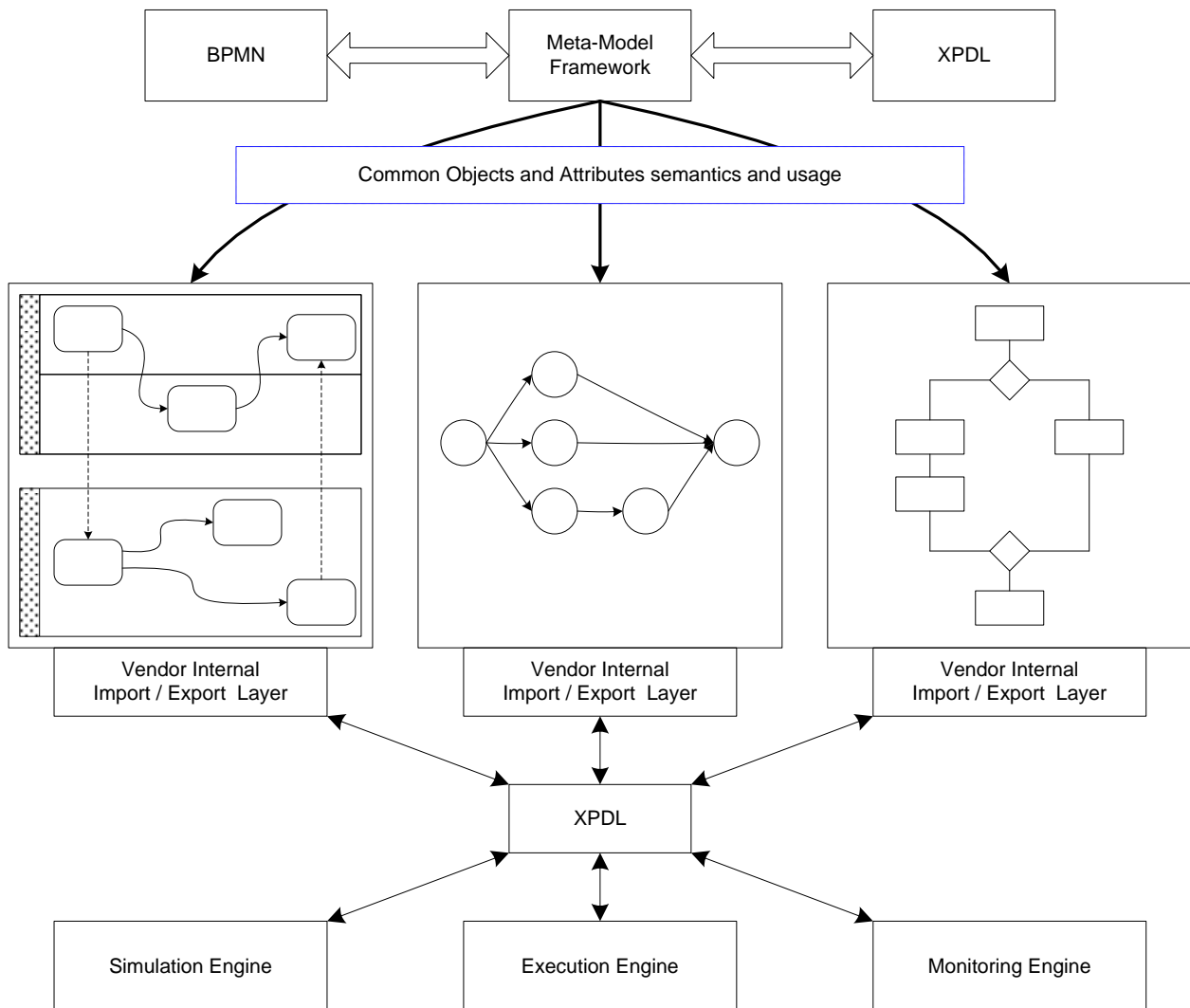


Figure 5.1: The Concept of the Process Definition Interchange

6. Meta-Model

The Meta-Model describes the top-level entities contained within a Process Definition, their relationships and attributes (including some which may be defined for simulation or monitoring purposes rather than for enactment). It also defines various conventions for grouping process definitions into related process models and the use of common definition data across a number of different process definitions or models.

6.1. Processes and Packages

The process model includes various entities whose scope may be wider than a single process definition. In particular the definitions of participants, applications and relevant data may be referenced from a number of process definitions. The meta-model assumes the use of a common process definition repository to hold the various entity types comprising the process definition. Within the repository itself and to support the efficient transfer of process definition data to/from the repository, the concept of a package is introduced, which acts as a container for the grouping of common data entities from a number of different process definitions, to avoid redefinition within each individual process definition.

The package provides a container to hold a number of common attributes from the process definition entity (author, version, status, etc.). Each process definition contained within the package will automatically inherit any common attributes from the package, unless they are separately re-specified locally within the process definition.

An XPDL Package corresponds to a BPMN Business Process Diagram. At the level below Package, there are four new elements which are discussed in later sections of this document:

1. **Pools** (and their lanes) are associated with processes and are used in layout and to define participants (see section 7.4.1) at the Pool/Process Level and performers for the sequence flow elements contained within Lanes.
2. **Message flows** are used to represent communication between processes, based on Web Services Description Language (WSDL) protocols.
3. **Associations** and **Artifacts** are used to document the process definitions. Associations and the Artifacts they connect to provide additional information for the reader of a BPMN Diagram, but do not directly affect the execution of the Process.

Within a package, the scope of the definitions of some entities is global and these entities can be referenced from all process definitions (and associated activities and transitions) contained within the package. Those entities are:

- participant specification (not a Pool Participant: see section 6.4.1)
- application declaration, and
- DataField

The package reference entity, when used in the package or its contained objects, provides a reference to a top-level entity in the referenced external package:

- Process ids for SubFlow reference
- participant specifications
- application declarations
- type declarations

Conventions on name and identifier management across different packages within the same repository address space to achieve any necessary global uniqueness are for user/vendor definition. The assumed convention during process enactment is that name reference searches follow the sequence:

- Process ids - firstly within the same model (including any references to process definitions for remote execution on a different service), then within any externally referenced model
- Applications / participants - firstly within the same model, then within any externally referenced model

Relevant data naming must be unique within a package; where such data is passed between processes as parameters the convention in this version of specification is that copy semantics will be used. Responsibility rests with process

designers / administrators to ensure consistent name / data type usage within process definitions / models to support subflow operations (including any required remote process interoperability).

6.2. Package Meta-Model

- Multiple process definitions are bound together in a model definition. The Package acts as a container for grouping together a number of individual process definitions and associated entity data, which is applicable to all the contained process definitions (and hence requires definition only once).

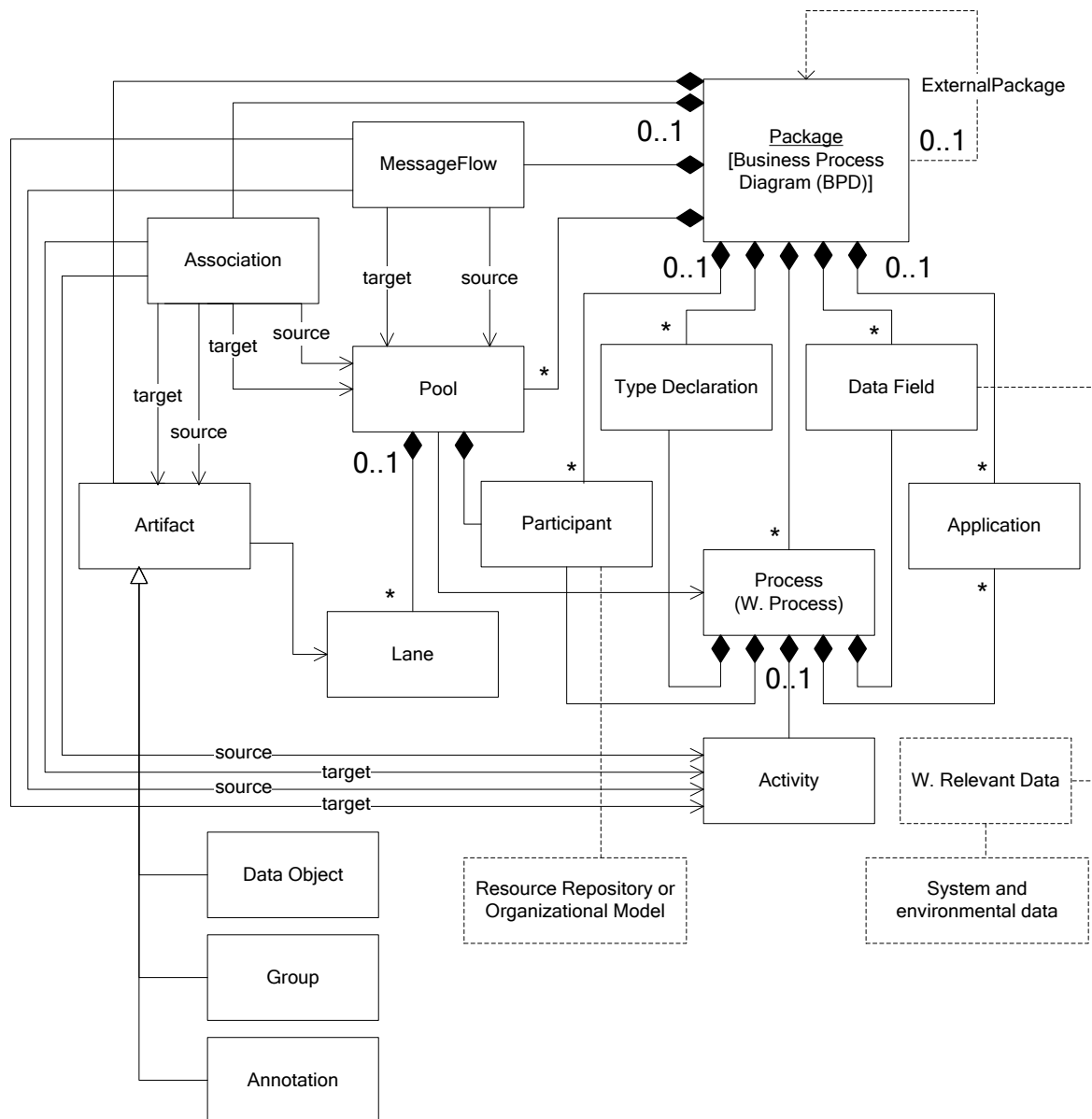


Figure 6.1: Package Definition Meta Model

The meta-model for the Package identifies the entities and attributes for the exchange, or storage, of process models. It defines various rules of inheritance to associate an individual process definition with entity definitions for participant specification, application declaration and relevant data field, which may be defined at the package level rather than at the level of individual process definitions.

The Package Definition allows the specification of a number of common process definition attributes, which will then apply to all individual process definitions contained within the package. Such attributes may then be omitted from the individual process definitions. (If they are re-specified at the level of an individual process definition this local attribute value takes precedence over the global value defined at the package level.)

6.2.1. Process Repository

The process definition import/export interface is assumed to operate to/from a definition repository of some form associated with the process or workflow management system. The import/export interface is realized by the transfer of files containing XPDL into or out of such repository. This interface specification allows the import or export of process definition data at the level of individual process definitions and packages.

The internal interface between the repository and control functions is specific to individual vendor products and does not form part of this standard. It is assumed that separation is provided (for example by version control) between repository usage as a static repository (for persistent, ongoing storage of process definition data) and any dynamic usage (for managing changes to the process execution of extant process instances).

The local storage structure of the process definition repository is not part of the WfMC standard. The use of a package is defined only as an aid to simplify the import/export of reusable data structures. Where a simple process repository structure is used, operating at a single level of process definition, shared information within an imported package may be replicated into each of the individual process definitions at the import interface (and similarly repacked, if required, for process definition export).

6.2.1.1. Redefinition and Scope

The possibility of redefining attributes and meta-model entities and referencing external packages introduces the principles of scope and hierarchy into the XPDL (and process repository) structures.

- (i) Relevant data field
Process relevant data field has a scope that is defined by the directly surrounding meta-model entity and is not nested. The visibility of its identifier is also defined by that entity.
- (ii) Attributes
Attributes including extended attributes have a scope that is defined by the directly surrounding meta-model entity and are nested, i.e. may be redefined at a lower level. Example: The name attribute is redefined in each entity definition. The visibility of extended attribute identifiers is within the particular entity and all sub-entities unless the identifier is redefined in a sub-entity.
- (iii) Participants and applications
Participants and applications have a scope and visibility equivalent to extended attributes. All referenced relevant data field and extended attributes have to be defined in the scope where they are used, at least in the same package.

For a referenced external package entity that needs itself reference to entities and their identifiers defined in its external package clause the mechanism is started with the root in that package. That guarantees that no conflict takes place if the invoking process has an entity with the same id, which the definer of the referenced package cannot be aware of.

The described mechanism of external package provides high flexibility for designers and administrators. One can separate organization descriptions (participant entities) and process definitions in separate models, one can add a new release of a process description or add a new process definition sharing the rest of the definition of previously defined and exchanged models without resubmitting the whole context etc.

6.3. Process Meta-Model

The meta-model identifies the basic set of entities and attributes for the exchange of process definitions. For a Process Definition the following entities must be defined, either explicitly at the level of the process definition, or by inheritance directly or via cross reference from a surrounding package.

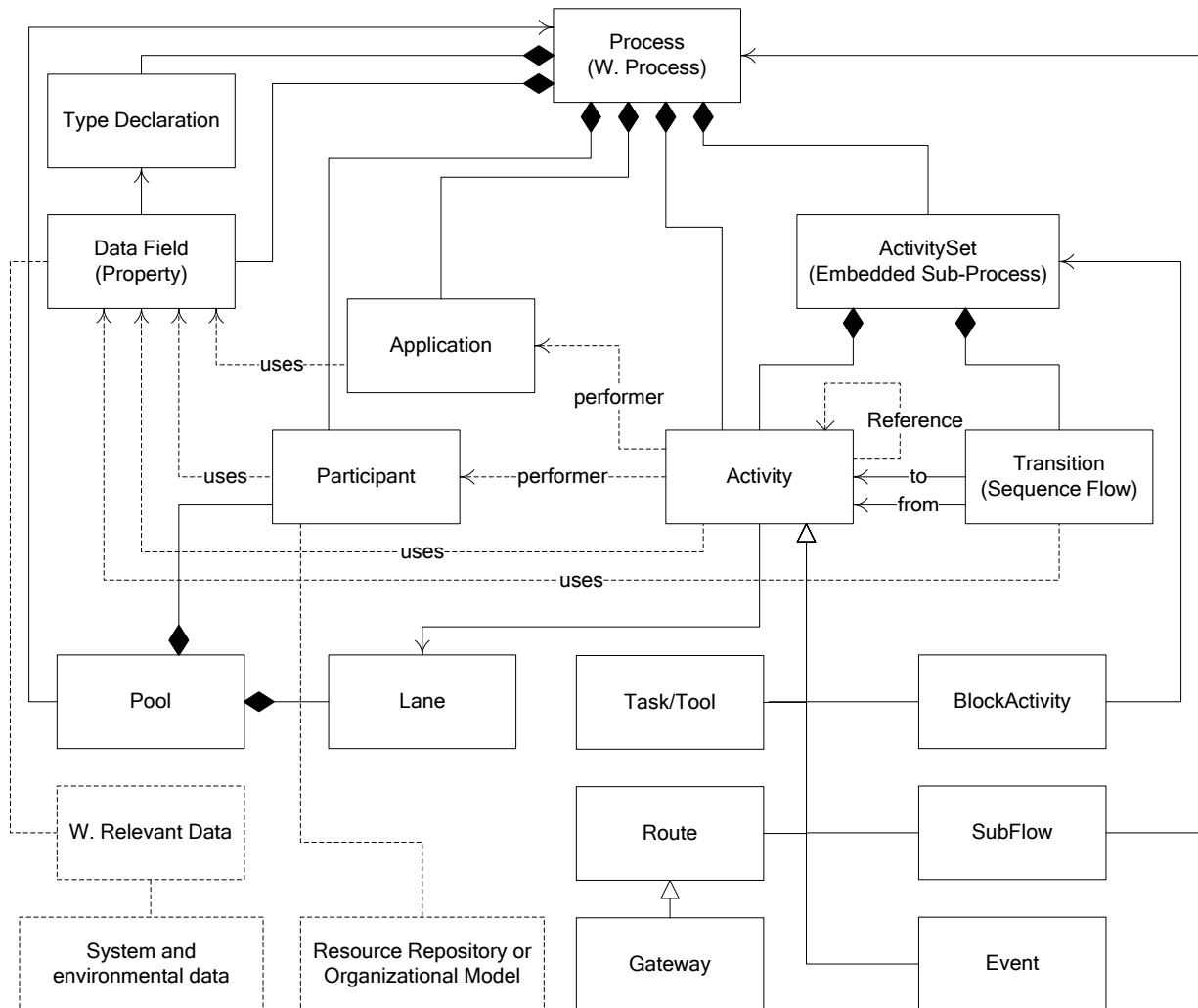


Figure 6.2: Process Definition Meta Model

These entities contain attributes that support a common description mechanism for processes. They are described in the subsequent document sections.

The XPDL Process and WorkflowProcess correspond to the BPMN Process. At the level below Process, there are two new elements: Assignments and Categories; these are discussed in later sections. Assignments allow Data Fields (Properties) to be assigned values in the course of execution of a Process. Categories are useful in reporting and analysis of running Processes but do not affect the behavior of the processes.

6.4. Entities Overview

The meta-model identifies the basic set of entities used in the exchange of process definitions. The top-level entities are as follows:

6.4.1. Swimlanes

Swimlanes are used to facilitate the graphical layout of a collection of processes and the activities they contain. They may designate participant (see section 7.4.1) information at the process level and performer information at the activity level. The Swimlane structure is depicted by a collection of non-overlapping rectangles called Pools. Each Pool may be further subdivided into a number of Lanes.

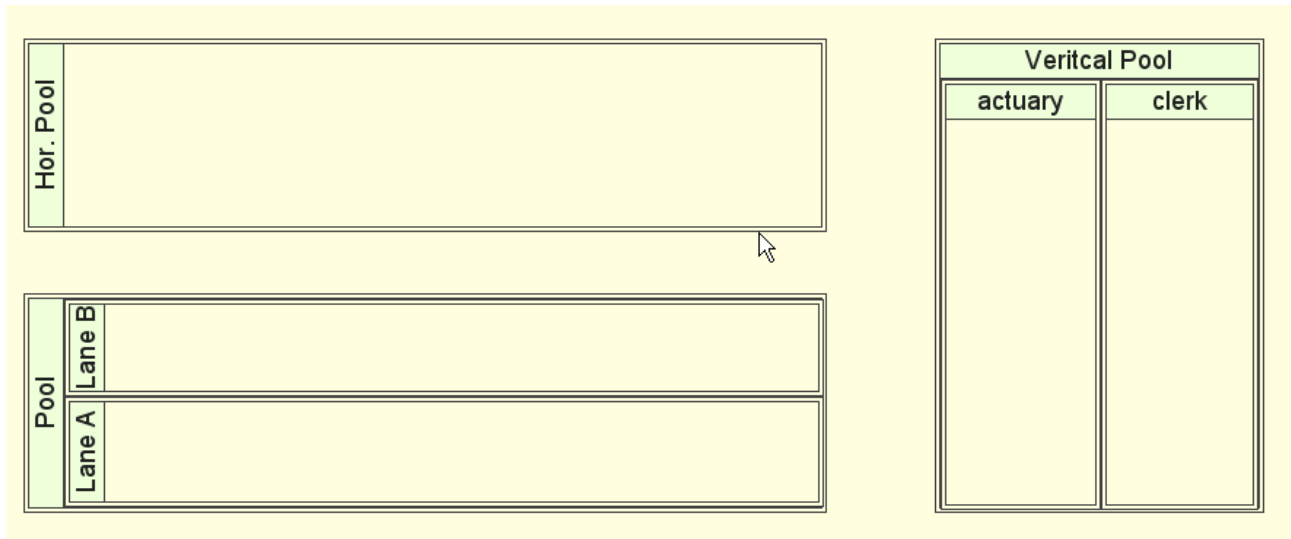


Figure 6.3: Swimlanes

6.4.1.1. Pool

A Pool acts as the container for flow objects (activities) and Sequence Flow (transitions) between them. The Sequence Flow may cross the boundaries between Lanes of a Pool, but cannot cross the boundaries of a Pool. The interaction between Pools is shown through Message Flow.

Another aspect of Pools is whether or not there is any activity detailed within the Pool. Thus, a given Pool may be shown as a “White Box,” with all details exposed, or as a “Black Box,” with all details hidden. No Sequence Flow is associated with a “Black Box” Pool, but Message Flow can attach to its boundaries.

A Pool with flow objects and Sequence Flow contains a Process. An attribute of the Pool identifies the contained Process. (This attribute is null if the Pool is a “Black Box”). The flow objects and Sequence Flow are in that Process, See Process Definition in sections 6.4.2 and 7.5.

Each page of the diagram is regarded as an invisible ‘background pool’. Activities and sequence flow not within an explicit Pool are treated as contained by the background pool. **Some implementations may not support multiple background pools.**

6.4.1.2. Lane

Lanes are used to subdivide a Pool. All the activities within a Lane may inherit one or more properties from the Lane. A typical use of this is to give the Lanes ‘role names’ and have the Activities inherit these role names as ‘Participant assignment/Performer expressions’.

6.4.2. Process Definition

The Process Definition entity provides contextual information that applies to other entities within the process. It is a

container for the process itself and provides information associated with administration (creation date, author, etc.) or to be used during process execution (initiation parameters to be used, execution priority, time limits to be checked, person to be notified, simulation information, etc.). Note that a BPMN Business Process Diagram (BPD) contains multiple processes.

6.4.3. Process Activity

An internal process consists of one or more activities, each comprising a logical, self-contained unit of work. In addition, special activities, referred to as routing activities or Gateways, are used to implement decisions that affect the Sequence Flow path through the process. Special activities, referred to as Events, affect when activities happen and what routes are taken.

A typical activity represents work, which will be performed by a combination of resource (specified by performer expressions) and/or computer applications (specified by application assignment). Other optional information may be associated with the activity such as information on whether it is to be started / finished automatically by the process or workflow management system or its priority relative to other activities where contention for resource or system services occurs. Usage of specific relevant data field items by the activity may also be specified. The scope of an activity is local to a specific process definition (although see the description of a subflow activity below).

Note that many of the details about activities are needed only in an execution environment. BPMN diagrams can be drawn and interchanged between design tools without including these details.

In addition to Applications, an activity may be implemented as one of a number of built-in BPMN **tasks**. Their attribute details are discussed in section 7.6.5.3. BPMN diagrams do not require the use of Applications.

An activity may be a subflow - in this case it is a container for the execution of a (separately specified) process definition, which may be executed locally within the same service, or (possibly using the process interoperability interface) on a remote service. The process definition identified within the subflow contains its own definition of activities, internal transitions, resource, and application assignments (although these may be inherited from a common source). In- and out-parameters permit the exchange of any necessary relevant data field between calling and called process (and, where necessary, on return). Such definitions are equivalent to BPMN **Reusable subprocesses**.

An activity may be a block activity that executes an activity set, or map of activities and transitions. Activities and transitions within an activity set share the name space of the containing process. An activity set is equivalent to a BPMN **embedded subprocess**.

An activity may be a route activity, which performs no work processing (and therefore has no associated resource or applications), but simply supports routing decisions among the incoming transitions and/or among the outgoing transitions. BPMN **gateways** are represented by Route activities.

Finally, an activity may represent a BPMN **event**. An event is something that “happens” during the course of a business process. These events affect the flow of the process and usually have a cause (trigger) or an impact (result). There are three types of Events, based on when they affect the flow: Start, Intermediate, and End. Their attribute details are discussed in section 7.6.4.

BPMN provides a specific graphical representation for the different activities:

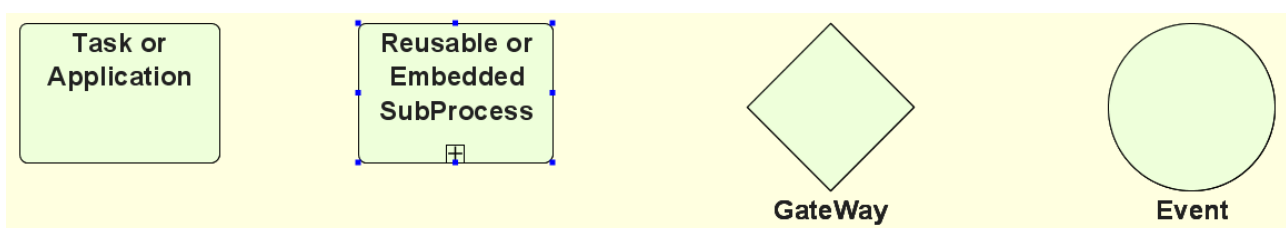


Figure 6.4: Activities

6.4.4. Transition Information

Activities are related to one another via flow control conditions (transition information). Each individual transition has three elementary properties, the from-activity, the to-activity and the condition under which the transition is made. Transition from one activity to another may be conditional (involving expressions which are evaluated to permit or inhibit the transition) or unconditional. The transitions within a process may result in the sequential or parallel operation

of individual activities within the process. The information related to associated split or join conditions is defined within the appropriate activity, split as a form of “post activity” processing in the from-activity, join as a form of “pre-activity” processing in the to- activity. This approach allows the control processing associated with process instance thread splitting and synchronization to be managed as part of the associated activity, and retains transitions as simple route assignment functions. The scope of a particular transition is local to the process definition, which contains it and the associated activities.

More complex transitions, which cannot be expressed using the simple elementary transition and the split and join functions associated with the from- and to- activities, are formed using route activities, which can be specified as intermediate steps between real activities allowing additional combinations of split and/or join operations. Using the basic transition entity plus route activities, routing structures of arbitrary complexity can be specified. Since several different approaches to transition control exist within the industry, several conformance classes are specified within XPD. These are described later in the document.

In graphical terms, a transition is a connection between two nodes. BPMN provides three different types of connections, referred to as Sequence Flow, Message Flow and Association. Sequence flow corresponds to Transition as described above. Message Flow and Association are described shortly. BPMN provides a specific graphical representation for the different connections:

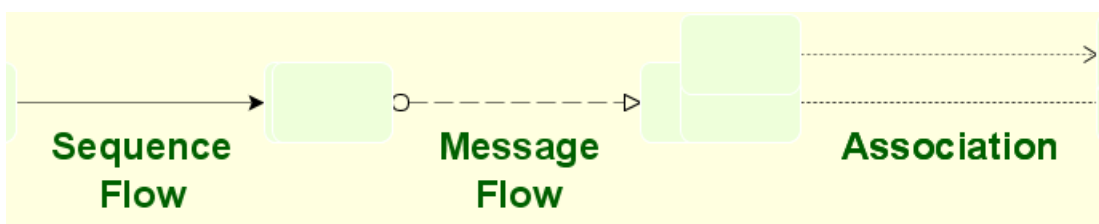


Figure 6.5: BPMN Connections

6.4.5. Participant Declaration

This provides descriptions of resources that can act as the performer of the various activities in the process definition. The particular resources, which can be assigned to perform a specific activity, are specified as an attribute of the activity, Performers, which links the activity to the set of resources which may be allocated to it. The participant declaration does not necessarily refer to a human or a single person, but may also identify a set of people of appropriate skill or responsibility, or machine automata resource rather than human. The meta-model includes some simple types of resource that may be defined within the participant declaration.

6.4.6. Application Declaration

This provides descriptions of the IT applications or interfaces which may be invoked by the service to support, or wholly automate, the processing associated with each activity, and identified within the activity by an application assignment attribute (or attributes). Such applications may be generic industry tools, specific departmental or enterprise services, or localized procedures implemented within the framework of the process or workflow management system. The application definition reflects the interface between the engine and the application or interface, including any parameters to be passed. Note that BPMN uses built-in Tasks which make use of Web Services to support or automate the processing, rather than IT applications.

6.4.7. Artifact

To satisfy additional modeling concepts that are not part of the basic set of flow elements (activities, sequence and message flow), BPMN provides the concept of Artifacts that can be linked to the existing Flow Objects through Associations (see below). Thus, Artifacts do not affect the basic Sequence or Message Flow, nor do they affect mappings to execution languages.

At this point, BPMN provides three standard Artifacts: A Data Object, a Group, and an Annotation. Additional standard Artifacts may be added to the BPMN specification in later versions. A modeler or modeling tool may extend a BPD (Business Process Diagram) and add new types of Artifacts to a Diagram. Any new Artifact must follow the specified Sequence Flow and Message Flow connection rules.

BPMN provides a specific graphical representation for the different artifacts:

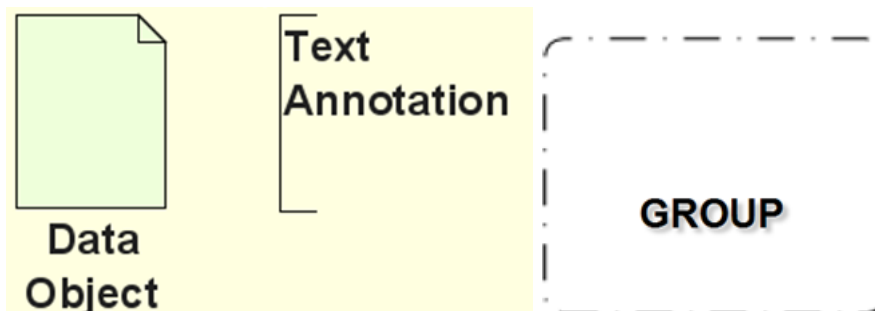


Figure 6.6: BPMN Artifacts

6.4.8. Message Flow

A Message Flow is used to show the flow of messages between two participants/processes (see section 7.4.1) that are prepared to send and receive them. In BPMN, two separate Pools in the Diagram will represent the two participants/processes (e.g., business entities or business roles). All Message Flow must connect two separate Pools. They can connect to the Pool boundary or to Flow Objects within the Pool boundary. They cannot connect two objects within the same Pool.

6.4.9. Association

An Association is used to associate information and Artifacts with Flow Objects. Text and graphical non-Flow Objects can be associated with the Flow Objects and Flow. An Association is also used to show the activities used to compensate for an activity.

An Association does not have a specific mapping to an execution language element. These objects and the Artifacts they connect to provide additional information for the reader of the BPMN Diagram, but do not directly affect the execution of the Process.

6.4.10. Relevant data field

This defines the data that is created and used within each process instance during process execution. The data is made available to activities or applications executed during the process and may be used to pass persistent information or intermediate results between activities and/or for evaluation in conditional expressions such as in transitions or performers (see 6.4.5). Relevant data field is of a particular type. XPDL includes definition of various basic and complex data types, (including date, string, etc.) Activities, invoked applications and/or transition conditions may refer to process relevant data field. The BPMN Property is an analogous concept.

6.4.11. Data Types and Expressions

The meta-model (and associated XPDL) assumes a number of standard data types (string, reference, integer, float, date/time, etc.); such data types are relevant to data fields, system or environmental data or participant data. Expressions may be formed using such data types to support conditional evaluations and assignment of new values to data fields. Data types may be extended using an XML schema or a reference to data defined in an external source.

6.4.12. System and Environmental Data

This is data which is maintained by the process or workflow management system or the local system environment, but which may be accessed by activities or used by the process or workflow management system in the evaluation of conditional expressions and assignments in the same way as relevant data fields.

6.4.13. Resource Repository

The resource repository accounts for the fact that participants can be humans, programs, or machines. In more sophisticated scenarios the participant declaration may refer to a resource repository, which may be an Organizational Model in the case of human participants. Note that this specification does not define or require a resource repository.

6.4.14. Vendor or User specific Extensions

Although the meta-model and associated XPDL contain most of the constructs which are likely to be required in the exchange of process definitions, there may be circumstances under which additional information (user or vendor specific) will need to be included within a process definition. Users and vendors are encouraged to work as far as possible within the standard entity / attribute sets; however, when extensions are needed the XPDL schema provides a standard way to extend it with vendor or user specific extensions.

6.4.14.1. Extended Elements and Attributes

The primary method to support such extensions is by the use of extended attributes. Extended attributes are those defined by the user or vendor, where necessary, to express any additional entity characteristics. XPDL schema supports namespace-qualified extensions to all the XPDL elements. The XPDL elements can be extended by adding new child elements, and new attributes.

6.4.14.2. Extended parameter mapping

No specific details of the scheme for encoding and passing parameter data are defined within this specification. Where parameters are passed on remote subflow invocation using the workflow Interoperability Specification (interface four), specifications are provided for the mapping of such parameters (for example into Wf-XML exchanges) using the operations within the concrete syntax specification for interoperability. Any local scheme for parameter mapping and encoding is vendor defined on a product-by-product basis and lies outside the scope of this specification.

7. XML Process Definition Language

7.1. Elements Common for Multiple Entities

7.1.1. Id Attribute of Many Objects

All IDs for objects should be unique within a package (XPDL file). For the package external ref feature (see section 7.2.5) the id must be qualified by a 'namespace' attributed to the external package so id-clash is avoided.

7.1.2. Graphic Information

Graphic information is optional and tool dependent. The graphic information (NodeGraphicsInfo and ConnectorGraphicsInfo) may appear multiple times on each XPDL element, depending on the number of tools that have added the graphical information to the XPDL file. Each tool, identified by ToolId, can add its own graphical information. Therefore, each tool can display and represent the same XPDL in totally different ways, because each tool uses its own graphical information, but retains the graphical information from other tools.

We recommend that where graphical portability between different products is important, the use of ToolId should be limited.

7.1.2.1. Pages

A complex business process may best be represented on multiple pages for viewing and printing purposes. We have added explicit support for this purpose. All graphical elements can refer to the page structure by using the PageId attribute.

```
<xsd:element name="Pages">
  <xsd:complexType>
    <xsd:sequence>
      <xsd:element ref="xpdl:Page" minOccurs="0" maxOccurs="unbounded"/>
      <xsd:any namespace="##other" processContents="lax" minOccurs="0" maxOccurs="unbounded"/>
    </xsd:sequence>
    <xsd:anyAttribute namespace="##other" processContents="lax"/>
  </xsd:complexType>
</xsd:element>

<xsd:element name="Page">
  <xsd:complexType>
    <xsd:sequence>
      <xsd:any namespace="##other" processContents="lax" minOccurs="0" maxOccurs="unbounded"/>
    </xsd:sequence>
    <xsd:attribute name="Name" type="xsd:string" use="optional"/>
    <xsd:attribute name="Id" type="xpdl:Id" use="required"/>
    <xsd:attribute name="Height" type="xsd:double" use="optional"/>
    <xsd:attribute name="Width" type="xsd:double" use="optional"/>
    <xsd:anyAttribute namespace="##other" processContents="lax"/>
  </xsd:complexType>
</xsd:element>
```

	Description
Height	Height of the page in pixels.
Id	Id of the page. Referred to in all Graphics to designate the page.
Name	Name of the page.
Width	Width of the node. Tool specific and depends on ToolId.

Table 1: Pages

7.1.2.2. *Coordinate Information*

Where coordinate information is provided, the following interpretation applies.

All co-ordinates have origin of top-left, relative to parent container or page.

Scale: Co-ordinate units are in pixels. However it would be nice to give other applications a hint as to the scale of a 'pixel' when the XPD file was saved (i.e. The XPD writer specifies co-ordinates and sizes in pixels but can also specify 'pixels to the millimeter' - the reading application can then, if it wishes, take this into account and scale to its pixel size appropriately).

This layout information is provided by the element 'LayoutInfo' and attribute 'PixelsPerMillimeter'. See PackagDefinition Header (section 7.2.1).

7.1.2.3. *NodeGraphicsInfo*

NodeGraphicsInfo is an optional entity that can be used by a tool to describe graphical information. Each graphical node in XPD (Activity, Pool, Lane, Artifact) has a list of NodeGraphicsInfo, one for each tool that has saved the corresponding information in the XPD file. If a tool chooses to use the NodeGraphicsInfo, it should select a tool id, which can be the name of the tool. Therefore multiple tools can work using the same XPD file and displaying the process with a different presentation layout.

```
<xsd:element name="NodeGraphicsInfo">
  <xsd:complexType>
    <xsd:sequence>
      <xsd:element ref="xpd:Coordinates" minOccurs="0"/>
      <xsd:any namespace="##other" processContents="lax" minOccurs="0" maxOccurs="unbounded"/>
    </xsd:sequence>
    <xsd:attribute name="ToolId" type="xsd:string" use="optional"/>
    <xsd:attribute name="IsVisible" type="xsd:boolean" use="optional" default="true"/>
    <xsd:attribute name="Page" type="xsd:NMTOKEN" use="optional"/>
    <xsd:annotation>
      <xsd:documentation>Deprecated in XPD 2.1, now use PageId and Page element</xsd:documentation>
    </xsd:annotation>
    <xsd:attribute>
      <xsd:attribute name="PageId" type="xpd:IdRef" use="optional"/>
      <xsd:attribute name="LaneId" type="xsd:NMTOKEN" use="optional"/>
      <xsd:attribute name="Height" type="xsd:double" use="optional"/>
      <xsd:attribute name="Width" type="xsd:double" use="optional"/>
      <xsd:attribute name="BorderColor" type="xsd:string" use="optional"/>
      <xsd:attribute name="FillColor" type="xsd:string" use="optional"/>
      <xsd:attribute name="Shape" type="xsd:string" use="optional"/>
      <xsd:anyAttribute namespace="##other" processContents="lax"/>
    </xsd:attribute>
  </xsd:complexType>
</xsd:element>

<xsd:element name="NodeGraphicsInfos">
  <xsd:complexType>
    <xsd:sequence>
      <xsd:element ref="xpd:NodeGraphicsInfo" minOccurs="0" maxOccurs="unbounded"/>
      <xsd:any namespace="##other" processContents="lax" minOccurs="0" maxOccurs="unbounded"/>
    </xsd:sequence>
    <xsd:anyAttribute namespace="##other" processContents="lax"/>
  </xsd:complexType>
</xsd:element>

<xsd:element name="Coordinates">
  <xsd:annotation>
    <xsd:documentation>BPMN and XPD</xsd:documentation>
  </xsd:annotation>
  <xsd:complexType>
    <xsd:sequence>
      <xsd:any namespace="##other" processContents="lax" minOccurs="0" maxOccurs="unbounded"/>
    </xsd:sequence>
    <xsd:attribute name="XCoordinate" type="xsd:double" use="optional"/>
    <xsd:attribute name="YCoordinate" type="xsd:double" use="optional"/>
    <xsd:anyAttribute namespace="##other" processContents="lax"/>
  </xsd:complexType>
</xsd:element>
```


	Description
BorderColor	Color of the border, expressed as a string. Tool specific and depends on ToolId.
Coordinates	X and Y coordinates of node's upper left corner (bounding box). Tool specific and depends on ToolId. Usual implementation based on upper left corner of page being (0, 0) and all coordinates ≥ 0 .
FillColor	Color of the fill, expressed as a string. Tool specific and depends on ToolId.
Height	Height of the node. Tool specific and depends on ToolId.
LaneId	If the node is in a Lane, this is the Id of the Lane.
ToolId	Tool id. This may correspond to the name of the tool generating the XPD L file. Note that multiple NodeGraphicsInfo elements may appear in an element. This allows each tool to have its NodeGraphicsInfo, allowing for different tools using the same XPD L file to represent the element in totally different ways. Each tool reads and writes its own NodeGraphicsInfo based on its ToolId, and it leaves untouched the NodeGraphicsInfo from other tools.
IsVisible	True indicates node should be shown.
Page [Deprecated]	The name of the page on which this node should be displayed. Used in XPD L 2.0 without sufficient guidelines to insure consistency and portability.
PageId	The id of the page on which this node should be displayed. Refers to Pages element described in section 7.1.2.1.
Shape	Shape, expressed as a string: used to override BPMN shapes.
Width	Width of the node. Tool specific and depends on ToolId.

Table 2: Node Graphics Info

7.1.2.4. ConnectorGraphicsInfo

ConnectorGraphicsInfo is an optional entity that can be used by a tool to describe graphical information for connecting objects (SequenceFlow, MessageFlow, Associations). Each connector in XPD L has a list of ConnectorGraphicsInfo, one for each tool that has saved the corresponding information in the XPD L file. If a tool chooses to use the ConnectorGraphicsInfo, it should select a tool id, which can be the name of the tool. Therefore multiple tools can work using the same XPD L file and displaying the process with a different presentation layout.

```

<xsd:element name="ConnectorGraphicsInfo">
  <xsd:annotation>
    <xsd:documentation>BPMN and XPD L</xsd:documentation>
  </xsd:annotation>
  <xsd:complexType>
    <xsd:sequence minOccurs="0">
      <xsd:element ref="xpd:Coordinates" minOccurs="0" maxOccurs="unbounded"/>
      <xsd:any namespace="##other" processContents="lax" minOccurs="0" maxOccurs="unbounded"/>
    </xsd:sequence>
    <xsd:attribute name="ToolId" type="xsd:NMTOKEN" use="optional"/>
    <xsd:attribute name="IsVisible" type="xsd:boolean" use="optional" default="true"/>
    <xsd:attribute name="Page" type="xsd:NMTOKEN" use="optional">
      <xsd:annotation>
        <xsd:documentation>Deprecated in XPD L 2.1, now use PageId and Page element</xsd:documentation>
      </xsd:annotation>
    </xsd:attribute>
    <xsd:attribute name="PageId" type="xpd:IdRef" use="optional"/>
    <xsd:attribute name="Style" type="xsd:string" use="optional"/>
    <xsd:attribute name="BorderColor" type="xsd:string" use="optional"/>
    <xsd:attribute name="FillColor" type="xsd:string" use="optional"/>
    <xsd:anyAttribute namespace="##other" processContents="lax"/>
  </xsd:complexType>
</xsd:element>

<xsd:element name="ConnectorGraphicsInfos">
  <xsd:complexType>
    <xsd:sequence>
      <xsd:element ref="xpd:ConnectorGraphicsInfo" minOccurs="0" maxOccurs="unbounded"/>
    </xsd:sequence>
  </xsd:complexType>
</xsd:element>

```

```

        <xsd:any namespace="##other" processContents="lax" minOccurs="0" maxOccurs="unbounded"/>
    </xsd:sequence>
    <xsd:anyAttribute namespace="##other" processContents="lax"/>
</xsd:complexType>
</xsd:element>

```

	Description
BorderColor	Color of the border, expressed as a string. Tool specific and depends on ToolId.
Coordinates	X and Y coordinates of points in the path. Tool specific and depends on ToolId.
FillColor	Color of the border, expressed as a string.
ToolId	Tool id. This may correspond to the name of the tool generating the XPDL file. Note that multiple NodeGraphicsInfo elements may appear in an element. This allows each tool to have its NodeGraphicsInfo, allowing for different tools using the same XPDL file to represent the element in totally different ways. Each tool read and writes its own NodeGraphicsInfo based on its ToolId, and it leaves untouched the NodeGraphicsInfo from other tools.
IsVisible	True indicates node should be shown.
Page [Deprecated]	The name of the page on which this node should be displayed. Used in XPDL 2.0 without sufficient guidelines to insure consistency and portability.
PageId	The id of the page on which this node should be displayed. Refers to Pages element described in section 7.1.2.1.
Shape	Shape, expressed as a string; used to override BPMN shapes.
Style	LineStyle. Tool specific and depends on ToolId. Should not conflict with BPMN recommended styles for SequenceFlow, MessageFlow and Association.

Table 3: Connector Graphics Info

7.1.3. Expression Type

The ExpressionType specifies the scripting language and particular script expression for a given XPDL expression. The script expression itself is contained within the body of the containing element. All three of the attributes need only be specified if they wish to override that specified in the Package Header.

ExpressionType is referred to in many elements that have expressions.

```

<xsd:complexType name="ExpressionType" mixed="true">
    <xsd:choice minOccurs="0" maxOccurs="unbounded">
        <xsd:any processContents="lax" minOccurs="0" maxOccurs="unbounded"/>
    </xsd:choice>
    <xsd:attribute name="ScriptType" type="xsd:string" use="optional"/>
    <xsd:attribute name="ScriptVersion" type="xsd:string" use="optional"/>
    <xsd:attribute name="ScriptGrammar" type="xsd:anyURI" use="optional"/>
    <xsd:anyAttribute namespace="##other" processContents="lax"/>
</xsd:complexType>

```

	Description
Type	Identifies the scripting language used in expressions. For consistency across implementations, when specifying a standard scripting language, it is recommended that the Type be selected from the following strings: text/javascript, text/vbscript, text/tcl, text/ecmascript, text/xml, application/xslt+xml.
Version	This is the version of the scripting language.
Grammar	This is a reference to a document that specifies the grammar of the language. It could be, for example, an XML schema, a DTD, or a BNF.

Table 4: ExpressionType

7.1.4. Extended Attributes

Extended Attributes can be used in all entities. They allow vendors to extend the functionality of this specification to meet individual product needs. A vendor can use extended attributes in two ways:

- a- The anonymous extended attribute provides a name and a value for the extension without the need to qualify the extension with a namespace.
- b- Namespace qualified extensions can be used to extend XPD L elements by adding child elements or by adding attributes. Namespace qualified extensions can be validated against a vendor provided schema (see section 7.2.1.1 Vendor extensions).

7.1.4.1. Anonymous Extended Attribute

The anonymous extended attributes use the ExtendedAttribute element to add an extension with a name and a value.

```
<xsd:element name="ExtendedAttribute">
  <xsd:complexType mixed="true">
    <xsd:choice minOccurs="0" maxOccurs="unbounded">
      <xsd:any namespace="##other" processContents="lax" minOccurs="0" maxOccurs="unbounded"/>
    </xsd:choice>
    <xsd:attribute name="Name" type="xsd:NMTOKEN" use="required"/>
    <xsd:attribute name="Value" type="xsd:string"/>
  </xsd:complexType>
</xsd:element>

<xsd:element name="ExtendedAttributes">
  <xsd:complexType>
    <xsd:sequence>
      <xsd:element ref="xpd l:ExtendedAttribute" minOccurs="0" maxOccurs="unbounded"/>
    </xsd:sequence>
  </xsd:complexType>
</xsd:element>
```

	Description
Name	Used to identify the Extended Attribute.
Value	Value of the extension.

Table 5: Extended Attributes

7.1.4.2. Namespace Qualified Extensions

In order for a tool to add namespace-qualified extensions, it first needs to extend the XPD L schema to add the extensions in the places in which the XPD L schema allows the tool to add extensions. The new generated schema should contain in addition to the XPD L namespace the tool namespace. The resulting schema can be used in addition to the XPD L schema to validate XPD L 2.1 files. The extension places are marked in the XPD L schema by [namespace="##other" processContents="lax"].

In addition, the tool should include the namespace, and it should add the VendorExtension section in XPD L (see 7.2.1.1 Vendor extensions), which contains a URI reference to the extended schema.

A child element can be added to a XPD L element, by adding a child element to the ExtendAttributes under the XPD L element. An attribute to a XPD L element can also be added by just qualifying it by the vendor namespace.

An example on how a vendor can create a schema with XPD L extensions is provided in section 8.3 Extending XPD L Schema.

7.1.5. Formal Parameters

Formal parameters can be used as attributes in process and application. They are passed during invocation and return of control (e.g. of an invoked application). These are the invocation parameters.

```
<xsd:element name="FormalParameter">
  <xsd:complexType>
    <xsd:sequence>
```

```

<xsd:element ref="xpd:DataType"/>
<xsd:element name="InitialValue" type="xpd:ExpressionType" minOccurs="0"/>
<xsd:element ref="xpd:Description" minOccurs="0"/>
<xsd:element ref="xpd:Length" minOccurs="0"/>
<xsd:any namespace="##other" processContents="lax" minOccurs="0" maxOccurs="unbounded"/>
</xsd:sequence>
<xsd:attribute name="Id" type="xsd:NMTOKEN" use="required"/>
<xsd:attribute name="Mode" default="IN">
  <xsd:simpleType>
    <xsd:restriction base="xsd:NMTOKEN">
      <xsd:enumeration value="IN"/>
      <xsd:enumeration value="OUT"/>
      <xsd:enumeration value="INOUT"/>
    </xsd:restriction>
  </xsd:simpleType>
</xsd:attribute>
<xsd:attribute name="Name" type="xsd:string" use="optional"/>
<xsd:attribute name="ReadOnly" type="xsd:boolean" use="optional" default="false"/>
<xsd:attribute name="Required" type="xsd:boolean" use="optional" default="false"/>
<xsd:attribute name="IsArray" type="xsd:boolean" use="optional" default="false"/>
<xsd:anyAttribute namespace="##other" processContents="lax"/>
</xsd:complexType>
</xsd:element>

<xsd:element name="FormalParameters">
  <xsd:complexType>
    <xsd:sequence>
      <xsd:choice minOccurs="0">
        <xsd:element ref="deprecated:FormalParameter" minOccurs="0" maxOccurs="unbounded"/>
        <xsd:element ref="xpd:FormalParameter" minOccurs="0" maxOccurs="unbounded"/>
      </xsd:choice>
      <xsd:choice minOccurs="0">
        <xsd:sequence>
          <xsd:element name="Extensions"/>
          <xsd:any namespace="##other" processContents="lax" minOccurs="0" maxOccurs="unbounded"/>
        </xsd:sequence>
      </xsd:choice>
    </xsd:sequence>
    <xsd:anyAttribute namespace="##other" processContents="lax"/>
  </xsd:complexType>
</xsd:element>

```

	Description
DataType	Data type of the formal parameter. See section 7.13.
Description	Textual description of the formal parameter.
Length	The length of the data. Used only for strings, to declare maximum length.
Id	Identifier for the parameter.
InitialValue	Pre-assignment of data for runtime.
Name	Name for the parameter.
IsArray	Indicates if the parameter is an array or a single value parameter.
Index	Index of the parameter (Deprecated)
Mode	IN Input Parameters OUT Output Parameters INOUT Parameters used as input and output
ReadOnly	The datafield or formal parameter is described as readOnly or as a constant and its value cannot be changed.
Required	Defines whether the parameter must be supplied, default to false.

Table 6: Formal Parameters

7.1.5.1. Parameter passing semantics

The parameter passing semantics is defined as:

- (a) Any read-only formal parameters (IN) are initialised by the value of the corresponding actual parameter in the call (an expression). This is pass-by-value semantics.
- (b) Any read/write formal parameters (INOUT) are initialised by the value of the corresponding actual (passed) parameter, which must be the identifier of a relevant data field entity. On completion of the process, the value of the formal out parameter is copied back to the original actual parameter (which must be the identifier of a relevant data field entity). This is copy-restore semantics.
- (c) Any write-only formal parameters (OUT) are initialised to zero (strings will be set to the empty string, complex data will have each element set to zero). On completion of the process, the value of the formal out parameter is copied back to the original actual parameter (which must be the identifier of a relevant data field entity). This is zero-restore semantics.

7.1.5.2. Concurrency semantics

Copying and restoring of parameters are treated as atomic operations; to avoid access conflicts from concurrent operations on relevant data field within the process instance these operations are serialized. Between copy and restore of (c) no locking is assumed and the returned parameter value will overwrite the local value (of the particular relevant data field item) at the time of the return call.

7.1.5.3. Formal-actual parameter mapping

The mapping of actual to formal parameters during invocation is defined by a parameter map list. The actual parameters are mapped 1:1 to the formal parameters in sequence, i.e. the first actual maps to the first formal, the second actual maps to the second formal etc. Type compatibility is required within the definitions and may be enforced by the run-time system. The effects of violation are locally defined and do not form part of this specification.

In case the actual parameter is an expression, the expression is evaluated and buffered by the engine, and the content of this buffer is used for formal-actual mapping. How the buffering and mapping is performed is outside the scope of this document.

7.1.6. External Reference

ExternalReference is a reference to an external definition of an entity. It can be used in DataTypes, Participant, and Application.

```
<xsd:element name="ExternalReference">
  <xsd:complexType>
    <xsd:sequence>
      <xsd:any namespace="##other" processContents="lax" minOccurs="0" maxOccurs="unbounded"/>
    </xsd:sequence>
    <xsd:attribute name="xref" type="xsd:NMTOKEN" use="optional"/>
    <xsd:attribute name="location" type="xsd:anyURI" use="required"/>
    <xsd:attribute name="namespace" type="xsd:anyURI" use="optional"/>
    <xsd:anyAttribute namespace="##other" processContents="lax"/>
  </xsd:complexType>
</xsd:element>
```

	Description
Location	It specifies the URI of the document that defines the type.
Namespace	It allows specification of the scope in which the entity is defined.
Xref	It specifies the identity of the entity within the external document.

Table 7: External Reference

Example 1: A FormalParameter that is defined by an XML schema:

```
<FormalParameter Id="PO">
  <DataType>
    <ExternalReference location="http://abc.com/schemas/po.xsd"/>
  </DataType>
```

```
<Description>PO specification for abc.com</Description>
</FormalParameter>
```

Example 2: A DataField defined by a Java class:

```
<DataField Id="PO" Name="PurchaseOrder" IsArray="FALSE">
  <DataType>
    <ExternalReference location="com.abc.purchases.PO"/>
  </DataType>
  <Description>PO specification for abc.com</Description>
</DataField>
```

7.1.6.1. Web Services

An activity in a process may invoke a web service. The ExternalReference element may be used as a reference to applications and data types that are defined in Web Service (WSDL) documents.

Example 3: A DataField whose data type is defined in a WSDL document:

```
<DataField Id="abcPO" Name="abcPurchaseOrder" IsArray="False">
  <DataType>
    <ExternalReference xref="PO" location="http://abc.com/services/poService.wsdl" namespace="poService/definitions/types"/>
  </DataType>
</DataField>
```

Example 4: An Application that is defined as an operation in a WSDL document:

```
<Application Id="placeOrder">
  <ExternalReference location="http://abc.com/PO/services/poService.wsdl"
    xref="PlaceOrder" namespace=
      "http://abc.com/services/poService.wsdl/definitions/portType"/>
</Application>
```

7.1.7. Assignment

Data fields may be explicitly assigned new values during the execution of a process. This may happen at the start or termination of a process or an activity. Assignments may also be associated with transitions/sequence flow, in which case the assignments are performed when the particular transition/outgoing sequence flow is chosen.

```
<xsd:element name="Assignment">
  <xsd:annotation>
    <xsd:documentation>BPMN and XPD L</xsd:documentation>
  </xsd:annotation>
  <xsd:complexType>
    <xsd:sequence>
      <xsd:element name="Target" type="xpdl:ExpressionType">
        <xsd:annotation>
          <xsd:documentation>Ivalue expression of the assignment, in XPD L may be the name of a DataField, in
BPMN name of a Property, in XPATH a reference</xsd:documentation>
        </xsd:annotation>
      </xsd:element>
      <xsd:element name="Expression" type="xpdl:ExpressionType">
        <xsd:annotation>
          <xsd:documentation>rvalue expression of the assignment</xsd:documentation>
        </xsd:annotation>
      </xsd:element>
      <xsd:any namespace="##other" processContents="lax" minOccurs="0" maxOccurs="unbounded"/>
    </xsd:sequence>
    <xsd:attribute name="AssignTime" use="optional" default="Start">
      <xsd:simpleType>
        <xsd:restriction base="xsd:NMTOKEN">
          <xsd:enumeration value="Start"/>
          <xsd:enumeration value="End"/>
        </xsd:restriction>
      </xsd:simpleType>
    </xsd:attribute>
    <xsd:anyAttribute namespace="##other" processContents="lax"/>
  </xsd:complexType>
</xsd:element>
```

```

<xsd:element name="Assignments">
  <xsd:annotation>
    <xsd:documentation>BPMN and XPDL</xsd:documentation>
  </xsd:annotation>
  <xsd:complexType>
    <xsd:sequence>
      <xsd:element ref="xpd:Assignment" maxOccurs="unbounded"/>
      <xsd:any namespace="##other" processContents="lax" minOccurs="0" maxOccurs="unbounded"/>
    </xsd:sequence>
    <xsd:anyAttribute namespace="##other" processContents="lax"/>
  </xsd:complexType>
</xsd:element>

```

	Description
Target	Lvalue expression, normally the name of DataField.
Expression	Rvalue expression in the scripting language specified for the package.
AssignTime	Specifies time of evaluation and assignment: Start or End of Process or Activity. Not relevant to transition/sequence flow.

Table 8: Assignment

7.1.8. Category

The modeler MAY add one or more Categories to various elements, such as Process, Activity and Transition; which can then be used for purposes such as reporting and analysis. In OLAP-based reports the categories would be members of the category dimension and allow filtering and slice-and-dice queries.

```

<xsd:element name="Category">
  <xsd:annotation>
    <xsd:documentation> BPMN (and XPDL??Allows arbitrary grouping of various types of elements, for
reporting.)</xsd:documentation>
  </xsd:annotation>
  <xsd:complexType>
    <xsd:sequence>
      <xsd:any namespace="##other" processContents="lax" minOccurs="0" maxOccurs="unbounded"/>
    </xsd:sequence>
    <xsd:attribute name="Id" type="xsd:NMTOKEN" use="required"/>
    <xsd:attribute name="Name" type="xsd:string" use="optional"/>
    <xsd:anyAttribute namespace="##other" processContents="lax"/>
  </xsd:complexType>
</xsd:element>

<xsd:element name="Categories">
  <xsd:complexType>
    <xsd:sequence>
      <xsd:element ref="xpd:Category" maxOccurs="unbounded"/>
      <xsd:any namespace="##other" processContents="lax" minOccurs="0" maxOccurs="unbounded"/>
    </xsd:sequence>
    <xsd:anyAttribute namespace="##other" processContents="lax"/>
  </xsd:complexType>
</xsd:element>

```

	Description
Id	Id of the category.
Name	Name of the category.

Table 9: Category

7.1.9. Artifact

BPMN provides modelers with the capability of showing additional information about a Process that is not directly related to the Sequence Flow or Message Flow of the Process.

At this point, BPMN provides three standard Artifacts: A Data Object, a Group, and an Annotation. Additional standard Artifacts may be added to the BPMN specification in later versions. A modeler or modeling tool may extend a BPD and add new types of Artifacts to a Diagram. Any new Artifact must follow the Sequence Flow and Message Flow connection rules (listed below). Associations can be used to link Artifacts to Flow Objects.

An Artifact is a graphical object that provides supporting information about the Process or elements within the Process. However, it does not directly affect the flow of the Process. Other examples of Artifacts include critical success factors and milestones.

BPMN provides a specific graphical representation for the different artifacts:

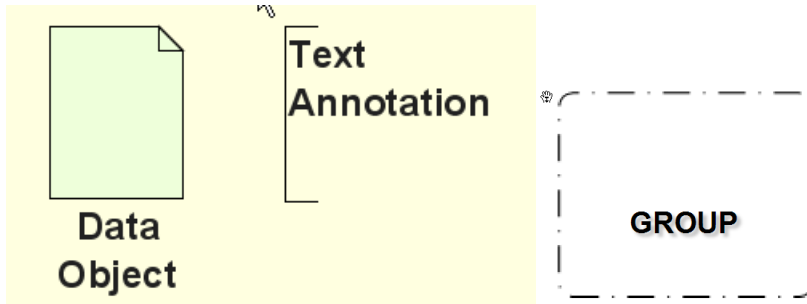


Figure 7.1: Artifacts

7.1.9.1. Sequence Flow Connections for Artifacts

- An Artifact MUST NOT be a target for Sequence Flow.
- An Artifact MUST NOT be a source for Sequence Flow.

7.1.9.2. Message Flow Connections for Artifacts

- An Artifact MUST NOT be a target for Message Flow.
- An Artifact MUST NOT be a source for Message Flow.

7.1.9.3. Schema for Artifacts

```
<xsd:element name="Artifact">
  <xsd:annotation>
    <xsd:documentation>BPMN: Not further defined here.</xsd:documentation>
  </xsd:annotation>
  <xsd:complexType>
    <xsd:sequence minOccurs="0">
      <xsd:element ref="xpd:Object" minOccurs="0"/>
      <xsd:element ref="xpd:Group" minOccurs="0"/>
      <xsd:element ref="xpd:DataObject" minOccurs="0"/>
      <xsd:element ref="xpd:NodeGraphicsInfos" minOccurs="0"/>
      <xsd:any namespace="##other" processContents="lax" minOccurs="0" maxOccurs="unbounded"/>
    </xsd:sequence>
    <xsd:attribute name="Id" type="xsd:NMTOKEN" use="required"/>
    <xsd:attribute name="Name" type="xsd:string" use="optional"/>
    <xsd:attribute name="ArtifactType" use="required">
      <xsd:simpleType>
        <xsd:restriction base="xsd:NMTOKEN">
          <xsd:enumeration value="DataObject"/>
          <xsd:enumeration value="Group"/>
          <xsd:enumeration value="Annotation"/>
        </xsd:restriction>
      </xsd:simpleType>
    </xsd:attribute>
    <xsd:attribute name="TextAnnotation" type="xsd:string" use="optional"/>
    <xsd:attribute name="Group" type="xsd:string" use="optional"/>
    <xsd:anyAttribute namespace="##other" processContents="lax"/>
  </xsd:complexType>
</xsd:element>
```



```

    </xsd:complexType>
  </xsd:element>

  <xsd:element name="Artifacts">
    <xsd:annotation>
      <xsd:documentation>BPMN</xsd:documentation>
    </xsd:annotation>
    <xsd:complexType>
      <xsd:sequence maxOccurs="unbounded">
        <xsd:element ref="xpd:Artifact"/>
        <xsd:any namespace="##other" processContents="lax" minOccurs="0" maxOccurs="unbounded"/>
      </xsd:sequence>
      <xsd:anyAttribute namespace="##other" processContents="lax"/>
    </xsd:complexType>
  </xsd:element>

```

	Description
Id	Id of the artifact.
Name	Name of the artifact.
ArtifactType	DataObject Group Annotation
DataObject	See section 7.1.9.5.
Group	Name of the Group. Attribute deprecated in 2.1. Replaced by Group Element. See section 7.1.9.6.
NodeGraphicsInfos	See section 7.1.1.
Object	See section 7.1.9.4.
TextAnnotation	Visible textual description.

Table 10: Artifact

7.1.9.4. Object

Referred to by numerous other graphical elements.

```

<xsd:element name="Object">
  <xsd:annotation>
    <xsd:documentation>BPMN: This is used to identify the Activity in an EndEvent Compensation???Also used to associate
categories and ocumentation with a variety of elements</xsd:documentation>
  </xsd:annotation>
  <xsd:complexType>
    <xsd:sequence minOccurs="0">
      <xsd:element ref="xpd:Categories" minOccurs="0"/>
      <xsd:element ref="xpd:Documentation" minOccurs="0"/>
      <xsd:any namespace="##other" processContents="lax" minOccurs="0" maxOccurs="unbounded"/>
    </xsd:sequence>
    <xsd:attribute name="Id" type="xsd:NMTOKEN" use="required">
      <xsd:annotation>
        <xsd:documentation>This identifies any Object in the BPMN diagram.</xsd:documentation>
      </xsd:annotation>
    </xsd:attribute>
    <xsd:attribute name="Name" type="xsd:string" use="optional"/>
    <xsd:anyAttribute namespace="##other" processContents="lax"/>
  </xsd:complexType>
</xsd:element>

```

	Description
Name	Name of the Object.
Categories	A list of categories. See section 7.1.8.
Documentation	Textual Documentation.

	Description
Id	Id of the object.

Table 11: Object

7.1.9.5. DataObject

In BPMN, a Data Object is considered an Artifact and not a Flow Object. It is considered an Artifact because it does not have any direct affect on the Sequence Flow or Message Flow of the Process, but it does provide information about what the Process does. That is, how documents, data, and other objects are used and updated during the Process. While the name “Data Object” may imply an electronic document, it can be used to represent many different types of objects, both electronic and physical.

As an Artifact, Data Objects generally will be associated with Flow Objects. An Association will be used to make the connection between the Data Object and the Flow Object. This means that the behavior of the Process can be modeled without Data Objects for modelers who want to reduce clutter. The same Process can be modeled with Data Objects for modelers who want to include more information without changing the basic behavior of the Process.

In some cases, the Data Object will be shown being sent from one activity to another, via a Sequence Flow. Data Objects will also be associated with Message Flow. They are not to be confused with the message itself, but could be thought of as the “payload” or content of some messages.

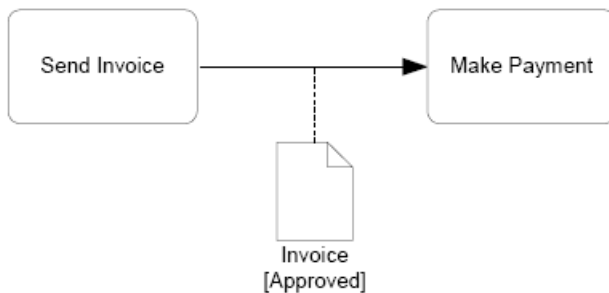


Figure 7.2: A Data Object associated with a Sequence Flow

In other cases, the same Data Object will be shown as being an input, then an output of a Process. Directionality added to the Association will show whether the Data Object is an input or an output. Also, the state attribute of the Data Object can change to show the impact of the Process on the Data Object.

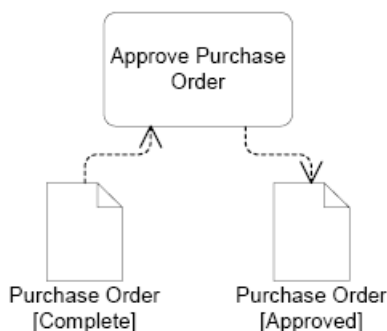


Figure 7.3: Data Objects shown as inputs and outputs

7.1.9.5.1. Schema for Data Objects

```
<xsd:element name="DataObject">
  <xsd:annotation>
    <xsd:documentation>BPMN</xsd:documentation>
  </xsd:annotation>
</xsd:element>
```

```

<xsd:complexType>
  <xsd:sequence>
    <xsd:element name="DataField" minOccurs="0" maxOccurs="unbounded">
      <xsd:complexType>
        <xsd:attribute name="Id" type="xpd:Id" use="required"/>
      </xsd:complexType>
    </xsd:element>
    <xsd:any namespace="##other" processContents="lax" minOccurs="0" maxOccurs="unbounded"/>
  </xsd:sequence>
  <xsd:attribute name="Id" type="xsd:NMTOKEN" use="required"/>
  <xsd:attribute name="Name" type="xsd:string" use="optional"/>
  <xsd:attribute name="State" type="xsd:string" use="optional"/>
  <xsd:attribute name="RequiredForStart" type="xsd:boolean" use="optional">
    <xsd:annotation>
      <xsd:documentation>Deprecated in BPMN1.1</xsd:documentation>
    </xsd:annotation>
  </xsd:attribute>
  <xsd:attribute name="ProducedAtCompletion" type="xsd:boolean" use="optional">
    <xsd:annotation>
      <xsd:documentation>Deprecated in BPMN1.1</xsd:documentation>
    </xsd:annotation>
  </xsd:attribute>
  <xsd:anyAttribute namespace="##other" processContents="lax"/>
</xsd:complexType>
</xsd:element>

```

	Description
Id	Id of the data object.
Name	Name is an attribute that is a text description of the object.
DataField	A list of data fields.
State	State is an optional attribute that indicates the impact the Process has had on the Data Object. Multiple Data Objects with the same name MAY share the same state within one Process.

Table 12: Data Object

7.1.9.6. Group

The Group object is an Artifact that provides a visual mechanism to group elements of a diagram informally. The grouping is tied to the Category supporting element (which is an attribute of all BPMN elements). That is, a Group is a visual depiction of a single Category. The graphical elements within the Group will be assigned the Category of the Group. (Note -- Categories can be highlighted through other mechanisms, such as color, as defined by a modeler or a modeling tool).



Figure 7.4: A Group Artifact

As an Artifact, a Group is not an activity or any Flow Object, and, therefore, cannot connect to Sequence Flow or Message Flow. In addition, Groups are not constrained by restrictions of Pools and Lanes. This means that a Group can stretch across the boundaries of a Pool to surround Diagram elements (see Figure below), often to identify activities that exist within a distributed business-to-business transaction.

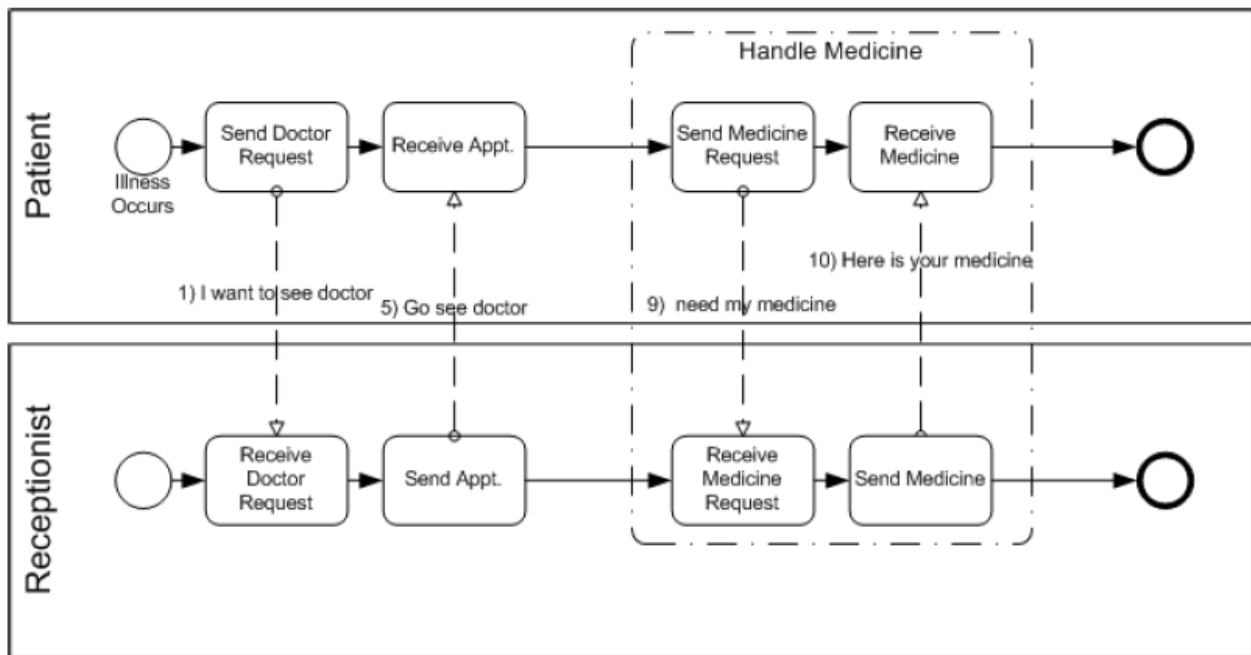


Figure 7.5: A Group around activities in different Pools

Groups are often used to highlight certain sections of a Diagram without adding additional constraints for performance-- as a Sub-Process would. The highlighted (grouped) section of the Diagram can be separated for reporting and analysis purposes. Groups do not affect the flow of the Process.

7.1.9.6.1.Schema for Groups

```
<xsd:element name="Group">
  <xsd:complexType>
    <xsd:sequence>
      <xsd:element ref="xpd:Category" minOccurs="0"/>
      <xsd:element name="Object" minOccurs="0" maxOccurs="unbounded">
        <xsd:complexType>
          <xsd:attribute name="Id" type="xpd:Id" use="required"/>
        </xsd:complexType>
      </xsd:element>
      <xsd:any namespace="##other" minOccurs="0" maxOccurs="unbounded"/>
    </xsd:sequence>
    <xsd:attribute name="Id" type="xsd:NMTOKEN" use="required"/>
    <xsd:attribute name="Name" type="xsd:string" use="optional"/>
    <xsd:anyAttribute namespace="##other" processContents="lax"/>
  </xsd:complexType>
</xsd:element>
```

	Description
Category	Category specifies the Category that the Group represents (Further details about the definition of a Category can be found in section 7.1.8). The name of the Category provides the label for the Group. The graphical elements within the boundaries of the Group will be assigned the Category.
Id	Id of the Group.
Name	Name is an attribute that is the text description of the Group.
Object	A list of the IDs of all the Objects in the Group.

Table 13: Group

7.2. Package Definition

It is possible to define several processes within one package, which may share the same tools and participants. We recommend creating one package per business process which should contain all the necessary processes as well as all the associated tools and participants, although it is not required. It is also possible to define just parts of one process definition or common parts of several processes within one package (e.g. a participant list or an application list).

The details of Package are all in PackageType. The xml included in Package checks for referential integrity: it makes sure that elements that refer to other elements using id in fact refer to elements that exist.

```

<xsd:element name="Package" type="xpd:PackageType">
  <!-- checks that process id referred to by pool exists -->
  <xsd:key name="ProcessIds.Package">
    <xsd:selector xpath="//xpd:WorkflowProcess | //xpd:ActivitySet"/>
    <xsd:field xpath="@Id"/>
  </xsd:key>
  <xsd:keyref name="PoolProcessIdRef.Package" refer="xpd:ProcessIds.Package">
    <xsd:selector xpath="//xpd:Pool"/>
    <xsd:field xpath="@Process"/>
  </xsd:keyref>
  <!-- checks that process id referred to by subflow exists (must be top-level, not an activityset) -->
  <xsd:key name="ProcessIdsTopLevel.Package">
    <xsd:selector xpath="//xpd:WorkflowProcess"/>
    <xsd:field xpath="@Id"/>
  </xsd:key>
  <xsd:keyref name="SubFlowIdRef.Package" refer="xpd:ProcessIdsTopLevel.Package">
    <xsd:selector xpath="//xpd:SubFlow"/>
    <xsd:field xpath="@Id"/>
  </xsd:keyref>
  <!-- checks that start activityset referred to by subflow exists (note: incomplete test, does not constrain to process specified by
subflow) -->
  <xsd:key name="ActivitySetIds.Package">
    <xsd:selector xpath="//xpd:ActivitySet"/>
    <xsd:field xpath="@Id"/>
  </xsd:key>
  <xsd:keyref name="SubFlowStartActivitySetIdRef.Package" refer="xpd:ActivitySetIds.Package">
    <xsd:selector xpath="//xpd:SubFlow"/>
    <xsd:field xpath="@StartActivitySetId"/>
  </xsd:keyref>
  <!-- checks that start activity referred to by subflow exists (note: incomplete test, does not constrain to process specified by
subflow) -->
  <xsd:key name="ActivityIds.Package">
    <xsd:selector xpath="//xpd:Activity"/>
    <xsd:field xpath="@Id"/>
  </xsd:key>
  <xsd:keyref name="SubFlowStartActivityIdRef.Package" refer="xpd:ActivityIds.Package">
    <xsd:selector xpath="//xpd:SubFlow"/>
    <xsd:field xpath="@StartActivityId"/>
  </xsd:keyref>
  <!-- checks that activity referred to by taskreference exists (note: may be incomplete test, does not constrain to same process
that contains the task) -->
  <xsd:keyref name="TaskReferenceTaskRef.Package" refer="xpd:ActivityIds.Package">
    <xsd:selector xpath="//xpd:TaskReference"/>
    <xsd:field xpath="@TaskRef"/>
  </xsd:keyref>
  <!-- checks that lane id referred to by nodegraphicsinfo exists -->
  <xsd:key name="LaneIds.Package">
    <xsd:selector xpath="//xpd:Lane"/>
    <xsd:field xpath="@Id"/>
  </xsd:key>
  <xsd:keyref name="NodeGraphicsInfoLaneIdRef.Package" refer="xpd:LaneIds.Package">
    <xsd:selector xpath="//xpd:NodeGraphicsInfo"/>
    <xsd:field xpath="@LaneId"/>
  </xsd:keyref>
  <!-- checks that source and target referred to by messageflow exists (note: incomplete test, does check that source/target are, or
are in, separate pools) -->
  <xsd:key name="PoolAndActivityIds.Package">
    <xsd:selector xpath="//xpd:Pool | //xpd:Activity"/>
    <xsd:field xpath="@Id"/>
  </xsd:key>

```

```

</xsd:key>
<xsd:keyref name="MessageFlowSourceRef.Package" refer="xpd:PoolAndActivityIds.Package">
  <xsd:selector xpath="//xpd:MessageFlow"/>
  <xsd:field xpath="@Source"/>
</xsd:keyref>
<xsd:keyref name="MessageFlowTargetRef.Package" refer="xpd:PoolAndActivityIds.Package">
  <xsd:selector xpath="//xpd:MessageFlow"/>
  <xsd:field xpath="@Target"/>
</xsd:keyref>
</xsd:element>

<xsd:complexType name="PackageType">
  <xsd:sequence>
    <xsd:element ref="xpd:PackageHeader"/>
    <xsd:element ref="xpd:RedefinableHeader" minOccurs="0"/>
    <xsd:element ref="xpd:ConformanceClass" minOccurs="0"/>
    <xsd:element ref="xpd:Script" minOccurs="0"/>
    <xsd:element ref="xpd:ExternalPackages" minOccurs="0"/>
    <xsd:element ref="xpd:TypeDeclarations" minOccurs="0"/>
    <xsd:element ref="xpd:Participants" minOccurs="0"/>
    <xsd:element ref="xpd:Applications" minOccurs="0"/>
    <xsd:element ref="xpd>DataFields" minOccurs="0"/>
    <xsd:element ref="xpd:PartnerLinkTypes" minOccurs="0"/>
    <xsd:element ref="xpd:Pages" minOccurs="0"/>
    <xsd:element ref="xpd:Pools" minOccurs="0"/>
    <xsd:element ref="xpd:MessageFlows" minOccurs="0"/>
    <xsd:element ref="xpd:Associations" minOccurs="0"/>
    <xsd:element ref="xpd:Artifacts" minOccurs="0"/>
    <xsd:element ref="xpd:WorkflowProcesses" minOccurs="0"/>
    <xsd:element ref="xpd:ExtendedAttributes" minOccurs="0"/>
    <xsd:any namespace="##other" processContents="lax" minOccurs="0" maxOccurs="unbounded"/>
  </xsd:sequence>
  <xsd:attribute name="Id" type="xpd:Id" use="required">
    <xsd:annotation>
      <xsd:documentation>BPMN: Corresponds to BPD identifier. Target of @DiagramRef in
Subflow.</xsd:documentation>
    </xsd:annotation>
  </xsd:attribute>
  <xsd:attribute name="Name" type="xsd:string" use="optional"/>
  <xsd:attribute name="Language" type="xsd:string" use="optional"/>
  <xsd:attribute name="QueryLanguage" type="xsd:string" use="optional"/>
  <xsd:anyAttribute namespace="##other" processContents="lax"/>
</xsd:complexType>

```

	Description
Applications	A list of Application Declarations. See section 7.3.
Artifacts	A list of Artifacts that can be linked to the existing Flow Objects through Associations. See sections 6.4.7. and 7.1.9.
Associations	A list of Associations which associate information and Artifacts with Flow Objects. See section 7.10.
ConformanceClass	Structural restriction on process definitions in this package. See section 7.2.3.
DataFields	A list of Relevant data fields defined for the package. See section 7.12.
ExtendedAttributes	A list of vendor-defined extensions that may be added to the package. See section 7.1.1.
ExternalPackages	Reference to another Package definition defined in a separate document.
Id	Used to identify the package.
Language	This holds the code for the language in which text is written as specified by ISO 639-2. Optionally this may be suffixed with a country code as specified by ISO 3166 to permit distinction between national dialects of the given language. The default is 'en_US'.
MessageFlows	A list of MessageFlows which go between Pools or activities in two pools. See section 7.8.
Name	Text. Used to identify the package.
PackageHeader	A set of elements specifying package characteristics.

	Description
Participants	A list of resources used in implementing processes in the package. See section 7.11.
PartnerLinkTypes	Partner link types for this package. See section 7.8.1.
Pools	A list of Pools for the Package. See section 7.4.
QueryLanguage	A Language MAY be provided so that the syntax of queries used in the Diagram can be understood. [Editors Note: Is this different than Scripting Language? TBD by BPMN.]
RedefinableHeader	A set of elements and attributes used by both the Package and Process definitions.
Script	Identifies the scripting language used in expressions.
TypeDeclarations	A list of Data Types used in the package. See section 7.13.
Processes	A list of the Processes that comprise this package. See section 7.5.

Table 14: Package Definition

7.2.1. Package definition Header

The package definition header keeps all information central to a package such as XPD L version, source vendor id, etc.

```

<xsd:element name="PackageHeader">
  <xsd:complexType>
    <xsd:sequence>
      <xsd:element ref="xpd:XPDLVersion"/>
      <xsd:element ref="xpd:Vendor"/>
      <xsd:element ref="xpd:Created"/>
      <xsd:element ref="xpd:ModificationDate" minOccurs="0"/>
      <xsd:element ref="xpd:Description" minOccurs="0"/>
      <xsd:element ref="xpd:Documentation" minOccurs="0"/>
      <xsd:element ref="xpd:PriorityUnit" minOccurs="0"/>
      <xsd:element ref="xpd:CostUnit" minOccurs="0"/>
      <xsd:element ref="xpd:VendorExtensions" minOccurs="0"/>
      <xsd:element ref="xpd:LayoutInfo" minOccurs="0"/>
      <xsd:any namespace="##other" processContents="lax" minOccurs="0" maxOccurs="unbounded"/>
    </xsd:sequence>
    <xsd:anyAttribute namespace="##other" processContents="lax"/>
  </xsd:complexType>
</xsd:element>

<xsd:element name="LayoutInfo">
  <xsd:complexType>
    <xsd:attribute name="PixelsPerMillimeter" type="xsd:float" use="optional">
      <xsd:annotation>
        <xsd:documentation>Co-ordinates / Sizes are in pixels - this attribute specifies the number of pixels per
millimeter used by application.</xsd:documentation>
      </xsd:annotation>
    </xsd:attribute>
    <xsd:anyAttribute namespace="##other" processContents="lax"/>
  </xsd:complexType>
</xsd:element>

<xsd:element name="XPDLVersion">
  <xsd:complexType>
    <xsd:simpleContent>
      <xsd:extension base="xsd:string">
        <xsd:anyAttribute namespace="##other" processContents="lax"/>
      </xsd:extension>
    </xsd:simpleContent>
  </xsd:complexType>
</xsd:element>

<xsd:element name="Vendor">
  <xsd:complexType>
    <xsd:simpleContent>

```

```

        <xsd:extension base="xsd:string">
          <xsd:anyAttribute namespace="##other" processContents="lax"/>
        </xsd:extension>
      </xsd:simpleContent>
    </xsd:complexType>
  </xsd:element>

  <xsd:element name="Created">
    <xsd:complexType>
      <xsd:simpleContent>
        <xsd:extension base="xsd:string">
          <xsd:anyAttribute namespace="##other" processContents="lax"/>
        </xsd:extension>
      </xsd:simpleContent>
    </xsd:complexType>
  </xsd:element>

  <xsd:element name="ModificationDate">
    <xsd:complexType>
      <xsd:simpleContent>
        <xsd:extension base="xsd:string">
          <xsd:anyAttribute namespace="##other" processContents="lax"/>
        </xsd:extension>
      </xsd:simpleContent>
    </xsd:complexType>
  </xsd:element>

  <xsd:element name="Description">
    <xsd:complexType>
      <xsd:simpleContent>
        <xsd:extension base="xsd:string">
          <xsd:anyAttribute namespace="##other" processContents="lax"/>
        </xsd:extension>
      </xsd:simpleContent>
    </xsd:complexType>
  </xsd:element>

  <xsd:element name="Documentation">
    <xsd:complexType>
      <xsd:simpleContent>
        <xsd:extension base="xsd:string">
          <xsd:anyAttribute namespace="##other" processContents="lax"/>
        </xsd:extension>
      </xsd:simpleContent>
    </xsd:complexType>
  </xsd:element>

  <xsd:element name="PriorityUnit">
    <xsd:complexType>
      <xsd:simpleContent>
        <xsd:extension base="xsd:string">
          <xsd:anyAttribute namespace="##other" processContents="lax"/>
        </xsd:extension>
      </xsd:simpleContent>
    </xsd:complexType>
  </xsd:element>

  <xsd:element name="CostUnit">
    <xsd:complexType>
      <xsd:simpleContent>
        <xsd:extension base="xsd:string">
          <xsd:anyAttribute namespace="##other" processContents="lax"/>
        </xsd:extension>
      </xsd:simpleContent>
    </xsd:complexType>
  </xsd:element>

```

	Description
CostUnit	Units used in Simulation Data (Usually expressed in terms of a currency). The currency codes specified by ISO 4217 are recommended.

	Description
Created	Creation date of Package Definition. Should be stored in either the Basic or Extended forms specified by ISO 8601. For example: 1985-04-12T10:15:30Z is the extended form of the 3:30 pm on the 12th April 1985 GMT.
Description	Textual description of the package.
Documentation	Operating System specific path- and filename of help file/description file.
LayoutInfo	All co-ordinates (in NodeGraphicsInfos) have origin of 'top-left, relative to parent container'. Co-ordinate units are in pixels. However it would be nice to give other applications a hint as to the scale of a 'pixel' when the XPDL file was saved (i.e. the XPDL writer specifies co-ordinates and sizes in pixels but can also specify 'pixels to the millimeter' - the reading application can then, if it wishes, take this into account and scale to its pixel size appropriately). See PixelsPerMillimeter below.
ModificationDate	This defines the date on which the Diagram was last modified (for this Version). Should be stored in either the Basic or Extended forms specified by ISO 8601. For example: 1985-04-12T10:15:30Z is the extended form of the 3:30 pm on the 12th April 1985 GMT.
PixelsPerMillimeter	The default unit should be Pixels. The transformation of whatever measurement unit is used internally is left up to the implementing tool.
PriorityUnit	A text string with user defined semantics.
Vendor	Defines the origin of this model definition and contains vendor's name, vendor's product name and product's release number.
VendorExtensions	List of extensions by vendors. There is a vendor extension entry for each tool that provides extensions in this XPDL content.
XPDLVersion	Version of this specification. The current value, for this specification, is "2.1".

Table 15: Package Definition Header – Attributes

7.2.1.1. Vendor extensions

Vendor extension is used for vendors to define extensions and provide a schema and a description for the extensions. For details, see section 7.1.2.2 Namespace Qualified Extensions.

```

<xsd:element name="VendorExtension">
  <xsd:complexType>
    <xsd:sequence>
      <xsd:any namespace="##other" processContents="lax"
        minOccurs="0" maxOccurs="unbounded"/>
    </xsd:sequence>
    <xsd:attribute name="ToolId" type="xsd:string" use="required"/>
    <xsd:attribute name="schemaLocation" type="xsd:anyURI" use="optional"/>
    <xsd:attribute name="extensionDescription" type="xsd:anyURI"
      use="optional"/>
    <xsd:anyAttribute namespace="##other" processContents="lax"/>
  </xsd:complexType>
</xsd:element>

<xsd:element name="VendorExtensions">
  <xsd:complexType>
    <xsd:sequence>
      <xsd:element ref="xpd:VendorExtension" minOccurs="0" maxOccurs="unbounded"/>
      <xsd:any namespace="##other" processContents="lax" minOccurs="0" maxOccurs="unbounded"/>
    </xsd:sequence>
    <xsd:anyAttribute namespace="##other" processContents="lax"/>
  </xsd:complexType>
</xsd:element>

```

	Description
ToolId	Identification of the tool adding this extension. It is the same value used in NodeGraphicsInfo ToolId. This value may be a URI.

	Description
SchemaLocation deprecated: see next	A URI indicating the location of the schema that can be used to validate the XPDL containing the extensions for the tool.
SchemaNamespace	The URI of the namespace for the vendor extension. The XSD for this URI MAY be specified by the xsi:schemaLocation as shown in the example below.
ExtensionDescription	A URI indicating the location of a document describing the extensions provided by the schema in schemaLocation.

Table 16: Vendor Extension -- Attributes

7.2.1.2. Example of specifying the vendor extension's schema location

Vendor extensions can specify the location of the schema to permit tools to validate the XPDL containing the extensions by using the schemaLocation attribute as follows:

```
<xpdl2:Package xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
  xmlns:vendorExt="http://www.vendor.com/vendorExt"
  xmlns:xpdl2="http://www.wfmc.org/2004/XPDL2.0alpha"
  xsi:schemaLocation="xpdl2 http://www.wfmc.org/standards/docs/TC-1025_bpmnxdpdl_24.xsd vendorExt
    http://www.vendor.com/VendorExtensions1.xsd"
  Id="_pTCasJIFEdye79YtjKhBOQ" Name="XPDL21Package">
```

In this example the vendor extension element would specify its SchemaNamespace attribute as:

```
http://www.vendor.com/vendorExt
```

7.2.2. Redefinable Header

The redefinable header covers those header attributes that may be defined in the definition header and may be redefined in the header of any process definition. In case of redefinition, the scope rules hold.

```
<xsd:element name="RedefinableHeader">
  <xsd:complexType>
    <xsd:sequence>
      <xsd:element ref="xpdl:Author" minOccurs="0"/>
      <xsd:element ref="xpdl:Version" minOccurs="0"/>
      <xsd:element ref="xpdl:Codepage" minOccurs="0"/>
      <xsd:element ref="xpdl:Countrykey" minOccurs="0"/>
      <xsd:element ref="xpdl:Responsibles" minOccurs="0"/>
      <xsd:any namespace="##other" processContents="lax" minOccurs="0" maxOccurs="unbounded"/>
    </xsd:sequence>
    <xsd:attribute name="PublicationStatus">
      <xsd:simpleType>
        <xsd:restriction base="xsd:NMTOKEN">
          <xsd:enumeration value="UNDER_REVISION"/>
          <xsd:enumeration value="RELEASED"/>
          <xsd:enumeration value="UNDER_TEST"/>
        </xsd:restriction>
      </xsd:simpleType>
    </xsd:attribute>
    <xsd:anyAttribute namespace="##other" processContents="lax"/>
  </xsd:complexType>
</xsd:element>

<xsd:element name="Author">
  <xsd:complexType>
    <xsd:simpleContent>
      <xsd:extension base="xsd:string">
        <xsd:anyAttribute namespace="##other" processContents="lax"/>
      </xsd:extension>
    </xsd:simpleContent>
  </xsd:complexType>
</xsd:element>

<xsd:element name="Version">
  <xsd:complexType>
    <xsd:simpleContent>
      <xsd:extension base="xsd:string">
```

```

        <xsd:anyAttribute namespace="##other" processContents="lax"/>
      </xsd:extension>
    </xsd:simpleContent>
  </xsd:complexType>
</xsd:element>

<xsd:element name="Codepage">
  <xsd:complexType>
    <xsd:simpleContent>
      <xsd:extension base="xsd:string">
        <xsd:anyAttribute namespace="##other" processContents="lax"/>
      </xsd:extension>
    </xsd:simpleContent>
  </xsd:complexType>
</xsd:element>

<xsd:element name="Countrykey">
  <xsd:complexType>
    <xsd:simpleContent>
      <xsd:extension base="xsd:string">
        <xsd:anyAttribute namespace="##other" processContents="lax"/>
      </xsd:extension>
    </xsd:simpleContent>
  </xsd:complexType>
</xsd:element>

<xsd:element name="Responsible">
  <xsd:complexType>
    <xsd:simpleContent>
      <xsd:extension base="xsd:string">
        <xsd:anyAttribute namespace="##other" processContents="lax"/>
      </xsd:extension>
    </xsd:simpleContent>
  </xsd:complexType>
</xsd:element>

<xsd:element name="Responsibles">
  <xsd:complexType>
    <xsd:sequence>
      <xsd:element ref="xpdl:Responsible" minOccurs="0" maxOccurs="unbounded"/>
      <xsd:any namespace="##other" processContents="lax" minOccurs="0" maxOccurs="unbounded"/>
    </xsd:sequence>
    <xsd:anyAttribute namespace="##other" processContents="lax"/>
  </xsd:complexType>
</xsd:element>

```

	Description
Author	Name of the author of this package definition.
Codepage	The codepage used for the text parts. If codepage is omitted, then UFT-8 is assumed.
Countrykey	Country code based on ISO 3166. It could be either the three digits country code number, or the two alpha characters country codes.
PublicationStatus	Status of the Process Definition. UNDER_REVISION RELEASED UNDER_TEST
Responsible(s)	Participant, who is responsible for this process; the supervisor during run time. Link to entity participant. Participant, who is responsible for this workflow of this Model definition (usually an Organisational Unit or a Human). It is assumed that the responsible is the supervisor during run time. Default: Initiating participant.
Version	Version of this Package Definition.

Table 17: Redefinable Header

7.2.3. Conformance Class Declaration

The conformance class declaration allows description of the conformance class to which the definitions in the model definition are restricted. The specified class applies to all the contained process definitions, unless it is re-defined locally at the process definition level.

There are two independent categories defined for conformance: Graph Conformance and BPMN Model Portability conformance.

7.2.3.1. Graph Conformance

The following Graph Conformance Classes are defined at the package level:

- NON-BLOCKED
 - There is no restriction for this class.
- LOOP-BLOCKED
 - The Activities and Transitions/SequenceFlows of a Process Definition form an acyclic graph (or set of disjoint acyclic graphs).
- FULL-BLOCKED
 - For each join (or respectively split) there is exactly one corresponding split (or respectively join) of the same kind. In an AND split no conditions are permitted; in a XOR split an unconditional or OTHERWISE Transition is required if there is a Transition with a condition (i.e. an undefined result of transition evaluation is not permitted).

7.2.3.2. BPMN Model Portability Conformance

7.2.3.2.1. Overview

BPMN can be used for both "abstract" activity flow modeling and for complete executable design. Many tools, however, make use of BPMN for the abstract modeling but add executable detail in tool-specific activity properties. One goal of XPD 2.1 is to promote portability of abstract activity flow models between tools. This requires separating the elements and attributes of BPMN related to activity flow modeling from those related to executable design. The BPMN spec does not define this separation, but XPD does, in the form of BPMN Model Portability conformance classes.

In broad terms, the "abstract model" elements are those that represent BPMN constructs that are printable in the business process diagram, such as those defining the flow object type or subtype (e.g., looping User task, collapsed subprocess, exclusive gateway, timer event), including only attributes specifying the subtype, label (Name attribute), and unique identifiers for the object itself and pointers to other identifiers in the diagram. Elements and attributes representing data, messages, or other implementation detail are omitted from the abstract process model. In other words, the model describes the "what" and the "when" of process activity flow, but not the "how" of flow object implementation.

XPD defines three Model Portability conformance classes, SIMPLE, STANDARD, and COMPLETE. A modeling tool asserting compliance to one of these classes means that the tool can import and understand all parts of a serialized BPMN instance conformant to the class. All three classes exclude implementation-related XPD elements and attributes. All three classes exclude vendor specific extensions via the use of Extended Attributes or user name spaces. They differ only in the set of abstract modeling elements supported.

The SIMPLE class includes the following BPMN objects: task, collapsed subprocess, gateway (exclusive data-based, inclusive, parallel), None start and None end events, pool, lane, data object, text annotation, sequence flow (uncontrolled, conditional, default), and association.

The STANDARD class includes the following BPMN objects: task (task type User, Service, Send, Receive); collapsed and expanded subprocess, looping or multi-instance activity, gateway (inclusive, exclusive data-based, exclusive event-based, parallel), start events (None, message, timer), catching intermediate events in sequence flow (timer, message), throwing intermediate events in sequence flow (message), attached intermediate events (timer, message, error), end events (None, error, message, terminate), pool, lane, data object, text annotation, sequence flow (uncontrolled, conditional, default), and association.

The COMPLETE class includes all task types, all event types, and all gateway types described by BPMN 1.1, message

flow, transactional subprocess, and ad hoc subprocess.

Each class is described by a filter transform (xslt) that can be applied to the XPDL instance, leaving only the elements and attributes of the class. If the original XPDL is schema-valid, the filtered XPDL will also be schema valid. A second transform provides additional validation rules required for conformance. [Editors note: examples to be provided]. If the original XPDL is identical to the filtered XPDL and has no validation errors, the original instance is said to be conformant to the class. If the original XPDL is not identical to the filtered XPDL, but the filtered XPDL has no validation errors, the filtered XPDL represents the class-conformant portion of the original instance.

7.2.3.2.2. BPMN Model Portability Conformance Class Summary

The following BPMN Model Portability Conformance classes are defined at the package level:

- NONE
 - The document does not support BPMN.
- SIMPLE
 - The document conforms to the requirements for portability of models containing a simple set of BPMN elements.
- STANDARD
 - The document conforms to the requirements for portability of models containing a standard set of BPMN elements.
- COMPLETE
 - The document conforms to the requirements for portability of models containing the full set of BPMN elements.

We will provide tools for validating BPMN abstract model portability conformance levels.

To test a document for STANDARD conformance the following steps are necessary:

- Run STANDARDFILTER xslt to discard detail not required for STANDARD conformance.
- Perform schema check on result to validate document and check for structural integrity.
- Run STANDARDCONSISTENCY xslt to validate consistency (additional checks required by BPMN specification).

Editors Note: SIMPLE and COMPLETE conformance tests have similar steps.

Note that a document that passes the COMPLETE conformance will also pass the STANDARD conformance and both will pass the SIMPLE conformance.

We envision other BPMN portability conformance classes, and other levels of abstract model portability conformance may be introduced in the future.

7.2.3.3. Conformance Schema

```
<xsd:element name="ConformanceClass">
  <xsd:complexType>
    <xsd:sequence>
      <xsd:any namespace="##other" processContents="lax" minOccurs="0" maxOccurs="unbounded"/>
    </xsd:sequence>
    <xsd:attribute name="GraphConformance" use="optional" default="NON_BLOCKED">
      <xsd:simpleType>
        <xsd:restriction base="xsd:NMTOKEN">
          <xsd:enumeration value="FULL_BLOCKED"/>
          <xsd:enumeration value="LOOP_BLOCKED"/>
          <xsd:enumeration value="NON_BLOCKED"/>
        </xsd:restriction>
      </xsd:simpleType>
    </xsd:attribute>
    <xsd:attribute name="BPMNModelPortabilityConformance" use="optional" default="NONE">
```

```

<xsd:simpleType>
  <xsd:restriction base="xsd:NMTOKEN">
    <xsd:enumeration value="NONE"/>
    <xsd:enumeration value="SIMPLE"/>
    <xsd:enumeration value="STANDARD"/>
    <xsd:enumeration value="COMPLETE"/>
  </xsd:restriction>
</xsd:simpleType>
</xsd:attribute>
<xsd:anyAttribute namespace="##other" processContents="lax"/>
</xsd:complexType>
</xsd:element>

```

	Description
GraphConformance	FULL-BLOCKED The network structure is restricted to proper nesting of SPLIT/JOIN and loops.
	LOOP-BLOCKED The network structure is restricted to proper nesting of loops.
	NON-BLOCKED There is no restriction on the network structure. This is the default.
BPMNModelPortabilityConformance	NONE The document is not BPMN compliant.
	SIMPLE The document conforms to the requirements for portability of models containing a simple set of BPMN elements.
	STANDARD The document conforms to the requirements for portability of models containing the standard set of BPMN elements.
	COMPLETE The document conforms to the requirements for portability of models containing the full set of BPMN elements.

Table 18: Conformance Class Declaration

7.2.4. Script

The Script element identifies the scripting language used in XPDL expressions. A text expression may be used wherever an element is of type `xsd:string`. One could, for example, use an expression within Cost elements.

An expression composed of formatted XML (e.g., MathML) may be used within the ActualParameter or Expression element (used within a TransitionCondition).

```

<xsd:element name="Script">
  <xsd:complexType>
    <xsd:sequence>
      <xsd:any namespace="##other" processContents="lax" minOccurs="0" maxOccurs="unbounded"/>
    </xsd:sequence>
    <xsd:attribute name="Type" type="xsd:string" use="required"/>
    <xsd:attribute name="Version" type="xsd:string" use="optional"/>
    <xsd:attribute name="Grammar" type="xsd:anyURI" use="optional"/>
    <xsd:anyAttribute namespace="##other" processContents="lax"/>
  </xsd:complexType>
</xsd:element>

```

	Description
Type	Identifies the scripting language used in expressions. For consistency across implementations, when specifying a standard scripting language, it is recommended that the Type be selected from the following strings: <code>text/javascript</code> , <code>text/vbscript</code> , <code>text/tcl</code> , <code>text/ecmascript</code> , <code>text/xml</code> , <code>application/xslt+xml</code> .
Version	This is the version of the scripting language.
Grammar	This is a reference to a document that specifies the grammar of the language. It could be, for example, an XML schema, a DTD, or a BNF.

Table 19: Script

7.2.5. External Package

External package reference allows referencing definitions in another Package definition or in other systems providing an Interface to the Process or Management system (e.g. a legacy Organisation Description Management Tool).

The ExternalPackages element allows XPDL modelers to isolate common objects in packages that can be included in multiple models. The element holds a list of ExternalPackage elements each of which refer to another XPDL document, an external package. External packages are indistinguishable from any other package and can contain any well formed XPDL model. However, when they are included into another document as an external package, only some of the information in the external package will be examined and used. In particular, the package level and process level Applications and Participants and the processes in external package can be used within the containing document.

The schema describing XPDL states that the ExternalPackages element appears within the Package element and that it may contain zero or more ExternalPackage elements. The ExternalPackage elements have three attributes: an id, a name, and a reference to the document to be included.

```
<xsd:element name="ExternalPackage">
  <xsd:complexType>
    <xsd:sequence>
      <xsd:element ref="xpd:ExtendedAttributes" minOccurs="0"/>
      <xsd:any namespace="##other" processContents="lax" minOccurs="0" maxOccurs="unbounded"/>
    </xsd:sequence>
    <xsd:attribute name="href" type="xsd:string"/>
    <xsd:attribute name="Id" type="xsd:NMTOKEN"/>
    <xsd:attribute name="Name" type="xsd:string" use="optional"/>
    <xsd:anyAttribute namespace="##other" processContents="lax"/>
  </xsd:complexType>
</xsd:element>

<xsd:element name="ExternalPackages">
  <xsd:complexType>
    <xsd:sequence>
      <xsd:element ref="xpd:ExternalPackage" minOccurs="0" maxOccurs="unbounded"/>
      <xsd:any namespace="##other" processContents="lax" minOccurs="0" maxOccurs="unbounded"/>
    </xsd:sequence>
    <xsd:anyAttribute namespace="##other" processContents="lax"/>
  </xsd:complexType>
</xsd:element>
```

	Description
ExtendedAttributes	Optional vendor-defined extensions to meet implementation needs. See section 7.1.4.
Href	A Model Identifier. Logical reference to a Model.
Id	The id of externally referenced package.
Name	The name given to the external package.

Table 20: External Package Reference

7.2.6. Example use of External Package

Here is an example extracted from a document generated by one company's XPDL/BPMN design tool:

```
<ExternalPackages>
  <ExternalPackage Id="11" Name="Muses" href="C:\Work\External Packages\Muses.xpd" />
  <ExternalPackage Id="12" Name="Stooges" href="C:\Work\External Packages\Stooges.xpd" />
</ExternalPackages>
```

When an application or participant name is mentioned in a document there is nothing to indicate it originates in an external package, so some effort must be made to insure that those names are unique.

When a process Id is specified in a Subflow or TaskApplication element, the PackageRef attribute is used to specify which external package defines the process.

7.3. Application Declaration

Application declaration is a list of all applications/services or tools required and invoked by the processes defined within the process definition or surrounding package. Tools may be defined (or, in fact, just named). This means, that the real definition of the tools is not necessary and may be handled by an object manager. The reason for this approach is the handling of multi-platform environments, where a different program (or function) has to be invoked for each platform. XPDL abstracts from the concrete implementation or environment (thus these aspects are not of interest at process definition time).

```
<xsd:element name="Application">
  <xsd:complexType>
    <xsd:sequence>
      <xsd:element ref="xpd:Description" minOccurs="0"/>
      <xsd:element name="Type" type="xpd:ApplicationType" minOccurs="0"/>
      <xsd:choice>
        <xsd:element ref="xpd:FormalParameters"/>
        <xsd:element ref="xpd:ExternalReference" minOccurs="0"/>
      </xsd:choice>
      <xsd:element ref="xpd:ExtendedAttributes" minOccurs="0"/>
      <xsd:any namespace="##other" processContents="lax" minOccurs="0" maxOccurs="unbounded"/>
    </xsd:sequence>
    <xsd:attribute name="Id" type="xsd:NMTOKEN" use="required"/>
    <xsd:attribute name="Name" type="xsd:string" use="optional"/>
    <xsd:anyAttribute namespace="##other" processContents="lax"/>
  </xsd:complexType>
</xsd:element>

<xsd:element name="Applications">
  <xsd:complexType>
    <xsd:sequence>
      <xsd:element ref="xpd:Application" minOccurs="0" maxOccurs="unbounded"/>
      <xsd:any namespace="##other" processContents="lax" minOccurs="0" maxOccurs="unbounded"/>
    </xsd:sequence>
    <xsd:anyAttribute namespace="##other" processContents="lax"/>
  </xsd:complexType>
</xsd:element>
```

	Description
Description	Short textual description of the application.
ExtendedAttributes	Optional vendor-defined extensions to meet implementation needs. See section 7.1.4.
ExternalReference	A reference to an external specification of the application signature. See section 7.1.6.
FormalParameters	A list of parameters that are interchanged with the application via the invocation interface. See section 7.1.5.
Id	Used to identify the application definition.
Name	Text used to identify an application (may be interpreted as a generic name of the tool).
Type	There are a number of standard Application Types. See section 7.3.2.

Table 21: Application Declaration

7.3.1. Invocation Parameters

An Application declaration may have parameter definitions for the (invocation) parameters and also use them within other entities.

Copying the invocation I N is treated as one atomic operation. The same holds for restoring the invocation O U T. Between these two operations no assumption is made about concurrency behaviour.

7.3.2. Application Types

Application Type contains several pieces of information required by common applications such as calling an EJB component or invoking a WebService. Support for a particular application type is not mandatory for the engine, but if the engine makes use of the listed technologies the additional information should be provided by Application Type.

7.3.2.1. EJB

Application type that defines information required to call a method of an EJB component. An EJB application has additional restrictions for formal parameters: there can be a maximum of one OUT formal parameter, and if it exists it has to be the last formal parameter, also there should be no INOUT formal parameters. With these restrictions IN formal parameters map directly to arguments of the method and the optional last OUT formal parameter becomes the return value of the method.

```
<xsd:element name="Ejb">
  <xsd:annotation>
    <xsd:documentation> Call EJB component -- There can be max one formal parameter that is OUT, if it exists
    it has to be the last formal parameter. no INOUT formal parameters</xsd:documentation>
  </xsd:annotation>
  <xsd:complexType>
    <xsd:sequence>
      <xsd:element name="JndiName">
        <xsd:complexType>
          <xsd:simpleContent>
            <xsd:extension base="xsd:string">
              <xsd:anyAttribute namespace="##other" processContents="lax"/>
            </xsd:extension>
          </xsd:simpleContent>
        </xsd:complexType>
      </xsd:element>
      <xsd:element name="HomeClass">
        <xsd:complexType>
          <xsd:simpleContent>
            <xsd:extension base="xsd:string">
              <xsd:anyAttribute namespace="##other" processContents="lax"/>
            </xsd:extension>
          </xsd:simpleContent>
        </xsd:complexType>
      </xsd:element>
      <xsd:element name="Method">
        <xsd:complexType>
          <xsd:simpleContent>
            <xsd:extension base="xsd:string">
              <xsd:anyAttribute namespace="##other" processContents="lax"/>
            </xsd:extension>
          </xsd:simpleContent>
        </xsd:complexType>
      </xsd:element>
      <xsd:any namespace="##other" processContents="lax" minOccurs="0" maxOccurs="unbounded"/>
    </xsd:sequence>
    <xsd:anyAttribute namespace="##other" processContents="lax"/>
  </xsd:complexType>
</xsd:element>
```

	Description
JndiName	JNDI name of the EJB.
HomeClass	Home class fully qualified name.
Method	Method that will be invoked.

Table 22: EJB Application Type

7.3.2.2. POJO

Application type that defines information required to call method on local Java class. Formal Parameters restrictions are the same as for EJB application type.

```

<xsd:element name="Pojo">
  <xsd:annotation>
    <xsd:documentation> Call method on Java class -- There can be max one formal parameter that is OUT, if it
exists it has to be the last formal parameter. no INOUT formal parameters</xsd:documentation>
  </xsd:annotation>
  <xsd:complexType>
    <xsd:sequence>
      <xsd:element name="Class">
        <xsd:complexType>
          <xsd:simpleContent>
            <xsd:extension base="xsd:string">
              <xsd:anyAttribute namespace="##other" processContents="lax"/>
            </xsd:extension>
          </xsd:simpleContent>
        </xsd:complexType>
      </xsd:element>
      <xsd:element name="Method">
        <xsd:complexType>
          <xsd:simpleContent>
            <xsd:extension base="xsd:string">
              <xsd:anyAttribute namespace="##other" processContents="lax"/>
            </xsd:extension>
          </xsd:simpleContent>
        </xsd:complexType>
      </xsd:element>
      <xsd:any namespace="##other" processContents="lax" minOccurs="0" maxOccurs="unbounded"/>
    </xsd:sequence>
    <xsd:anyAttribute namespace="##other" processContents="lax"/>
  </xsd:complexType>
</xsd:element>

```

	Description
Class	Fully qualified name of the class.
Method	Method that will be invoked.

Table 23: POJO Application Type

7.3.2.3. XSLT

Application that uses XSL transformation on formal parameters. The Application should have one IN and one OUT formal parameter, or if the transformation transforms the formal parameter into a document in the same schema the application can have one INOUT formal parameter.

```

<xsd:element name="Xslt">
  <xsd:annotation>
    <xsd:documentation> Execute Tranformation -- Formal Parameters restrictions: one IN and one OUT formal
parameters or only one INOUT formal parameter</xsd:documentation>
  </xsd:annotation>
  <xsd:complexType>
    <xsd:sequence>
      <xsd:any namespace="##other" processContents="lax" minOccurs="0" maxOccurs="unbounded"/>
    </xsd:sequence>
    <xsd:attribute name="location" type="xsd:anyURI"/>
    <xsd:anyAttribute namespace="##other" processContents="lax"/>
  </xsd:complexType>
</xsd:element>
<xsd:element name="Script">
  <xsd:annotation>
    <xsd:documentation> Execute Script -- No additional restrictions for formal parameters. The suggestion: every
Formal Parameter should be registered in the script scope as a global variable</xsd:documentation>
  </xsd:annotation>
  <xsd:complexType>
    <xsd:sequence>
      <xsd:element name="Expression" type="xpd:ExpressionType" minOccurs="0"/>
      <xsd:any namespace="##other" processContents="lax" minOccurs="0" maxOccurs="unbounded"/>
    </xsd:sequence>
    <xsd:anyAttribute namespace="##other" processContents="lax"/>
  </xsd:complexType>
</xsd:element>

```

	Description
Location	Location of the XSL transformation.

Table 24: XSLT Application Type

7.3.2.4. Script

Application that executes a script (expression) using formal parameters. The script should have access only to formal parameters of the application.

```
<xsd:element name="Script">
  <xsd:annotation>
    <xsd:documentation> Execute Script -- No additional restrictions for formal parameters. The suggestion: every Formal Parameter
    should be registered in the script scope as a global variable</xsd:documentation>
  </xsd:annotation>
  <xsd:complexType>
    <xsd:sequence>
      <xsd:element name="Expression" type="xpdl:ExpressionType" minOccurs="0"/>
      <xsd:any namespace="##other" processContents="lax" minOccurs="0" maxOccurs="unbounded"/>
    </xsd:sequence>
    <xsd:anyAttribute namespace="##other" processContents="lax"/>
  </xsd:complexType>
</xsd:element>
```

	Description
Expression	The script.

Table 25: Script Application Type

7.3.2.5. WebService

Application that invokes a Web Service. All IN formal parameters should be mapped into content of the input message; all OUT formal parameters should be mapped to parts of the output message.

```
<xsd:element name="WebService">
  <xsd:annotation>
    <xsd:documentation> For WSDL 1.2 -- Invoke WebService, all IN Fprmal Parameters will be mapped to input message, all OUT
    Formal Parameters will be maped from output message</xsd:documentation>
  </xsd:annotation>
  <xsd:complexType>
    <xsd:sequence>
      <xsd:element ref="xpdl:WebServiceOperation"/>
      <xsd:element ref="xpdl:WebServiceFaultCatch" minOccurs="0" maxOccurs="unbounded"/>
      <xsd:any namespace="##other" processContents="lax" minOccurs="0" maxOccurs="unbounded"/>
    </xsd:sequence>
    <xsd:attribute name="InputMsgName" type="xsd:string" use="required">
      <xsd:annotation>
        <xsd:documentation>The name of inputMessage as defined in the WSDL which will help in uniquely identifying the
        operation to be invoked</xsd:documentation>
      </xsd:annotation>
    </xsd:attribute>
    <xsd:attribute name="OutputMsgName" type="xsd:string" use="optional">
      <xsd:annotation>
        <xsd:documentation>The name of inputMessage as defined in the WSDL which will help in uniquely identifying the
        operation to be invoked</xsd:documentation>
      </xsd:annotation>
    </xsd:attribute>
    <xsd:anyAttribute namespace="##other" processContents="lax"/>
  </xsd:complexType>
</xsd:element>
```

	Description
WebServiceOperation	The web service operation used to invoke this application.
WebServiceFaultCatch	Provides a way to catch faults generated by the application.

	Description
InputMsgName	The name of inputMessage as defined in the WSDL which will help in uniquely identifying the operation to be invoked.
OutputMsgName	The name of outputMessage as defined in the WSDL which will help in uniquely identifying the operation to be invoked.

Table 26: WebService Application Type

7.3.2.6. BusinessRule

Application that invokes a Business Rule.

```

<xsd:element name="BusinessRule">
  <xsd:annotation>
    <xsd:documentation>Invoke business rule</xsd:documentation>
  </xsd:annotation>
  <xsd:complexType>
    <xsd:sequence>
      <xsd:element name="RuleName">
        <xsd:complexType>
          <xsd:simpleContent>
            <xsd:extension base="xsd:string">
              <xsd:anyAttribute namespace="##other" processContents="lax"/>
            </xsd:extension>
          </xsd:simpleContent>
        </xsd:complexType>
      </xsd:element>
      <xsd:element name="Location">
        <xsd:complexType>
          <xsd:simpleContent>
            <xsd:extension base="xsd:anyURI">
              <xsd:anyAttribute namespace="##other" processContents="lax"/>
            </xsd:extension>
          </xsd:simpleContent>
        </xsd:complexType>
      </xsd:element>
      <xsd:any namespace="##other" processContents="lax" minOccurs="0" maxOccurs="unbounded"/>
    </xsd:sequence>
    <xsd:anyAttribute namespace="##other" processContents="lax"/>
  </xsd:complexType>
</xsd:element>

```

	Description
RuleName	Name of the Business Rule.
Location	Location of the Rule.

Table 27: BusinessRule Application Type

7.3.2.7. Form

The standard does not decide which kind of a form layout should be used. The Form Application Type defines a place where all form related information should be stored.

```

<xsd:element name="Form">
  <xsd:annotation>
    <xsd:documentation>Placeholder for all form related additional information.</xsd:documentation>
  </xsd:annotation>
  <xsd:complexType>
    <xsd:sequence>
      <xsd:element name="FormLayout" minOccurs="0">
        <xsd:complexType>
          <xsd:complexContent>
            <xsd:extension base="xsd:anyType">
              <xsd:anyAttribute namespace="##other" processContents="lax"/>
            </xsd:extension>
          </xsd:complexContent>
        </xsd:complexType>
      </xsd:element>
    </xsd:sequence>
  </xsd:complexType>

```

```

        </xsd:element>
        <xsd:any namespace="##other" processContents="lax" minOccurs="0" maxOccurs="unbounded"/>
    </xsd:sequence>
    <xsd:anyAttribute namespace="##other" processContents="lax"/>
</xsd:complexType>
</xsd:element>

```

	Description
FormLayout	Optional description of form layout.

Table 28: Form Application Type

7.4. Swimlanes

BPMN uses the concept known as “swimlanes” to help partition and organize activities. It is possible that a BPMN Diagram may depict more than one private process, as well as the processes that show the collaboration between private processes or Participants. If so, then each private business process will be considered as being performed by different Participants. Graphically, each Participant will be partitioned; that is, will be contained within a rectangular box call a “Pool.” Pools can have sub-Swimlanes that are called, simply, “Lanes.”

BPMN private processes correspond to XPD L processes. The BPMN term ‘participant’ is not the same as the XPD L ‘participant’ element.

For a general description of SwimLanes, Pools and Lanes refer to section 6.4.1.

7.4.1. Pool

A Pool represents a Participant in the Process. A Participant can be a specific business entity (e.g. a company) or can be a more general business role (e.g., a buyer, seller, or manufacturer). Graphically, a Pool is a container for partitioning a Process from other Pools, when modeling business-to-business situations, although a Pool need not have any internal details (i.e., it can be a “black box”).

Note that the term Participant in the context of Pools is a BPMN concept that differs from the same term used in XPD L Participant Declaration, Participant Assignment and Performer expressions.

7.4.1.1. BPMN Graphics for Pools

- A Pool is a square-cornered rectangle that **MUST** be drawn with a solid single black line.
 - One, and only one, Pool in a diagram **MAY** be presented without a boundary. If there is more than one Pool in the diagram, then the remaining Pools **MUST** have a boundary.

Note: Some XPD L editors support the notion of multiple pages, where each page will have a background pool.



Figure 7.6: Pool

To help with the clarity of the Diagram, A Pool will extend the entire length of the Diagram, either horizontally or

vertically. However, there is no specific restriction to the size and/or positioning of a Pool. Modelers and modeling tools can use Pools (and Lanes) in a flexible manner in the interest of conserving the “real estate” of a Diagram on a screen or a printed page. A Pool acts as the container for the Sequence Flow between activities. The Sequence Flow can cross the boundaries between Lanes of a Pool, but cannot cross the boundaries of a Pool. The interaction between Pools is shown through Message Flow.

Another aspect of Pools is whether or not there is any activity detailed within the Pool. Thus, a given Pool may be shown as a “White Box,” with all details exposed, or as a “Black Box,” with all details hidden. No Sequence Flow is associated with a “Black Box” Pool, but Message Flow can attach to its boundaries (see Figure below).

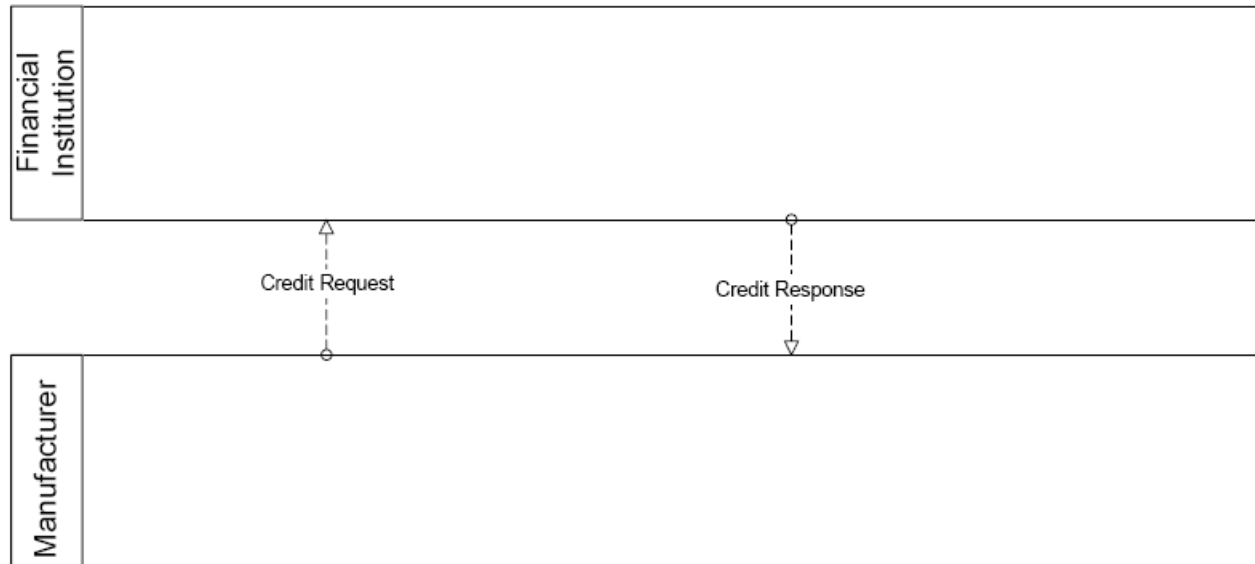


Figure 7.7: Message Flow connecting to the boundaries of two Pools

For a “White Box” Pool, the activities within are organized by Sequence Flow. Message Flow can cross the Pool boundary to attach to the appropriate activity (see below).

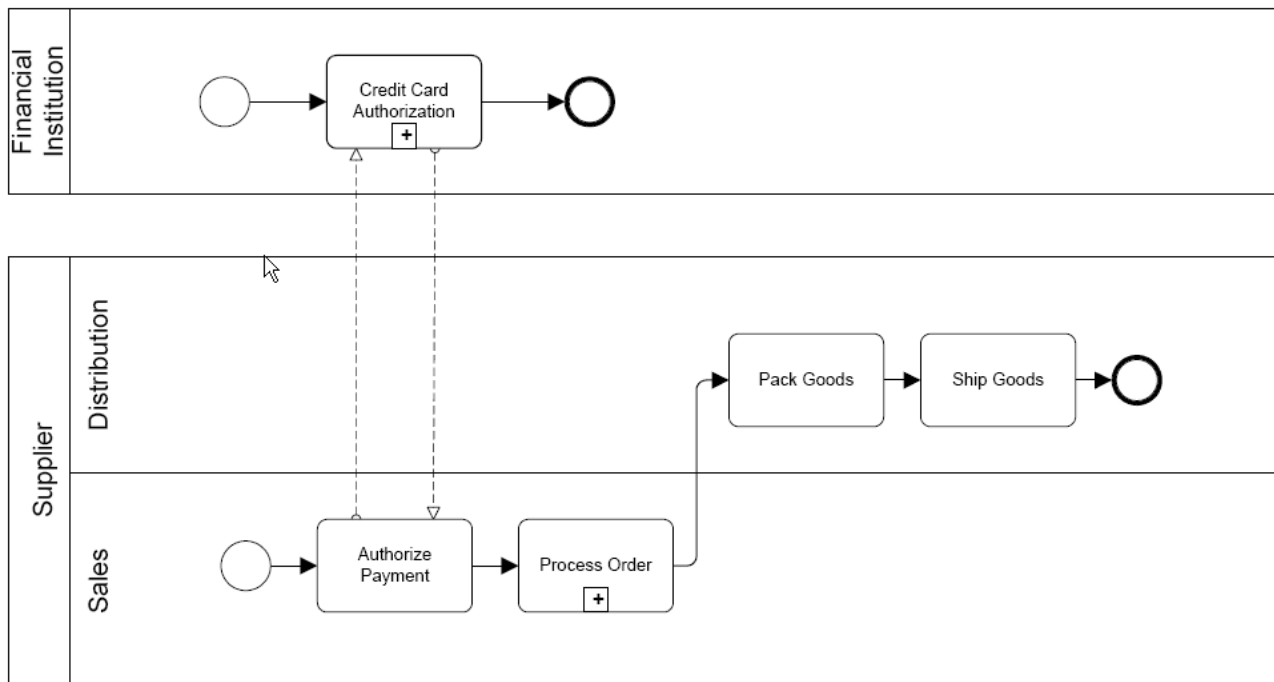


Figure 7.8: Message Flow connecting to Flow Objects within two Pools

All Business Process Diagrams contain at least one Pool. In most cases, a BPD that consists of a single Pool will only display the activities of the Process and not display the boundaries of the Pool. Furthermore, a BPD may show the “main” Pool without boundaries. In such cases there can be, at most, only one invisibly-bounded pool in the diagram and the name of that pool can be the same as the diagram. [Note: In XPDL the concept of “PACKAGE” is a generalization of a BPD. There is no necessary correspondence between the PACKAGE name and the Process or Pool name.] Consequently, the activities that represent the work performed from the point of view of the modeler or the modeler’s organization are considered “internal” activities and need not be surrounded by the boundaries of a Pool, while the other Pools in the Diagram must have their boundary (see Figure below).

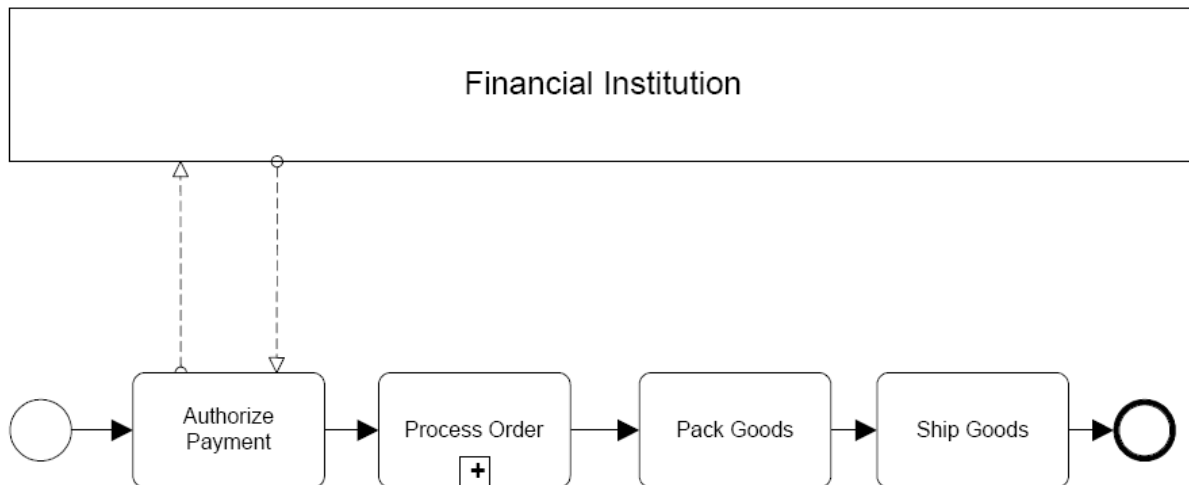


Figure 7.9: Main (Internal) Pool without boundaries

7.4.1.2. Schema for Pools

```

<xsd:element name="Pool">
  <xsd:annotation>
    <xsd:documentation>BPMN</xsd:documentation>
  </xsd:annotation>
  <xsd:complexType>
    <xsd:sequence>
      <xsd:element ref="xpd:Lanes" minOccurs="0"/>
      <xsd:element ref="xpd:Object" minOccurs="0"/>
      <xsd:element ref="xpd:NodeGraphicsInfos" minOccurs="0"/>
      <xsd:any namespace="##other" processContents="lax" minOccurs="0" maxOccurs="unbounded"/>
    </xsd:sequence>
    <xsd:attribute name="Id" type="xpd:Id" use="required">
      <xsd:annotation>
        <xsd:documentation>BPMN</xsd:documentation>
      </xsd:annotation>
    </xsd:attribute>
    <xsd:attribute name="Name" type="xsd:string" use="optional">
      <xsd:annotation>
        <xsd:documentation>BPMN: Pool label in diagram</xsd:documentation>
      </xsd:annotation>
    </xsd:attribute>
    <xsd:attribute name="Orientation" use="optional" default="HORIZONTAL">
      <xsd:simpleType>
        <xsd:restriction base="xsd:NMTOKEN">
          <xsd:enumeration value="HORIZONTAL"/>
          <xsd:enumeration value="VERTICAL"/>
        </xsd:restriction>
      </xsd:simpleType>
    </xsd:attribute>
    <xsd:attribute name="Process" type="xpd:IdRef" use="optional">
      <xsd:annotation>
        <xsd:documentation>BPMN: Pointer to WorkflowProcess/@Id; presence indicates this pool is part of the
        internal (private) process.</xsd:documentation>
      </xsd:annotation>
    </xsd:attribute>
  </xsd:complexType>
</element>

```

```

<xsd:attribute name="Participant" type="xsd:NMTOKEN" use="optional"/>
<xsd:attribute name="BoundaryVisible" type="xsd:boolean" use="required"/>
<xsd:attribute name="MainPool" type="xsd:boolean" use="optional" default="false"/>
<xsd:anyAttribute namespace="##other" processContents="lax"/>
</xsd:complexType>
</xsd:element>

<xsd:element name="Pools">
  <xsd:annotation>
    <xsd:documentation>BPMN</xsd:documentation>
  </xsd:annotation>
  <xsd:complexType>
    <xsd:sequence>
      <xsd:element ref="xpd:Pool" minOccurs="0" maxOccurs="unbounded"/>
      <xsd:any namespace="##other" processContents="lax" minOccurs="0" maxOccurs="unbounded"/>
    </xsd:sequence>
    <xsd:anyAttribute namespace="##other" processContents="lax"/>
  </xsd:complexType>
</xsd:element>

```

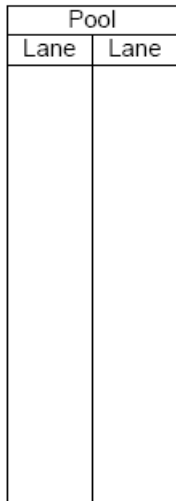
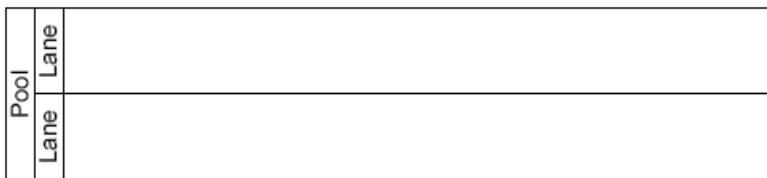
	Description
BoundaryVisible	This attribute defines if the rectangular boundary for the Pool is visible. Only one Pool on a page MAY have the attribute set to False.
Id	The id of the Pool.
Lanes	The lanes in the pool. See section 7.4.2.
MainPool	This attribute defines if the Pool is the “main” Pool or the focus of the diagram. Only one Pool in the Diagram MAY have the attribute set to True.
Name	The name of the pool.
NodeGraphicsInfos	See section 7.1.1.
Object	See section 7.1.9.4
Orientation	HORIZONTAL VERTICAL
Participant	The Modeler MAY define the Participant for a Pool. The Participant can be either a Role or an Entity. This defines the role that the Pool will play in a Diagram that includes collaboration. Note that the term Participant in the context of Pools is a BPMN concept that differs from the same term used in XPDL Participant Declaration, Participant Assignment and Performer expressions.
Process	
ProcessRef in BPMN	The Process attribute defines the Process that is contained within the Pool. Each Pool MAY have a Process.

Table 29: Pools

7.4.2. Lane

7.4.2.1. BPMN Graphics for Lanes

A Lane is a sub-partition within a Pool and will extend the entire length of the Pool, either vertically (see Figure below) or horizontally (see Figure below). If the pool is invisibly bounded, the lane associated with the pool must extend the entire length of the pool. Text associated with the Lane (e.g., its name and/or any attribute) can be placed inside the shape, in any direction or location, depending on the preference of the modeler or modeling tool vendor. Our examples place the name as a banner on the left side (for horizontal Pools) or at the top (for vertical Pools) on the other side of the line that separates the Pool name; however, this is not a requirement.

*Figure 7.10: Two Lanes in a Vertical Pool**Figure 7.11: Two Lanes in a Horizontal Pool*

Lanes are used to organize and categorize activities within a Pool. The meaning of the Lanes is up to the modeler. BPMN does not specify the usage of Lanes. Lanes are often used for such things as internal roles (e.g., Manager, Associate), systems (e.g., an enterprise application), an internal department (e.g., shipping, finance), etc. In addition, Lanes can be nested (see Figure below) or defined in a matrix. For example, there could be an outer set of Lanes for company departments and then an inner set of Lanes for roles within each department.

Note: In XPDL we have added the **optional** Performers element that specifically designates a set of default performers for all TASKS in the Lane.

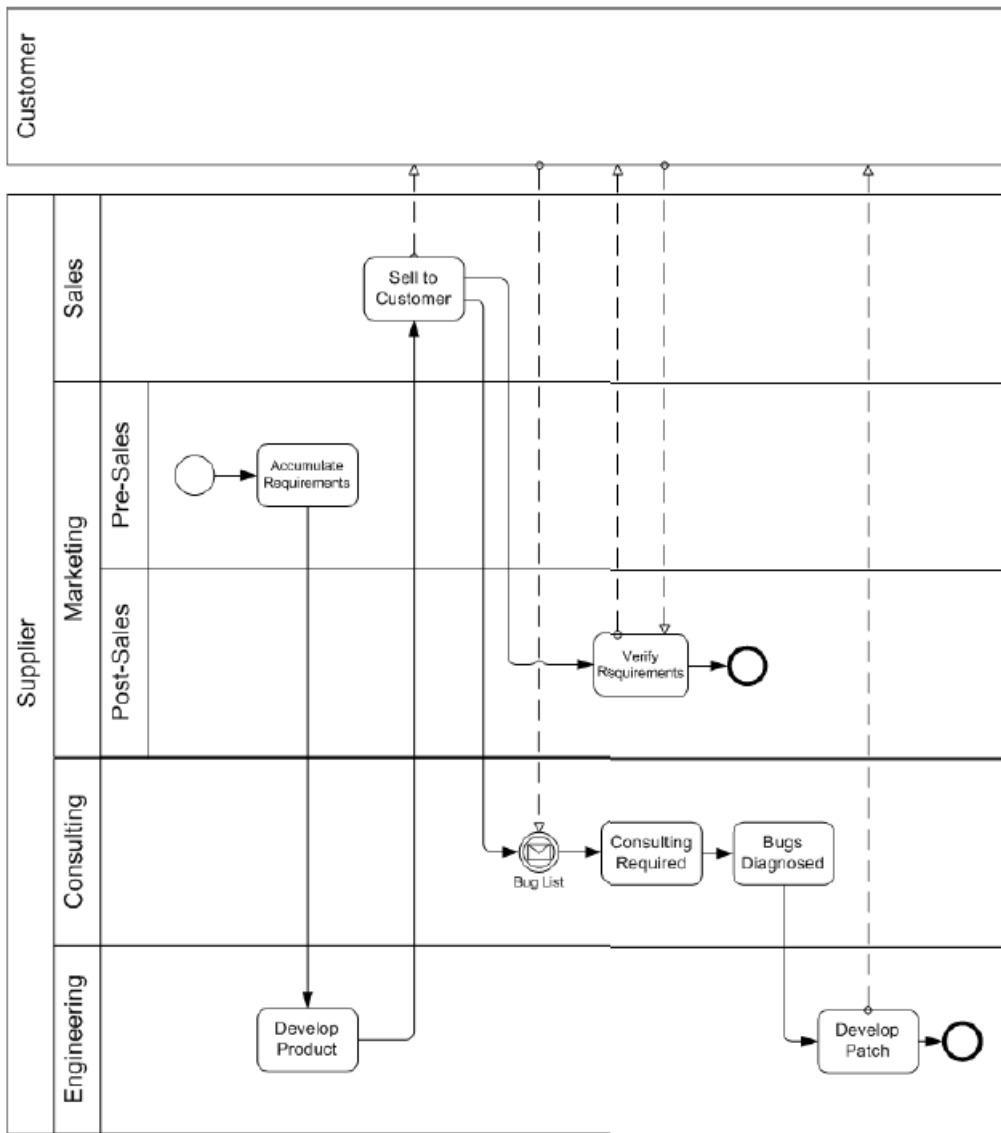


Figure 7.12: An Example of Nested Lanes

7.4.2.2. Schema for Lanes

```

<xsd:element name="Lane">
  <xsd:annotation>
    <xsd:documentation>BPMN</xsd:documentation>
  </xsd:annotation>
  <xsd:complexType>
    <xsd:sequence minOccurs="0">
      <xsd:element ref="xpd:Object" minOccurs="0"/>
      <xsd:element ref="xpd:NodeGraphicsInfos" minOccurs="0"/>
      <xsd:element ref="xpd:Performers" minOccurs="0"/>
      <xsd:element name="NestedLane" minOccurs="0" maxOccurs="unbounded">
        <xsd:complexType>
          <xsd:attribute name="LaneId" type="xsd:NMTOKEN" use="required"/>
        </xsd:complexType>
      </xsd:element>
      <xsd:any namespace="##other" processContents="lax" minOccurs="0" maxOccurs="unbounded"/>
    </xsd:sequence>
    <xsd:attribute name="Id" type="xsd:NMTOKEN" use="required"/>
    <xsd:attribute name="Name" type="xsd:string" use="optional"/>
    <xsd:anyAttribute namespace="##other" processContents="lax"/>
  </xsd:complexType>

```

```

</xsd:element>

<xsd:element name="Lanes">
  <xsd:annotation>
    <xsd:documentation>BPMN</xsd:documentation>
  </xsd:annotation>
  <xsd:complexType>
    <xsd:sequence>
      <xsd:element ref="xpd:Lane" minOccurs="0" maxOccurs="unbounded"/>
      <xsd:any namespace="##other" processContents="lax" minOccurs="0" maxOccurs="unbounded"/>
    </xsd:sequence>
    <xsd:anyAttribute namespace="##other" processContents="lax"/>
  </xsd:complexType>
</xsd:element>

```

	Description
Id	The id of the Lane.
NestedLane	This element identifies any Lanes that are nested within the current Lane.
Name	The name of the Lane.
NodeGraphicsInfos	See section 7.1.1.
Object	See section 7.1.9.4.
Performers	A Swim Lane in a Pool is often used to designate the default 'Role' required to perform any of the activities in the lane. This optional element provides the ability to specify the default performers for all activities in the lane. Any individual activity can override this with its own performer expression.

Table 30: Lane

7.5. Process Definition

The Process Definition defines the elements that make up a process. It contains definitions or declarations, respectively, for Activity and, optionally, for Transition, Application, and Process Relevant Data entities. Attributes may be specified for administration relevant data like author, and version; for runtime relevant data like priority; and for BPR and simulation relevant data.

BPMN Processes have similar attributes. A BPMN re-usable process is contained in a Pool which refers to the process via its Process attribute.

A Process may run as an implementation of an activity of type SubFlow; in this case parameters may be defined as attributes of the process. BPMN uses the term Sub-Process. See details in 7.6.5.4.2. Also see Semantics of Reusable Subprocess [BPMN perspective] in section 7.6.5.4.3. For details about the start and end of sub-processes see 7.6.5.4.5.

Where a process definition includes input parameters and is instantiated by means other than a SubFlow/subprocess call (for example by local event) the method for initializing any input parameters is locally defined. In such circumstances any relevant data field associated with the instantiated process definition, which is included within the parameter list will be initialized to the value specified in the “default value” (where specified). Where relevant data field is not passed as an input parameter, or initialized by “default value” the result is undefined. Similarly where a subflow terminates abnormally without returning out parameter values to the calling process, the result is undefined.

In general the scope of the defined entity identifier and name is the surrounding entity. The identifier is unique in this scope. For the Process identifier and name the scope is the surrounding Package.

When a process definition is instantiated it is necessary to determine which activity is the first (start) activity. There are a number of ways to do this.

- If there is only one activity that has no incoming transitions this is obvious.
- A single activity may have its StartActivity attribute set to true.
- The process attributes DefaultStartActivitySet and/or DefaultStartActivity may be present.
- The process invocation may specify the StartActivitySet and/or StartActivity.

Here we summarize the rules.

The following logic applies:

- a. Unless otherwise specified in the process invocation (see ProcessRef 7.6.5.4), DefaultStartActivitySet and/or DefaultStartActivity determine where the process will start executing.
- b. If present, DefaultStartActivitySetId must be the id of an Activity Set in the process
- c. If present, DefaultStartActivityId must be the id of a start activity
 - i. In the Default Activity Set if that's present
 - ii. In the top level process activities otherwise
- d. If DefaultStartActivitySetId is present but not DefaultStartActivityId it is assumed that DefaultStartActivitySetId has exactly one start activity
- e. If neither is present it is assumed that the top level activities contain exactly one start activity
- f. It is assumed that a process invocation can designate StartActivitySetId and StartActivityId and thereby control where process execution starts. In particular sub process invocation can contain the information (see ProcessRef 7.6.5.4).

BPMN has a more complicated semantics for determining when and where a process starts. Refer to section 7.6.4.2 [Start Event](#) for a complete discussion.

7.5.1. Schema

The details for WorkflowProcess are in ProcessType. The XML in WorkflowProcess enforces referential integrity.

```
<xsd:element name="WorkflowProcess" type="xpd:ProcessType">
  <xsd:key name="ActivitySetIds.WorkflowProcess">
    <xsd:selector xpath="/xpd:ActivitySets/xpd:ActivitySet"/>
    <xsd:field xpath="@Id"/>
  </xsd:key>
  <xsd:key name="ActivityIds.WorkflowProcess">
    <xsd:selector xpath="/xpd:Activities/xpd:Activity |
/xpd:ActivitySets/xpd:ActivitySet/xpd:Activities/xpd:Activity"/>
    <xsd:field xpath="@Id"/>
  </xsd:key>
  <!-- constrain to only activities in the top-level, not activitysets -->
  <xsd:key name="ActivityIdsTopLevel.WorkflowProcess">
    <xsd:selector xpath="/xpd:Activities/xpd:Activity"/>
    <xsd:field xpath="@Id"/>
  </xsd:key>
  <!-- constrain to only transitions in the top-level, not activitysets -->
  <xsd:key name="TransitionIdsTopLevel.WorkflowProcess">
    <xsd:selector xpath="/xpd:Transitions/xpd:Transition"/>
    <xsd:field xpath="@Id"/>
  </xsd:key>
  <!-- check that specified default start activityset exists -->
  <xsd:keyref name="DefaultStartActivitySetIdRef.WorkflowProcess" refer="xpd:ActivitySetIds.WorkflowProcess">
    <xsd:selector xpath="."/>
    <xsd:field xpath="@DefaultStartActivitySetId"/>
  </xsd:keyref>
  <!-- check that specified default start activity exists (note: incomplete test, does not constrain to optional activityset specified by DefaultStartActivitySetId) -->
  <xsd:keyref name="DefaultStartActivityIdRef.WorkflowProcess" refer="xpd:ActivityIds.WorkflowProcess">
    <xsd:selector xpath="."/>
    <xsd:field xpath="@DefaultStartActivityId"/>
  </xsd:keyref>
  <!-- check that the activityset specified in a blockactivity exists -->
  <xsd:keyref name="BlockActivityActivitySetIdRef.WorkflowProcess" refer="xpd:ActivitySetIds.WorkflowProcess">
    <xsd:selector xpath="//xpd:BlockActivity"/>
    <xsd:field xpath="@ActivitySetId"/>
  </xsd:keyref>
  <!-- check that the start activity specified in a blockactivity exists (note: incomplete test, does not constrain to activityset specified by ActivitySetId) -->
  <xsd:keyref name="BlockActivityStartActivityIdRef.WorkflowProcess" refer="xpd:ActivityIds.WorkflowProcess">
    <xsd:selector xpath="//xpd:BlockActivity"/>
    <xsd:field xpath="@StartActivityId"/>
  </xsd:keyref>
  <!-- check that the from and to specified in a transition exists -->
  <xsd:keyref name="TransitionFromRef.WorkflowProcess" refer="xpd:ActivityIdsTopLevel.WorkflowProcess">
```

```

        <xsd:selector xpath="/xpd:Transitions/xpd:Transition"/>
        <xsd:field xpath="@From"/>
    </xsd:keyref>
    <xsd:keyref name="TransitionToRef.WorkflowProcess" refer="xpd:ActivityIdsTopLevel.WorkflowProcess">
        <xsd:selector xpath="/xpd:Transitions/xpd:Transition"/>
        <xsd:field xpath="@To"/>
    </xsd:keyref>
    <!-- check that the id specified in a transitionref exists -->
    <xsd:keyref name="TransitionRefIdRef.WorkflowProcess" refer="xpd:TransitionIdsTopLevel.WorkflowProcess">
        <xsd:selector
xpath="/xpd:Activities/xpd:Activity/xpd:TransitionRestrictions/xpd:TransitionRestriction/xpd:Split/xpd:TransitionRefs/xpd:Transiti
onRef"/>
        <xsd:field xpath="@Id"/>
    </xsd:keyref>
</xsd:element>

<xsd:complexType name="ProcessType">
    <xsd:sequence>
        <xsd:element ref="xpd:ProcessHeader"/>
        <xsd:element ref="xpd:RedefinableHeader" minOccurs="0"/>
        <xsd:element ref="xpd:FormalParameters" minOccurs="0"/>
        <xsd:element ref="xpd:InputSets" minOccurs="0"/>
        <xsd:element ref="xpd:OutputSets" minOccurs="0"/>
        <xsd:choice minOccurs="0">
            <xsd:sequence minOccurs="0">
                <xsd:element ref="xpd:Participants" minOccurs="0"/>
                <xsd:element ref="xpd:Applications" minOccurs="0"/>
                <xsd:element ref="xpd:DataFields" minOccurs="0"/>
            </xsd:sequence>
            <xsd:sequence minOccurs="0">
                <xsd:element ref="deprecated:DataFields" minOccurs="0"/>
                <xsd:element ref="deprecated:Participants" minOccurs="0"/>
                <xsd:element ref="deprecated:Applications" minOccurs="0"/>
            </xsd:sequence>
        </xsd:choice>
        <xsd:element ref="xpd:ActivitySets" minOccurs="0" maxOccurs="1"/>
        <xsd:element ref="xpd:Activities" minOccurs="0"/>
        <xsd:element ref="xpd:Transitions" minOccurs="0"/>
        <xsd:element ref="xpd:ExtendedAttributes" minOccurs="0"/>
        <xsd:element ref="xpd:Assignments" minOccurs="0"/>
        <xsd:element ref="xpd:PartnerLinks" minOccurs="0"/>
        <xsd:element ref="xpd:Object" minOccurs="0"/>
        <xsd:choice minOccurs="0">
            <xsd:sequence>
                <xsd:element name="Extensions"/>
                <xsd:any namespace="##other" processContents="lax"
minOccurs="0" maxOccurs="unbounded"/>
            </xsd:sequence>
        </xsd:choice>
    </xsd:sequence>
    <xsd:attribute name="Id" type="xsd:NMTOKEN" use="required"/>
    <xsd:attribute name="Name" type="xsd:string" use="optional"/>
    <xsd:attribute name="AccessLevel" use="optional" default="PUBLIC">
        <xsd:simpleType>
            <xsd:restriction base="xsd:NMTOKEN">
                <xsd:enumeration value="PUBLIC"/>
                <xsd:enumeration value="PRIVATE"/>
            </xsd:restriction>
        </xsd:simpleType>
    </xsd:attribute>
    <xsd:attribute name="ProcessType" use="optional" default="None">
        <xsd:simpleType>
            <xsd:restriction base="xsd:NMTOKEN">
                <xsd:enumeration value="None"/>
                <xsd:enumeration value="Private"/>
                <xsd:enumeration value="Abstract"/>
                <xsd:enumeration value="Collaboration"/>
            </xsd:restriction>
        </xsd:simpleType>
    </xsd:attribute>
    <xsd:attribute name="Status" use="optional" default="None">
        <xsd:simpleType>
            <xsd:restriction base="xsd:NMTOKEN">
                <xsd:enumeration value="None"/>
                <xsd:enumeration value="Ready"/>
            </xsd:restriction>
        </xsd:simpleType>
    </xsd:attribute>

```

```

<xsd:enumeration value="Active"/>
<xsd:enumeration value="Cancelled"/>
<xsd:enumeration value="Aborting"/>
<xsd:enumeration value="Aborted"/>
<xsd:enumeration value="Completing"/>
<xsd:enumeration value="Completed"/>
</xsd:restriction>
</xsd:simpleType>
</xsd:attribute>
<xsd:attribute name="SuppressJoinFailure" type="xsd:boolean" use="optional"
  default="false"/>
<xsd:attribute name="EnableInstanceCompensation" type="xsd:boolean"
  use="optional" default="false"/>
<xsd:attribute name="AdHoc" type="xsd:boolean" use="optional" default="false"/>
<xsd:attribute name="AdHocOrdering" use="optional" default="Parallel">
  <xsd:simpleType>
    <xsd:restriction base="xsd:NMTOKEN">
      <xsd:enumeration value="Sequential"/>
      <xsd:enumeration value="Parallel"/>
    </xsd:restriction>
  </xsd:simpleType>
</xsd:attribute>
<xsd:attribute name="AdHocCompletionCondition" type="xsd:string"
  use="optional"/>
<xsd:attribute name="DefaultStartActivitySetId" type="xsd:NMTOKEN"
  use="optional"/>
<xsd:attribute name="DefaultStartActivityId" type="xsd:NMTOKEN"
  use="optional"/>
<xsd:anyAttribute namespace="##other" processContents="lax"/>
</xsd:complexType>

```

	Description
AccessLevel	The Access level of a process may be either PUBLIC or PRIVATE. If PUBLIC the process may be invoked by an external system or application. A process with private access may only be invoked from a SubFlow/subprocess Activity (see section 7.6.5.3.10). Use is optional and default is PUBLIC.
Activities	A list of activities that comprise the process. See section 7.6.
ActivitySets	A list of self contained sets of activities and transitions. Used to represent a BPMN embedded subprocess.
AdHoc	See section 7.5.9.
AdHocOrdering	See section 7.5.9.
AdHocCompletionCondition	See section 7.5.9.
Applications	A list of Application Declarations. See section 7.3.
Assignments	A list of data field assignments . See section 7.1.7.
DataFields	A list of Relevant data fields defined for the process. See section 7.12.
DefaultStartActivityId	If present, DefaultStartActivityId must be the id of a start activity <ul style="list-style-type: none"> • In the Default StartActivitySet if that's present • In the top level process activities otherwise
DefaultStartActivitySetId	If present, DefaultStartActivitySetId must be the id of an Activity Set in the process.
EnableInstanceCompensation	See section 7.5.8.
ExtendedAttributes	Optional vendor-defined extensions to meet implementation needs. See section 7.1.1.
FormalParameters	A list of parameters that may be passed to the process. See section 7.1.5.
Id	Used to identify the process.

	Description
InputSets (BPMN alternative to Formal Parameters)	The InputSets attribute defines the data requirements for input to the Process. Zero or more InputSets MAY be defined. Each Input set is sufficient to allow the Process to be performed (if it has first been instantiated by the appropriate signal arriving from an incoming Sequence Flow). See section 7.6.10.
Name	Text Used to identify the process.
Object	See section 7.1.9.4.
OutputSets (BPMN alternative to Formal Parameters)	The OutputSets attribute defines the data requirements for output from the Process. Zero or more OutputSets MAY be defined. At the completion of the Process, only one of the OutputSets may be produced--It is up to the implementation of the Process to determine which set will be produced. However, the IORules attribute MAY indicate a relationship between an OutputSet and an InputSet that started the Process. See section 7.6.11.
Participants	A list of resources used in implementing the process. See section 7.11.
PartnerLinks	Partner links used by this process. See section 7.8.2.
ProcessHeader	A set of elements specifying process characteristics.
ProcessType	BPMN types: None, Private, Abstract, Collaboration. See section 7.5.5.
RedefinableHeader	A set of elements and attributes used by both the Package and Process definitions.
Status	See section 7.5.6.
SuppressJoinFailure	See section 7.5.7.
Transitions	A list of the transitions that connect the process activities. See section 7.7.

Table 31: Process Definition

7.5.2. Process Definition Header

The process definition header keeps all information specific for a process definition such as process version, priority, duration of validity, etc.

```

<xsd:element name="ProcessHeader">
  <xsd:complexType>
    <xsd:sequence>
      <xsd:element ref="xpd:Created" minOccurs="0"/>
      <xsd:element ref="xpd:Description" minOccurs="0"/>
      <xsd:element ref="xpd:Priority" minOccurs="0"/>
      <xsd:element ref="xpd:Limit" minOccurs="0"/>
      <xsd:element ref="xpd:ValidFrom" minOccurs="0"/>
      <xsd:element ref="xpd:ValidTo" minOccurs="0"/>
      <xsd:element ref="xpd:TimeEstimation" minOccurs="0"/>
      <xsd:any namespace="##other" processContents="lax" minOccurs="0" maxOccurs="unbounded"/>
    </xsd:sequence>
    <xsd:attribute name="DurationUnit">
      <xsd:simpleType>
        <xsd:restriction base="xsd:NMTOKEN">
          <xsd:enumeration value="Y"/>
          <xsd:enumeration value="M"/>
          <xsd:enumeration value="D"/>
          <xsd:enumeration value="h"/>
          <xsd:enumeration value="m"/>
          <xsd:enumeration value="s"/>
        </xsd:restriction>
      </xsd:simpleType>
    </xsd:attribute>
    <xsd:anyAttribute namespace="##other" processContents="lax"/>
  </xsd:complexType>
</xsd:element>

<xsd:element name="Created">
  <xsd:complexType>

```

```
<xsd:simpleContent>
  <xsd:extension base="xsd:string">
    <xsd:anyAttribute namespace="##other" processContents="lax"/>
  </xsd:extension>
</xsd:simpleContent>
</xsd:complexType>
</xsd:element>

<xsd:element name="Description">
  <xsd:complexType>
    <xsd:simpleContent>
      <xsd:extension base="xsd:string">
        <xsd:anyAttribute namespace="##other" processContents="lax"/>
      </xsd:extension>
    </xsd:simpleContent>
  </xsd:complexType>
</xsd:element>

<xsd:element name="Limit">
  <xsd:complexType>
    <xsd:simpleContent>
      <xsd:extension base="xsd:string">
        <xsd:anyAttribute namespace="##other" processContents="lax"/>
      </xsd:extension>
    </xsd:simpleContent>
  </xsd:complexType>
</xsd:element>

<xsd:element name="Priority">
  <xsd:complexType>
    <xsd:simpleContent>
      <xsd:extension base="xsd:string">
        <xsd:anyAttribute namespace="##other" processContents="lax"/>
      </xsd:extension>
    </xsd:simpleContent>
  </xsd:complexType>
</xsd:element>

<xsd:element name="TimeEstimation">
  <xsd:complexType>
    <xsd:sequence>
      <xsd:element ref="xpd:WaitingTime" minOccurs="0"/>
      <xsd:element ref="xpd:WorkingTime" minOccurs="0"/>
      <xsd:element ref="xpd:Duration" minOccurs="0"/>
      <xsd:any namespace="##other" processContents="lax" minOccurs="0" maxOccurs="unbounded"/>
    </xsd:sequence>
    <xsd:anyAttribute namespace="##other" processContents="lax"/>
  </xsd:complexType>
</xsd:element>

<xsd:element name="WaitingTime">
  <xsd:complexType>
    <xsd:simpleContent>
      <xsd:extension base="xsd:string">
        <xsd:anyAttribute namespace="##other" processContents="lax"/>
      </xsd:extension>
    </xsd:simpleContent>
  </xsd:complexType>
</xsd:element>

<xsd:element name="WorkingTime">
  <xsd:complexType>
    <xsd:simpleContent>
      <xsd:extension base="xsd:string">
        <xsd:anyAttribute namespace="##other" processContents="lax"/>
      </xsd:extension>
    </xsd:simpleContent>
  </xsd:complexType>
</xsd:element>

<xsd:element name="Duration">
  <xsd:complexType>
    <xsd:simpleContent>
      <xsd:extension base="xsd:string">
```



```

        <xsd:anyAttribute namespace="##other" processContents="lax"/>
      </xsd:extension>
    </xsd:simpleContent>
  </xsd:complexType>
</xsd:element>

<xsd:element name="ValidFrom">
  <xsd:complexType>
    <xsd:simpleContent>
      <xsd:extension base="xsd:string">
        <xsd:anyAttribute namespace="##other" processContents="lax"/>
      </xsd:extension>
    </xsd:simpleContent>
  </xsd:complexType>
</xsd:element>

<xsd:element name="ValidTo">
  <xsd:complexType>
    <xsd:simpleContent>
      <xsd:extension base="xsd:string">
        <xsd:anyAttribute namespace="##other" processContents="lax"/>
      </xsd:extension>
    </xsd:simpleContent>
  </xsd:complexType>
</xsd:element>

```

	Description
Created	Creation date of process definition.
Description	Short textual description of the process.
Duration	Expected duration time to perform a task in units of DurationUnit.
DurationUnit	Describes the default unit to be applied to an integer duration value that has no unit tag. Possible units are: Y - year M - month D - day H - hour m - minute s – second
Limit	Expected duration for time management purposes (e.g. starting an escalation procedure etc.) in units of DurationUnit. It is counted from the starting date/time of the Process. The consequences of reaching the limit value are not defined in this document (i.e. vendor specific). It is assumed that in this case at least the Responsible of the current process is notified of this situation.
Priority	The priority of the process type. The units are defined in the Package header priority units.
TimeEstimation	Grouping of waiting time, working time, and duration. Used for simulation purposes.
ValidFrom	The date that the process definition is active from. Empty string means system date. Default: Inherited from Model Definition.
ValidTo	The date at which the process definition becomes valid. Empty string means unlimited validity. Default: Inherited from Model Definition.
WaitingTime	Describes the amount of time, which is needed to prepare the performance of the task (time estimation) (waiting time is provided by the analysis environment and may be updated by the runtime environment) in units of DurationUnit.
WorkingTime	Describes the amount of time the performer of the activity needs to perform the task (time estimation) (working time is needed for analysis purposes and is provided by the evaluation of runtime parameters) in units of DurationUnit.

Table 32: Process Definition Header

7.5.3. Process Redefinable Header

Refer to Redefinable Header at the Package level: 7.2.2 .

```

<xsd:element name="RedefinableHeader">
  <xsd:complexType>
    <xsd:sequence>
      <xsd:element ref="xpd:Author" minOccurs="0"/>
      <xsd:element ref="xpd:Version" minOccurs="0"/>
      <xsd:element ref="xpd:Codepage" minOccurs="0"/>
      <xsd:element ref="xpd:Countrykey" minOccurs="0"/>
      <xsd:element ref="xpd:Responsibles" minOccurs="0"/>
      <xsd:any namespace="##other" processContents="lax" minOccurs="0" maxOccurs="unbounded"/>
    </xsd:sequence>
    <xsd:attribute name="PublicationStatus">
      <xsd:simpleType>
        <xsd:restriction base="xsd:NMTOKEN">
          <xsd:enumeration value="UNDER_REVISION"/>
          <xsd:enumeration value="RELEASED"/>
          <xsd:enumeration value="UNDER_TEST"/>
        </xsd:restriction>
      </xsd:simpleType>
    </xsd:attribute>
    <xsd:anyAttribute namespace="##other" processContents="lax"/>
  </xsd:complexType>
</xsd:element>

<xsd:element name="Author">
  <xsd:complexType>
    <xsd:simpleContent>
      <xsd:extension base="xsd:string">
        <xsd:anyAttribute namespace="##other" processContents="lax"/>
      </xsd:extension>
    </xsd:simpleContent>
  </xsd:complexType>
</xsd:element>

<xsd:element name="Codepage">
  <xsd:complexType>
    <xsd:simpleContent>
      <xsd:extension base="xsd:string">
        <xsd:anyAttribute namespace="##other" processContents="lax"/>
      </xsd:extension>
    </xsd:simpleContent>
  </xsd:complexType>
</xsd:element>

<xsd:element name="Countrykey">
  <xsd:complexType>
    <xsd:simpleContent>
      <xsd:extension base="xsd:string">
        <xsd:anyAttribute namespace="##other" processContents="lax"/>
      </xsd:extension>
    </xsd:simpleContent>
  </xsd:complexType>
</xsd:element>

<xsd:element name="Responsible">
  <xsd:complexType>
    <xsd:simpleContent>
      <xsd:extension base="xsd:string">
        <xsd:anyAttribute namespace="##other" processContents="lax"/>
      </xsd:extension>
    </xsd:simpleContent>
  </xsd:complexType>
</xsd:element>

<xsd:element name="Responsibles">
  <xsd:complexType>
    <xsd:sequence>
      <xsd:element ref="xpd:Responsible" minOccurs="0" maxOccurs="unbounded"/>
    </xsd:sequence>
  </xsd:complexType>
</xsd:element>

```

```

        <xsd:any namespace="##other" processContents="lax" minOccurs="0" maxOccurs="unbounded"/>
    </xsd:sequence>
    <xsd:anyAttribute namespace="##other" processContents="lax"/>
</xsd:complexType>
</xsd:element>

```

	Description
Author	Name of the author of this process definition. (The one who put it into the repository).
Codepage	The codepage used for the text parts. Default: Inherited from Model Definition.
Countrykey	Country code based on ISO 3166. It could be either the three digits country code number, or the two alpha characters country codes. Default: Inherited from Model Definition.
PublicationStatus	Status of the Process Definition. Default: Inherited from Model Definition. UNDER_REVISION RELEASED UNDER_TEST
Responsible(s)	Participant, who is responsible for this process (usually an Organisational Unit or a Human). It is assumed that the responsible is the supervisor during execution of the process. Default: Inherited from Model Definition.
Version	Version of this process definition.

Table 33: Process Redefinable Header

7.5.4. Activity Set/Embedded SubProcess

An activity set is a self-contained set of activities and transitions. Transitions in the set should refer only to activities in the same set and there should be no transitions into or out of the set. Activity sets can be executed by block activities (see section 7.6.3). An Activity Set is re-usable; it may be referred to by more than one Block Activity.

The xml at the end of ActivitySet, starting with keyname, ensures referential integrity.

```

<xsd:element name="ActivitySet">
  <xsd:complexType>
    <xsd:sequence>
      <xsd:element ref="xpd:Activities" minOccurs="0"/>
      <xsd:element ref="xpd:Transitions" minOccurs="0"/>
      <xsd:element ref="xpd:Object" minOccurs="0"/>
      <xsd:any namespace="##other" processContents="lax" minOccurs="0" maxOccurs="unbounded"/>
    </xsd:sequence>
    <xsd:attribute name="Id" type="xpd:Id" use="required"/>
    <xsd:attribute name="Name" type="xsd:string" use="optional">
      <xsd:annotation>
        <xsd:documentation source="added to XPD 2.0"/>
      </xsd:annotation>
    </xsd:attribute>
    <xsd:attribute name="AdHoc" type="xsd:boolean" use="optional" default="false">
      <xsd:annotation>
        <xsd:documentation>BPMN: for Embedded subprocess</xsd:documentation>
      </xsd:annotation>
    </xsd:attribute>
    <xsd:attribute name="AdHocOrdering" use="optional" default="Parallel">
      <xsd:annotation>
        <xsd:documentation>BPMN: for Embedded subprocess</xsd:documentation>
      </xsd:annotation>
    <xsd:simpleType>
      <xsd:restriction base="xsd:NMTOKEN">
        <xsd:enumeration value="Sequential"/>
        <xsd:enumeration value="Parallel"/>
      </xsd:restriction>
    </xsd:simpleType>
  </xsd:complexType>

```

```

        <xsd:attribute name="AdHocCompletionCondition" type="xsd:string" use="optional">
          <xsd:annotation>
            <xsd:documentation>BPMN: for Embedded subprocess</xsd:documentation>
          </xsd:annotation>
        </xsd:attribute>
        <xsd:attribute name="DefaultStartActivityId" type="xpdIdRef" use="optional"/>
        <xsd:anyAttribute namespace="##other" processContents="lax"/>
      </xsd:complexType>
      <xsd:key name="ActivityIds.ActivitySet">
        <xsd:selector xpath="/xpdId:Activities/xpdId:Activity"/>
        <xsd:field xpath="@Id"/>
      </xsd:key>
      <xsd:key name="TransitionIds.ActivitySet">
        <xsd:selector xpath="/xpdId:Transitions/xpdId:Transition"/>
        <xsd:field xpath="@Id"/>
      </xsd:key>
      <!-- check that the default start activity id exists -->
      <xsd:keyref name="DefaultStartActivityIdRef.ActivitySet" refer="xpdId:ActivityIds.ActivitySet">
        <xsd:selector xpath="/" />
        <xsd:field xpath="@DefaultStartActivityId"/>
      </xsd:keyref>
      <!-- check that the from and to specified in a transition exists -->
      <xsd:keyref name="TransitionFromRef.ActivitySet" refer="xpdId:ActivityIds.ActivitySet">
        <xsd:selector xpath="/xpdId:Transitions/xpdId:Transition"/>
        <xsd:field xpath="@From"/>
      </xsd:keyref>
      <xsd:keyref name="TransitionToRef.ActivitySet" refer="xpdId:ActivityIds.ActivitySet">
        <xsd:selector xpath="/xpdId:Transitions/xpdId:Transition"/>
        <xsd:field xpath="@To"/>
      </xsd:keyref>
      <!-- check that the id specified in a transitionref exists -->
      <xsd:keyref name="TransitionRefIdRef.ActivitySet" refer="xpdId:TransitionIds.ActivitySet">
        <xsd:selector
          xpath="/xpdId:Activities/xpdId:Activity/xpdId:TransitionRestrictions/xpdId:TransitionRestriction/xpdId:Split/xpdId:TransitionRefs/xpdId:Transiti
          onRef"/>
        <xsd:field xpath="@Id"/>
      </xsd:keyref>
    </xsd:element>

    <xsd:element name="ActivitySets">
      <xsd:complexType>
        <xsd:sequence>
          <xsd:element ref="xpdId:ActivitySet" minOccurs="0" maxOccurs="unbounded"/>
          <xsd:any namespace="##other" processContents="lax" minOccurs="0" maxOccurs="unbounded"/>
        </xsd:sequence>
        <xsd:anyAttribute namespace="##other" processContents="lax"/>
      </xsd:complexType>
    </xsd:element>

```

	Description
Activities	A list of activities that comprise the process. See section 7.6.
AdHoc	See section 7.5.9.
AdHocOrdering	See section 7.5.9.
AdHocCompletionCondi tion	See section 7.5.9.
DefaultStartActivityId	Unless otherwise specified in the ActivitySet invocation (BlockActivity 7.6.3), this is where the activity set will start executing. If present, it must be the id of a start activity in the activity set. If not present it is assumed the activity set contains exactly one start activity.
Id	Used to identify the process.
Name	Name of the activity set/embedded sub-process.
Object	See section 7.1.9.4.
Transitions	A list of the transitions that connect the process activities. See section 7.7.

Table 34: ActivitySet

7.5.5. ProcessType in BPMN mapping to WS-BPEL

ProcessType is an attribute that provides information about which lower level language the Pool will be mapped to. By default, the ProcessType is None (or undefined). A Private ProcessType MAY be mapped to an executable WS-BPEL process. An Abstract ProcessType is also called the public interface of a process (or other web services) and MAY be mapped to an abstract WS-BPEL process. A Collaboration ProcessType will have two Lanes that represent business roles (e.g., buyer or seller) and will show the interactions between these roles. These Pools MAY be mapped to languages such as ebXML or WS Choreography. If the Process is to be used to create a WS-BPEL document, then the attribute MUST be set to Private or Abstract.

7.5.6. Status

The Status of a Process is determined when the Process is being executed by a process engine. The Status of a Process can be used within Assignment Expressions.

The following states are recognized:

- None
- Ready
- Active
- Cancelled
- Aborting
- Aborted
- Completing
- Completed

7.5.7. SuppressJoinFailure

This attribute is included for mapping to WS-BPEL. This specifies whether or not a WS-BPEL joinFailure fault will be suppressed for all activities in the WS-BPEL process.

7.5.8. EnableInstanceCompensation

This attribute is included for mapping to WS-BPEL. It specifies whether or not a compensation can be performed after the Process has completed normally.

7.5.9. AdHoc

AdHoc is a boolean attribute, which has a default of False. This specifies whether the Process is Ad Hoc or not. The activities within an Ad Hoc Process are not controlled or sequenced in a particular order; their performance is determined by the performers of the activities.

If the Process is Ad Hoc (the AdHoc attribute is True), then the AdHocOrdering attribute MUST be included. This attribute defines if the activities within the Process can be performed in Parallel or must be performed sequentially. The default setting is Parallel and the setting of Sequential is a restriction on the performance that may be required due to shared resources.

If the Process is Ad Hoc (the AdHoc attribute is True), then the AdHocCompletionCondition attribute MUST be included. This attribute defines the conditions when the Process will end.

7.6. Process Activity

The Activity Definition is used to define each elementary activity that makes up a process. Attributes may be defined to

specify activity control information, implementation alternatives, performer assignment, runtime relevant information like priority, and data used specifically in BPR and simulation situations (and not used within enactment). In addition, restrictions on data access and to transition evaluation (e.g. Split and Join) can be described. Mandatory attributes are used to define the activity identifier and type; a small number of other attributes are optional but have common usage across all activity types. Other attribute usage depends upon the activity type as shown in the table below.

For the Activity identifier and name the scope is the surrounding process.

The activity description is used to describe several different activity types. All these activities share the same (common) general activity attributes, but the usage of other attributes, particularly participant and application assignment and the use of relevant data field may be specialized to the activity type. The following table identifies the usage of other attributes / entity types for the different activity types.

Entity Types (usage within Activity Type)	Activity Type				
	Implementation Type			Route/GateWay/Event	BlockActivity
	None	Application/ Task	SubFlow/subprocess		
Transition Restriction	Normal	Normal	Normal, plus subflow call / return within activity	Normal; any additional controls implemented within Route activity	Normal; refers to activities within same context, not to activities within ActivitySet
Performers/Parti cipant Assignment	Normal	Normal/See Task details	N/A	N/A	N/A
Application Assignment	None	Yes/See task details	N/A	N/A	N/A
Use of relevant data field	Normal	Normal	May be used in parameter passing	May be used in routing control conditions	May be used in routing control conditions

Table 35: Entity type relationships for different Activity types

BPMN provides specific graphics for the activity types supported.

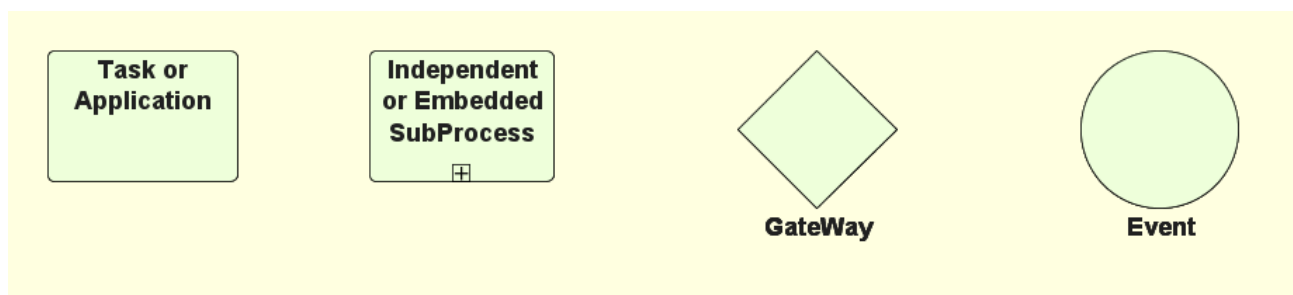


Figure 7.13: BPMN Activity Types

In XPDL a Reusable SubProcess is called a **Subflow** and Embedded SubProcess is called a **BlockActivity**. GateWay is called a **RouteActivity**. Event is a new construct for XPDL 2.0. Note that BPMN does not use Application; this is terminology from XPDL.

Notes on usage:

Transition restrictions, subflow, and route activities are described in the sequel. In general, normal transition restrictions may be declared at the level of the activity boundary within the surrounding process, whereas specialized flow conditions (subflow, or the internal part of a route activity) operate “internal” to the activity (but may reference activities within the surrounding process definition). The following diagram illustrates the generic structure of an activity and the above variants.

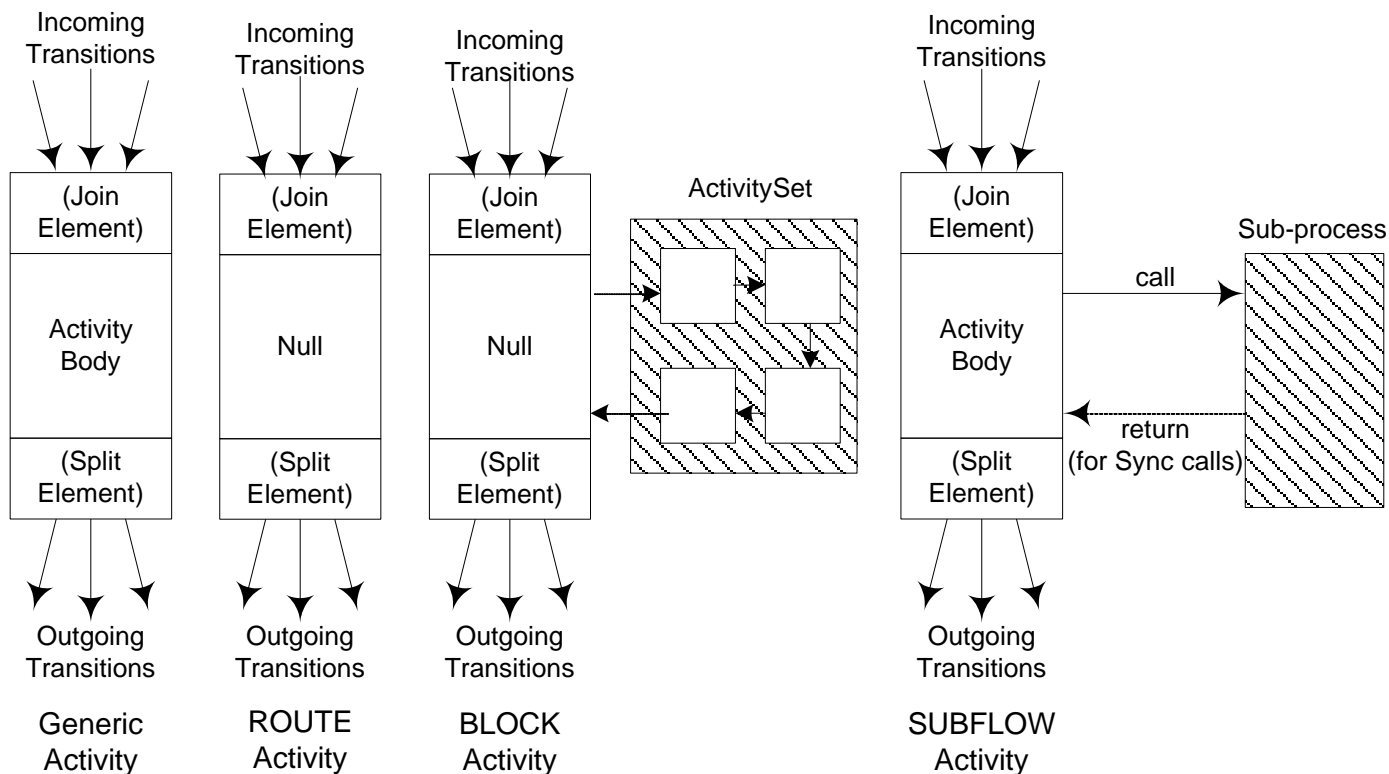


Figure 7.14: Activity Structures & Transition Conditions

Where the implementation type is NONE, the activity is manually controlled and its completion must be explicitly signaled to the process or management system. Such activities might typically comprise instructions to the participant to undertake a non-automated task of some type and inform a supervisor when completed.

Relevant data field may (potentially) be referenced within any activity although its use in manual activities is undefined through the process definition. Where an activity is of type SubFlow any in-parameters passed to the called (sub-) process must have been declared as relevant data fields within the calling process / activity definition, or have been inherited from the surrounding package. (Similar requirements apply to any out-parameters returned to the calling process.) Routing and block activities may refer to such data within conditional expressions within the join/split control logic.

```
<xsd:element name="Activity">
  <xsd:annotation>
    <xsd:documentation>BPMN extension</xsd:documentation>
  </xsd:annotation>
  <xsd:complexType>
    <xsd:sequence>
      <xsd:element ref="xpd:Description" minOccurs="0"/>
      <xsd:element ref="xpd:Limit" minOccurs="0"/>
      <xsd:choice minOccurs="0">
        <xsd:element ref="xpd:Route"/>
        <xsd:element ref="xpd:Implementation">
          <xsd:annotation>
            <xsd:documentation>BPMN: corresponds to an activity, which could be a task or
            subprocess.[Suggest change element to BpmnActivity, since there is an attribute Implementation which means something else
            entirely.]</xsd:documentation>
          </xsd:annotation>
        </xsd:element>
      </xsd:choice>
      <xsd:choice minOccurs="0">
        <xsd:element ref="deprecated:BlockActivity"/>
        <xsd:element ref="xpd:BlockActivity"/>
      </xsd:choice>
      <xsd:element ref="xpd:Event">
        <xsd:annotation>
          <xsd:documentation>BPMN: Identifies XPDL activity as a BPMN event.</xsd:documentation>
        </xsd:annotation>
      </xsd:element>
    </xsd:sequence>
  </xsd:complexType>
</xsd:element>
```

```

</xsd:choice>
<xsd:element ref="xpd:Transaction" minOccurs="0"/>
<xsd:element ref="xpd:Performers" minOccurs="0"/>
<xsd:element ref="deprecated:StartMode" minOccurs="0"/>
<xsd:element ref="deprecated:FinishMode" minOccurs="0"/>
<xsd:element ref="xpd:Priority" minOccurs="0"/>
<xsd:choice minOccurs="0">
  <xsd:element ref="deprecated:Deadline" minOccurs="0" maxOccurs="unbounded"/>
  <xsd:element ref="xpd:Deadline" minOccurs="0" maxOccurs="unbounded"/>
</xsd:choice>
<xsd:element ref="xpd:SimulationInformation" minOccurs="0"/>
<xsd:element ref="xpd:Icon" minOccurs="0"/>
<xsd:element ref="xpd:Documentation" minOccurs="0"/>
<xsd:element ref="xpd:TransitionRestrictions" minOccurs="0"/>
<xsd:element ref="xpd:ExtendedAttributes" minOccurs="0"/>
<xsd:element ref="xpd:DataFields" minOccurs="0"/>
<xsd:element ref="xpd:InputSets" minOccurs="0"/>
<xsd:element ref="xpd:OutputSets" minOccurs="0"/>
<xsd:element ref="xpd:IORules" minOccurs="0"/>
<xsd:element ref="xpd:Loop" minOccurs="0"/>
<xsd:element ref="xpd:Assignments" minOccurs="0"/>
<xsd:element ref="xpd:Object" minOccurs="0"/>
<xsd:element ref="xpd:NodeGraphicsInfos" minOccurs="0"/>
<xsd:choice minOccurs="0">
  <xsd:sequence>
    <xsd:element name="Extensions"/>
    <xsd:any namespace="##other" processContents="lax" minOccurs="0" maxOccurs="unbounded"/>
  </xsd:sequence>
</xsd:choice>
</xsd:sequence>
<xsd:attribute name="Id" type="xpd:Id" use="required">
  <xsd:annotation>
    <xsd:documentation>BPMN: unique identifier of the flow object</xsd:documentation>
  </xsd:annotation>
</xsd:attribute>
<xsd:attribute name="IsForCompensation" type="xsd:boolean" use="optional"/>
<xsd:attribute name="Name" type="xsd:string" use="optional">
  <xsd:annotation>
    <xsd:documentation>BPMN: label of the flow object in the diagram</xsd:documentation>
  </xsd:annotation>
</xsd:attribute>
<xsd:attribute name="StartActivity" type="xsd:boolean" use="optional">
  <xsd:annotation>
    <xsd:documentation>Designates the first activity to be executed when the process is instantiated. Used when
there is no other way to determine this Conflicts with BPMN StartEvent and no process definition should use both.</xsd:documentation>
  </xsd:annotation>
</xsd:attribute>
<xsd:attribute name="Status" use="optional" default="None">
  <xsd:annotation>
    <xsd:documentation> BPMN: Status values are assigned during execution. Status can be treated as a property
and used in expressions local to an Activity. It is unclear that status belongs in the XPD document.</xsd:documentation>
  </xsd:annotation>
<xsd:simpleType>
  <xsd:restriction base="xsd:NMTOKEN">
    <xsd:enumeration value="None"/>
    <xsd:enumeration value="Ready"/>
    <xsd:enumeration value="Active"/>
    <xsd:enumeration value="Cancelled"/>
    <xsd:enumeration value="Aborting"/>
    <xsd:enumeration value="Aborted"/>
    <xsd:enumeration value="Completing"/>
    <xsd:enumeration value="Completed"/>
  </xsd:restriction>
</xsd:simpleType>
</xsd:attribute>
<xsd:attribute name="StartMode">
  <xsd:simpleType>
    <xsd:restriction base="xsd:NMTOKEN">
      <xsd:enumeration value="Automatic"/>
      <xsd:enumeration value="Manual"/>
    </xsd:restriction>
  </xsd:simpleType>
</xsd:attribute>
<xsd:attribute name="FinishMode">
  <xsd:simpleType>

```



```

        <xsd:restriction base="xsd:NMTOKEN">
            <xsd:enumeration value="Automatic"/>
            <xsd:enumeration value="Manual"/>
        </xsd:restriction>
    </xsd:simpleType>
</xsd:attribute>
<xsd:attribute name="StartQuantity" type="xsd:integer" use="optional" default="1"/>
<xsd:attribute name="CompletionQuantity" type="xsd:integer" use="optional" default="1"/>
<xsd:attribute name="IsATransaction" type="xsd:boolean" use="optional" default="false"/>
<xsd:anyAttribute namespace="##other" processContents="lax"/>
</xsd:complexType>
</xsd:element>

<xsd:element name="Activities">
    <xsd:complexType>
        <xsd:sequence>
            <xsd:element ref="xpd:Activity" minOccurs="0" maxOccurs="unbounded">
                <xsd:annotation>
                    <xsd:documentation>BPMN: corresponds to a flow object, which could be a BPMN activity, gateway, or
event</xsd:documentation>
                </xsd:annotation>
            </xsd:element>
            <xsd:any namespace="##other" processContents="lax" minOccurs="0" maxOccurs="unbounded"/>
        </xsd:sequence>
        <xsd:anyAttribute namespace="##other" processContents="lax"/>
    </xsd:complexType>
</xsd:element>

<xsd:element name="Performer">
    <xsd:annotation>
        <xsd:documentation>A String or Expression designating the Performer</xsd:documentation>
    </xsd:annotation>
    <xsd:complexType>
        <xsd:simpleContent>
            <xsd:extension base="xsd:string">
                <xsd:anyAttribute namespace="##other" processContents="lax"/>
            </xsd:extension>
        </xsd:simpleContent>
    </xsd:complexType>
</xsd:element>

<xsd:element name="Performers">
    <xsd:annotation>
        <xsd:documentation>BPMN and XPD</xsd:documentation>
    </xsd:annotation>
    <xsd:complexType>
        <xsd:sequence>
            <xsd:element ref="xpd:Performer" maxOccurs="unbounded"/>
            <xsd:any namespace="##other" processContents="lax" minOccurs="0" maxOccurs="unbounded"/>
        </xsd:sequence>
        <xsd:anyAttribute namespace="##other" processContents="lax"/>
    </xsd:complexType>
</xsd:element>

<xsd:element name="Icon">
    <xsd:complexType>
        <xsd:simpleContent>
            <xsd:extension base="xsd:string">
                <xsd:attribute name="XCOORD" type="xsd:integer" use="optional"/>
                <xsd:attribute name="YCOORD" type="xsd:integer" use="optional"/>
                <xsd:attribute name="WIDTH" type="xsd:integer" use="optional"/>
                <xsd:attribute name="HEIGHT" type="xsd:integer" use="optional"/>
                <xsd:attribute name="SHAPE" use="optional" default="RoundRectangle">
                    <xsd:simpleType>
                        <xsd:restriction base="xsd:NMTOKEN">
                            <xsd:enumeration value="RoundRectangle"/>
                            <xsd:enumeration value="Rectangle"/>
                            <xsd:enumeration value="Ellipse"/>
                            <xsd:enumeration value="Diamond"/>
                            <xsd:enumeration value="Ellipse"/>
                            <xsd:enumeration value="UpTriangle"/>
                            <xsd:enumeration value="DownTriangle"/>
                        </xsd:restriction>
                    </xsd:simpleType>
                </xsd:attribute>
            </xsd:extension>
        </xsd:simpleContent>
    </xsd:complexType>
</xsd:element>

```

```

        </xsd:attribute>
        <xsd:anyAttribute namespace="##other" processContents="lax"/>
    </xsd:extension>
    </xsd:simpleContent>
    </xsd:complexType>
</xsd:element>

```

	Description
Assignments	A list of data field assignments. See section 7.1.7.
BlockActivity	An Activity that executes an ActivitySet. See 7.6.3.
CompletionQuantity	The default value is 1. The value MUST NOT be less than 1. This attribute defines the number of Tokens that must be generated from the activity. This number of Tokens will be sent down any outgoing Sequence Flow (assuming any Sequence Flow Conditions are satisfied).
Deadline	Specification of a deadline and action to be taken if it is reached. It is better to use the BPMN timer event to provide this functionality.
Description	Textual description of the activity.
Documentation	The address (e.g. path- and filename) for a help file or a description file of the activity.
DataFields(Properties)	Allows declaration of relevant data local to the activity. See section 7.12 .
Event	See section 7.6.4.
ExtendedAttributes	Optional extensions to meet individual implementation needs.
FinishMode	Describes how the system operates at the end of the Activity.
Icon	Alternative graphics for an icon to represent the activity in a graphical modeller. May be used to override the modeller icon for an activity. This may be deprecated in the future.
Id	Used to identify the process activity.
Implementation	A "regular" Activity. Mandatory if not a Route. Alternative implementations are "no", "Task", "SubFlow" or "Reference".
InputSets	See section 7.6.10.
IORules	The IORules attribute is a collection of expressions, each of which specifies the required relationship between one input and one output. That is, if the activity is instantiated with a specified input, that activity shall complete with the specified output.
IsATransaction	If the activity is a block activity or is implemented as a subflow IsATransaction determines whether or not the behavior of the Sub-Process will be treated as a Transaction.
Limit	Expected duration for time management purposes (e.g. starting an escalation procedure etc.) in units of DurationUnit. It is counted from the starting date/time of the Process. The consequences of reaching the limit value are not defined in this document (i.e. vendor specific). Note that BPMN provides Timer Events which can be attached to the boundary of a regular or subflow/subprocess activity.
Loop	See section 7.6.13.
Name	Text Used to identify the process activity.
NodeGraphicsInfos	Optional. See section 7.1.1.
Object	See section 7.1.9.4.
OutputSets	See section 7.6.11.
Performers	List of Links to entity participants. Each Performer may be an expression. Default: Any Participant.
Priority	A value that describes the initial priority of this activity when it starts execution. If this attribute is not defined but a priority is defined in the Process definition then that is used. By default it is assumed that the priority levels are the natural numbers starting with zero, and that the higher the value the higher the priority (i.e.: 0, 1,..., n).
Route	A "dummy" Activity used for routing. A BPMN Gateway.

	Description
SimulationInformation	Estimations for simulation of an Activity. No default. See section 7.6.8.
StartActivity	Designates the first activity to be executed when the process is instantiated. Used when there is no other way to determine this. Conflicts with BPMN StartEvent and no process definition should contain both.
StartMode	Describes how the execution of an Activity is triggered.
StartQuantity	The default value is 1. The value MUST NOT be less than 1. This attribute defines the number of Tokens that must arrive before the activity can begin.
Status	Status values are assigned during execution. Status can be treated as a property and used in expressions local to an Activity.
TransactionRef Issue: The XML actually has a Transaction subelement for the activity, instead of a ref to a transaction. Are transactions reusable by multiple activities???	If the IsATransaction attribute is False, then a Transaction MUST NOT be identified. If the IsATransaction attribute is True, then a Transaction MUST be identified. Note that Transactions that are in different Pools and are connected through Message Flow MUST have the same TransactionId. See section 7.6.12.
TransitionRestrictions	Provides further restrictions and context-related semantics description of Transitions.

Table 36: Process Activity

7.6.1. Execution Control Attributes

These are attributes of an Activity that allow the definition of various activity-specific features for Activity execution control. Refer to the Table for Process Activity.

Automation mode defines the degree of automation when triggering and terminating an activity. There are two automation modes:

- **Automatic mode** is fully controlled by the process or workflow engine, i.e. the engine proceeds with execution of the activity within the process automatically, as soon as any incoming transition conditions are satisfied. Similarly, completion of the activity and progression to any post activity conditional logic occurs automatically on termination of the final invoked application.
- **Manual mode** requires explicit user interaction to cause activity start or finish. In such systems the activity start and/or completion is as a result of explicit user action.

The automation modes can be specified independently for the *start* and *end* of an Activity.

7.6.2. Route Activity

The Route activity makes use of Transition restrictions (sub elements of Activity) to implement complex routing logic. Refer to the discussion at the beginning of section 7.6, Figure 7.14 and the section on Transition Restriction: (section 7.6.9).

The Route Activity is a "dummy" Activity that permits the expression of "cascading" Transition conditions (e.g. of the type "IF condition-1 THEN TO Activity-1 ELSE IF condition-2 THEN TO Activity-2 ELSE Activity-3 ENDIF"). Some vendors might implement "cascading" transition conditions directly without requiring an activity counterpart for a route; others might require it. Wherever possible vendors and process designers are encouraged to structure such cascading conditions using an Exclusive Gateway or an XOR split from the outgoing activity. Certain transition combinations cannot be expressed within a single transition list from the outgoing activity or a single incoming list to an activity. These cases require the use of one or more dummy activities; examples are:

- Combination of XOR and AND split conditions on outgoing transitions from an activity.

- Combination of XOR and AND join conditions on incoming transitions to an activity
- Transitions involving conditional AND joins of a subset of threads, with continuation of individual threads

A route activity has neither a performer nor an application.

For simulation purposes the following simulation data values should be assumed: Duration "0", Cost "0", WorkingTime "0", WaitingTime "0". For Priority and Instantiation the maximum value should be assumed.

```

<xsd:element name="Route">
  <xsd:complexType>
    <xsd:sequence>
      <xsd:any namespace="##other" processContents="lax" minOccurs="0" maxOccurs="unbounded"/>
    </xsd:sequence>
    <xsd:attribute name="GatewayType" use="optional" default="Exclusive">
      <xsd:annotation>
        <xsd:documentation> Used when needed for BPMN Gateways. Gate and sequence information is associated
with the Transition Element.</xsd:documentation>
      </xsd:annotation>
      <xsd:simpleType>
        <xsd:restriction base="xsd:NMTOKEN">
          <xsd:enumeration value="XOR">
            <xsd:annotation>
              <xsd:documentation>Deprecated in BPMN1.1</xsd:documentation>
            </xsd:annotation>
          </xsd:enumeration>
          <xsd:enumeration value="Exclusive"/>
          <xsd:enumeration value="OR">
            <xsd:annotation>
              <xsd:documentation>Deprecated in BPMN1.1</xsd:documentation>
            </xsd:annotation>
          </xsd:enumeration>
          <xsd:enumeration value="Inclusive"/>
          <xsd:enumeration value="Complex"/>
          <xsd:enumeration value="AND"/>
          <xsd:enumeration value="Parallel"/>
        </xsd:restriction>
      </xsd:simpleType>
    </xsd:attribute>
    <xsd:attribute name="XORType" use="optional" default="Data">
      <xsd:annotation>
        <xsd:documentation>Deprecated in BPMN1.1</xsd:documentation>
      </xsd:annotation>
      <xsd:simpleType>
        <xsd:restriction base="xsd:NMTOKEN">
          <xsd:enumeration value="Data"/>
          <xsd:enumeration value="Event"/>
        </xsd:restriction>
      </xsd:simpleType>
    </xsd:attribute>
    <xsd:attribute name="ExclusiveType" use="optional" default="Data">
      <xsd:simpleType>
        <xsd:restriction base="xsd:NMTOKEN">
          <xsd:enumeration value="Data"/>
          <xsd:enumeration value="Event"/>
        </xsd:restriction>
      </xsd:simpleType>
    </xsd:attribute>
    <xsd:attribute name="Instantiate" type="xsd:boolean" use="optional" default="false"/>
    <xsd:attribute name="MarkerVisible" type="xsd:boolean" use="optional" default="false">
      <xsd:annotation>
        <xsd:documentation>Applicable only to XOR Gateways</xsd:documentation>
      </xsd:annotation>
    </xsd:attribute>
    <xsd:attribute name="IncomingCondition" type="xsd:string" use="optional"/>
    <xsd:attribute name="OutgoingCondition" type="xsd:string" use="optional"/>
    <xsd:anyAttribute namespace="##other" processContents="lax"/>
  </xsd:complexType>
</xsd:element>

```

	Description
--	-------------

	Description
GatewayType	Used when necessary for BPMN gateways. Note that TransitionRestriction (section 7.6.9) has all the attributes necessary for defining Gateways.
IncomingCondition	For a Complex Gateway, if there are multiple incoming Sequence Flow, an IncomingCondition expression MUST be set by the modeler. This will consist of an expression that can reference Sequence Flow names and/or Process Properties (Data).
Instantiate	Event-Based Gateways can be defined as the instantiation mechanism for the Process with the Instantiate attribute. This attribute MAY be set to true if the Gateway is the first element after the Start Event or a starting Gateway if there is no Start Event (i.e., there are no incoming Sequence Flow).
MarkerVisible	This attribute determines if the XOR Marker is displayed in the center of the Gateway diamond (an "X"). The marker is displayed if the attribute is True and it is not displayed if the attribute is False. By default, the marker is not displayed.
OutGoingCondition	For a Complex Gateway, if there are multiple outgoing Sequence Flow, an OutgoingCondition expression MUST be set by the modeler. This will consist of an expression that can reference (outgoing) Sequence Flow Ids and/or Process Properties (Data).

Table 37: Route Activity

7.6.2.1. Gateway Activity

Gateways are modeling elements that are used to control how Sequence Flows interact as they converge and diverge within a Process. If the flow does not need to be controlled, then a Gateway is not needed. The term "Gateway" implies that there is a gating mechanism that either allows or disallows passage through the Gateway--that is, as Tokens arrive at a Gateway, they can be merged together on input and/or split apart on output as the Gateway mechanisms are invoked. To be more descriptive, a Gateway is actually a collection of "Gates." Although the Gates are not graphically depicted, the Gates are used by the Sequence Flow to connect to or from the Gateway.

BPMN Gateway activities are represented by Route Activities, using three new attributes:

- GatewayType
- Instantiate
- MarkerVisible

Note that GatewayType is included as an optional supplement to TransitionRestrictions (see section 7.6.9).

A Gateway is used to control the divergence and convergence of Sequence Flow. Thus, it will determine branching, forking, merging, and joining of paths. Internal Markers will indicate the type of behavior control.

BPMN provides specific graphics for the gateway types supported.

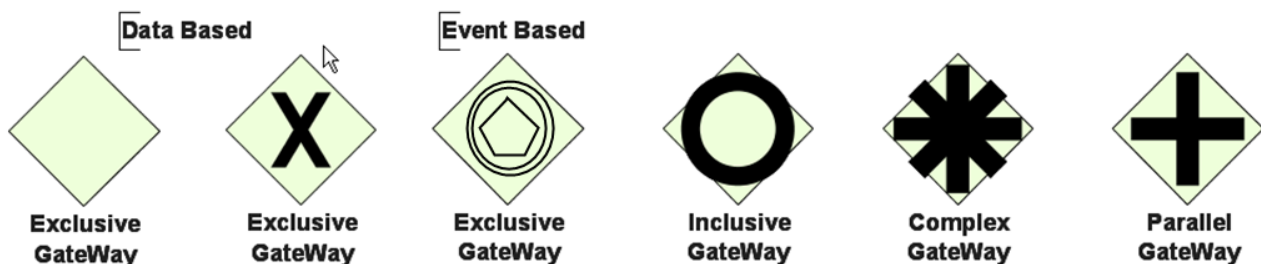


Figure 7.15: Gateway Types

Note – Although the shape of a Gateway is a diamond, it is not a requirement that incoming and outgoing Sequence Flow must connect to the corners of the diamond. Sequence Flow can connect to any position on the boundary of the Gateway shape.

- The internal marker associated with the Gateway MUST be placed inside the shape, in any size or location, depending on the preference of the modeler or modeling tool vendor, with the exception that the marker for the

Data- Based Exclusive Gateway is not required.

The Gateways will control the flow of both diverging and/or converging Sequence Flow. That is, a particular Gateway could have multiple input Gates and multiple output Gates at the same time (there is one Sequence Flow per Gate). The type of Gateway will determine the same type of behavior for both the diverging and converging Sequence Flow. Modelers and modeling tools may want to enforce a best practice of a Gateway only performing one of these functions. Thus, it would take two sequential Gateways to first converge and then diverge the Sequence Flow.

7.6.2.2. Examples of Gateways and their Representation

7.6.2.2.1.XOR Gate – Data based

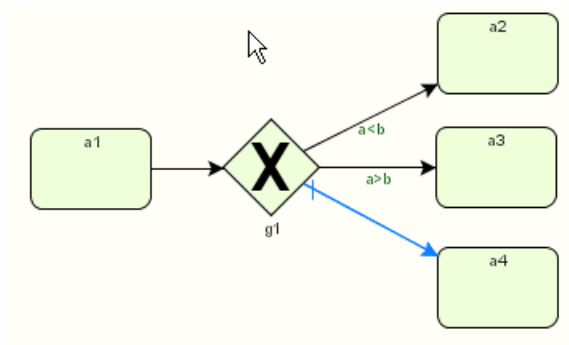


Figure 7.16: Exclusive Decision – Data Based

```

<Activities>
  <Activity Id="3" Name="a1"/>
  <Activity Id="4" Name="g1">
    <Route GatewayType="EXCLUSIVE" MarkerVisible="TRUE"/>
    <TransitionRestrictions>
      <TransitionRestriction>
        <Split Type="EXCLUSIVE">
          <TransitionRefs>
            <TransitionRef Id="9"/>
            <TransitionRef Id="10"/>
            <TransitionRef Id="11"/>
          </TransitionRefs>
        </Split>
      </TransitionRestriction>
    </TransitionRestrictions>
  </Activity>
  <Activity Id="5" Name="a2"/>
  <Activity Id="6" Name="a3"/>
  <Activity Id="7" Name="a4"/>
</Activities>
<Transitions>
  <Transition Id="8" Name="" From="3" To="4" FlowType="SequenceFlow"/>
  <Transition Id="9" Name="" From="4" To="5" FlowType="SequenceFlow">
    <Condition Type="CONDITION">a<b</Condition>
  </Transition>
  <Transition Id="10" Name="" From="4" To="6" FlowType="SequenceFlow">
    <Condition Type="CONDITION">a>b</Condition>
  </Transition>
  <Transition Id="11" Name="" From="4" To="7" FlowType="SequenceFlow">
    <Condition Type="OTHERWISE"/>
  </Transition>
</Transitions>

```

7.6.2.2.2.Merge

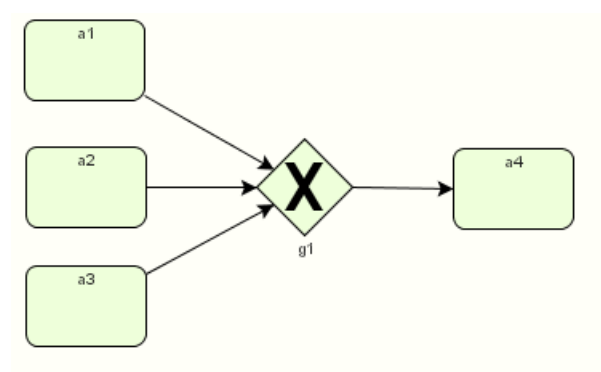


Figure 7.17: Exclusive Merge

```

<Activities>
  <Activity Id="3" Name="a1"/>
  <Activity Id="4" Name="a2"/>
  <Activity Id="5" Name="a3"/>
  <Activity Id="6" Name="g1">
    <Route GatewayType="Exclusive" MarkerVisible="TRUE"/>
  </Activity>
  <Activity Id="7" Name="a4"/>
</Activities>
<Transitions>
  <Transition Id="8" Name="" From="3" To="6" FlowType="SequenceFlow"/>
  <Transition Id="9" Name="" From="4" To="6" FlowType="SequenceFlow"/>
  <Transition Id="10" Name="" From="5" To="6" FlowType="SequenceFlow"/>
  <Transition Id="11" Name="" From="6" To="7" FlowType="SequenceFlow"/>
</Transitions>

```

7.6.2.3. BPMN Semantics for Gateway Types

7.6.2.3.1. Common Gateway Sequence Flow Connections

This section applies to all Gateways. Additional Sequence Flow Connection rules will be specified for each type of Gateway in the sections below.

- A Gateway MAY be a target for Sequence Flow; it can have zero or more incoming Sequence Flows. An incoming Flow MAY be from an alternative path or a parallel path
 - If the Gateway does not have an incoming Sequence Flow, and there is no Start Event for the Process, then the Gateway's divergence behavior, depending on the GatewayType attribute (see below), SHALL be performed when the Process is instantiated.
- A Gateway MAY be a source of Sequence Flow; it can have zero or more outgoing Flows.
- A Gateway MAY have both multiple incoming and outgoing Sequence Flows.

Note – The incoming and outgoing Sequence Flows are not required to attach to the corners of the Gateway's diamond shape. Sequence Flow can attach to any location on the boundary of a Gateway.

7.6.2.3.2. Common Gateway Message Flow Connections

This section applies to all Gateways.

- A Gateway MUST NOT be a target for Message Flow.
- A Gateway MUST NOT be a source for Message Flow.

7.6.2.3.3. Exclusive Gateways

Exclusive Gateways (Decisions) are locations within a business process where the Sequence Flow can take two or more alternative paths. This is basically the “fork in the road” for a process. For a given performance (or instance) of the process, only one of the paths can be taken (this should not be confused with forking of paths). A Decision is not an activity from the business process perspective, but is a type of Gateway that controls the Sequence Flow between activities. It can be thought of as a question that is asked at that point in the Process. The question has a defined set of alternative answers (Gates). Each Decision Gate is associated with a condition expression found within an outgoing

Sequence Flow. When a Gate is chosen during the performance of the Process, the corresponding Sequence Flow is then chosen. A Token arriving at the Decision would be directed down the appropriate path, based on the chosen Gate.

The Exclusive Decision has two or more outgoing Sequence Flows, but only one of them may be taken during the performance of the Process. Thus, the Exclusive Decision defines a set of alternative paths for the Token to take as it traverses the Flow. There are two types of Exclusive Decisions: Data-Based and Event-Based.

7.6.2.3.3.1. Data-Based

The Data-Based Exclusive Gateways are the most commonly used type of Gateways. The set of Gates for Data-Based Exclusive Decisions is based on the boolean expression contained in the ConditionExpression attribute of the outgoing Sequence Flow of the Gateway. These expressions use the values of process data to determine which path should be taken (hence the name Data-Based).

- The Data-Based Exclusive Gateway MAY use a marker that is shaped like an “X” and is placed within the Gateway diamond to distinguish it from other Gateways. This marker is not required.
 - A Diagram SHOULD be consistent in the use of the “X” internal indicator. That is, a Diagram SHOULD NOT have some Gateways with an indicator and some Gateways without an indicator.

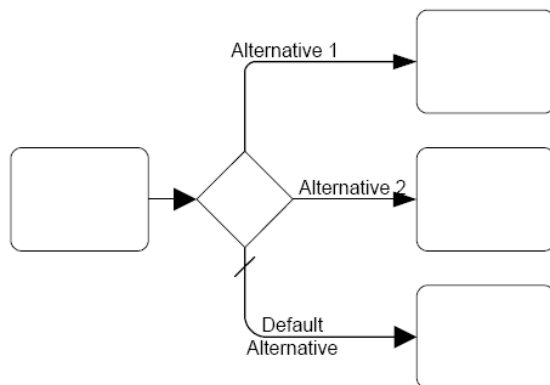


Figure 7.18: Exclusive Decision without Indicator

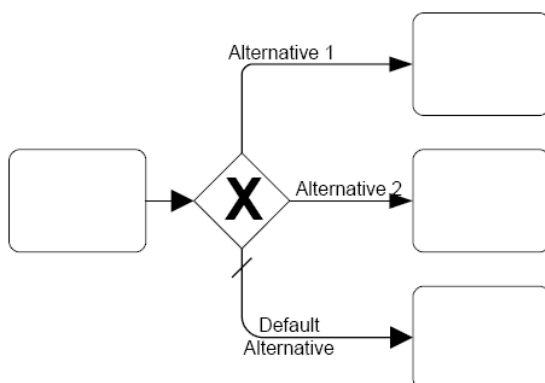


Figure 7.19: Exclusive Decision with Indicator

Note – The “X” internal indicator for the Data-Based Exclusive Gateway was included in BPMN to complete the set of indicators for the different types of Gateways. However, it is also understood that most modelers would be familiar with an empty decision diamond that represents an exclusive branching of the process and that most decisions would probably take this form. Thus, Data-Based Exclusive Gateway internal indicator was made optional so that modelers and modeling tools could create diagrams that would conform with the basic flow expectations of modelers.

The conditions for the alternative Gates should be evaluated in a specific order. The first one that evaluates as TRUE will determine the Sequence Flow that will be taken. Since the behavior of this Gateway is exclusive, any other conditions that may actually be TRUE will be ignored--only one Gate can be chosen. One of the Gates may be “default” (or otherwise), and is the last Gate considered. This means that if none of the other Gates are chosen, then the default

Gate will be chosen—along with its associated Sequence Flow. The default Gate is not mandatory for a Gateway. This means that if it is not used, then it is up to the modeler to insure that at least one Gate be valid at runtime. BPMN does not specify what will happen if there are no valid Gates. However, BPMN does specify that there **MUST NOT** be implicit flow and that all Normal Flow of a Process must be expressed through Sequence Flow. This would mean that a Process Model that has a Gateway that potentially does not have a valid Gate at runtime is an invalid model.

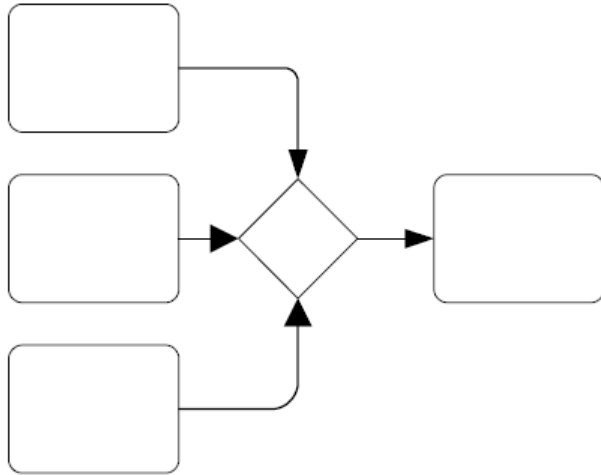


Figure 7.20: Exclusive Merge Without the Indicator

Exclusive Gateways can also be used as a merge for alternative Sequence Flow, although it is rarely required for the modeler to use them this way. The merging behavior of the Gateway can also be modeled as seen below. The behavior of both are the same if all the incoming flow are alternative.

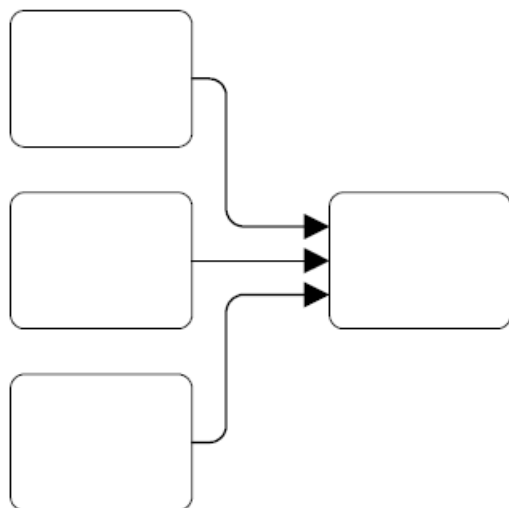


Figure 7.21: Uncontrolled Sequence Flow

There are certain situations where an Exclusive Gateway is required to act as a merging object. In the figure below an Exclusive Gateway (labeled “Merge”) merges two alternative Sequence Flow that were generated by an upstream Decision. The alternative Sequence Flows are merged in preparation for a Parallel Gateway that synchronizes a set of parallel Sequence Flows that were generated even further upstream. If the merging Gateway was not used, then there would have been four incoming Sequence Flows into the Parallel Gateway. However, only three of the four Sequence Flows would ever pass a Token at one time. Thus, the Gateway would be waiting for a fourth Token that would never arrive. Thus, the Process would be stuck at the point of the Parallel Gateway.

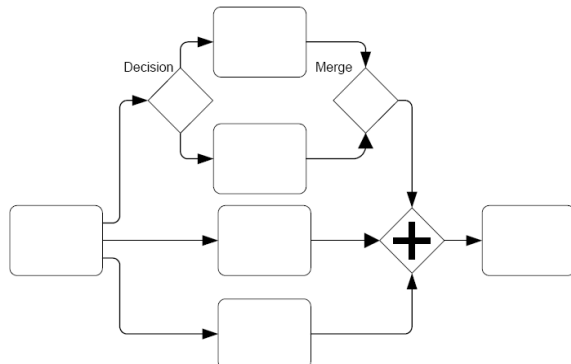


Figure 7.22: Exclusive Gateway is required to act as a merging object

In simple situations, Exclusive Gateways need not be used for merging Sequence Flow, but there are more complex situations where they are required. Thus, a modeler should always be aware of the behavior of a situation where Sequence Flows are uncontrolled. Some modelers or modeling tools may, in fact, require that Exclusive Gateways be used in all situations as a matter of Best Practice.

Sequence Flow Connections for Data-Based Exclusive Gateway:

To define the exclusive nature of this Gateway's behavior for converging Sequence Flows:

- If there are multiple incoming Sequence Flows, all of them will be used to continue the flow of the Process (as if there were no Gateway). That is,
 - Process flow **SHALL** continue when a signal (a Token) arrives from any of a set of Sequence Flows.
 - Signals from other Sequence Flows within that set may arrive at other times and the flow will continue when they arrive as well, without consideration or synchronization of signals that have arrived from other Sequence Flows.

To define the exclusive nature of this Gateway's behavior for diverging Sequence Flows:

- If there are multiple outgoing Sequence Flows, then only one Gate (or the DefaultGate) **SHALL** be selected during performance of the Process
 - The Gate **SHALL** be chosen based on the result of evaluating the ConditionExpression that is defined for the Sequence Flow associated with the Gate
 - The Conditions associated with the Gates **SHALL** be evaluated in the order in which the Gates appear on the list for the Gateway.
 - If a ConditionExpression is evaluated as "TRUE," then that Gate **SHALL** be chosen and any Gates remaining on the list **MUST NOT** be evaluated.
 - If none of the ConditionExpressions for the Gates are evaluated as "TRUE," then the DefaultGate **SHALL** be chosen.

Note – If the Gateway does not have a DefaultGate and none of the Gate ConditionExpressions are evaluated as "TRUE," then the Process is considered to have an invalid model.

7.6.2.3.3.2. Event-Based

The inclusion of Event-Based Exclusive Gateways is the result of recent developments in the handling of distributed systems and was derived from the BPEL4WS pick. On the input side, their behavior is the same as a Data-Based Exclusive Gateway. On the output side, the basic idea is that this Decision represents a branching point in the process where the alternatives are based on events that occur at that point in the Process, rather than the evaluation of expressions using process data. A specific event, usually the receipt of a message, determines which of the paths will be taken. For example, if a company is waiting for a response from a customer, they will perform one set of activities if the customer responds "Yes" and another set of activities if the customer responds "No." The customer's response determines which path is taken. The identity of the Message determines which path is taken. That is, the "Yes" Message

and the “No” message are different messages—they are not the same message with different values within a property of the Message. The receipt of the message can be modeled with a Task of TaskType Receive or an Intermediate Event with a Message Trigger. In addition to Messages, other Triggers for Intermediate Events can be used, such as Timers.

- The Event-Based Exclusive Gateway MUST use a marker that is the same as the Multiple Intermediate Event and is placed within the Gateway diamond to distinguish it from other Gateways.
- The Event-Based Exclusive Decisions are configured by having outgoing Sequence Flow target a Task of TaskType Receive or an Intermediate Event.
 - All of the outgoing Sequence Flow must have this type of target; there cannot be a mixing of condition expressions and Intermediate Events for a given Decision.

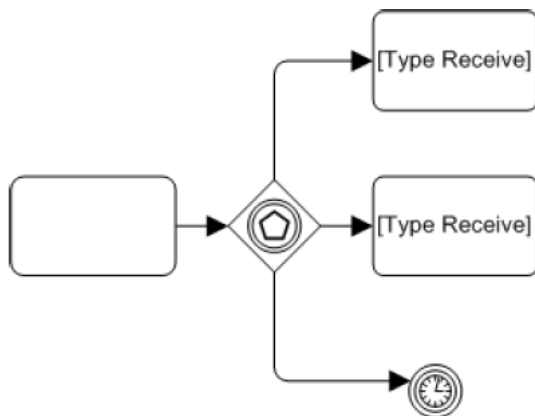


Figure 7.23: An Event-Based Exclusive Gateway using Receive Tasks

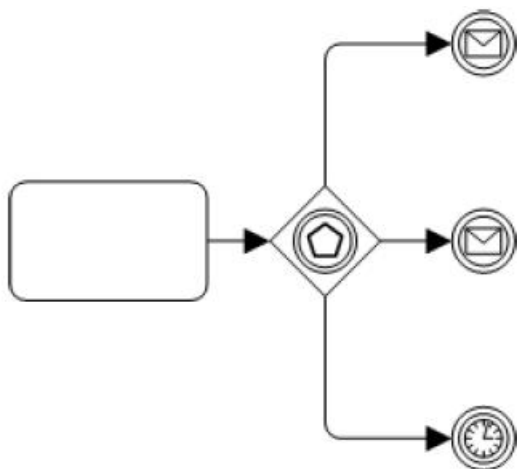


Figure 7.24: An Event-Based Exclusive Gateway using Message Events

Because this Gateway is an Exclusive Gateway, the merging functionality for the Event-Based Exclusive Gateway is the same as the Data-Based Exclusive Gateway described in the previous section. A Gateway can be used to start a Process. In a sense, the Process is bootstrapped by the receipt of a message. The receipt of any of the messages defined by the Gateway configuration will instantiate the Process. Thus, the Gateway provides a set of alternative ways for the Process to begin. In order for the Gateway to Instantiate the Process it must meet one of the following conditions

- The Process does not have a Start Event and the Gateway has no incoming Sequence Flow.
- The Incoming Sequence Flow for the Gateway has a source of a Start Event.
 - Note that no other incoming Sequence Flow are allowed for the Gateway (in particular, a loop connection from a downstream object).

- The Targets for the Gateway's outgoing Sequence Flow MUST NOT be a Timer Intermediate Event.

SequenceFlow Connections for Event-Based Exclusive Gateway

To define the exclusive nature of this Gateway's behavior for converging Sequence Flows

- If there are multiple incoming Sequence Flows, all of them will be used to continue the flow of the Process (as if there were no Gateway). That is,
 - Process flow SHALL continue when a signal (a Token) arrives from any of a set of Sequence Flows.
 - Signals from other Sequence Flows within that set may arrive at other times and the flow will continue when they arrive as well, without consideration or synchronization of signals that have arrived from other Sequence Flows.

To define the exclusive nature of this Gateway's behavior for diverging Sequence Flows:

- Only one Gate SHALL be selected during performance of the Process.
 - The Gate SHALL be chosen based on the Target of the Gate's Sequence Flow.
 - If a Target is instantiated (e.g., a message is received or a time is exceeded), then that Gate SHALL be chosen and the remaining Gates MUST NOT be evaluated (i.e., their Targets will be disabled).
- The outgoing Sequence Flow Condition attribute MUST be set to None.
- The Target of the Gateway's outgoing Sequence Flow MUST be one of the following objects:
 - Task with the TaskType attribute set to Receive.
 - Intermediate Event with the Trigger attribute set to Message, Timer, Signal, or Conditional.
 - If one Gate Target is a Task, then an Intermediate Event with a Trigger Message MUST NOT be used as a Target for another Gate. That is, messages MUST be received by only Receive Tasks or only Message Events, but not a mixture of both for a given Gateway.

7.6.2.3.4. Inclusive Gateways

This Decision represents a branching point where Alternatives are based on conditional expressions contained within outgoing Sequence Flow. However, in this case, the True evaluation of one condition expression does not exclude the evaluation of other condition expressions. All Sequence Flow with a True evaluation will be traversed by a Token. In some sense it like is a grouping of related independent Binary (Yes/No) Decisions--and can be modeled that way. Since each path is independent, all combinations of the paths may be taken, from zero to all. However, it should be designed so that at least one path is taken.

Note – If none of the Inclusive Decision Gate ConditionExpressions are evaluated as “TRUE,” then the Process is considered to have an invalid model.

There are two mechanisms for modeling this type of Decision:

The first method for modeling Inclusive Decision situations does not actually use an Inclusive Gateway, but instead uses a collection of conditional Sequence Flows, marked with mini-diamonds--the Gates without the Gateway. Conditional Sequence Flow Transitions [XPDL term] have their ConditionType attribute set to CONDITION and the ConditionExpression attribute set to a boolean mathematical expression based on information available to the Process. These Sequence Flow are indicated by a “mini-diamond” marker at the start of the Sequence Flow line.

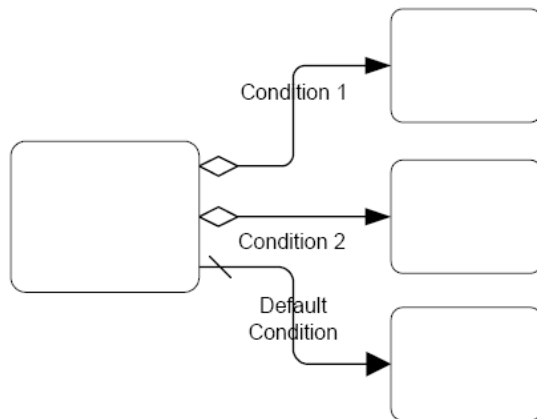


Figure 7.25: An Inclusive Decision using Conditional Sequence Flow

There are some restrictions in using the conditional Sequence Flow (with mini-diamonds):

- The source object **MUST NOT** be an Event. The source object **MAY** a Gateway, but the mini-diamond **MUST NOT** be displayed in this case. The source object **MAY** be an activity (Task or Sub-Process) and the mini-diamond **SHALL** be displayed in this case.
 - A source Gateway **MUST NOT** be of type Parallel.
- If a conditional Sequence Flow is used from a source activity, then there **MUST** be at least one other outgoing Sequence Flow from that activity
 - The additional Sequence Flow(s) **MAY** also be conditional, but it is not required that they are conditional.

The second method for modeling Inclusive Decision situations uses an Inclusive Gateway, sometimes in combination with other Gateways. A marker will be placed in the center of the Gateway to indicate that the behavior of the Gateway is inclusive.

- The Inclusive Gateway **MUST** use a marker that is in the shape of a circle or an “O” and is placed within the Gateway diamond to distinguish it from other Gateways.

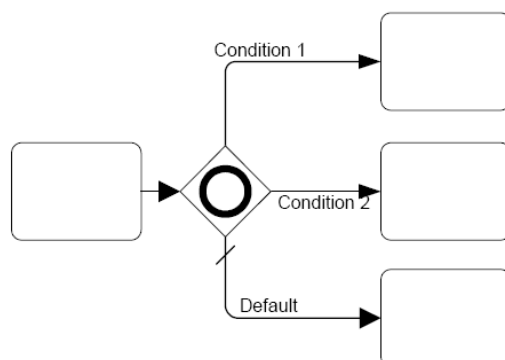


Figure 7.26: An Inclusive Decision using an Inclusive Gateway

The behavior of the two models depicted above are equivalent. Again, it is up to the modeler to insure that at least one of the conditions will be TRUE when the Process is performed.

When the Inclusive Gateway is used as a Merge, it will synchronize all Tokens that have been produced upstream, but

at most one for each incoming Sequence Flow.

Note: Tokens with a loop are upstream of every node in the loop. It requires that Tokens for all Sequence Flow that were actually produced by an upstream (by an Inclusive situation, for example) be synchronized. If an upstream Inclusive produces two out of a possible three Tokens, then a downstream Inclusive will synchronize those two Tokens and not wait for another Token, even though there are three incoming Sequence Flow (see Figure below).

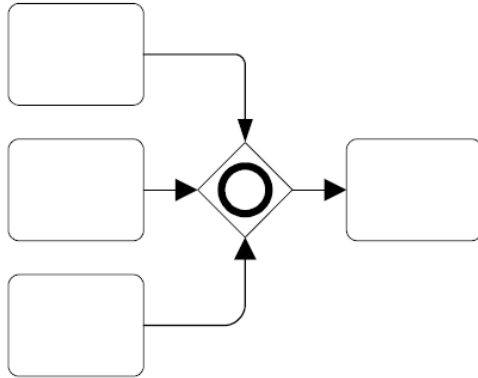


Figure 7.27: An Inclusive Gateway Merging Sequence Flow

SequenceFlow Connections for Inclusive Gateway

To define the inclusive nature of this Gateway's behavior for converging Sequence Flows:

- If there are multiple incoming Sequence Flows, one or more of them will be used to continue the flow of the Process. That is,
 - Process flow **SHALL** continue when the signals (Tokens) arrive from all of the incoming Sequence Flows that are expecting a signal based on the upstream structure of the Process (e.g., an upstream Inclusive Decision).
 - Some of the incoming Sequence Flow will not have signals and the pattern of which Sequence Flow will have signals may change for different instantiations of the Process.

Note – Incoming Sequence Flows that have a source that is a downstream activity (that is, is part of a loop) will be treated differently than those that have an upstream source. They will be considered as part of a different set of Sequence Flows from those Sequence Flows that have a source that is an upstream activity.

To define the inclusive nature of this Gateway's behavior for diverging Sequence Flows

- One or more Gates **SHALL** be selected during performance of the Process.
 - The Gates **SHALL** be chosen based on the Condition expression that is defined for the Sequence Flow associated with the Gates.
 - The Condition associated with all Gates **SHALL** be evaluated.
 - If a Condition is evaluated as "TRUE," then that Gate **SHALL** be chosen, independent of what other Gates have or have not been chosen
 - If none of the ConditionExpressions for the Gates are evaluated as "TRUE," then the DefaultGate **SHALL** be chosen.

7.6.2.3.5. Complex Gateways

BPMN includes a Complex Gateway to handle situations that are not easily handled through the other types of Gateways. Complex Gateways can also be used to combine a set of linked simple Gateways into a single, more compact situation. Modelers can provide complex expressions that determine the merging and/or splitting behavior of the Gateway.

- The Complex Gateway **MUST** use a marker that is in the shape of an asterisk and is placed within the Gateway diamond (see Figure below) to distinguish it from other Gateways.

When the Gateway is used as a Decision (see Figure below), then an expression determines which of the outgoing

Sequence Flow will be chosen for the Process to continue. The expression may refer to process data and the status of the incoming Sequence Flow. For example, an expression may evaluate Process data and then select different sets of outgoing Sequence Flow, based on the results of the evaluation. However, the expression should be designed so that at least one of the outgoing Sequence Flow will be chosen.

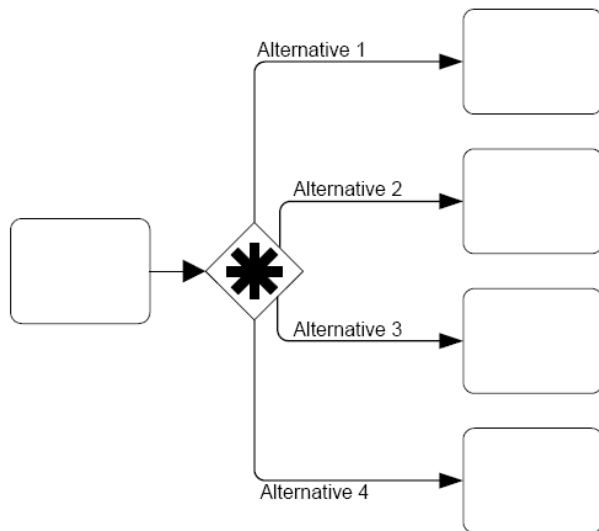


Figure 7.28: A Complex Decision (Gateway)

When the Gateway is used as a Merge (see Figure below), then there will be an expression that will determine which of the incoming Sequence Flows will be required for the Process to continue. The expression may refer to process data and the status of the incoming Sequence Flows. For example, an expression may specify that any 3 out of 5 incoming Tokens will continue the Process. Another example would be an expression that specifies that a Token is required from Sequence Flow “a” and that a Token from either Sequence Flow “b” or “c” is acceptable. However, the expression should be designed so that the Process is not stalled at that location.

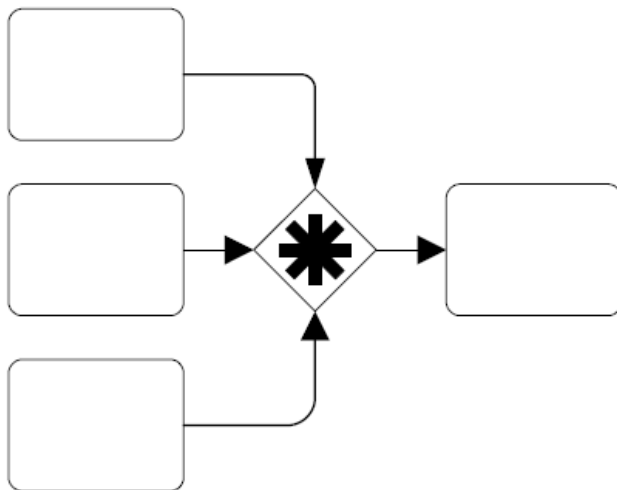


Figure 7.29: A Complex Merge (Gateway)

Sequence Flow Connection Rules for a Complex Gateway

To define the complex nature of this Gateway’s behavior for converging Sequence Flows:

- If there are multiple incoming Sequence Flows, one or more of them will be used to continue the flow of the Process. The exact combination of incoming Sequence Flows will be determined by the Gateway’s IncomingCondition expression.

- Process flow **SHALL** continue when the appropriate number of signals (Tokens) arrives from appropriate incoming Sequence Flows.
- Signals from other Sequence Flows within that set **MAY** arrive, but they **MUST NOT** be used to continue the flow of the Process.

Note – Incoming Sequence Flows that have a source that is a downstream activity (that is, is part of a loop) will be treated differently than those that have an upstream source. They will be considered as part of a different set of Sequence Flows from those Sequence Flows that have a source that is an upstream activity.

To define the inclusive nature of this Gateway's behavior for diverging Sequence Flows

- One or more Gates **SHALL** be selected during performance of the Process.
 - The Gates **SHALL** be chosen based on the Gateway's OutgoingCondition expression.

7.6.2.3.6. Parallel Gateways

Parallel Gateways provide a mechanism to synchronize parallel flows and to create parallel flows. These Gateways are not required to create parallel flows, but they can be used to clarify the behavior of complex situations where a string of Gateways are used and parallel flow is required. In addition, some modelers may wish to create a “best practice” where Parallel Gateways are always used for creating parallel paths. This practice will create an extra modeling element where one is not required, but will provide a balanced approach where forking and joining elements can be paired up.

- The Parallel Gateway **MUST** use a marker that is in the shape of a plus sign and is placed within the Gateway diamond to distinguish it from other Gateways.

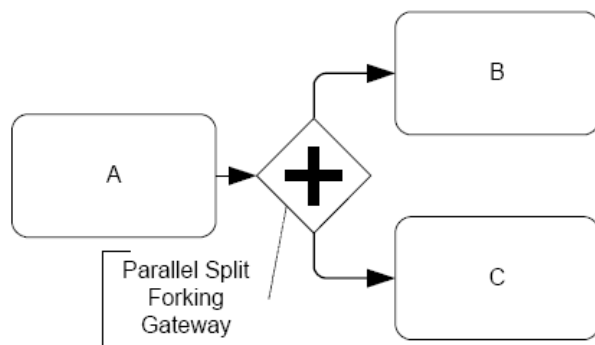


Figure 7.30: A Parallel Gateway

Parallel Gateways are used for synchronizing parallel flow.

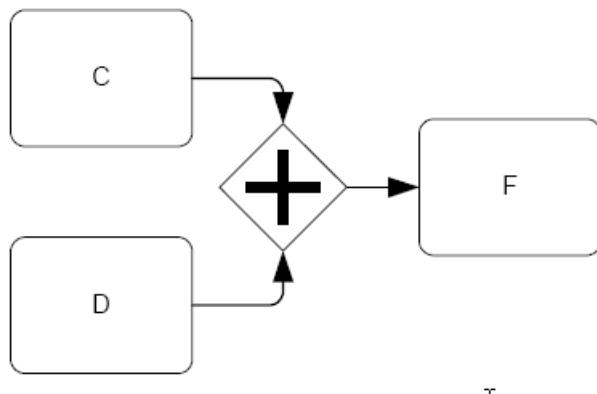


Figure 7.31: Joining – the joining of parallel paths

Sequence Flow Connections for Parallel Gateways

To define the parallel nature of this Gateway's behavior for converging Sequence Flows:

- If there are multiple incoming Sequence Flows, all of them will be used to continue the flow of the Process-- the flow will be synchronized. That is
 - Process flow **SHALL** continue when a signal (a Token) has arrived from all of a set of Sequence Flows (i.e., the process will wait for all signals to arrive before it can continue).

Note – Incoming Sequence Flows that have a source that is a downstream activity (that is, is part of a loop) will be treated differently than those that have an upstream source. They will be considered as part of a different set of Sequence Flows from those Sequence Flows that have a source that is an upstream activity.

To define the parallel nature of this Gateway's behavior for diverging Sequence Flows:

- All Gates **SHALL** be selected during performance of the Process.

7.6.3. Block Activity/Embedded Sub-Process

A block activity executes an ActivitySet or self-contained activities/transitions map. From the Block Activity execution proceeds to the first activity in the set (unless otherwise specified by optional properties) and continues within the set until it reaches an exit activity (an activity with no output transitions). Execution then returns to follow the output transitions of the block activity.

A block activity/embedded subprocess call is transactional if the parent Activity element has been specified as transactional.

7.6.3.1. Schema for BlockActivity

```

<xsd:element name="BlockActivity">
  <xsd:complexType>
    <xsd:sequence>
      <xsd:any namespace="##other" processContents="lax" minOccurs="0" maxOccurs="unbounded"/>
    </xsd:sequence>
    <xsd:attribute name="ActivitySetId" type="xpdIdRef" use="required">
      <xsd:annotation>
        <xsd:documentation>BPMN: Corresponds to embedded subprocess. Pointer to ActivitySet/@Id in
        XPDId.</xsd:documentation>
      </xsd:annotation>
    </xsd:attribute>
    <xsd:attribute name="StartActivityId" type="xpdIdRef" use="optional">
      <xsd:attribute name="View" use="optional" default="COLLAPSED">
        <xsd:annotation>
          <xsd:documentation>BPMN: Determines whether the subprocess is rendered as Collapsed or Expanded in
          diagram. Default is Collapsed.</xsd:documentation>
        </xsd:annotation>
      </xsd:attribute>
    </xsd:attribute>
    <xsd:simpleType>
      <xsd:restriction base="xsd:NMTOKEN">
        <xsd:enumeration value="COLLAPSED"/>
        <xsd:enumeration value="EXPANDED"/>
      </xsd:restriction>
    </xsd:simpleType>
  </xsd:complexType>
</xsd:element>

```

	Description
ActivitySetId	The ActivitySet to be executed.
StartActivityId	If present, must be the id of a start activity in the ActivitySet referenced by the ActivitySetId attribute of BlockActivity. If not present then the start activity is deducible by some other means. See ActivitySet section 7.5.4.
View	Indicates whether the activity is COLLAPSED or EXPANDED.

Table 38 BlockActivity

7.6.4. Event Activity

An Event is something that “happens” during the course of a business process. These Events affect the flow of the Process and usually have a cause (trigger or CATCH) or an impact (result or THROW). The term “event” is general enough to cover many things in a business process. The start of an activity, the end of an activity, the change of state of a document, a message that arrives, etc., all could be considered events. However, BPMN has restricted the use of events to include only those types of events that will affect the sequence or timing of activities of a process. BPMN further categorizes Events into three main types: Start, Intermediate, and End. Start and most Intermediate Events have “Triggers” that define the cause for the event. There are multiple ways that these events can be triggered. End Events may define a “Result” that is a consequence of a Sequence Flow ending. There are multiple types of Results that can be defined.

All Events share the same shape footprint, a small circle. Different line styles distinguish the three types of flow Events. All Events also have an open center so that BPMN-defined and modeler-defined icons can be included within the shape to help identify the Trigger or Result of the Event.

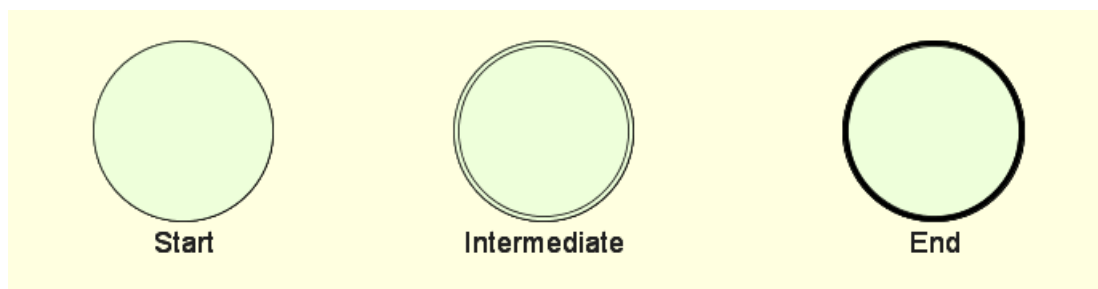


Figure 7.32: Three Types of Events

7.6.4.1. Schema for Event

```
<xsd:element name="Event">
  <xsd:annotation>
    <xsd:documentation>BPMN</xsd:documentation>
  </xsd:annotation>
  <xsd:complexType>
    <xsd:choice>
      <xsd:element ref="xpd:StartEvent" minOccurs="0"/>
      <xsd:element ref="xpd:IntermediateEvent" minOccurs="0"/>
      <xsd:element ref="xpd:EndEvent" minOccurs="0"/>
    </xsd:choice>
    <xsd:anyAttribute namespace="##other" processContents="lax"/>
  </xsd:complexType>
</xsd:element>
```

Entity Types and Attributes(usage within EventType)	StartEvent	Intermediate Event	End Event	Reference
Activity				Used for Compensation. See section 7.6.4.5.1.
ErrorCode				See section 7.6.4.5.2.
Implementation	x	X		WebService Other Unspecified
Name				See section 7.6.4.5.4.
Message	x	X	x	See section 7.9.4.
SubFlow/ProcessRef				See section 7.6.4.5.4.
Result			x	See section 7.6.4.4.5.

TriggerResultCompensation		X	x	See section 7.6.4.5.1.
ResultError		X	x	See section 7.6.4.5.2.
ResultMultiple			x	See section 7.6.4.5.3.
ConditionName				See section 7.6.4.5.10.
Target		X		A Target MAY be included for the Intermediate Event. The Target MUST be an activity. This means that the Intermediate Event is attached to the boundary of the activity and is used to signify an exception or compensation for that activity. See section 7.6.4.3.
TimeCycle				See section 7.6.4.5.11.
TimeDate				See section 7.6.4.5.11.
Trigger	x	X		
TriggerIntermediateMultiple		X		See section 7.6.4.5.8.
TriggerMultiple	x			See section 7.6.4.5.9.
TriggerResultLink		X		See section 7.6.4.5.4.
TriggerResultMessage	x	X	x	See section 7.6.4.5.5.
TriggerResultCancel		X	x	
TriggerResultSignal	x	X	x	See section 7.6.4.5.7.
TriggerConditional	x	X		See section 7.6.4.5.10.
TriggerTimer	x	X		See section 7.6.4.5.11.
WebService	x	X		See section 7.9.6.

Table 39: Event

7.6.4.2. Start Event

As the name implies, the Start Event indicates where a particular Process will start. In terms of Sequence Flow, the Start Event starts the flow of the Process, and thus, will not have any incoming Sequence Flow—no Sequence Flow can connect to a Start Event.

7.6.4.2.1. Token Flow

To discuss Sequence Flow it is useful to refer to Petri Nets in general and in particular Place-Transition Nets and high-level nets such as Colored Petri Nets [High-Level Petri Nets, Springer-Verlag, 1991]. ‘Tokens’ traveling through such a structure characterize the ‘State’ of the system.

In our case a Token traverses the Sequence Flow and passes through the Flow Objects in the Process. Process behavior can then be described by the paths of the Token. To support parallel activity (caused by and-split (Fork) a token has a unique identity and ‘child-tokens’ with appropriate IDs are generated by the Fork.

A Start Event generates an instance of the Process. Thus a token is created at the Start Event node. This token travels through the network of Sequence Flow Activities and Gateways and is eventually consumed by an End Event. Arrival at an And-Join Gateway requires multiple child tokens to be recombined. Arrival at an Intermediate Event requires the occurrence of the event (see discussion of Intermediate Event) in order for the token to exit that event. There should always be either Sequence Flow or a graphical indicator, such as an Intermediate Event to show all the potential paths

of Tokens in Normal sequence Flow. An example of implicit flow is when a Token arrives at a Gateway, but none of the Gates are valid, the Token would then (implicitly) pass to the end of the Process, which occurs with some modeling notations. Tokens can also be directed through exception handling Intermediate Events, which act like a forced end to an activity.

Message flow can be modeled by a different class of tokens. We do not discuss this further in this specification.

7.6.4.2.2. Semantics of the Start Event

Semantics of the Start Event include:

- A Start Event is **OPTIONAL**
 - If a Process is complex and/or the starting conditions are not obvious, then it is **RECOMMENDED** that a Start Event be used
 - If a BPMN process or subprocess does not have an explicit (drawn) Start Event, any BPMN activity or gateway with no incoming Sequence Flow (except for a Compensating Activity) is enabled when the process or subprocess is instantiated, i.e. is considered to include an implicit Start Event. Such implicit Start Events are not allowed if any explicit Start or End events are used in the same process or subprocess. A flow object with implicit Start Events shall have an implied trigger type of None, except for a Task with task type Receive or an Event Gateway.
 - If there is an End Event, then there **MUST** be at least one Start Event.
 - If the Start Event is used, then there **MUST NOT** be other flow elements that do not have incoming Sequence Flow—all other Flow Objects **MUST** be a target of at least one Sequence Flow.
 - Exceptions to this are activities that are defined as being Compensation activities (have the Compensation Marker). Compensation activities **MUST NOT** have any incoming Sequence Flow, even if there is a Start Event in the Process level.
 - An exception to this is the Intermediate Event, which **MAY** be without an incoming Sequence Flow (when attached to an activity boundary).
 - If the Start Event is not used, then all Flow Objects that do not have an incoming Sequence Flow (i.e., are not a target of a Sequence Flow) **SHALL** be instantiated when the Process is instantiated. There is an assumption that there is only one implicit Start Event, meaning that all the starting Flow Objects will start at the same time
 - Exceptions to this are activities that are defined as being Compensation activities (have the Compensation Marker). Compensation Activities are not considered a part of the Normal Flow and **MUST NOT** be instantiated when the Process is instantiated.
- There **MAY** be multiple Start Events for a given Process level.
 - Each Start Event is an independent event. That is, a Process Instance **SHALL** be generated when the Start Event is triggered.
 - If the Process is used as a Sub-Process and there are multiple 'None' Start Events, then when flow is transferred from the parent Process to the Sub-Process, only one of the Sub-Process's Start Events will be Triggered. The TargetRef attribute of the Sequence Flow incoming to the Sub-Process object can be extended to identify the appropriate Start Event (as defined in the Sub-Process's "Sequence Flow Connections" on page 69). **[Note: XPDL provides a specific mechanism for choosing among multiple Start Activities. See StartActivityId in Process Definition 6.4.2]**

Note – The behavior of Process may be harder to understand if there are multiple Start Events. It is **RECOMMENDED** that this feature be used sparingly and that the modeler be aware that other readers of the Diagram may have difficulty understanding the intent of the Diagram.

When the trigger for a Start Event occurs, a new Process will be instantiated and a Token will be generated for each outgoing Sequence Flow from that event. The TokenId set for each of the Tokens will contain information such that the Tokens from the same parallel Fork [**AND-Split**] can be identified and the number of Tokens in the fork determined. These Tokens will begin their flow and not wait for any other Start Event to be triggered.

If there is a dependency for more than one Event to happen before a Process can start (e.g. two messages are required to start), then the Start Events must flow to the same activity within that Process. The attributes of the activity would specify when the activity could begin. If the attributes specify that the activity must wait for all inputs, then all Start Events will have to be triggered before the Process begins. In addition, a correlation mechanism will be required so that different triggered Start Events will apply to the same process instance.

7.6.4.2.3. Types of Start Events

There are many ways that a business process can be started (instantiated). The Trigger for a Start Event is designed to show the general mechanism that will instantiate that particular Process. There are six types of Start Events in BPMN: None, Message, Timer, Conditional, Signal and Multiple.







Trigger	Description	Marker
None	The modeler does not display the type of Event. It is also used for a Sub-Process that starts when the flow is triggered by its Parent Process.	
Message	A Message arrives from a participant and triggers the start of the Process.	
Timer	A specific time-date or a specific cycle (e.g., every Monday at 9am) can be set that will trigger the start of the Process.	
Conditional	This type of event is triggered when a Condition such as “S&P 500 changes by more than 10% since opening,” or “Temperature above 300C” become true. The ConditionExpression for the Event must become false and then true before the Event can be triggered again.	
Signal	A signal arrives that has been broadcast from another Process and triggers the start of the Process. Note that the Signal is not a Message, which has a specific target for the Message. Multiple Processes can have Start Events that are triggered from the same broadcasted Signal.	
Multiple	This means that there are multiple ways of triggering the Process. Only one of them will be required to start the Process. The attributes of the Start Event will define which of the other types of Triggers apply.	

Table 40: Start Event subtypes

7.6.4.2.4. Start Event Sequence Flow Connections

- A Start Event **MUST NOT** be a target for Sequence Flow; it **MUST NOT** have incoming Sequence Flow.
 - An exception to this is when a Start Event is used in an Expanded Sub-Process and is attached to the boundary of that Sub-Process. In this case, a Sequence Flow from the higher-level Process **MAY** connect to that Start Event in lieu of connecting to the actual boundary of the Sub-Process. Note: this is not necessary and inconsistent with the rest of the notation. It is not supported in XPD.
- A Start Event **MUST** be a source for Sequence Flow.
- Multiple Sequence Flow **MAY** originate from a Start Event. For each Sequence Flow that has the Start Event as a source, a new parallel path **SHALL** be generated.
 - The Condition attribute for all outgoing Sequence Flows **MUST** be set to None.
 - When a Start Event is not used, then all Flow Objects that do not have an incoming Sequence Flow **SHALL** be the start of a separate parallel path.

Each path will have a separate unique Token that will traverse the Sequence Flow.

7.6.4.2.5. Start Event Message Flow Connections

Note – All Message Flows must connect two separate Pools. They can connect to the Pool boundary or to Flow Objects within the Pool boundary. They cannot connect two objects within the same Pool.

- A Start Event **MAY** be the target for Message Flows; it can have 0 (zero) or more incoming Message Flows. Each Message Flow arriving at a Start Event represents an instantiation mechanism (a Trigger) for the process. Only one of the Triggers is required to start a new Process.
 - The Trigger attribute of the Start Event **MUST** be set to “Message” or “Multiple” if there are any incoming Message Flows.
 - The Trigger attribute of the Start Event **MUST** be set to “Multiple” if there are more than

one incoming Message Flow.

- A Start Event MUST NOT be a source for Message Flow; it MUST NOT have outgoing Message Flows.

7.6.4.2.6. Schema for StartEvent

```
<xsd:element name="StartEvent">
  <xsd:annotation>
    <xsd:documentation>BPMN</xsd:documentation>
  </xsd:annotation>
  <xsd:complexType>
    <xsd:choice minOccurs="0">
      <xsd:element ref="xpd:TriggerResultMessage" minOccurs="0"/>
      <xsd:element ref="xpd:TriggerTimer" minOccurs="0"/>
      <xsd:element ref="xpd:TriggerConditional" minOccurs="0"/>
      <xsd:element ref="xpd:TriggerResultSignal" minOccurs="0"/>
      <xsd:element ref="xpd:TriggerMultiple" minOccurs="0"/>
    </xsd:choice>
    <xsd:attribute name="Trigger" use="required">
      <xsd:annotation>
        <xsd:documentation>BPMN: Trigger or Result type for the event</xsd:documentation>
      </xsd:annotation>
      <xsd:simpleType>
        <xsd:restriction base="xsd:NMTOKEN">
          <xsd:enumeration value="None"/>
          <xsd:enumeration value="Message"/>
          <xsd:enumeration value="Timer"/>
          <xsd:enumeration value="Conditional"/>
          <xsd:enumeration value="Signal"/>
          <xsd:enumeration value="Multiple"/>
        </xsd:restriction>
      </xsd:simpleType>
    </xsd:attribute>
    <xsd:attribute name="Implementation" use="optional" default="WebService">
      <xsd:annotation>
        <xsd:documentation>Required if the Trigger is Message</xsd:documentation>
      </xsd:annotation>
      <xsd:simpleType>
        <xsd:restriction base="xsd:NMTOKEN">
          <xsd:enumeration value="WebService"/>
          <xsd:enumeration value="Other"/>
          <xsd:enumeration value="Unspecified"/>
        </xsd:restriction>
      </xsd:simpleType>
    </xsd:attribute>
    <xsd:anyAttribute namespace="##other" processContents="lax"/>
  </xsd:complexType>
</xsd:element>
```

	Description
Implementation	WebService Other Unspecified See section 7.9.6.
Trigger	None, Message, Timer, Conditional, Signal, Multiple. "None" is used typically for subflow invocations, including embedded subflows.
TriggerMultiple	This means that there are multiple ways of triggering the Process. Only one of them will be required to start the Process. The attributes of the Start Event will define which of the other types of Triggers apply. See section 7.6.4.5.9.
TriggerResultMessage	A message arrives from a participant and triggers the start of the Process. See section 7.6.4.5.5.
TriggerConditional	This type of event is triggered when the conditions for a rule such as "S&P 500 changes by more than 10% since opening," or "Temperature above 300C" become true. See section 7.6.4.5.10.
TriggerResultSignal	A signal arrives that has been broadcast from another Process and triggers the start of the Process. Note that the Signal is not a Message, which has a specific target for the Message. Multiple Processes can have Start Events that are triggered from the same broadcasted Signal.
TriggerTimer	A specific time-date or a specific cycle (e.g., every Monday at 9am) can be set that will trigger the start of the Process. See section 7.6.4.5.11.

Table 41: Start Event Activity

7.6.4.3. Intermediate Event

Intermediate Events occur between a Start Event and an End Event. This is an event that occurs after a Process has been started. It will affect the flow of the process, but will not start or (directly) terminate the process. Intermediate Events can be used to:

- Show where messages are expected or sent within the Process,
- Show where delays are expected within the Process,
- Disrupt the Normal Flow through exception handling, or
- Show the extra work required for compensation.

One use of Intermediate Events is to represent exception or compensation handling. This will be shown by placing the Intermediate Event on the boundary of a Task or Sub-Process (either collapsed or expanded). The figure below displays an example of an Intermediate Event attached to a Task. The Intermediate Event can be attached to any location of the activity boundary and the outgoing Sequence Flow can flow in any direction. However, in the interest of clarity of the Diagram, we recommend that the modeler choose a consistent location on the boundary. For example, if the Diagram orientation is horizontal, then the Intermediate Events can be attached to the bottom of the activity and the Sequence Flow directed down, then to the right. If the Diagram orientation is vertical, then the Intermediate Events can be attached to the left or right side of the activity and the Sequence Flow directed to the left or right, then down.

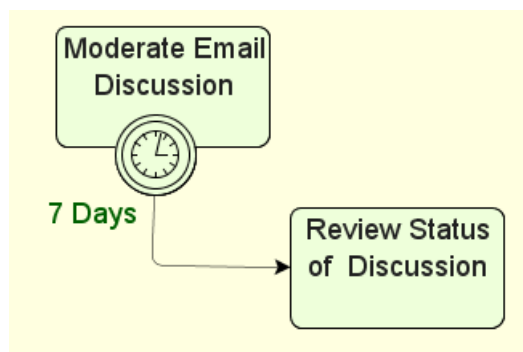















Figure 7.33: Intermediate Event on an Activity Boundary

7.6.4.3.1. Types of Intermediate Events

There are ten (10) types of Intermediate Events in BPMN: None, Message, Timer, Error, Cancel, Compensation, Conditional, Link, Signal and Multiple. Each type of Intermediate Event will have a different icon placed in the center of the Intermediate Event shape to distinguish one from another. An Intermediate Event that is placed within the normal flow of a Process can be used for one of two purposes. The Event can respond to (“catch”) the Event Trigger or the Event can be used to set off (“throw”) the Event Trigger. An Intermediate Event that is attached to the boundary of an Activity can only be used to “catch” the Event Trigger.

When a Token arrives at an Intermediate Event that is placed within the normal flow of a Process, one of two things will happen. If the Event is used to “throw” the Event Trigger, then Trigger of the Event will immediately occur (e.g., the Message will be sent) and the Token will move down the outgoing Sequence Flow. If the Event is used to “catch” the Event Trigger, then the Token will remain at the Event until the Trigger occurs (e.g., the Message is received). Then the Token will move down the outgoing Sequence Flow.

Trigger	Description	Marker
None	This is valid only for Intermediate Events that are in the main flow of the Process. The modeler does not display the type of Event. It is used for modeling methodologies that use Events to indicate some change of state in the Process.	

Trigger	Description	Marker
Message	A message arrives from a participant and triggers the Event. This causes the Process to continue if it was waiting for the message, or changes the flow for exception handling. When used to “catch” the message, then the Event marker will be unfilled (see top figure on the right). In Normal Flow, Message Intermediate Events can be used for sending messages to a participant. When used to “throw” the message, the Event marker will be filled (see bottom figure on the right) If used for exception handling it will change the Normal Flow into an Exception Flow.	 
Timer	A specific time-date or a specific cycle (e.g., every Monday at 9am) can be set that will trigger the Event. If used within the main flow it acts as a delay mechanism. If used for exception handling it will change the Normal Flow into an Exception Flow.	
Error	This type of Event can only be attached to the boundary of an activity, thus it reacts to (catches) a named error, or to any error if a name is not specified.	
Cancel	This type of Intermediate Event is used within a Transaction Sub-Process. This type of Event MUST be attached to the boundary of a Sub-Process. It SHALL be triggered if a Cancel End Event is reached within the Transaction Sub-Process. It also SHALL be triggered if a Transaction Protocol “Cancel” message has been received while the Transaction is being performed.	
Compensation	This is used for compensation handling--both activating and performing compensation. When used in Normal flow, this Intermediate Event indicates that a Compensation is necessary. Thus, it is used to “throw” the Compensation event, and the Event marker MUST be filled (see the bottom figure on the right). If the Event identifies an activity, then that is the activity (and no other) that will be compensated. Otherwise, the compensation is broadcast to all activities that have completed within the Process Instance including the top-level Process and including all Sub-Processes. Each completed activity that is subject to compensation will be compensated, in the reverse order of the completion of the activities. To be compensated, an activity MUST have a Compensation Intermediate Event attached to its boundary. When attached to the boundary of an activity, the Event will be triggered by a thrown compensation that identifies that activity or to a broadcast compensation. When used to “catch” the Compensation event, the Event marker MUST be unfilled (see the top figure on the right). When the Event is triggered, the Compensation Activity that is Associated with the Event will be performed.	 
Conditional	This type of event is triggered when a Condition becomes true.	
Link	A Link is a mechanism for connecting two sections of a Process. Link Events can be used to create looping situations or to avoid long Sequence Flow lines. Link Event uses are limited to a single Process level (i.e., they cannot link a parent Process with a Sub-Process). Paired Intermediate Events can also be used as “Off-Page Connectors” for printing a Process across multiple pages. They can also be used as generic “Go To” objects within the Process level. There can be multiple Source Link Events, but there can only be one Target Link Event. When used to “catch” from the Source Link, the Event marker will be unfilled (see the top figure on the right). When used to “throw” to the Target Link, the Event marker will be filled (see the bottom figure on the right).	 
Signal	This type of event is used for sending or receiving Signals. A Signal is for general communication within and across Process Levels, across Pools, and between Business Process Diagrams. A BPMN Signal is similar to a signal flare that shot into the sky for anyone who might be interested to notice and then react. Thus, there is a source of the Signal, but no specific intended target. This is different than a BPMN Message, which has a specific Source and a specific Target (which can be an Entity or an abstract Role). This type of Intermediate Event can send or receive a Signal if the Event is part of a Normal Flow. The Event can only receive a Signal when attached to the boundary of an activity. The Signal Event differs from an Error Event in that the Signal defines a more general, non-error condition for interrupting activities (such as the successful completion of another activity) as well as having a larger scope than Error Events. When used to “catch” the signal, the Event marker will be unfilled (see the top figure on the right). When used to “throw” the signal, the Event marker will be filled.	 



Trigger	Description	Marker
Multiple	This means that there are multiple Triggers assigned to the Event. If used within normal flow, the Event can “catch” the Trigger or “throw” the Trigger. When attached to the boundary of an activity, the Event can only “catch” the Trigger. When used to “catch” the Trigger, only one of the assigned Triggers is required and the Event marker will be unfilled (see the top figure on the right). When used to “throw” the Trigger (the same as a Multiple End Event), all the assigned Triggers will be thrown and the Event marker will be filled (see the bottom figure on the right).	 

Table 42: Intermediate Event sub types

7.6.4.3.2. Activity Boundary Connections

An Intermediate Event can be attached to the boundary of an activity under the following conditions:

- (One or more) Intermediate Events MAY be attached directly to the boundary of an Activity.
 - To be attached to the boundary of an Activity, an Intermediate Event MUST be one of the following Triggers: Message, Timer, Error, Cancel, Compensation, Conditional, Signal or Multiple.
 - An Intermediate Event with a Cancel Trigger MAY be attached to a Sub-Process boundary only if the IsATransaction attribute of the Sub-Process is set to TRUE.

7.6.4.3.3. Intermediate Event Sequence Flow Connections

- The following Intermediate Events MAY be attached to the boundary of an Activity: Message, Timer, Error, Cancel (only Sub-Process that is a Transaction), Compensation, Conditional, Signal and Multiple. Thus, the following MUST NOT: None, and Link.
 - If the Intermediate Event is attached to the boundary of an activity:
 - The Intermediate Event MUST NOT be a target for Sequence Flow; it cannot have an incoming Flow
 - The Intermediate Event MUST be a source for Sequence Flow; it can have one (and only one) outgoing Sequence Flow.
 - An exception to this: an Intermediate Event with a Compensation Trigger MUST NOT have an outgoing Sequence Flow (it MAY have an outgoing Association).
- The following Intermediate Events MAY be used in Normal Flow: None, Message, Timer, Compensation, Conditional, Link, and Signal. Thus, the following MUST NOT: Cancel and Error.
 - If the Intermediate Event is used within Normal Flow:
 - Intermediate Events of the following types MUST be a target of a Sequence Flow: None, and Compensation. They MUST have one (and only one) incoming Flow.
 - Intermediate Events of the following types MAY be a target of a Sequence Flow: Message, Timer, Conditional, Link, and Signal. They MAY have one (and only one) incoming Flow.

Note –These types of Intermediate Events will always be ready to accept the Event Triggers (once) while the Process in which they are contained is active. They are NOT optional and are expected to be triggered during the performance of the Process.

- An Intermediate Event MUST be a source for Sequence Flow; it MUST have one (and only one) outgoing Sequence Flow.
 - An exception to this: a Source Link Intermediate Event (as defined below), is not required to have an outgoing Sequence Flow.
- An Intermediate Event with a Link Trigger MUST NOT be both a target and a source of a Sequence Flow.

To define the use of a Link Intermediate Event as an “Off-Page Connector” or a “Go To” object:

- A Link Intermediate Event MAY be the target (Target Link) or a source (Source Link) of a Sequence Flow,

but MUST NOT be both a target and a source.

- If there is a Source Link, there MUST be a matching Target Link (they have the same Name).
 - There MAY be multiple Source Links for a single Target Link.
 - There MUST NOT be multiple Target Links for a single Source Link.

7.6.4.3.4. Intermediate Event Message Flow Connections

Note – All Message Flows must connect two separate Pools. They can connect to the Pool boundary or to Flow Objects within the Pool boundary. They cannot connect two objects within the same Pool.

- An Intermediate Event of type Message MAY be the target for Message Flow; it can have one incoming Message Flow.
- An Intermediate Event of type Message MAY be a source for Message Flow; it can have one outgoing Message Flow.
- An Intermediate Event of type Message MAY have an incoming Message Flow or an outgoing Message Flow, but not both.

7.6.4.3.5. Schema for Intermediate Event

```

<xsd:element name="IntermediateEvent">
  <xsd:annotation>
    <xsd:documentation>BPMN</xsd:documentation>
  </xsd:annotation>
  <xsd:complexType>
    <xsd:choice minOccurs="0">
      <xsd:element ref="xpd:TriggerResultMessage" minOccurs="0"/>
      <xsd:element ref="xpd:TriggerTimer" minOccurs="0"/>
      <xsd:element ref="xpd:ResultError" minOccurs="0"/>
      <xsd:element ref="xpd:TriggerResultCompensation" minOccurs="0">
        <xsd:annotation>
          <xsd:documentation>BPMN: Must be present if if Trigger or ResultType is Compensation.[This event
can be attached or throwing. Thus name of element should be TriggerResultCompensation.]</xsd:documentation>
        </xsd:annotation>
      </xsd:element>
      <xsd:element ref="xpd:TriggerConditional" minOccurs="0"/>
      <xsd:element ref="xpd:TriggerResultLink" minOccurs="0">
        <xsd:annotation>
          <xsd:documentation>BPMN: Link event connects source and target nodes of the same process or
subprocess. Equivalent to a sequence flow between source and target nodes.</xsd:documentation>
        </xsd:annotation>
      </xsd:element>
      <xsd:element ref="xpd:TriggerResultCancel" minOccurs="0"/>
      <xsd:element ref="xpd:TriggerResultSignal" minOccurs="0"/>
      <xsd:element ref="xpd:TriggerIntermediateMultiple" minOccurs="0">
        <xsd:annotation>
          <xsd:documentation>BPMN: if the TriggerType is Multiple then this must be present. Only valid for
attached event. [EventDetail elements are incorrect. They should be message, timer, error, conditional, signal,
cancel.]</xsd:documentation>
        </xsd:annotation>
      </xsd:element>
    </xsd:choice>
    <xsd:attribute name="Trigger" use="required">
      <xsd:simpleType>
        <xsd:restriction base="xsd:NMTOKEN">
          <xsd:enumeration value="None"/>
          <xsd:enumeration value="Message"/>
          <xsd:enumeration value="Timer"/>
          <xsd:enumeration value="Error"/>
          <xsd:enumeration value="Cancel"/>
          <xsd:enumeration value="Conditional"/>
          <xsd:enumeration value="Link"/>
          <xsd:enumeration value="Signal"/>
          <xsd:enumeration value="Compensation"/>
          <xsd:enumeration value="Multiple"/>
        </xsd:restriction>
      </xsd:simpleType>
    </xsd:attribute>
  </xsd:complexType>
</xsd:element>

```

```

<xsd:attribute name="Implementation" use="optional" default="WebService">
  <xsd:annotation>
    <xsd:documentation>Required if the Trigger is Message</xsd:documentation>
  </xsd:annotation>
  <xsd:simpleType>
    <xsd:restriction base="xsd:NMTOKEN">
      <xsd:enumeration value="WebService"/>
      <xsd:enumeration value="Other"/>
      <xsd:enumeration value="Unspecified"/>
    </xsd:restriction>
  </xsd:simpleType>
</xsd:attribute>
<xsd:attribute name="Target" type="xpd:Id" use="optional">
  <xsd:annotation>
    <xsd:documentation>BPMN: Presence of attribute indicates attached intermediate event; attribute value points
to the BPMN activity (task or subprocess) the event is attached to. Absence of the attribute indicates intermediate event in sequence flow.
Pointer to Activity/@Id, where activity type must be a task or subprocess. </xsd:documentation>
  </xsd:annotation>
</xsd:attribute>
<xsd:anyAttribute namespace="##other" processContents="lax"/>
</xsd:complexType>
</xsd:element>

```

	Description
Implementation	WebService Other Unspecified See 7.9.6.
TriggerResultCompensation	This is used for compensation handling--both setting and performing compensation. It calls for compensation if the Event is part of a Normal Flow. It reacts to a named compensation call when attached to the boundary of an activity. See 7.6.4.5.1.
ResultError	This is used for error handling--both to set (throw) and to react to (catch) errors. It sets (throws) an error if the Event is part of a Normal Flow. It reacts to (catches) a named error, or to any error if a name is not specified, when attached to the boundary of an activity. See 7.6.4.5.2.
Target	A Target MAY be included for the Intermediate Event. The Target MUST be an activity (Sub-Process or Task). This means that the Intermediate Event is attached to the boundary of the activity and is used to signify an exception or compensation for that activity.
Trigger	None, Message, Timer, Error, Cancel, Conditional, Link, Signal, Compensation, Multiple. The None and Link Trigger MUST NOT be used when the Event is attached to the boundary of an Activity. The Multiple, Rule, and Cancel Triggers MUST NOT be used when the Event is part of the Normal Flow of the Process. The Cancel Trigger MUST NOT be used when the Event is attached to the boundary of a Transaction or if the Event is not contained within a Process that is a Transaction. "None" is used typically for Intermediate Events that are in the main flow of the Process. It is used for modeling methodologies that use Events to indicate some change of state in the Process.
TriggerCancel	This type of Intermediate Event is used within a Transaction Sub-Process. This type of Event MUST be attached to the boundary of a Sub-Process. It SHALL be triggered if a Cancel End Event is reached within the Transaction Sub-Process. It also SHALL be triggered if a Transaction Protocol "Cancel" message has been received while the Transaction is being performed.
TriggerIntermediateMultiple	This means that there are multiple triggers listed. See 7.6.4.5.9
TriggerResultLink	If the Trigger is a Link, then the Name MUST be supplied. See 7.6.4.5.4
TriggerResultMessage	A message arrives from a participant and triggers the Event. This causes the Process to continue if it was waiting for the message, or changes the flow for exception handling. In Normal Flow, Message Intermediate Events can be used for sending messages to a participant. If used for exception handling it will change the Normal Flow into an Exception Flow. See section 7.6.4.5.5.
TriggerConditional	This type of event is triggered when the conditions for a rule such as "S&P 500 changes by more than 10% since opening," or "Temperature above 300C" become true. See section 7.6.4.5.10.

	Description
TriggerResultSignal	This type of event is used for sending or receiving Signals. A Signal is for general communication within and across Process Levels, across Pools, and between Business Process Diagrams. A BPMN Signal is similar to a signal flare that shot into the sky for anyone who might be interested to notice and then react. Thus, there is a source of the Signal, but no specific intended target. This is different than a BPMN Message, which has a specific Source and a specific Target (which can be an Entity or an abstract Role). This type of Intermediate Event can send or receive a Signal if the Event is part of a Normal Flow. The Event can only receive a Signal when attached to the boundary of an activity. The Signal Event differs from an Error Event in that the Signal defines a more general, non-error condition for interrupting activities (such as the successful completion of another activity) as well as having a larger scope than Error Events. When used to “catch” the signal, the Event marker will be unfilled (see the top figure on the right). When used to “throw” the signal, the Event marker will be filled.
TriggerTimer	A specific time-date or a specific cycle (e.g., every Monday at 9am) can be set that will trigger the Event. If used within the main flow it acts as a delay mechanism. If used for exception handling it will change the Normal Flow into an Exception Flow. See section 7.6.4.5.11.

Table 43: Intermediate Event Activity

7.6.4.4. End Event

As the name implies, the End Event indicates where a process will end. In terms of Sequence Flow, the End Event ends the flow of the Process, and thus, will not have any outgoing Sequence Flow—no Sequence Flow can connect from an End Event.

An End Event consumes a Token that had been generated from a Start Event within the same level of Process. If parallel Sequence Flows target the End Event, then the Tokens will be consumed as they arrive. All the Tokens that were generated within the Process must be consumed by an End Event before the Process has been completed. In other circumstances, if the Process is a Sub-Process, it can be stopped prior to normal completion through interrupting Intermediate Events. In this situation the Tokens will be consumed by an Intermediate Event attached to the boundary of the Sub-Process.

7.6.4.4.1. Semantics of the End Event

- There MAY be multiple End Events within a single level of a process.
- An End Event is OPTIONAL: a given Process level—a top-level Process or an expanded Sub-Process—MAY (is not required to) have this shape:
 - If an End Event is not used, then the implicit End Event for the Process SHALL NOT have a Result.
 - If there is a Start Event, then there MUST be at least one End Event.
 - If an End Event is used, then there MUST NOT be other flow elements that do not have any outgoing Sequence Flow—all other Flow Objects MUST be a source of at least one Sequence Flow.
 - Exceptions to this are activities that are defined as being Compensation activities (have the Compensation Marker). Compensation Activities MUST NOT have any outgoing Sequence Flow, even if there is an End Event in the Process level.
 - If the End Event is not used, then all Flow Objects that do not have any outgoing Sequence Flow (i.e., are not a source of a Sequence Flow) mark the end of a path in the Process. However, the process MUST NOT end until all parallel paths have completed.
 - Exceptions to this are activities that are defined as being Compensation activities (have the Compensation Marker). Compensation Activities are not considered a part of the Normal Flow and MUST NOT mark the end of the Process.

For Processes without an End Event, a Token entering a path-ending Flow Object will be consumed when the processing performed by the object is completed (i.e., when the path has completed), as if the Token had then gone on to reach an End Event. When all Tokens for a given instance of the Process are consumed, then the Process will reach a

state of being completed.

7.6.4.4.2. Types of End Events

There are eight (8) types of End Events in BPMN: None, Message, Error, Cancel, Compensation, Signal, Terminate, and Multiple. These types define the consequence of reaching an End Event. This will be referred to as the End Event Result.









Result	Description	Marker
None	The modeler does not display the type of Event. It is also used to show the end of a Sub-Process that ends, which causes the flow goes back to its Parent Process.	
Message	This type of End indicates that a message is sent to a participant at the conclusion of the Process.	
Error	This type of End indicates that a named Error should be generated. The Error will be caught by the Error intermediate event with the same ErrorCode or no ErrorCode which is on the boundary of the nearest enclosing parent activity (hierarchically). The behavior of the process is unspecified if no enclosing parent activity has such an Error intermediate event. The system executing the process may define additional Error handling in this case, a common one being termination of the process instance.	
Cancel	This type of End is used within a Transaction Sub-Process. It will indicate that the Transaction should be cancelled and will trigger a Cancel Intermediate Event attached to the Sub-Process boundary. In addition, it will indicate that a Transaction Protocol Cancel message should be sent to any Entities involved in the Transaction.	
Compensation	This type of End indicates that a Compensation is necessary. If an activity is identified, then that is the activity that will be compensated. Otherwise, all activities that have completed within the Process, starting with the top-level Process and including all Sub-Processes, are subject to compensation, proceeding in reverse order. To be compensated, an activity MUST have a Compensation Intermediate Event attached to its boundary.	
Signal	This type of End indicates that a Signal will be broadcasted when the End has been reached. Note that the Signal, which is broadcast to any Process that can receive the Signal, can be sent across Process levels or Pools, but is not a Message (which has a specific Source and Target).	
Terminate	This type of End indicates that all activities in the Process should be immediately ended. This includes all instances of Multi-Instances. The Process is ended without compensation or event handling.	
Multiple	This means that there are multiple consequences of ending the Process. All of them will occur (e.g., there might be multiple messages sent). The attributes of the End Event will define which of the other types of Results apply.	

Table 44: End Event subtypes

7.6.4.4.3. End Event Sequence Flow Connections

- An End Event MUST be a target for Sequence Flow.
- An End Event MAY have multiple incoming Sequence Flows.

The Flow MAY come from either alternative or parallel paths. For modeling convenience, each path MAY connect to a separate End Event object. The End Event is used as a Sink for all Tokens that arrive at the Event. All Tokens that are generated at the Start Event for that Process must eventually arrive at an End Event. The Process will be in a running state until all Tokens are consumed.

- An End Event MUST NOT be a source for Sequence Flow; that is, there MUST NOT be outgoing Sequence Flow.
 - An exception to this is when an End Event is used in an Expanded Sub-Process and is attached to the boundary of that Sub-Process. In this case, a Sequence Flow from the higher-level Process MAY connect from that End Event in lieu of connecting from the actual boundary of the Sub-Process. Note: XPD L does not support an End Event attached to the Sub-Process boundary.

7.6.4.4.4. End Event Message Flow Connections

Note – All Message Flow must connect two separate Pools. They can connect to the Pool boundary or to Flow Objects within the Pool boundary. They cannot connect two objects within the same Pool.

- An End Event **MUST NOT** be the target for Message Flow; it can have no incoming Message Flow. If the Intermediate Event has an incoming Message Flow, then it **MUST NOT** have an outgoing Message Flow.
- An Intermediate Event of type Message, if it is used within Normal Flow, **MAY** be the source for Message Flow; it can have one outgoing Message Flow. If the Intermediate Event has an outgoing Message Flow, then it **MUST NOT** have an incoming Message Flow.

7.6.4.4.5. Schema for End Event

```
<xsd:element name="EndEvent">
  <xsd:annotation>
    <xsd:documentation>BPMN</xsd:documentation>
  </xsd:annotation>
  <xsd:complexType>
    <xsd:choice>
      <xsd:element ref="xpd:TriggerResultMessage" minOccurs="0"/>
      <xsd:element ref="xpd:ResultError" minOccurs="0"/>
      <xsd:element ref="xpd:TriggerResultCompensation" minOccurs="0"/>
      <xsd:element ref="xpd:TriggerResultSignal" minOccurs="0"/>
      <xsd:element ref="xpd:ResultMultiple" minOccurs="0"/>
    </xsd:choice>
    <xsd:attribute name="Result" use="optional" default="None">
      <xsd:simpleType>
        <xsd:restriction base="xsd:NMTOKEN">
          <xsd:enumeration value="None"/>
          <xsd:enumeration value="Message"/>
          <xsd:enumeration value="Error"/>
          <xsd:enumeration value="Cancel"/>
          <xsd:enumeration value="Compensation"/>
          <xsd:enumeration value="Signal"/>
          <xsd:enumeration value="Terminate"/>
          <xsd:enumeration value="Multiple"/>
        </xsd:restriction>
      </xsd:simpleType>
    </xsd:attribute>
    <xsd:attribute name="Implementation" use="optional" default="WebService">
      <xsd:annotation>
        <xsd:documentation> Required if the Trigger or Result is Message</xsd:documentation>
      </xsd:annotation>
      <xsd:simpleType>
        <xsd:restriction base="xsd:NMTOKEN">
          <xsd:enumeration value="WebService"/>
          <xsd:enumeration value="Other"/>
          <xsd:enumeration value="Unspecified"/>
        </xsd:restriction>
      </xsd:simpleType>
    </xsd:attribute>
    <xsd:anyAttribute namespace="##other" processContents="lax"/>
  </xsd:complexType>
</xsd:element>
```

	Description
Implementation	WebService Other Unspecified See 7.9.6.
Result	<p>None, Message, Error, Cancel, Compensation, Signal, Terminate, Multiple.</p> <p>‘None’ is used when the modeler does not display the type of Event. It is also used to show the end of a Sub-Process that ends, which causes the flow goes back to its Parent Process.</p> <p>“Terminate” indicates that all activities in the Process should be immediately ended. This includes all instances of Multi-Instances. The Process is ended without compensation or event handling.</p>

	Description
TriggerResultCompensation	This type of End will indicate that a Compensation is necessary. The Compensation identifier will trigger an Intermediate Event when the Process is rolling back. See section 7.6.4.5.1,
ResultError	This type of End indicates that a named Error should be generated. This Error will be caught by an Intermediate Event within the Event Context. See section 7.6.4.5.2.
ResultMultiple	This means that there are multiple consequences of ending the Process. All of them will occur (e.g., there might be multiple messages sent). The attributes of the End Event will define which of the other types of Results apply. See section 7.6.4.5.3.

Table 45: End Event Activity

7.6.4.5. Common Elements Used in Start, Intermediate and End Events

7.6.4.5.1. TriggerResultCompensation

For an End Event: If the Result is a Compensation, then the Activity that needs to be compensated MAY be supplied. If an Activity is not supplied, then the Event is broadcast to all completed activities in the Process Instance.

For an Intermediate Event within Normal Flow: If the Trigger is a Compensation, then the Activity that needs to be compensated MAY be supplied. If an Activity is not supplied, then the Event is broadcast to all completed activities in the Process Instance. This “throws” the compensation.

For an Intermediate Event attached to the boundary of an Activity: This Event “catches” the compensation. No further information is required. The Id of the activity the Event is attached to will provide the Id necessary to match the compensation event with the event that “threw” the compensation.

Compensation requires specific notation and is a special circumstance that occurs outside the Normal Flow of the Process. For this reason, the Compensation Intermediate Event does not have an outgoing Sequence Flow, but instead has an outgoing directed Association. The target of this Association is the activity that will compensate for the work done in the source activity, and will be referred to as the Compensation Activity. The Compensation Activity is special in that it does not follow the normal Sequence Flow rules--as mentioned, it is outside the Normal Flow of the Process. This activity cannot have any incoming or outgoing Sequence Flow. The Compensation marker (as is in the Compensation Intermediate Event) will be displayed in the bottom center of the Activity to show this status of the activity.

```

<xsd:element name="TriggerResultCompensation">
  <xsd:annotation>
    <xsd:documentation>BPMN: Must be present if if Trigger or ResultType is Compensation.</xsd:documentation>
  </xsd:annotation>
  <xsd:complexType>
    <xsd:sequence>
      <xsd:any namespace="##other" processContents="lax" minOccurs="0" maxOccurs="unbounded"/>
    </xsd:sequence>
    <xsd:attribute name="ActivityId" type="xsd:NMTOKEN" use="optional">
      <xsd:annotation>
        <xsd:documentation> This supplies the Id of the Activity to be Compensated. Used only for intermediate events or end events in the seunce flow. Events attached to the boundary of an activity already know the Id.</xsd:documentation>
      </xsd:annotation>
    </xsd:attribute>
    <xsd:anyAttribute namespace="##other" processContents="lax"/>
  </xsd:complexType>
</xsd:element>

```

	Description
ActivityId	See Discussion above.

Table 46: Event Trigger Result Compensation

7.6.4.5.2.ResultError

This is used for error handling--both to set (throw) and to react to (catch) errors. It sets (throws) an error if the Event is part of a Normal Flow (either Intermediate or End Event). It reacts to (catches) a named error, or to any error if a name is not specified, when attached to the boundary of an activity.

For an End Event: If the Result is an Error, then the ErrorCode MUST be supplied. This “throws” the error.

For an Intermediate Event within Normal Flow: If the Trigger is an Error, then the ErrorCode MUST be entered. This “throws” the error.

For an Intermediate Event attached to the boundary of an Activity: If the Trigger is an Error, then the ErrorCode MAY be entered. This Event “catches” the error. If there is no ErrorCode, then any error SHALL trigger the Event. If there is an ErrorCode, then only an error that matches the ErrorCode SHALL trigger the Event.

```
<xsd:element name="ResultError">
  <xsd:annotation>
    <xsd:documentation>BPMN: Must be present if Trigger or ResultType is error.</xsd:documentation>
  </xsd:annotation>
  <xsd:complexType>
    <xsd:sequence>
      <xsd:any namespace="##other" processContents="lax" minOccurs="0" maxOccurs="unbounded"/>
    </xsd:sequence>
    <xsd:attribute name="ErrorCode" type="xsd:string" use="optional"/>
    <xsd:anyAttribute namespace="##other" processContents="lax"/>
  </xsd:complexType>
</xsd:element>
```

	Description
ErrorCode	String designates the error Code.

Table 47: Event Result Error

7.6.4.5.3.ResultMultiple

For an End Event:

This means that there are multiple consequences of ending the Process. All of them will occur (e.g., there might be multiple messages sent). The attributes of the End Event will define which of the other types of Results apply.

```
<xsd:element name="ResultMultiple">
  <xsd:annotation>
    <xsd:documentation>BPMN: Must be present if ResultType is Multiple.</xsd:documentation>
  </xsd:annotation>
  <xsd:complexType>
    <xsd:sequence>
      <xsd:annotation>
        <xsd:documentation>at least two results must be present</xsd:documentation>
      </xsd:annotation>
      <xsd:element ref="xpd:TriggerResultMessage" minOccurs="0"/>
      <xsd:element ref="xpd:TriggerResultLink" minOccurs="0"/>
      <xsd:element ref="xpd:TriggerResultCompensation" minOccurs="0"/>
      <xsd:element ref="xpd:ResultError" minOccurs="0"/>
      <xsd:any namespace="##other" processContents="lax" minOccurs="0" maxOccurs="unbounded"/>
    </xsd:sequence>
    <xsd:anyAttribute namespace="##other" processContents="lax"/>
  </xsd:complexType>
</xsd:element>
```

	Description
	List of all applicable result elements.

Table 48: Event Result Multiple

7.6.4.5.4.TriggerResultLink

For an Intermediate Event:

Paired Intermediate Events can be used as “Go To” objects within a Process.

For all Event Types:

The Name MUST be entered.


```

<xsd:element name="TriggerResultLink">
  <xsd:annotation>
    <xsd:documentation>BPMN: if the Trigger or Result Type is Link then this must be present.</xsd:documentation>
  </xsd:annotation>
  <xsd:complexType>
    <xsd:sequence>
      <xsd:any namespace="##other" processContents="lax" minOccurs="0" maxOccurs="unbounded"/>
    </xsd:sequence>
    <xsd:attribute name="CatchThrow" use="optional" default="CATCH">
      <xsd:simpleType>
        <xsd:restriction base="xsd:NMTOKEN">
          <xsd:enumeration value=" CATCH "/>
          <xsd:enumeration value="THROW"/>
        </xsd:restriction>
      </xsd:simpleType>
    </xsd:attribute>
    <xsd:attribute name="Name" type="xsd:NMTOKEN" use="optional">
      <xsd:annotation>
        <xsd:documentation>The link can only be used within one process as a shorthand for a long sequence flow
      </xsd:documentation>
    </xsd:annotation>
  </xsd:complexType>
</xsd:element>

```

	Description
Name	Unique name for this link.

Table 49: Event Trigger Result Link

7.6.4.5. TriggerResultMessage

For Start Event:

A message arrives [CATCH] and starts the Process.

For End Event:

This type of End indicates that a message is sent [THROW] at the conclusion of the Process.

For Intermediate Event:

A message arrives from a participant and triggers the Event. This causes the Process to continue if it was waiting for the message, or changes the flow for exception handling. In Normal Flow, Message Intermediate Events can be used for sending messages to a participant. If used for exception handling it will change the Normal Flow into an Exception Flow.

```

<xsd:element name="TriggerResultMessage">
  <xsd:annotation>
    <xsd:documentation> BPMN: If the Trigger or Result Type is Message then this must be present</xsd:documentation>
  </xsd:annotation>
  <xsd:complexType>
    <xsd:sequence>
      <xsd:element name="Message" type="xpd:MessageType" minOccurs="0"/>
      <xsd:element ref="xpd:WebServiceOperation" minOccurs="0"/>
      <xsd:any namespace="##other" processContents="lax" minOccurs="0" maxOccurs="unbounded"/>
    </xsd:sequence>
    <xsd:attribute name="CatchThrow" use="optional" default="CATCH">
      <xsd:simpleType>
        <xsd:restriction base="xsd:NMTOKEN">
          <xsd:enumeration value=" CATCH "/>
          <xsd:enumeration value="THROW"/>
        </xsd:restriction>
      </xsd:simpleType>
    </xsd:attribute>
    <xsd:anyAttribute namespace="##other" processContents="lax"/>
  </xsd:complexType>
</xsd:element>

```

	Description
--	-------------

	Description
Message	Describes the message (See section 7.9.4).
WebServiceOperation	Describes the web services operation (See section 7.9.6)

Table 50: Event Trigger Result Message

7.6.4.5.6. TriggerResultCancel

A Cancel Intermediate Event is used within a Transaction Sub-Process. This type of Event MUST be attached to the boundary of a Sub-Process. It SHALL be triggered if a Cancel End Event is reached within the Transaction Sub-Process. It also SHALL be triggered if a Transaction Protocol “Cancel” message has been received while the Transaction is being performed.

A Cancel End Event is used within a Transaction Sub-Process. It will indicate that the Transaction should be cancelled and will trigger a Cancel Intermediate Event attached to the Sub-Process boundary. In addition, it will indicate that a Transaction Protocol Cancel message should be sent to any Entities involved in the Transaction.

Currently there are no attributes provided for this event.

```
<xsd:element name="TriggerResultCancel"/>
```

7.6.4.5.7. TriggerResultSignal

A Signal is for general communication within and across Process Levels, across Pools, and between Business Process Diagrams. A BPMN Signal is similar to a signal flare that shot into the sky for anyone who might be interested to notice and then react. Thus, there is a source of the Signal, but no specific intended target. This is different than a BPMN Message, which has a specific Source and a specific Target (which can be an Entity or an abstract Role).

For Start Event:

A signal arrives [CATCH] that has been broadcast from another Process and triggers the start of the Process. Note that the Signal is not a Message, which has a specific target for the Message. Multiple Processes can have Start Events that are triggered from the same broadcasted Signal.

For End Event:

This type of End indicates that a Signal will be broadcast [THROW] when the End has been reached. Note that the Signal, which is broadcast to any Process that can receive the Signal, can be sent across Process levels or Pools, but is not a Message (which has a specific Source and Target).

For Intermediate Event:

This type of Intermediate Event can send [THROW] or receive [CATCH] a Signal if the Event is part of a Normal Flow. The Event can only receive a Signal when attached to the boundary of an activity. The Signal Event differs from an Error Event in that the Signal defines a more general, non-error condition for interrupting activities (such as the successful completion of another activity) as well as having a larger scope than Error Events. When used to “catch” the signal, the Event marker will be unfilled. When used to “throw” the signal, the Event marker will be filled.

```
<xsd:element name="TriggerResultSignal">
  <xsd:complexType>
    <xsd:sequence>
      <xsd:element name="Properties" type="xpd:ExpressionType" maxOccurs="unbounded"/>
      <xsd:any namespace="##other" processContents="lax" minOccurs="0" maxOccurs="unbounded"/>
    </xsd:sequence>
    <xsd:attribute name="Name" type="xsd:string" use="optional">
      <xsd:annotation>
        <xsd:documentation>Text description of the signal</xsd:documentation>
      </xsd:annotation>
    </xsd:attribute>
    <xsd:attribute name="CatchThrow" use="optional" default="CATCH">
      <xsd:simpleType>
        <xsd:restriction base="xsd:NMTOKEN">
          <xsd:enumeration value="CATCH"/>
          <xsd:enumeration value="THROW"/>
        </xsd:restriction>
      </xsd:simpleType>
    </xsd:attribute>
  </xsd:complexType>
</xsd:element>
```

```

</xsd:attribute>
<xsd:anyAttribute namespace="##other" processContents="lax"/>
</xsd:complexType>
</xsd:element>

```

	Description
Name	Name is an attribute that is text description of the Signal.
Properties	Multiple Properties MAY be entered for the Signal. ???Needs to be fixed. Is this a list of name value pairs or what. XPDL uses DataFields, but they also contain initial values: see Target in assignment element ???

Table 51: Trigger Result Signal

7.6.4.5.8.TriggerIntermediateMultiple

If the Trigger is a Multiple, then each Trigger on the list MUST have the appropriate data as specified for the attributes. The Trigger MUST NOT be of type None or Multiple.

```

<xsd:element name="TriggerIntermediateMultiple">
  <xsd:annotation>
    <xsd:documentation>BPMN: if the TriggerType is Multiple then this must be present.</xsd:documentation>
  </xsd:annotation>
  <xsd:complexType>
    <xsd:sequence>
      <xsd:annotation>
        <xsd:documentation>BPMN: For Multiple, at least two triggers must be present.</xsd:documentation>
      </xsd:annotation>
      <xsd:element ref="xpdل:TriggerResultMessage" minOccurs="0"/>
      <xsd:element ref="xpdل:TriggerTimer" minOccurs="0"/>
      <xsd:element ref="xpdل:ResultError" minOccurs="0"/>
      <xsd:element ref="xpdل:TriggerResultCompensation" minOccurs="0"/>
      <xsd:element ref="xpdل:TriggerConditional" minOccurs="0"/>
      <xsd:element ref="xpdل:TriggerResultLink" minOccurs="0"/>
      <xsd:any namespace="##other" processContents="lax" minOccurs="0" maxOccurs="unbounded"/>
    </xsd:sequence>
    <xsd:anyAttribute namespace="##other" processContents="lax"/>
  </xsd:complexType>
</xsd:element>

```

	Description
	List of applicable triggers.

Table 52: Event Trigger Intermediate Multiple

7.6.4.5.9.TriggerMultiple

If the Trigger attribute is a Multiple, then a list of two or more Triggers MUST be provided. Each Trigger MUST have the appropriate data. The Trigger MUST NOT be of type None or Multiple.

```

<xsd:element name="TriggerMultiple">
  <xsd:annotation>
    <xsd:documentation>BPMN: if the TriggerType is Multiple then this must be present.</xsd:documentation>
  </xsd:annotation>
  <xsd:complexType>
    <xsd:sequence>
      <xsd:annotation>
        <xsd:documentation>BPMN: For Multiple, at least two triggers must be present.</xsd:documentation>
      </xsd:annotation>
      <xsd:element ref="xpdل:TriggerResultMessage" minOccurs="0"/>
      <xsd:element ref="xpdل:TriggerTimer" minOccurs="0"/>
      <xsd:element ref="xpdل:TriggerConditional" minOccurs="0"/>
      <xsd:element ref="xpdل:TriggerResultLink" minOccurs="0"/>
      <xsd:any namespace="##other" processContents="lax" minOccurs="0" maxOccurs="unbounded"/>
    </xsd:sequence>
    <xsd:anyAttribute namespace="##other" processContents="lax"/>
  </xsd:complexType>
</xsd:element>

```

	Description
	List of applicable triggers.

Table 53: Event Trigger Multiple

7.6.4.5.10.TriggerConditional

If the Trigger is a Conditional, then a Condition **MUST** be entered.

For Intermediate Event:

This is only used for exception handling. This type of event is triggered when a Condition becomes true. A Condition is an expression that evaluates some Process data.

```
<xsd:element name="TriggerConditional">
  <xsd:complexType>
    <xsd:sequence>
      <xsd:element name="Expression" type="xpd:ExpressionType" minOccurs="0"/>
      <xsd:any namespace="##other" processContents="lax" minOccurs="0" maxOccurs="unbounded"/>
    </xsd:sequence>
    <xsd:attribute name="ConditionName" type="xsd:string" use="optional"/>
    <xsd:anyAttribute namespace="##other" processContents="lax"/>
  </xsd:complexType>
</xsd:element>
```

	Description
ConditionName	Name is an optional attribute that is a text description of the Condition. If a Name is not entered, then a ConditionExpression MUST be entered (see the attribute below).
Expression	A ConditionExpression may be entered. In some cases the Condition itself will be stored and maintained in a separate application (e.g., a Rules Engine). If a ConditionExpression is not entered, then a Name MUST be entered (see the attribute above).

Table 54: Trigger Conditional

7.6.4.5.11.TriggerTimer

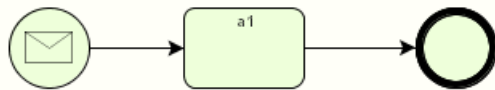
If the Trigger is a Timer, then a TimeDate **MAY** be entered. If a TimeDate is not entered, then a TimeCycle **MUST** be entered (see the attribute below).

```
<xsd:element name="TriggerTimer">
  <xsd:annotation>
    <xsd:documentation>BPMN: If the Trigger Type is Timer then this must be present</xsd:documentation>
  </xsd:annotation>
  <xsd:complexType>
    <xsd:sequence>
      <xsd:any namespace="##other" processContents="lax" minOccurs="0" maxOccurs="unbounded"/>
    </xsd:sequence>
    <xsd:attribute name="TimeDate" type="xsd:string" use="optional">
      <xsd:annotation>
        <xsd:documentation>One of TimeDate or TimeCycle must be present</xsd:documentation>
      </xsd:annotation>
    </xsd:attribute>
    <xsd:attribute name="TimeCycle" type="xsd:string" use="optional"/>
    <xsd:anyAttribute namespace="##other" processContents="lax"/>
  </xsd:complexType>
</xsd:element>
```

	Description
TimeDate	String (Should be Date) or TimeDateExpression
TimeCycle	String (Should be expression designating repetitive occurrence based on time). TimeDateExpression

Table 55: Event Trigger Timer

7.6.4.6. Examples of Events and their representation



```

<Activities>
  <Activity Id="3" Name="">
    <Event >
      <StartEvent Trigger="Message"></StartEvent>
    </Event>
  </Activity>
  <Activity Id="4" Name="a1"/>
  <Activity Id="5" Name="">
    <Event >
      <EndEvent Result="None"/>
    </Event>
  </Activity>
</Activities>
<Transitions>
  <Transition Id="6" Name="" From="3" To="4" FlowType="SequenceFlow"/>
  <Transition Id="7" Name="" From="4" To="5" FlowType="SequenceFlow"/>
</Transitions>
  
```

7.6.4.7. Review of Events

Start and most Intermediate Events have “Triggers” that define the cause for the event. There are multiple ways that these events can be triggered. End Events may define a “Result” that is a consequence of a Sequence Flow ending. Start Events can only react to (“catch”) a Trigger. End Events can only create (“throw”) a Result. Intermediate Events can catch or throw Triggers. For the Events, Triggers that catch, the markers are unfilled, and for Triggers and Results that throw, the markers are filled.

BPMN provides specific graphics for the event types supported:

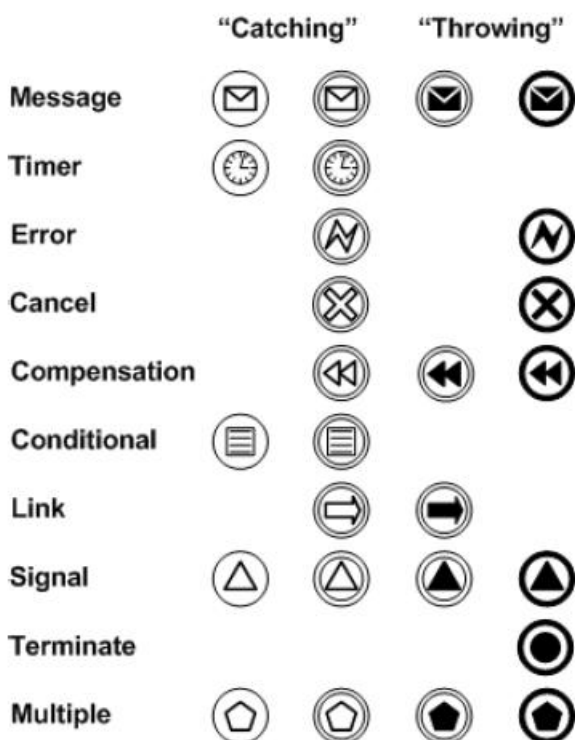


Figure 7.34: Event Subtypes – Catching and Throwing

7.6.5. Implementation Alternatives

It is assumed that the execution of the Activity is atomic with respect to the data under control of the Process or Workflow engine. That implies that in the case of a system crash, an abort, or a cancellation of the Activity, the

Relevant data field and the control data are rolled back (automatically or by other means), or an appropriate compensating activity is applied. (This does not necessarily hold for audit data.) This version of the specification does not include any specific controls over data synchronization or recovery (for example between execution, subflows or applications under execution).

```

<xsd:element name="Implementation">
  <xsd:complexType>
    <xsd:choice minOccurs="0">
      <xsd:element ref="xpd:No" minOccurs="0">
        <xsd:annotation>
          <xsd:documentation>BPMN: corresponds to a task with unspecified TaskType</xsd:documentation>
        </xsd:annotation>
      </xsd:element>
      <xsd:element ref="deprecated:Tool" minOccurs="0" maxOccurs="unbounded"/>
      <xsd:element ref="xpd:Task" minOccurs="0">
        <xsd:annotation>
          <xsd:documentation>BPMN: corresponds to a task with specified TaskType</xsd:documentation>
        </xsd:annotation>
      </xsd:element>
      <xsd:element ref="xpd:SubFlow" minOccurs="0">
        <xsd:annotation>
          <xsd:documentation>BPMN: corresponds to Reusable subprocess. May run in different pool or same
pool.</xsd:documentation>
        </xsd:annotation>
      </xsd:element>
      <xsd:element ref="xpd:Reference" minOccurs="0"/>
    </xsd:choice>
    <xsd:anyAttribute namespace="##other" processContents="lax"/>
  </xsd:complexType>
</xsd:element>

```

An Activity may be implemented in one of four ways as described in the following table:

	Description
No implementation	Implementation by manual procedures (i.e. not supported by process or workflow).
Tool	Implementation is supported by (one or more) application(s). Deprecated, see Task.
Task	Implementation by a BPMN Task or Application (Tool). See section 7.6.5.3.
SubFlow/ ProcessRef	Implementation by another process. Note that BlockActivity is used for ActivitySet/Embedded subprocess.
Reference	Implementation by BPMN reference. See section 7.6.5.5.

Table 56: Implementation Alternatives

7.6.5.1. No Implementation

No Implementation means that the implementation of this Activity is not supported by Workflow using automatically invoked applications or procedures. Two Alternatives have been identified as to how this may be used:

It is a Manual Activity. In this case FinishMode value Manual is required.

It is an "implicit" activity, which is known to the Process Engine (e.g. by vendor-specific Extended Attributes) in terms of any processing requirements. An example is the Pre- and Post-processing Activities in a Process, which generate and clear hidden data when starting and terminating a process (e.g. managing the relationship to imaging system and archive). In this case the StartMode and FinishMode values Automatic are common.

Note that application initiation may still be handled directly by the participant under local control in a manual activity; this lies outside the scope of the specification.

```

<xsd:element name="No">
  <xsd:complexType>
    <xsd:sequence>
      <xsd:any namespace="##other" processContents="lax" minOccurs="0" maxOccurs="unbounded"/>
    </xsd:sequence>
    <xsd:anyAttribute namespace="##other" processContents="lax"/>
  </xsd:complexType>
</xsd:element>

```

7.6.5.2. Tool

Deprecated. See TaskApplication 7.6.5.3.10

7.6.5.3. Task

A Task is an atomic activity that is included within a Process. A Task is used when the work in the Process is not broken down to a finer level of Process Model detail. BPMN includes a set of built-in Tasks. Generally, an end-user and/or an application and/or WebService are used to perform the Task when it is executed. A Task object shares the same shape as the Sub-Process, which is a rectangle that has rounded corners.

7.6.5.3.1. BPMN Graphics for Tasks

A Task is a rounded corner rectangle that **MUST** be drawn with a single thin black line.

BPMN specifies three types of markers for Task: a Loop Marker or a Multiple Instance Marker and a Compensation Marker. A Task may have one or two of these markers

- The marker for a Task that is a standard loop **MUST** be a small line with an arrowhead that curls back upon itself.
 - The Loop Marker **MAY** be used in combination with the Compensation Marker.
- The marker for a Task that is a multi-instance loop **MUST** be a set of three vertical lines in parallel
 - The Multiple Instance Marker **MAY** be used in combination with the Compensation Marker
- The marker for a Task that is used for compensation **MUST** be a pair of left facing triangles (like a tape player “rewind” button).
 - The Compensation Marker **MAY** be used in combination with the Loop Marker or the Multiple Instance Marker.
- All the markers that are present **MUST** be grouped and the whole group centered at the bottom of the shape.



Figure 7.35: Task Markers

In addition to categories of Task shown above, there are different types of Tasks identified within BPMN to separate the types of inherent behavior that Tasks might represent. However, BPMN does not specify any graphical indicators for the different types of Tasks. Modelers or modeling tools may choose to create their own indicators or markers to show the readers of the diagram the type of Task. This is permitted by BPMN as long as the basic shape of the Task (a rounded rectangle) is not modified. The list of Task types may be extended along with any corresponding indicators.

7.6.5.3.2. Schema for Tasks

The Activity is implemented by one of the seven BPMN tasks or by an Application (Tool).

```
<xsd:element name="Task">
  <xsd:annotation>
    <xsd:documentation>BPMN</xsd:documentation>
  </xsd:annotation>
  <xsd:complexType>
    <xsd:choice>
      <xsd:element ref="xpd:TaskService">
        <xsd:annotation>
          <xsd:documentation>BPMN: TaskType = Service. In BPMN generally signifies any automated
activity.</xsd:documentation>
        </xsd:annotation>
      </xsd:element>
    </xsd:choice>
  </xsd:complexType>
</xsd:element>
```

```

</xsd:element>
<xsd:element ref="xpd:TaskReceive">
  <xsd:annotation>
    <xsd:documentation>BPMN: TaskType = Receive. Waits for a message, then continues. Equivalent to a
"catching" message event. In BPMN, "message" generally signifies any signal from outside the process (pool).</xsd:documentation>
  </xsd:annotation>
</xsd:element>
<xsd:element ref="xpd:TaskManual">
  <xsd:annotation>
    <xsd:documentation>BPMN: TaskType = Manual. Used for human tasks other than those accessed via
workflow.</xsd:documentation>
  </xsd:annotation>
</xsd:element>
<xsd:element ref="xpd:TaskReference">
  <xsd:annotation>
    <xsd:documentation>BPMN: TaskType = Reference. Task properties defined in referenced
activity.</xsd:documentation>
  </xsd:annotation>
</xsd:element>
<xsd:element ref="xpd:TaskScript">
  <xsd:annotation>
    <xsd:documentation>BPMN: TaskType = Script. Used for automated tasks executed by scripts on
process engine, to distinguish from automated tasks performed externally (Service).</xsd:documentation>
  </xsd:annotation>
</xsd:element>
<xsd:element ref="xpd:TaskSend">
  <xsd:annotation>
    <xsd:documentation>BPMN: Task Type = Send. Equivalent to a "throwing" message event. Sends a
message immediately and continues. In BPMN, "message" signifies any signal sent outside the process (pool).</xsd:documentation>
  </xsd:annotation>
</xsd:element>
<xsd:element ref="xpd:TaskUser">
  <xsd:annotation>
    <xsd:documentation>BPMN: Task Type = User. Generally used for human tasks.
  </xsd:documentation>
  </xsd:annotation>
</xsd:element>
<xsd:element ref="xpd:TaskApplication"/>
</xsd:choice>
<xsd:anyAttribute namespace="##other" processContents="lax"/>
</xsd:complexType>
</xsd:element>

```

7.6.5.3.3.TaskManual

A TaskType of Manual MUST NOT have an incoming or an outgoing Message Flow.

```

<xsd:element name="TaskManual">
  <xsd:annotation>
    <xsd:documentation>BPMN</xsd:documentation>
  </xsd:annotation>
  <xsd:complexType>
    <xsd:sequence>
      <xsd:element ref="xpd:Performers" minOccurs="0"/>
      <xsd:any namespace="##other" processContents="lax" minOccurs="0" maxOccurs="unbounded"/>
    </xsd:sequence>
    <xsd:anyAttribute namespace="##other" processContents="lax"/>
  </xsd:complexType>
</xsd:element>

```

	Description
Performers	A list of performers that will be performing the Manual Task. The Performers entry could be in the form of a specific individual, a group, or an organization. Similar to the 'Implementation:No' activity (see section 7.6.5.1).

Table 57: Task Manual

7.6.5.3.4.TaskReceive

A TaskType of Receive MUST NOT have an outgoing Message Flow.

A Receive Task is a simple Task that is designed to wait for a message to arrive from an external participant (relative to the Business Process). Once the message has been received, the Task is completed. A Receive Task is often used to start a Process. In a sense, the Process is bootstrapped by the receipt of the message. In order for the Task to Instantiate the Process it must meet one of the following conditions:

- The Process does not have a Start Event and the Receive Task has no incoming Sequence Flow
- The Incoming Sequence Flow for the Receive Task has a source of a Start Event.
 - Note that no other incoming Sequence Flows are allowed for the Receive Task (in particular, a loop connection from a downstream object).

```
<xsd:element name="TaskReceive">
  <xsd:annotation>
    <xsd:documentation>BPMN</xsd:documentation>
  </xsd:annotation>
  <xsd:complexType>
    <xsd:sequence>
      <xsd:element name="Message" type="xpd:MessageType" minOccurs="0">
        <xsd:annotation>
          <xsd:documentation>BPMN: Implementation-related but required by spec.</xsd:documentation>
        </xsd:annotation>
      </xsd:element>
      <xsd:element ref="xpd:WebServiceOperation" minOccurs="0"/>
      <xsd:any namespace="##other" processContents="lax" minOccurs="0" maxOccurs="unbounded"/>
    </xsd:sequence>
    <xsd:attribute name="Instantiate" type="xsd:boolean" use="required"/>
    <xsd:attribute name="Implementation" use="optional" default="WebService">
      <xsd:annotation>
        <xsd:documentation>BPMN: Implementation-related but required by spec.</xsd:documentation>
      </xsd:annotation>
      <xsd:simpleType>
        <xsd:restriction base="xsd:NMTOKEN">
          <xsd:enumeration value="WebService"/>
          <xsd:enumeration value="Other"/>
          <xsd:enumeration value="Unspecified"/>
        </xsd:restriction>
      </xsd:simpleType>
    </xsd:attribute>
    <xsd:anyAttribute namespace="##other" processContents="lax"/>
  </xsd:complexType>
</xsd:element>
```

	Description
Implementation	WebService Other Unspecified
Instantiate	Receive Tasks can be defined as the instantiation mechanism for the Process with the Instantiate attribute. This attribute MAY be set to true if the Task is the first activity after the Start Event or a starting Task if there is no Start Event. Multiple Tasks MAY have this attribute set to True.
Message changed to MessageRef BPMN1.1	A Message for the Message attribute Should be entered as an implementation detail. This indicates that the Message will be received by the Task. The Message in this context is equivalent to an in-only message pattern (Web service). One or more corresponding incoming Message Flows MAY be shown on the diagram. However, the display of the Message Flow is not required. The Message is applied to all incoming Message Flow, but can arrive for only one of the incoming Message Flow for a single instance of the Task. See section 7.9.4.
WebServiceOperation	Describes the web service operation to be used by this task. (See section 7.9.6)

Table 58: Task Receive

7.6.5.3.5.TaskReference

There may be times where a modeler may want to reference another activity that has been defined. If the two (or more) activities share the exact same behavior, then by one referencing the other, the attributes that define the behavior only have to be created once and maintained in only one location.

```

<xsd:element name="TaskReference">
  <xsd:annotation>
    <xsd:documentation>BPMN</xsd:documentation>
  </xsd:annotation>
  <xsd:complexType>
    <xsd:sequence>
      <xsd:any namespace="##other" processContents="lax" minOccurs="0" maxOccurs="unbounded"/>
    </xsd:sequence>
    <xsd:attribute name="TaskRef" type="xpd:IdRef" use="required">
      <xsd:annotation>
        <xsd:documentation>BPMN: Pointer to Activity/@Id that defines the task.</xsd:documentation>
      </xsd:annotation>
    </xsd:attribute>
    <xsd:anyAttribute namespace="##other" processContents="lax"/>
  </xsd:complexType>
</xsd:element>

```

	Description
TaskRef	The Task being referenced MUST be identified.

Table 59: TaskReference

7.6.5.3.6.TaskSend

A TaskType of Send MUST NOT have an incoming Message Flow.

A Send Task is a simple Task that is designed to send a message to an external participant (relative to the Business Process). Once the message has been sent, the Task is completed.

```

<xsd:element name="TaskSend">
  <xsd:annotation>
    <xsd:documentation>BPMN</xsd:documentation>
  </xsd:annotation>
  <xsd:complexType>
    <xsd:sequence>
      <xsd:element name="Message" type="xpd:MessageType" minOccurs="0">
        <xsd:annotation>
          <xsd:documentation>BPMN: Implementation-related but required by spec</xsd:documentation>
        </xsd:annotation>
      </xsd:element>
      <xsd:element ref="xpd:WebServiceOperation" minOccurs="0"/>
      <xsd:element ref="xpd:WebServiceFaultCatch" minOccurs="0" maxOccurs="unbounded"/>
      <xsd:any namespace="##other" processContents="lax" minOccurs="0" maxOccurs="unbounded"/>
    </xsd:sequence>
    <xsd:attribute name="Implementation" use="optional" default="WebService">
      <xsd:annotation>
        <xsd:documentation>Required if the Task is Send</xsd:documentation>
      </xsd:annotation>
      <xsd:simpleType>
        <xsd:restriction base="xsd:NMTOKEN">
          <xsd:enumeration value="WebService"/>
          <xsd:enumeration value="Other"/>
          <xsd:enumeration value="Unspecified"/>
        </xsd:restriction>
      </xsd:simpleType>
    </xsd:attribute>
    <xsd:anyAttribute namespace="##other" processContents="lax"/>
  </xsd:complexType>
</xsd:element>

```

	Description
Implementation	WebService Other Unspecified

	Description
Message BPMN1.1 MessageRef	A Message for the Message attribute should be entered as implementation detail. This indicates that the Message will be sent by the Task. The Message in this context is equivalent to an out-only message pattern (Web service). One or more corresponding outgoing Message Flow MAY be shown on the diagram. However, the display of the Message Flow is not required. The Message is applied to all outgoing Message Flow and the Message will be sent down all outgoing Message Flow at the completion of a single instance of the Task. See section 7.9.4
WebServiceOperation	Describes the web services operation to be used by this task. See section 7.9.6.
WebServiceFaultCatch	Describes how to process faults generated by the web service operation in this task. See section 7.9.7.

Table 60: TaskSend

7.6.5.3.7.TaskService

A Service Task is a Task that provides some sort of service, which could be a Web service or an automated application.

```

<xsd:element name="TaskService">
  <xsd:annotation>
    <xsd:documentation>BPMN</xsd:documentation>
  </xsd:annotation>
  <xsd:complexType>
    <xsd:sequence>
      <xsd:element name="MessageIn" type="xpd:MessageType" minOccurs="0">
        <xsd:annotation>
          <xsd:documentation>BPMN: Implementation-related but required by spec.</xsd:documentation>
        </xsd:annotation>
      </xsd:element>
      <xsd:element name="MessageOut" type="xpd:MessageType" minOccurs="0">
        <xsd:annotation>
          <xsd:documentation>BPMN: Implementation-related but required by spec.</xsd:documentation>
        </xsd:annotation>
      </xsd:element>
      <xsd:element ref="xpd:WebServiceOperation" minOccurs="0"/>
      <xsd:element ref="xpd:WebServiceFaultCatch" minOccurs="0" maxOccurs="unbounded"/>
      <xsd:any namespace="##other" processContents="lax" minOccurs="0" maxOccurs="unbounded"/>
    </xsd:sequence>
    <xsd:attribute name="Implementation" use="optional" default="WebService">
      <xsd:annotation>
        <xsd:documentation>BPMN: Implementation-related, but required if the Task is
Service</xsd:documentation>
      </xsd:annotation>
    </xsd:attribute>
    <xsd:simpleType>
      <xsd:restriction base="xsd:NMTOKEN">
        <xsd:enumeration value="WebService"/>
        <xsd:enumeration value="Other"/>
        <xsd:enumeration value="Unspecified"/>
      </xsd:restriction>
    </xsd:simpleType>
  </xsd:complexType>
</xsd:element>

```

	Description
Implementation	WebService Other Unspecified
MessageIn Editors note: InMessageRef in BPMN1.1	A Message for the InMessage attribute may be entered. This indicates that the Message will be received at the start of the Task, after the availability of any defined InputSets (child element of Activity). One or more corresponding incoming Message Flows MAY be shown on the diagram. However, the display of the Message Flow is not required. The Message is applied to all incoming Message Flow, but can arrive for only one of the incoming Message Flow for a single instance of the Task. See Section 7.9.4.

	Description
MessageOut Editors note: OutMessageRef in BPMN1.1	A Message for the OutMessage attribute may be entered. The sending of this message marks the completion of the Task, which may cause the production of an OutputSet (child element of Activity One or more corresponding outgoing Message Flow MAY be shown on the diagram. However, the display of the Message Flow is not required. The Message is applied to all outgoing Message Flow and the Message will be sent down all outgoing Message Flow at the completion of a single instance of the Task. See section 7.9.4.
WebServiceFaultCatch Editors note: Not in BPMN1.1	Describes how to process faults generated by the web service operation in this task. See section 7.9.7.
WebServiceOperation	Describes the web services operation to be used by this task. See section 7.9.6.

Table 61: Task Service

7.6.5.3.8.TaskScript

A Task Type of Script MUST NOT have an incoming or an outgoing Message Flow.

A Script Task is executed by a business process engine. The modeler or implementer defines a script in a language that the engine can interpret. When the Task is ready to start, the engine will execute the script. When the script is completed, the Task will also be completed.

```

<xsd:element name="TaskScript">
  <xsd:annotation>
    <xsd:documentation>BPMN</xsd:documentation>
  </xsd:annotation>
  <xsd:complexType>
    <xsd:sequence>
      <xsd:element name="Script" type="xpd:ExpressionType">
        <xsd:annotation>
          <xsd:documentation>BPMN</xsd:documentation>
        </xsd:annotation>
      </xsd:element>
      <xsd:any namespace="##other" processContents="lax" minOccurs="0" maxOccurs="unbounded"/>
    </xsd:sequence>
    <xsd:anyAttribute namespace="##other" processContents="lax"/>
  </xsd:complexType>
</xsd:element>

```

	Description
Script	The modeler MAY include a script that can be run when the Task is performed. If a script is not included, then the Task will act equivalent to a TaskType of None.

Table 62: Task Script

7.6.5.3.9.TaskUser

A User Task is a typical “workflow” task where a human performer performs the Task with the assistance of a software application and is scheduled through a task list manager of some sort.

```

<xsd:element name="TaskUser">
  <xsd:annotation>
    <xsd:documentation>BPMN</xsd:documentation>
  </xsd:annotation>
  <xsd:complexType>
    <xsd:sequence>
      <xsd:element ref="xpd:Performers" minOccurs="0"/>
      <xsd:element name="MessageIn" type="xpd:MessageType" minOccurs="0"/>
      <xsd:element name="MessageOut" type="xpd:MessageType" minOccurs="0"/>
      <xsd:element ref="xpd:WebServiceOperation" minOccurs="0"/>
      <xsd:any namespace="##other" processContents="lax" minOccurs="0" maxOccurs="unbounded"/>
    </xsd:sequence>
    <xsd:attribute name="Implementation" use="optional" default="WebService">
      <xsd:annotation>

```

```

        <xsd:documentation>Required if the Task is User</xsd:documentation>
      </xsd:annotation>
      <xsd:simpleType>
        <xsd:restriction base="xsd:NMTOKEN">
          <xsd:enumeration value="WebService"/>
          <xsd:enumeration value="Other"/>
          <xsd:enumeration value="Unspecified"/>
        </xsd:restriction>
      </xsd:simpleType>
    </xsd:attribute>
    <xsd:anyAttribute namespace="##other" processContents="lax"/>
  </xsd:complexType>
</xsd:element>

```

	Description
Implementation	WebService Other Unspecified
MessageIn Editors note: changed to InMessageRef in BPMN1.1	A Message for the InMessage attribute may be entered. This indicates that the Message will be sent at the start of the Task, after the availability of any defined InputSets. A corresponding outgoing Message Flow MAY be shown on the diagram. However, the display of the Message Flow is not required. See section 7.9.4.
MessageOut Editors note: changed to OutMessageRef	A Message for the OutMessage attribute may be entered. The sending of this message marks the completion of the Task, which may cause the production of an OutputSet. One or more corresponding outgoing Message Flows MAY be shown on the diagram. However, the display of the Message Flow is not required. The Message is applied to all outgoing Message Flows and the Message will be sent down all outgoing Message Flows at the completion of a single instance of the Task. See section 7.9.4.
Performers	One or more Performers MAY be entered. The Performers attribute defines the human resource that will be performing the Task. The Performers entry could be in the form of a specific individual, a group, or an organization.
WebServiceOperation	Describes the web services operation to be used by this task. See section 7.9.6.

Table 63: Task User

7.6.5.3.10. TaskApplication (Tool)

The Activity is implemented by (one or more) tools. A tool may be an application program (link to entity Application); which may be invoked via Interface 3 (WfMC) - see the Workflow Client Application API (WAPI - Interface 2).

```

<xsd:element name="TaskApplication">
  <xsd:complexType>
    <xsd:sequence>
      <xsd:choice minOccurs="0">
        <xsd:element ref="xpd:ActualParameters"/>
        <xsd:element ref="xpd:DataMappings"/>
      </xsd:choice>
      <xsd:element ref="xpd:Description" minOccurs="0"/>
      <xsd:any namespace="##other" processContents="lax" minOccurs="0" maxOccurs="unbounded"/>
    </xsd:sequence>
    <xsd:attribute name="Id" type="xsd:NMTOKEN" use="required"/>
    <xsd:attribute name="Name" type="xsd:string" use="optional"/>
    <xsd:attribute name="PackageRef" type="xsd:NMTOKEN" use="optional"/>
    <xsd:anyAttribute namespace="##other" processContents="lax"/>
  </xsd:complexType>
</xsd:element>

```

	Description
Actual Parameters	A list of parameters to be passed to the subflow/subprocess. See section 7.1.5.3.
DataMappings	Alternative approach to passing values between process and application. See section 7.6.5.4.7.
Description	Textual description.
ExtendedAttributes	Optional extensions to meet individual implementation needs.

	Description
Id	Identifier used to identify the application or procedure, depending on the Type.
Name	Name used to identify the application or procedure.
PackageRef	Used if the application is not in this package.

Table 64: Tool

7.6.5.3.11. Task Sequence Flow Connections

- A Task MAY be a target for Sequence Flow; it can have multiple incoming Flow. Incoming Flow MAY be from an alternative path and/or a parallel paths.

Note – If the Task has multiple incoming Sequence Flow, then this is considered uncontrolled flow. This means that when a Token arrives from one of the Paths, the Task will be instantiated. It will not wait for the arrival of Tokens from the other paths. If another Token arrives from the same path or another path, then a separate instance of the Task will be created. If the flow needs to be controlled, then the flow should converge with a Gateway that precedes the Task. **XPDL provides the concept of TransitionRestriction which is applicable to all activity types, including Task. Hence it is possible to model controlled flow without using a gateway. However, this may create problems in transferring a process definition to a BPMN editor.**

- If the Task does not have an incoming Sequence Flow, and there is no Start Event for the Process, then the Task MUST be instantiated when the process is instantiated.
 - Exceptions to this are Tasks that are defined as being Compensation activities (have the Compensation Marker). Compensation Tasks are not considered a part of the Normal Flow and MUST NOT be instantiated when the Process is instantiated.
- A Task MAY be a source for Sequence Flow; it can have multiple outgoing Flow. If there are multiple outgoing Sequence Flow, then this means that a separate parallel path is being created for each Flow.

Tokens will be generated for each outgoing Sequence Flow from the Task. The TokenIds for each of the Tokens will be set such that it can be identified that the Tokens are all from the same parallel Fork as well as the number of Tokens that exist in parallel. **Editorial comment. This doesn't mention having conditions associated with each path. See 'conditional flow in section 7.7.2.2. Also note that XPDL transition restrictions support the more general case.**

- If the Task does not have an outgoing Sequence Flow, and there is no End Event for the Process, then the Task marks the end of one or more paths in the Process. When the Task ends and there are no other parallel paths active, then the Process MUST be completed.
 - Exceptions to this are Tasks that are defined as being Compensation activities (have the Compensation Marker). Compensation Tasks are not considered a part of the Normal Flow and MUST NOT mark the end of the Process.

7.6.5.3.12. Task Message Flow Connections

Note – All Message Flow must connect two separate Pools. They can connect to the Pool boundary or to Flow Objects within the Pool boundary. They cannot connect two objects within the same Pool.

- A Task MAY be the target for Message Flow; it can have zero or more incoming Message Flow. If there multiple incoming Message Flow, then a single Message will be applied to all the Message Flow. However, only one Message can be received, from a single Message Flow, for a given instance of the Task
- A Task MAY be a source for Message Flow; it can have zero or more outgoing Message Flow. If there are multiple outgoing Message Flows, then a single Message will be applied to all the Message Flow. That Message will be sent down all the outgoing Message Flows.

7.6.5.4. SubFlow/Sub-Process

The Activity is refined as a subflow. The subflow may be executed synchronously or asynchronously. The subflow identifiers used are inherited from the surrounding Package declaration.

SubFlow calls are transactional if the parent Activity has been defined that way. See Table 35.

In the case of **asynchronous execution** the execution of the Activity is continued after a process instance of the referenced Process Definition is initiated (in this case execution proceeds to any post activity split logic after subflow initiation. No return parameters are supported from such called processes. Synchronization with the initiated subflow, if required, has to be done by other means such as events, not described in this document. This style of subflow is characterized as chained (or forked) subflow operation.

In the case of **synchronous execution** the execution of the Activity is suspended after a process instance of the referenced Process Definition is initiated. After execution termination of this process instance the Activity is resumed. Return parameters may be used between the called and calling processes on completion of the subflow. This style of subflow is characterized as hierarchic subflow operation.

7.6.5.4.1. Remote SubProcess Node

A Subflow activity is a node in a process which invokes another process, typically passing formal parameters to it, and receiving result values back.

The ASAP and Wf-XML protocols allow for the same sort of interaction with a subprocess which is located remotely, and accessed purely through SOAP calls. The parent process runs on one server, and the subprocess on a different server, possibly implemented with different technology.

This is an extension to the SubFlow, to allow the specification of the "End Point Reference" of the remote web service that represents the factory of the subprocess. End Point Reference is defined by WS-Addressing, and most commonly appears as a URL but is not necessarily limited to this.

A workflow/BPM engine that understands how to perform a remote subprocess interaction will offer in the design tool the ability for the user to specify the URI of the remote process (factory). This URI might be found in any number of ways including being listed on a web page, entered as a UDDI entry, or retrieved using a Wf-XML ListFactories request. The data mapping then is set up in the same way as for a normal subprocess. When this system writes out the XPDL, it will include this new tag in the SubFlow tag. The presence of this tag will indicate that this is a remote subprocess; the omission of it indicates that this is not a remote subprocess.

7.6.5.4.2. Schema for SubFlow/Sub-Process

```
<xsd:element name="SubFlow">
  <xsd:complexType>
    <xsd:sequence>
      <xsd:choice minOccurs="0">
        <xsd:element ref="xpd:ActualParameters"/>
        <xsd:element ref="xpd:DataMappings"/>
      </xsd:choice>
      <xsd:element ref="xpd:EndPoint" minOccurs="0"/>
      <xsd:any namespace="##other" processContents="lax" minOccurs="0" maxOccurs="unbounded"/>
    </xsd:sequence>
    <xsd:attribute name="Id" type="xpd:IdRef" use="required">
      <xsd:annotation>
        <xsd:documentation>BPMN: Corresponds to BPMN attribute ProcessRef, pointer to WorkflowProcess/@Id in
        BPD referenced by PackageRef. [Suggest name change to ProcessRef; this is IDREF not ID].</xsd:documentation>
      </xsd:annotation>
    </xsd:attribute>
    <xsd:attribute name="Name" type="xsd:string" use="optional"/>
    <xsd:attribute name="Execution" use="optional" default="SYNCHR">
      <xsd:simpleType>
        <xsd:restriction base="xsd:NMTOKEN">
          <xsd:enumeration value="ASYNCHR"/>
          <xsd:enumeration value="SYNCHR"/>
        </xsd:restriction>
      </xsd:simpleType>
    </xsd:attribute>
  </xsd:complexType>
</xsd:element>
```

```

<xsd:attribute name="View" use="optional" default="COLLAPSED">
  <xsd:annotation>
    <xsd:documentation>BPMN: Determines rendering of subprocess as Collapsed or Expanded. Default is
Collapsed.</xsd:documentation>
  </xsd:annotation>
  <xsd:simpleType>
    <xsd:restriction base="xsd:NMTOKEN">
      <xsd:enumeration value="COLLAPSED"/>
      <xsd:enumeration value="EXPANDED"/>
    </xsd:restriction>
  </xsd:simpleType>
</xsd:attribute>
<xsd:attribute name="PackageRef" type="xpdl:IdRef" use="optional">
  <xsd:annotation>
    <xsd:documentation>BPMN: Corresponds to BPMN attribute DiagramRef, pointer to a BPD identified by
Package/@Id. [Maybe IDREF doesn't work here since ID is in a different document.]</xsd:documentation>
  </xsd:annotation>
</xsd:attribute>
<xsd:attribute name="InstanceDataField" type="xsd:string" use="optional">
  <xsd:annotation>
    <xsd:documentation>Used to store the instance id of the subflow instantiated by the activity. This is then
available later on (e.g. for correlation, messaging etc.) especially in the case of asynchronous invocation.</xsd:documentation>
  </xsd:annotation>
</xsd:attribute>
<xsd:attribute name="StartActivitySetId" type="xpdl:IdRef" use="optional"/>
<xsd:attribute name="StartActivityId" type="xpdl:IdRef" use="optional"/>
<xsd:anyAttribute namespace="##other" processContents="lax"/>
</xsd:complexType>
</xsd:element>

```

	Description
Actual Parameters	A list of parameters to be passed to the subflow. See section 7.1.5.3.
DataMapping	Alternative approach to passing values between caller and called process. See section 7.6.5.4.7.
PackageRef	Used if the subflow/process is not this package.
EndPointRef	To handle remote subprocess node.
Execution	<div>ASYNCHR Executed asynchronously.</div> <div>SYNCHR Executed synchronously. Is default.</div>
ExtendedAttributes	See section 6.4.14.
Id	Used to identify the process that is invoked.
InstanceDataField	The name of the DataField in which to store the subflow instance id for subsequent use such as messaging or correlation. Typically used with ASYNCHR execution.
Name	The name of the SubFlow/Process.
StartActivityId	If present, StartActivityId must be the id of a start activity: <ul style="list-style-type: none"> In the referenced Activity Set if that's present In the top level activities of the referenced process otherwise
StartActivitySetId	If present, StartActivitySetId must match the id of an activity set in the referenced process.
View	Indicates whether the activity is COLLAPSED or EXPANDED.

Table 65: SubFlow

BPMN provides a specific graphical representation for the different activities:

The SubFlow [Sub-Process] can be in a collapsed view that hides its details or in an expanded view that shows its details within the view of the Process in which it is contained. In the collapsed form, the Sub-Process activity uses a marker to distinguish it as a Sub-Process, rather than a Task or other simple activity.

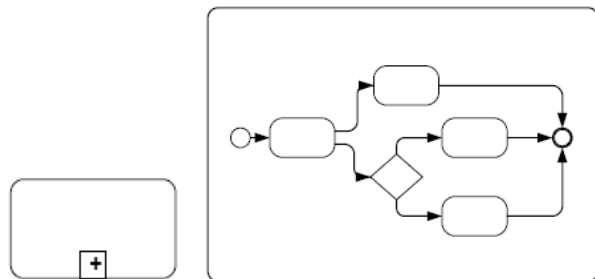


Figure 7.36: Collapsed and Expanded Subflow

Expanded Sub-Processes may be used for multiple purposes. They can be used to “flatten” a hierarchical process so that all detail can be shown at the same time. They are used to create a context for exception handling that applies to a group of activities. Compensations can be handled similarly.

Some BPMN editors may not support the EXPANDED VIEW.

Expanded Sub-Process may be used as a mechanism for showing a group of parallel activities in a less-cluttered, more compact way. In the figure below, activities “C” and “D” are enclosed in an unlabeled Expanded Sub-Process. These two activities will be performed in parallel. Notice that the Expanded Sub-Process does not include a Start Event or an End Event and the Sequence Flow to/from these Events. This usage of Expanded Sub-Processes for “parallel boxes” is the motivation for having Start and End Events being optional objects.

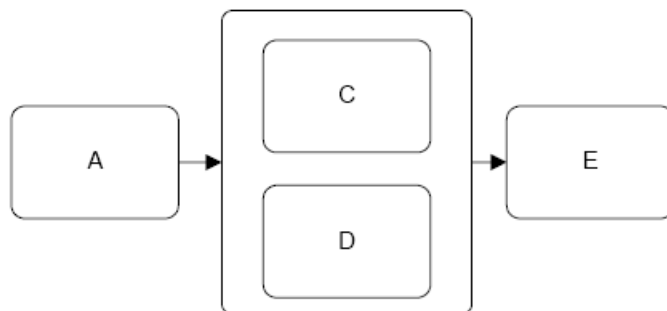


Figure 7.37: Expanded Subprocess for parallel activities

BPMN specifies five types of standard markers for Sub-Processes. The (Collapsed) Sub-Process Marker can be combined with four other markers: a Loop Marker or a Parallel Marker, a Compensation Marker, and an Ad Hoc Marker. A collapsed Sub-Process may have one to three of these other markers, in all combinations except that Loop and Multiple Instance cannot be shown at the same time

- The marker for a Sub-Process that loops **MUST** be a small line with an arrowhead that curls back upon itself.
 - The Loop Marker **MAY** be used in combination with any of the other markers except the Multiple Instance Marker.
- The marker for a Sub-Process that has multiple instances **MUST** be a set of three vertical lines in parallel.
 - The Multiple Instance Marker **MAY** be used in combination with any of the other markers except the Loop Marker.
- The marker for a Sub-Process that is Ad Hoc **MUST** be a “tilde” symbol.
 - The Ad-Hoc Marker **MAY** be used in combination with any of the other markers
- The marker for a Sub-Process that is used for compensation **MUST** be a pair of left facing triangles (like a tape player “rewind” button).
 - The Compensation Marker **MAY** be used in combination with any of the other markers.
- All the markers that are present **MUST** be grouped and the whole group centered at the bottom of the shape.

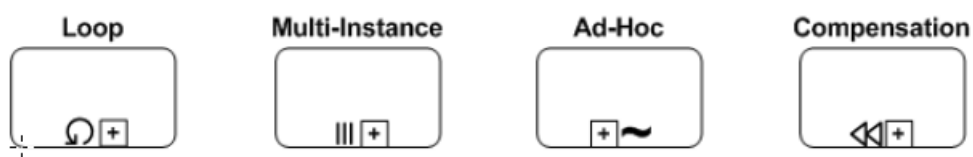


Figure 7.38: SubProcess Markers

7.6.5.4.3. Semantics of ReusableSubprocess [BPMN perspective]

A Reusable Sub-Process object is an activity within a Process that “calls” to another Process. The Process that is called is not dependent on the Reusable Sub-Process object’s parent Process for global data. The Reusable Sub-Process object may pass data to/from the called Process [see DataMapping].

The called Process will be instantiated as a Sub-Process through a ‘None’ Start Event. Being reusable, the Process could also be instantiated as a Sub-Process by other Independent Sub- Process objects (in the same or other diagrams). In addition, it can be instantiated as a top-level Process through a separate Start Event that has a Trigger (other than None) [See diagram below].

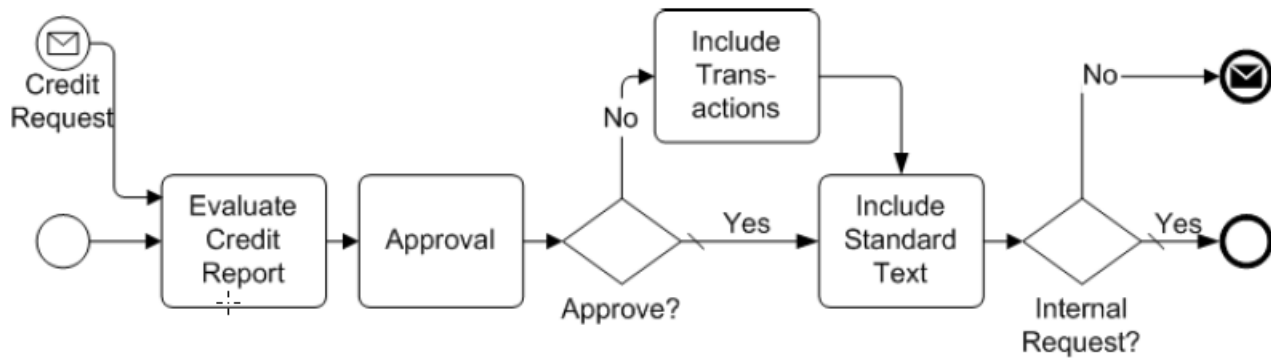


Figure 7.39: Reusable Subprocess Semantics: BPMN perspective

7.6.5.4.4. Sub-Process Behavior as a Transaction

A Sub-Process, either collapsed or expanded, can be set as being a Transaction, which will have a special behavior that is controlled through a transaction protocol. The boundary of the activity will be double-lined to indicate that it is a Transaction (see Figure below).

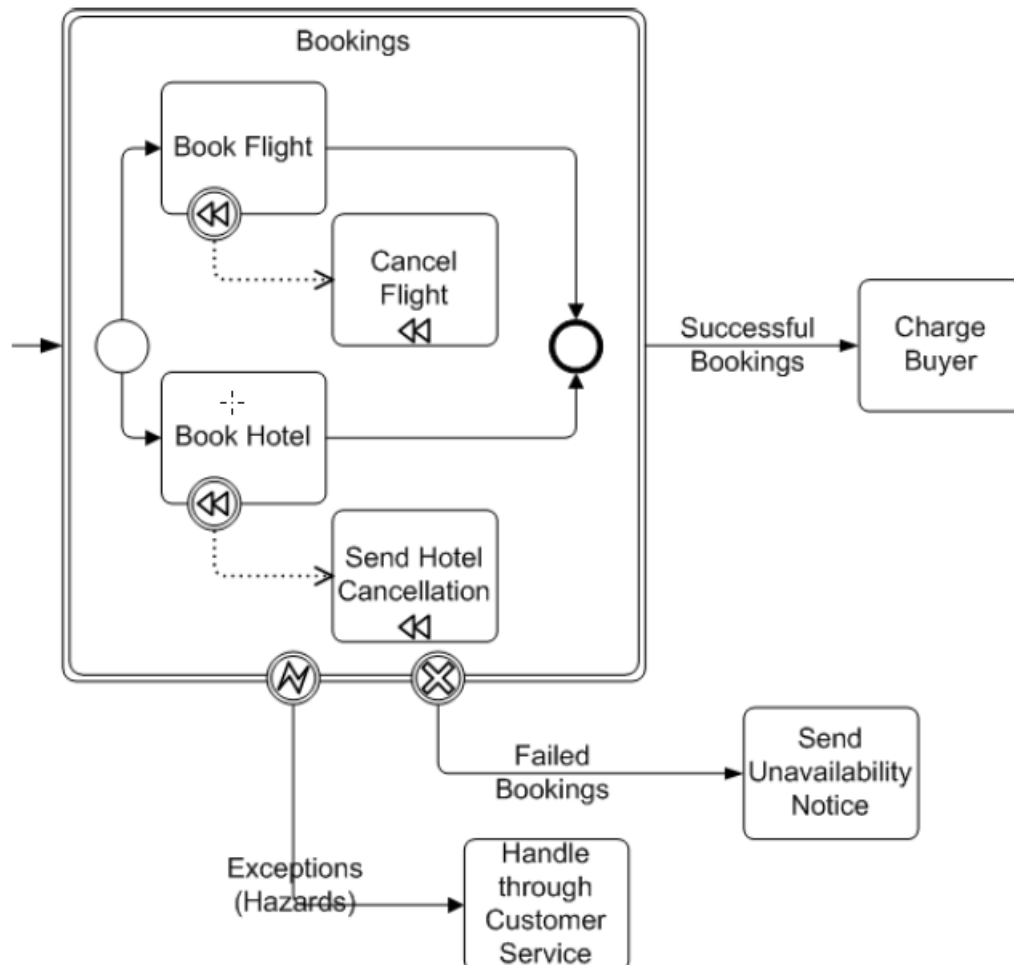


Figure 7.40: Subprocess behavior as a Transaction

There are three basic outcomes of a Transaction:

- Successful completion: this will be shown as a normal Sequence Flow that leaves the Sub-Process.
- Failed completion (Cancel): When a Transaction is cancelled, then the activities inside the Transaction will be subjected to the cancellation actions, which could include rolling back the process and compensation for specific activities. Note that other mechanisms for interrupting a Sub-Process will not cause Compensation (e.g., Error, Timer, and anything for a non-Transaction activity). A Cancel Intermediate Event, attached to the boundary of the activity, will direct the flow after the Transaction has been rolled back and all compensation has been completed. The Cancel Intermediate Event can only be used when attached to the boundary of a Transaction activity. It cannot be used in any Normal Flow and cannot be attached to a non-Transaction activity. There are two mechanisms that can signal the cancellation of a Transaction:
 - A Cancel End Event is reached within the Transaction Sub-Process. A Cancel End Event can only be used within a Sub-Process that is set to a Transaction.
 - A Cancel Message can be received via the Transaction Protocol that is supporting the execution of the Sub- Process.
- Hazard: This means that something went terribly wrong and that a normal success or cancel is not possible. We are using an Error to show Hazards. When a Hazard happens, the activity is interrupted (without Compensation) and the flow will continue from the Error Intermediate Event.

The behavior at the end of a successful Transaction Sub-Process is slightly different than that of a normal Sub-Process. When each path of the Transaction Sub-Process reaches a non-Cancel End Event(s), the flow does not immediately move back up to the higher-level Parent Process, as does a normal Sub-Process. First, the transaction protocol must verify that all the participants have successfully completed their end of the Transaction. Most of the time this will be true and the flow will then move up to the higher-level Process. But it is possible that one of the participants may end

up with a problem that causes a Cancel or a Hazard. In this case, the flow will then move to the appropriate Intermediate Event, even though it had apparently finished successfully

7.6.5.4.5. SubProcess Activity Sequence Flow Connections

- A Sub-Process MAY be a target for Sequence Flow; it can have multiple incoming Flow. Incoming Flow MAY be from an alternative path and/or a parallel paths.
 - The Incoming Sequence Flow's attribute TargetRef MAY be extended to include both the Sub-Process object (at the parent level) and a Start Event that resides within the details of the Sub-Process. This provides a direct connection from the parent-level Sequence Flow to the lower-level Start Event for situations where there is more than one Start Event in the Sub-Process. The form of the extension would be "Sub-Process.Start".
 - Note that XPDL provides an alternate method for specifying which start event: the attribute StartActivityID of the Subflow activity
 - If the details of the Sub-Process (i.e., it's Start Events) are not visible or accessible to the modeler, then the determination as to which Start Event, if there are multiple, will be triggered is undefined. But only one of the Start Events will be triggered.

Note – If the Sub-Process has multiple incoming Sequence Flow, then this is considered uncontrolled flow. This means that when a Token arrives from one of the Paths, the Sub-Process will be instantiated. It will not wait for the arrival of Tokens from the other paths. If another Token arrives from the same path or another path, then a separate instance of the Sub-Process will be created. If the flow needs to be controlled, then the flow should converge on a Gateway that precedes the Sub-Process. **XPDL provides the concept of TransitionRestriction which is applicable to all activity types, including Subflow/Subprocess. Hence it is possible to model controlled flow without using a gateway. However, this may create problems in transferring a process definition to a BPMN editor.**

- If the Sub-Process does not have an incoming Sequence Flow, and there is no Start Event for the Process, then the Sub-Process MUST be instantiated when the process is instantiated.
 - Exceptions to this are Sub-Processes that are defined as being Compensation activities (have the Compensation Marker). Compensation Sub-Processes are not considered a part of the Normal Flow and MUST NOT be instantiated when the Process is instantiated.
- A Sub-Process MAY be a source for Sequence Flow; it can have multiple outgoing Flow. If there are multiple outgoing Sequence Flow, then this means that a separate parallel path is being created for each Flow.

Tokens will be generated for each outgoing Sequence Flow from Sub-Process. The TokenIds for each of the Tokens will be set such that it can be identified that the Tokens are all from the same parallel Fork as well as the number of Tokens that exist in parallel. **This doesn't mention having conditions associated with each path. See 'conditional flow' in section 7.7.2.2. Also note that XPDL transition restrictions support the more general case.**

- If the Sub-Process does not have an outgoing Sequence Flow, and there is no End Event for the Process, then the Sub-Process marks the end of one or more paths in the Process. When the Sub-Process ends and there are no other parallel paths active, then the Process MUST be completed.
 - Exceptions to this are Sub-Processes that are defined as being Compensation activities (have the Compensation Marker). Compensation Sub-Processes are not considered a part of the Normal Flow and MUST NOT mark the end of the Process.

7.6.5.4.6. SubProcess Activity Message Flow Connections

Note – All Message Flow must connect two separate Pools. They can connect to the Pool boundary or to Flow Objects within the Pool boundary. They cannot connect two objects within the same Pool

- A Sub-Process MAY be the target for Message Flow; it can have zero or more incoming Message Flows.
- A Sub-Process MAY be a source for Message Flow; it can have zero or more outgoing Message Flows.

7.6.5.4.7. DataMapping

```

<xsd:element name="DataMapping">
  <xsd:annotation>
    <xsd:documentation>XPDL and BPMN:Maps fields between calling and called processes or
subprocesses</xsd:documentation>
  </xsd:annotation>
  <xsd:complexType>
    <xsd:sequence>
      <xsd:element name="Actual" type="xpd:ExpressionType"/>
      <xsd:element name="TestValue" type="xpd:ExpressionType" minOccurs="0"/>
      <xsd:any namespace="##other" processContents="lax" minOccurs="0" maxOccurs="unbounded"/>
    </xsd:sequence>
    <xsd:attribute name="Formal" type="xsd:string" use="required"/>
    <xsd:attribute name="Direction" default="IN"/>
    <xsd:simpleType>
      <xsd:restriction base="xsd:NMTOKEN">
        <xsd:enumeration value="IN"/>
        <xsd:enumeration value="OUT"/>
        <xsd:enumeration value="INOUT"/>
      </xsd:restriction>
    </xsd:simpleType>
  </xsd:complexType>
  <xsd:anyAttribute namespace="##other" processContents="lax"/>
</xsd:element>

<xsd:element name="DataMappings">
  <xsd:annotation>
    <xsd:documentation>XPDL and BPMN:Maps fields or properties between calling and called processes or
subprocesses</xsd:documentation>
  </xsd:annotation>
  <xsd:complexType>
    <xsd:sequence>
      <xsd:element ref="xpd:DataMapping" minOccurs="0" maxOccurs="unbounded"/>
      <xsd:any namespace="##other" processContents="lax" minOccurs="0" maxOccurs="unbounded"/>
    </xsd:sequence>
    <xsd:anyAttribute namespace="##other" processContents="lax"/>
  </xsd:complexType>
</xsd:element>

```

	Description
Actual	Name of DataField whose value should be passed. If Direction is 'IN' can be an expression.
Direction	IN OUT INOUT
Formal	Name of DataField in receiving subprocess or application.
TestValue	The purpose of this tag is to make it possible to enter test run or simulation values. This would enable the process engine to fake the call to the subprocess/application. Instead of making the call to application/sub process, an engine could just pass the specified test values as a return to the parent process, as if the call has really happened. The TestValue tag would be allowed only for the OUT and INOUT directed mappings.

Table 66: DataMapping

An Example showing use of TestValue

```

<DataMappings>
.....
  <DataMapping Formal="subprocParam1" Direction="OUT">
    <Actual>ParProcFieldName</Actual>
    <TestValue>This subprocess has not been invoked</TestValue>
  </DataMapping>
.....

```

</DataMappings>

Note: BPMN provides Datamapping using InputMaps and OutputMaps. ???Do we need to include these elements???

7.6.5.5. Reference

There may be times where a modeler may want to reference another Sub-Process that has been defined. If the two SubProcesses share the exact same behavior and properties, then by one referencing the other, the attributes that define the behavior only have to be created once and maintained in only one location.

There may be times where a modeler may want to reference another activity that has been defined. If the two (or more) activities share the exact same behavior, then by one referencing the other, the attributes that define the behavior only have to be created once and maintained in only one location.

```
<xsd:element name="Reference">
  <xsd:annotation>
    <xsd:documentation>BPMN</xsd:documentation>
  </xsd:annotation>
  <xsd:complexType>
    <xsd:sequence>
      <xsd:any namespace="##other" processContents="lax" minOccurs="0" maxOccurs="unbounded"/>
    </xsd:sequence>
    <xsd:attribute name="ActivityId" type="xpd:IdRef" use="required">
      <xsd:annotation>
        <xsd:documentation>BPMN: Reference to a BPMN task or subprocess definition elsewhere; should not be
used for gateway or event. Pointer to Activity/@Id in XPDL.</xsd:documentation>
      </xsd:annotation>
    </xsd:attribute>
    <xsd:anyAttribute namespace="##other" processContents="lax"/>
  </xsd:complexType>
</xsd:element>
```

	Description
Activity Id	The Id of the activity that defines the desired behaviour.

Table 67: Reference

7.6.6. Performer Relationship

The relationship of the Activity to a (potential) performer is given by the Performers attribute (see section 6.4.5). It provides a link to the entity Participant. Default: Any Participant.

The Participant identifiers used in the Performer attribute have either to be declared in the surrounding Process definition or are inherited from the surrounding Package declaration or coming from external packages.

The question whether the expression evaluation results in an empty set of performers or a non unique performer is to be handled by the process or workflow management system at run time or, where defined, by the external resource repository or organizational model. The runtime resolution of both cases is outside the scope of this specification

- In the first case (empty set) the engine may e.g. retry at a later time, or it may signal this to the supervisor of the process. The approach used is local to the WFMS and does not form part of this specification.
- The second case (non-unique) may arise where the performer definition is by function/skill type (defined as "Role") and/or is an organization unit, which is itself a container for a set of participants. In these situations the approach adopted for Performer/participant assignment is local to the WFMS and does not form part of this specification. Common scenarios are:
 - Where an activity includes multiple work items that may be implemented in parallel, separate work items may be presented to a number of performers.
 - In other situations the activity may be assigned according to a local load-balancing algorithm or presented to multiple potential performers in their work lists and assigned to the first accepting participant. (It is the responsibility of the engine to provide the appropriate behavior.)
 - The assignment of an activity to an organizational unit (e.g. a department) may result in the activity being offered to all members of the organizational unit and assigned to the first accepting participant

or allow the manager of the unit to redirect the activity to a designated departmental member.

In all cases the Performers/participant assignments defined within the meta-model and expressed in XPDL only relate Activities to defined Participants (including the use of expressions and defined Functions) and do not differentiate between cases where the defined Participant is atomic (e.g. a person) or not (e.g. a team). The local behavior of the engine and the resource repository or organizational model in handling these situations is not defined.

7.6.7. Deadline

Deadlines are used to raise an exception upon the expiration of a specific period of time.

Note that BPMN provides the Timer Event as a general method for handling Deadlines. See section 7.6.4.5.11.

Upon the arrival of a deadline, an exception condition is raised and the appropriate exception transitions are followed. If the deadline is synchronous, then the activity is terminated before flow continues on the exception path. If the deadline is asynchronous, then an implicit AND SPLIT is performed, and a new thread of processing is started on the appropriate exception transition. Asynchronous exceptions can cause side effects, and should be used carefully. Some of these side effects are discussed later in this section.

A sample deadline is below. In the sample, an asynchronous “notifyException” will be raised after 3 days. The activity will continue normally at this point. If the activity is still executing after 5 days it will be terminated and a “timeoutException” will be raised.

Sample Deadline

```
<Deadline Execution="ASYNCHR">
  <DeadlineDuration>3 days</DeadlineDuration>
  <ExceptionName>notifyException</ExceptionName>
</Deadline>
<Deadline Execution="SYNCHR">
  <DeadlineDuration>5 days</DeadlineDuration>
  <ExceptionName>timeoutException</ExceptionName>
</Deadline>
```

The syntax of the deadline duration is implementation dependent. The duration may be relative or absolute and may use relevant data field.

If a synchronous deadline occurs on a block activity or a subflow, stopping the activity includes stopping all the threads in the block, or the subflow and all its threads and nested subflows as well. From a modeling perspective, this can be treated as “immediate termination.” If an engine chooses to deviate from this, such as allowing an in-process manual activity to complete, it should document this behavior.

An asynchronous exception can be a powerful tool, allowing intermediate notification and graceful process termination by altering relevant data field. But an asynchronous exception can also create race conditions and possible side effects. For instance, the running activity could complete while the asynchronous exception is being processed. In addition, because an implicit split is performed, flow control can be complicated if the asynchronous exception processing joins back up with the deadlined processing thread. Care must be taken by the designer to properly handle race conditions and avoid unwanted side effects.

7.6.7.1. Schema for Deadline

```
<xsd:element name="Deadline">
  <xsd:annotation>
    <xsd:documentation>BPMN provides a timer event to support this type of functionality and it is the preferred method for
    doing this.</xsd:documentation>
  </xsd:annotation>
  <xsd:complexType>
    <xsd:sequence>
      <xsd:element name="DeadlineDuration" type="xpd:ExpressionType" minOccurs="0"/>
      <xsd:element name="ExceptionName" minOccurs="0">
        <xsd:annotation>
          <xsd:documentation>This name should match that specified in
          Transition/Condition/Expression</xsd:documentation>
        </xsd:annotation>
        <xsd:complexType>
          <xsd:simpleContent>
            <xsd:extension base="xsd:string">
              <xsd:anyAttribute namespace="##other" processContents="lax"/>
            </xsd:extension>
          </xsd:simpleContent>
        </xsd:complexType>
      </xsd:element>
    </xsd:sequence>
  </xsd:complexType>
</xsd:element>
```

```

        </xsd:complexType>
      </xsd:element>
      <xsd:any namespace="##other" processContents="lax" minOccurs="0" maxOccurs="unbounded"/>
    </xsd:sequence>
    <xsd:attribute name="Execution">
      <xsd:simpleType>
        <xsd:restriction base="xsd:NMTOKEN">
          <xsd:enumeration value="ASYNCHR"/>
          <xsd:enumeration value="SYNCHR"/>
        </xsd:restriction>
      </xsd:simpleType>
    </xsd:attribute>
    <xsd:anyAttribute namespace="##other" processContents="lax"/>
  </xsd:complexType>
</xsd:element>

```

	Description
Execution	<p>Define the system behaviour on raising the arrival of the deadline</p> <p>ASYNCHR The deadline is to be raised asynchronously. This is an implicit AND SPLIT operation, where the activity continues and another thread is started following the named exception transition. Another deadline may occur on the same activity, because it continues running.</p> <p>SYNCHR The activity is completed abnormally and flow continues on the named exception transition.</p>
DeadlineDuration	<p>An expression indicating the time of the deadline. This expression is implementation dependent and may include at least:</p> <p>Times relative to the beginning of the activity. (2 days)</p> <p>Fixed times (January 1) or (January 1, 2002)</p> <p>Times computed using relevant data field (varName days)</p>
ExceptionName	The name of the exception to be raised on arrival of the deadline.

Table 68: Deadline

7.6.8. Simulation Information

```

<xsd:element name="SimulationInformation">
  <xsd:complexType>
    <xsd:sequence>
      <xsd:element ref="xpd:Cost"/>
      <xsd:element ref="xpd:TimeEstimation"/>
      <xsd:any namespace="##other" processContents="lax" minOccurs="0" maxOccurs="unbounded"/>
    </xsd:sequence>
    <xsd:attribute name="Instantiation">
      <xsd:simpleType>
        <xsd:restriction base="xsd:NMTOKEN">
          <xsd:enumeration value="ONCE"/>
          <xsd:enumeration value="MULTIPLE"/>
        </xsd:restriction>
      </xsd:simpleType>
    </xsd:attribute>
    <xsd:anyAttribute namespace="##other" processContents="lax"/>
  </xsd:complexType>
</xsd:element>

<xsd:element name="TimeEstimation">
  <xsd:complexType>
    <xsd:sequence>
      <xsd:element ref="xpd:WaitingTime" minOccurs="0"/>

```



```

        <xsd:element ref="xpd:WorkingTime" minOccurs="0"/>
        <xsd:element ref="xpd:Duration" minOccurs="0"/>
        <xsd:any namespace="##other" processContents="lax" minOccurs="0" maxOccurs="unbounded"/>
    </xsd:sequence>
    <xsd:anyAttribute namespace="##other" processContents="lax"/>
</xsd:complexType>
</xsd:element>

<xsd:element name="WaitingTime">
    <xsd:complexType>
        <xsd:simpleContent>
            <xsd:extension base="xsd:string">
                <xsd:anyAttribute namespace="##other" processContents="lax"/>
            </xsd:extension>
        </xsd:simpleContent>
    </xsd:complexType>
</xsd:element>

<xsd:element name="WorkingTime">
    <xsd:complexType>
        <xsd:simpleContent>
            <xsd:extension base="xsd:string">
                <xsd:anyAttribute namespace="##other" processContents="lax"/>
            </xsd:extension>
        </xsd:simpleContent>
    </xsd:complexType>
</xsd:element>

<xsd:element name="Duration">
    <xsd:complexType>
        <xsd:simpleContent>
            <xsd:extension base="xsd:string">
                <xsd:anyAttribute namespace="##other" processContents="lax"/>
            </xsd:extension>
        </xsd:simpleContent>
    </xsd:complexType>
</xsd:element>

<xsd:element name="Cost">
    <xsd:complexType>
        <xsd:simpleContent>
            <xsd:extension base="xsd:string">
                <xsd:anyAttribute namespace="##other" processContents="lax"/>
            </xsd:extension>
        </xsd:simpleContent>
    </xsd:complexType>
</xsd:element>

<xsd:element name="CostStructure">
    <xsd:annotation>
        <xsd:documentation>
Activities incur costs in a number of ways, they use up
resources which may be people, machines, services, computers,
office space, etc. Activities also use up fixed costs which
may be assigned on an activity by activity basis, thus allowing
for the assignment of overhead. Fixed costs are assigned in bulk,
that is to say there is one fixed cost per activity. However
resource costs are assigned on a resource by resource basis,
each one having a cost and an associated time unit.
        </xsd:documentation>
    </xsd:annotation>
    <xsd:complexType>
        <xsd:choice>
            <xsd:element ref="xpd:ResourceCosts" minOccurs="0" maxOccurs="unbounded"/>
            <xsd:element name="FixedCost" type="xsd:integer"/>
        </xsd:choice>
    </xsd:complexType>
</xsd:element>

<xsd:element name="ResourceCosts">
    <xsd:complexType>
        <xsd:sequence>
            <xsd:element name="ResourceCostName">
                <xsd:simpleType>

```

```

        <xsd:restriction base="xsd:string">
            <xsd:maxLength value="100"/>
            <xsd:minLength value="0"/>
            <xsd:whiteSpace value="preserve"/>
        </xsd:restriction>
    </xsd:simpleType>
</xsd:element>
<xsd:element name="ResourceCost">
    <xsd:simpleType>
        <xsd:restriction base="xsd:decimal">
            <xsd:fractionDigits value="2"/>
        </xsd:restriction>
    </xsd:simpleType>
</xsd:element>
<xsd:element name="CostUnitOfTime">
    <xsd:simpleType>
        <xsd:restriction base="xsd:NMTOKEN">
            <xsd:enumeration value="second"/>
            <xsd:enumeration value="minute"/>
            <xsd:enumeration value="hour"/>
        </xsd:restriction>
    </xsd:simpleType>
</xsd:element>
</xsd:sequence>
</xsd:complexType>
</xsd:element>

```

	Description
Cost	Average cost.
CostStructure	Adding detailed cost structure to simulation allows for greater comparison with real time results gathered from business activity monitoring tools as well as capturing greater detail typically housed in process engineering tools.
Duration	Expected duration time to perform a task in units of DurationUnit.
Instantiation	<p>Defines the capability of an activity to be activated. Defines how many times an Activity can be activated for higher throughput (e.g. how many individuals can capture a role). This can be once or many times (multiple).</p> <p>ONCE The Activity can only be instantiated once. Default.</p> <p>MULTIPLE The Activity can be instantiated multiple times.</p>
Time Estimation	Expected duration (summary of working time, waiting time, and duration) in units of DurationUnit.
Waiting Time	Average waiting time in units of DurationUnit.
Working Time	Average working time in units of DurationUnit.

Table 69: Simulation Information

7.6.9. Transition Restriction

```

<xsd:element name="TransitionRestriction">
    <xsd:complexType>
        <xsd:sequence>
            <xsd:element ref="xpd:Join" minOccurs="0"/>
            <xsd:element ref="xpd:Split" minOccurs="0"/>
            <xsd:any namespace="##other" processContents="lax" minOccurs="0" maxOccurs="unbounded"/>
        </xsd:sequence>
        <xsd:anyAttribute namespace="##other" processContents="lax"/>
    </xsd:complexType>
</xsd:element>

```

	Description
--	-------------

	Description
Join	Specifies that the incoming Transitions of the Activity are JOIN-ed.
Split	Specifies that the outgoing Transitions of the Activity are SPLIT-ed.

Table 70: Transition Restrictions

7.6.9.1. Join

A join describes the semantics of an activity with multiple incoming Transitions.

Note that the Types are not consistent with the new BPMN 1.1 types as used in Route/Gateway Activity. To fix this requires the appropriate attribute values and also the attribute 'ExclusiveType'. The old schema must be preserved as well, to support existing XPDL 2.0 users.

```

<xsd:element name="Join">
  <xsd:complexType>
    <xsd:sequence>
      <xsd:any namespace="##other" processContents="lax" minOccurs="0" maxOccurs="unbounded"/>
    </xsd:sequence>
    <xsd:attribute name="Type">
      <xsd:simpleType>
        <xsd:restriction base="xsd:NMTOKEN">
          <xsd:enumeration value="XOR">
            <xsd:annotation>
              <xsd:documentation>Deprecated in BPMN1.1</xsd:documentation>
            </xsd:annotation>
          </xsd:enumeration>
          <xsd:enumeration value="Exclusive"/>
          <xsd:enumeration value="OR">
            <xsd:annotation>
              <xsd:documentation>Deprecated in BPMN1.1</xsd:documentation>
            </xsd:annotation>
          </xsd:enumeration>
          <xsd:enumeration value="Inclusive"/>
          <xsd:enumeration value="Complex"/>
          <xsd:enumeration value="AND">
            <xsd:annotation>
              <xsd:documentation>Deprecated in BPMN1.1</xsd:documentation>
            </xsd:annotation>
          </xsd:enumeration>
          <xsd:enumeration value="Parallel"/>
        </xsd:restriction>
      </xsd:simpleType>
    </xsd:attribute>
    <xsd:attribute name="ExclusiveType" use="optional" default="Data">
      <xsd:simpleType>
        <xsd:restriction base="xsd:NMTOKEN">
          <xsd:enumeration value="Data"/>
          <xsd:enumeration value="Event"/>
        </xsd:restriction>
      </xsd:simpleType>
    </xsd:attribute>
    <xsd:attribute name="IncomingCondition" type="xsd:string"/>
    <xsd:anyAttribute namespace="##other" processContents="lax"/>
  </xsd:complexType>
</xsd:element>

```

	Description
--	-------------

	Description
Type	<p>Parallel (AND) Join of (all) concurrent threads within the process instance with incoming transitions to the activity: Synchronization is required. The number of threads to be synchronized might be dependent on the result of the conditions of previous AND split(s). Equivalent to BPMN 'OR' gateway merge logic. BPMN 'AND' gateway merge logic requires all incoming transition threads to be synchronized, regardless of previous splits.</p> <p>Inclusive (OR) See above.</p> <p>Exclusive (XOR) Join for alternative threads: No synchronisation is required.</p> <p>ExclusiveType (XOREVENT) Identical to XOR for merges.</p> <p>COMPLEX This makes use of the attribute IncomingCondition. It determines which of the incoming transitions/Sequence Flow are required for the Process to continue. The expression may refer to process data and the status of the incoming Sequence Flow. For example, an expression may specify that any 3 out of 5 incoming Tokens will continue the Process. Another example would be an expression that specifies that a Token is required from Sequence Flow "a" and that a Token from either Sequence Flow "b" or "c" is acceptable. However, the expression should be designed so that the Process is not stalled at that location.</p>

Table 71: Join

The Parallel (AND) join can be seen as a "rendezvous precondition" of the Activity; the activity is not initiated until the transition conditions on all incoming routes evaluate true.

The Exclusive (XOR) join initiates the Activity when the transition conditions of any (one) of the incoming transitions evaluates true.

7.6.9.2. Split

A split describes the semantics where multiple outgoing Transitions for an Activity exist.

Note that the Types are not consistent with the new BPMN 1.1 types as used in Route/Gateway Activity. To fix this requires the appropriate attribute values and also the attribute 'ExclusiveType'. The old schema must be preserved as well, to support existing XPD 2.0 users.

```

<xsd:element name="Split">
  <xsd:complexType>
    <xsd:sequence>
      <xsd:element ref="xpd:TransitionRefs" minOccurs="0"/>
      <xsd:any namespace="##other" processContents="lax" minOccurs="0" maxOccurs="unbounded"/>
    </xsd:sequence>
    <xsd:attribute name="Type">
      <xsd:simpleType>
        <xsd:restriction base="xsd:NMTOKEN">
          <xsd:enumeration value="XOR">
            <xsd:annotation>
              <xsd:documentation>Deprecated in BPMN1.1</xsd:documentation>
            </xsd:annotation>
          </xsd:enumeration>
          <xsd:enumeration value="Exclusive"/>
          <xsd:enumeration value="OR">
            <xsd:annotation>
              <xsd:documentation>Deprecated in BPMN1.1</xsd:documentation>
            </xsd:annotation>
          </xsd:enumeration>
          <xsd:enumeration value="Inclusive"/>
          <xsd:enumeration value="Complex"/>
          <xsd:enumeration value="AND">
            <xsd:annotation>
              <xsd:documentation>Deprecated in BPMN1.1</xsd:documentation>
            </xsd:annotation>
          </xsd:enumeration>
        </xsd:restriction>
      </xsd:simpleType>
    </xsd:attribute>
  </xsd:complexType>
</xsd:element>

```

```

        <xsd:enumeration value="Parallel"/>
      </xsd:restriction>
    </xsd:simpleType>
  </xsd:attribute>
  <xsd:attribute name="ExclusiveType" use="optional" default="Data">
    <xsd:simpleType>
      <xsd:restriction base="xsd:NMTOKEN">
        <xsd:enumeration value="Data"/>
        <xsd:enumeration value="Event"/>
      </xsd:restriction>
    </xsd:simpleType>
  </xsd:attribute>
  <xsd:attribute name="OutgoingCondition" type="xsd:string"/>
  <xsd:anyAttribute namespace="##other" processContents="lax"/>
</xsd:complexType>
</xsd:element>

<xsd:element name="TransitionRef">
  <xsd:complexType>
    <xsd:sequence>
      <xsd:any namespace="##other" processContents="lax" minOccurs="0" maxOccurs="unbounded"/>
    </xsd:sequence>
    <xsd:attribute name="Id" type="xpdIdRef" use="required"/>
    <xsd:attribute name="Name" type="xsd:string" use="optional"/>
    <xsd:anyAttribute namespace="##other" processContents="lax"/>
  </xsd:complexType>
</xsd:element>

<xsd:element name="TransitionRefs">
  <xsd:complexType>
    <xsd:sequence>
      <xsd:element ref="xpdIdRef" minOccurs="0" maxOccurs="unbounded"/>
      <xsd:any namespace="##other" processContents="lax" minOccurs="0" maxOccurs="unbounded"/>
    </xsd:sequence>
    <xsd:anyAttribute namespace="##other" processContents="lax"/>
  </xsd:complexType>
</xsd:element>

```

	Description
Transition Refs	A list of outgoing transitions from the Activity. Each transition is identified by its Id.

	Description
Type	<p>Parallel (AND) Defines a number of possible concurrent threads represented by the outgoing Transitions of this Activity. If the Transitions have conditions the actual number of executed parallel threads is dependent on the conditions associated with each transition, which are evaluated concurrently. Note that the BPMN 'AND' gateway is a special case where none of the transitions (sequence flow gates) have conditions.</p> <p>Inclusive (OR) Another BPMN variant of AND. Here the transitions may have conditions and multiple paths out may be chosen. The difference is that a default path may also be specified so that, in case none of the other paths are chosen, the default will be selected.</p> <p>Exclusive (XOR) List of Identifiers of outgoing Transitions of this Activity, representing, alternatively executed transitions. The decision as to which single transition route is selected is dependent on the conditions of each individual transition as they are evaluated in the sequence specified in the list. The first TRUE condition (or no condition) ends the list evaluation. An OTHERWISE transition should be chosen if no prior transition is chosen. Equivalent to BPMN XOR data based Gateway.</p> <p>ExclusiveType (XOREVENT) Similar to XOR except that none of the transitions have conditions and there can be no OTHERWISE transition. The target activities must be Tasks with the TaskType attribute set to Receive or Intermediate Events with the Trigger attribute set to Message, Timer, Rule, or Link. If one transition/Gate target is a Task, then an Intermediate Event with a Trigger Message MUST NOT be used as a target for another transition/Gate. That is, messages MUST be received by only Receive Tasks or only Message Events, but not a mixture of both for a given Gateway.</p> <p>COMPLEX This makes use of the attribute OutgoingCondition. It determines which of the outgoing transitions/Sequence Flow will be chosen for the Process to continue. The expression may refer to process data and the status of the incoming Sequence Flow. For example, an expression may evaluate Process data and then select different sets of outgoing Sequence Flow, based on the results of the evaluation. However, The expression should be designed so that at least one of the outgoing Sequence Flow will be chosen.</p>

Table 72: Split

A Parallel (AND) split with transitions having conditions may be referred to as "conditional AND", "multiple-choice OR", or "nonexclusive OR", respectively. The number of actual concurrent threads is determined at execution time when evaluating the conditions. Following such an AND split the process instance (or thread of the process instance) is forked into a number of separate execution threads which result from the transitions condition evaluation. (Note that no list of identifiers is required since all outgoing transitions from the activity are evaluated and no sequence is necessary.)

If within the AND_SPLIT or XOR_SPLIT there is a transition having condition OTHERWISE, then a two-step evaluation is performed. In the first step evaluation is made of all the Transitions except that within the OTHERWISE condition. If none of them (including those having no condition) evaluate to TRUE, then in the second step the OTHERWISE transition is evaluated (only one transition with an OTHERWISE clause is permitted in the list of outgoing transitions from an activity).

An OTHERWISE alternative can be used to guarantee that there is no undefined status from the Process execution (i.e. at least one outgoing transition from an activity will always occur).

7.6.9.3. BPMN View of Routing Logic

7.6.9.3.1.Fork

BPMN uses the term "fork" to refer to the dividing of a path into two or more parallel paths (also known as an AND-Split described in sections 7.6.2 and 7.6.9.2). It is a place in the Process where activities can be performed concurrently, rather than sequentially. There are two options: Multiple Outgoing Sequence Flow can be used. This represents

“uncontrolled” flow and is the preferred method for most situations. A Parallel Gateway can be used. This will be used rarely, usually in combination with other Gateways.

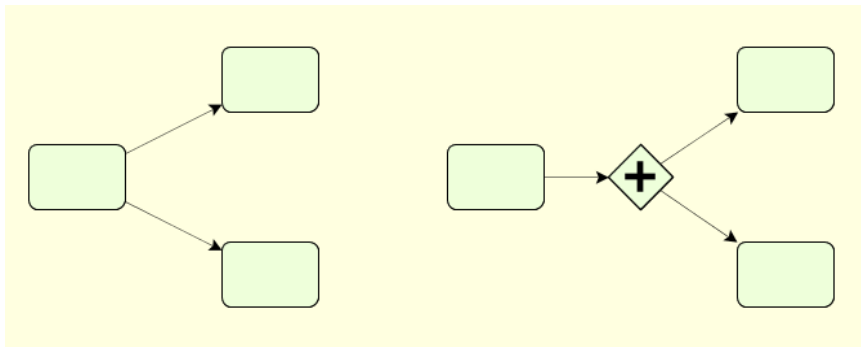


Figure 7.41: BPMN Fork

7.6.9.3.2.Join

BPMN uses the term “join” to refer to the combining of two or more parallel paths into one path (also known as an AND-Join or synchronization). A Parallel Gateway is used to show the joining of multiple Flow.

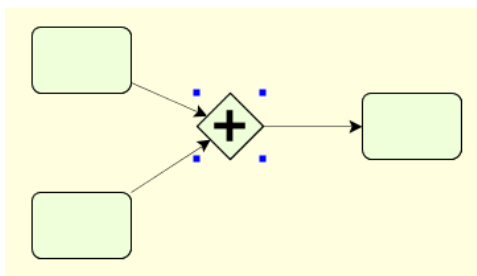


Figure 7.42: BPMN Join

7.6.9.3.3.Exclusive Data-Based Decision

This Decision represents a branching point where Alternatives are based on conditional expressions contained within the outgoing Sequence Flow (“Data- Based” see section 7.6.2.2.1). Only one of the Alternatives will be chosen.

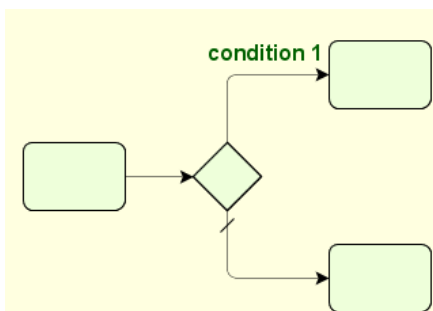


Figure 7.43: BPMN Exclusive Data-Based Decision

7.6.9.3.4. Exclusive Event-Based Decision

This Decision represents a branching point where Alternatives are based on an Event that occurs at that point in the Process (see section 7.6.4.3). The specific Event, usually the receipt of a Message, determines which of the paths will be taken. Other types of Events can be used, such as Timer. Only one of the Alternatives will be chosen. There are two options for receiving Messages: Tasks of Type Receive can be used (below left). Intermediate Events of Type Message can be used (below right).

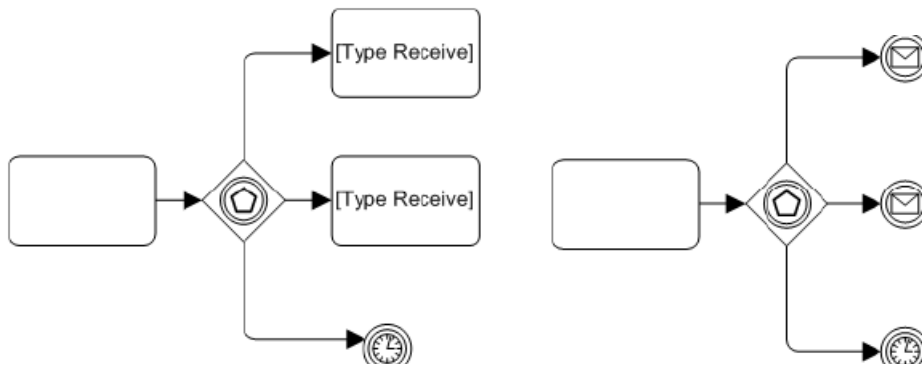


Figure 7.44: BPMN Event-Based Decision

7.6.9.3.5. Inclusive Decision

This Decision represents a branching point where Alternatives are based on conditional expressions contained within the outgoing Sequence Flow (7.6.2.1, 7.6.9.2). In some sense it is a grouping of related independent Binary (Yes/No) Decisions. Since each path is independent, all combinations of the paths may be taken, from zero to all. However, it should be designed so that at least one path is taken. A Default Condition could be used to ensure that at least one path is taken. There are two versions of this type of Decision: The first uses a collection of conditional Sequence Flow, marked with mini-diamonds (see below left figure). The second uses a Gateway (see below right figure).

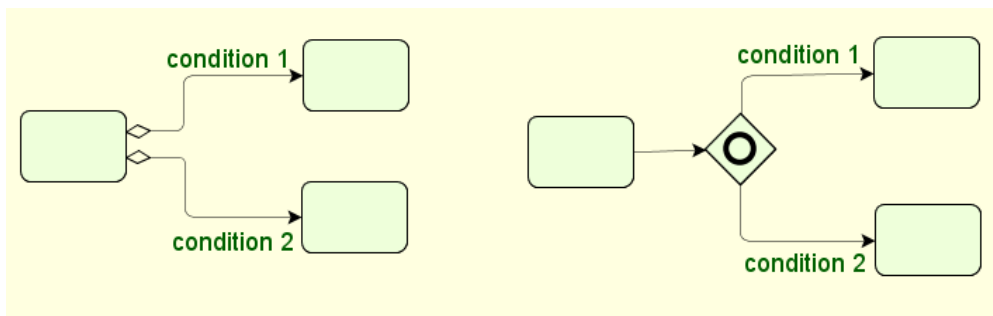


Figure 7.45: BPMN Inclusive Decision

7.6.9.3.6. Merging

BPMN uses the term “merge” to refer to the exclusive combining of two or more paths into one path (also known as an OR-Join described in section 7.6.2.2.2). A Merging Exclusive Gateway is used to show the merging of multiple Flow. If all the incoming flows are alternatives, then a Gateway is not needed. That is, uncontrolled flow provides the same behavior.

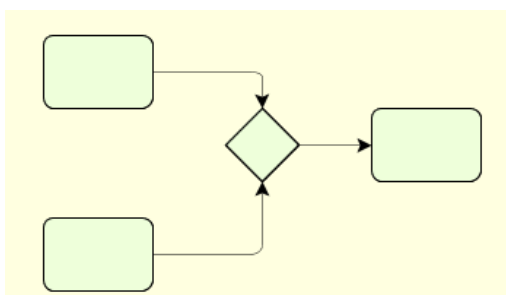


Figure 7.46: BPMN Merge

7.6.9.3.7. Sequence Flow Looping

Loops can be created by connecting a Sequence Flow to an “upstream” object. An object is considered to be upstream if that object has an outgoing Sequence Flow that leads to a series of other Sequence Flow, the last of which is an incoming Sequence Flow for the original object.

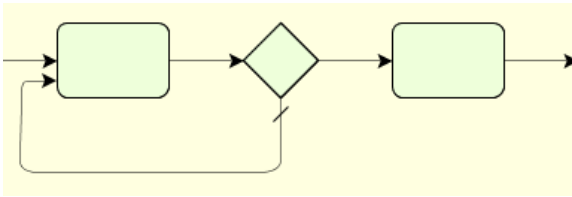


Figure 7.47: Sequence Flow Looping

7.6.9.3.8. Activity Looping

The attributes of Tasks and Sub-Processes will determine if they are repeated or performed once. There are two types of loops: Standard and Multi-Instance (see section 7.6.13). For Standard a small looping indicator will be displayed at the bottom-center of the activity. For Multi-Instance a small parallel indicator will be displayed at the bottom-center of the activity.



Figure 7.48: Activity Looping

7.6.9.3.9. Off-Page Connector

Generally used for printing, this object will show where the Sequence Flow leaves one page and then restarts on the next page. A Link Intermediate Event can be used as an Off-Page Connector.



Figure 7.49: Off-Page Connector

7.6.10. InputSets

The InputSets attribute defines the data requirements for input to the activity. Zero or more InputSets MAY be defined. Each InputSet is sufficient to allow the activity to be performed (if it has first been instantiated by the appropriate signal arriving from an incoming Sequence Flow).

In BPMN 1.1 the element Input has been replaced by ArtifactInputs and PropertyInputs. We preserve the element in the schema for compatibility.

Zero or more ArtifactInputs MAY be defined for each InputSet. For the combination of ArtifactInputs and PropertyInputs, there MUST be at least one item defined for the InputSet. An ArtifactInput is an Artifact, usually a DataObject. Note that the Artifacts MAY also be displayed on the diagram and MAY be connected to the activity through an Association--however, it is not required for them to be displayed.

Zero or more PropertyInputs MAY be defined for each InputSet. For the combination of ArtifactInputs and PropertyInputs, there MUST be at least one item defined for the InputSet.

```
<xsd:element name="Input">
  <xsd:annotation>
    <xsd:documentation>BPMN</xsd:documentation>
  </xsd:annotation>
  <xsd:complexType>
    <xsd:sequence>
      <xsd:any namespace="##other" processContents="lax" minOccurs="0" maxOccurs="unbounded"/>
    </xsd:sequence>
    <xsd:attribute name="ArtifactId" type="xsd:NMTOKEN" use="required"/>
    <xsd:anyAttribute namespace="##other" processContents="lax"/>
  </xsd:complexType>
</xsd:element>
```

```

</xsd:element>

<xsd:element name="ArtifactInput">
  <xsd:complexType>
    <xsd:sequence>
      <xsd:any namespace="##other" processContents="lax" minOccurs="0" maxOccurs="unbounded"/>
    </xsd:sequence>
    <xsd:attribute name="ArtifactId" type="xsd:NMTOKEN" use="required"/>
    <xsd:attribute name="RequiredForStart" type="xsd:boolean" use="optional" default="true"/>
    <xsd:anyAttribute namespace="##other" processContents="lax"/>
  </xsd:complexType>
</xsd:element>

<xsd:element name="PropertyInput">
  <xsd:complexType>
    <xsd:sequence>
      <xsd:any namespace="##other" processContents="lax" minOccurs="0" maxOccurs="unbounded"/>
    </xsd:sequence>
    <xsd:attribute name="PropertyId" type="xsd:NMTOKEN" use="required"/>
    <xsd:anyAttribute namespace="##other" processContents="lax"/>
  </xsd:complexType>
</xsd:element>

<xsd:element name="InputSet">
  <xsd:annotation>
    <xsd:documentation>BPMN</xsd:documentation>
  </xsd:annotation>
  <xsd:complexType>
    <xsd:sequence>
      <xsd:element ref="xpd:Input" maxOccurs="unbounded"/>
      <xsd:element ref="xpd:ArtifactInput" minOccurs="0" maxOccurs="unbounded"/>
      <xsd:element ref="xpd:PropertyInput" minOccurs="0" maxOccurs="unbounded"/>
      <xsd:any namespace="##other" processContents="lax" minOccurs="0" maxOccurs="unbounded"/>
    </xsd:sequence>
    <xsd:anyAttribute namespace="##other" processContents="lax"/>
  </xsd:complexType>
</xsd:element>

<xsd:element name="InputSets">
  <xsd:annotation>
    <xsd:documentation>BPMN</xsd:documentation>
  </xsd:annotation>
  <xsd:complexType>
    <xsd:sequence>
      <xsd:element ref="xpd:InputSet" maxOccurs="unbounded"/>
      <xsd:any namespace="##other" processContents="lax" minOccurs="0" maxOccurs="unbounded"/>
    </xsd:sequence>
    <xsd:anyAttribute namespace="##other" processContents="lax"/>
  </xsd:complexType>
</xsd:element>

```

	Description
ArtifactId	See section 6.4.7. and 7.1.9.
ArtifactInputs	A list of Artifacts.
PropertyInputs	A list of Properties.
RequiredForStart	The default value for this attribute is True. This means that the Input is required for an activity to start. If set to False, then the activity MAY start with the input if it is available, but MAY accept the input (more than once) after the activity has started. An InputSet may have some ArtifactInputs that have this attribute set to True and some that are set to False.

Table 73: Input

7.6.11. OutputSets

The OutputSets attribute defines the data requirements for output from the activity. Zero or more OutputSets MAY be defined. At the completion of the activity, only one of the OutputSets may be produced. It is up to the implementation of the activity to determine which set will be produced. However, the IORules attribute MAY indicate a relationship

between an OutputSet and an InputSet that started the activity.

One or more Outputs **MUST** be defined for each OutputSet. An Output is an Artifact, usually a Document Object. Note that the Artifacts **MAY** also be displayed on the diagram and **MAY** be connected to the activity through an Association. However, it is not required for them to be displayed.

```

<xsd:element name="Output">
  <xsd:annotation>
    <xsd:documentation>BPMN</xsd:documentation>
  </xsd:annotation>
  <xsd:complexType>
    <xsd:sequence>
      <xsd:any namespace="##other" processContents="lax" minOccurs="0" maxOccurs="unbounded"/>
    </xsd:sequence>
    <xsd:attribute name="ArtifactId" type="xsd:NMTOKEN" use="required"/>
    <xsd:anyAttribute namespace="##other" processContents="lax"/>
  </xsd:complexType>
</xsd:element>

<xsd:element name="OutputSet">
  <xsd:annotation>
    <xsd:documentation>BPMN</xsd:documentation>
  </xsd:annotation>
  <xsd:complexType>
    <xsd:sequence>
      <xsd:element ref="xpd:Output" maxOccurs="unbounded"/>
      <xsd:any namespace="##other" processContents="lax" minOccurs="0" maxOccurs="unbounded"/>
    </xsd:sequence>
    <xsd:anyAttribute namespace="##other" processContents="lax"/>
  </xsd:complexType>
</xsd:element>

<xsd:element name="OutputSets">
  <xsd:annotation>
    <xsd:documentation>BPMN</xsd:documentation>
  </xsd:annotation>
  <xsd:complexType>
    <xsd:sequence>
      <xsd:element ref="xpd:OutputSet" maxOccurs="unbounded"/>
      <xsd:any namespace="##other" processContents="lax" minOccurs="0" maxOccurs="unbounded"/>
    </xsd:sequence>
    <xsd:anyAttribute namespace="##other" processContents="lax"/>
  </xsd:complexType>
</xsd:element>

```

	Description
Artifact	See section 6.4.7. and 7.1.9.
Output	A list of Artifacts.
OutputSet	A list of outputs

Table 74: Output

7.6.12. Transaction

A Sub-Process activity, whether it is Reusable (implemented by subflow) or embedded (block activity), can be set as being a Transaction, which will have a special behavior that is controlled through a transaction protocol (such as BTP or WSTransaction).

There are three basic outcomes of a Transaction:

- Successful completion: this will be shown as a normal Sequence Flow that leaves the Sub-Process.
- Failed completion (Cancel):

When a Transaction is cancelled, then the activities inside the Transaction will be subjected to the cancellation actions, which could include rolling back the process and compensation for specific activities. Note that other

mechanisms for interrupting a Sub-Process will not cause Compensation (e.g., Error, Timer, and anything for a non-Transaction activity). A Cancel Intermediate Event, attached to the boundary of the activity, will direct the flow after the Transaction has been rolled back and all compensation has been completed. The Cancel Intermediate Event can only be used when attached to the boundary of a Transaction activity. It cannot be used in any Normal Flow and cannot be attached to a non-Transaction activity. There are two mechanisms that can signal the cancellation of a Transaction:

- A Cancel End Event is reached within the Transaction Sub-Process. A Cancel End Event can only be used within a Sub-Process that is set to a Transaction.
 - A Cancel Message can be received via the Transaction Protocol that is supporting the execution of the Sub-Process.
- Hazard: This means that something went terribly wrong and that a normal success or cancel is not possible. We are using an Error to show Hazards. When a Hazard happens, the activity is interrupted (without Compensation) and the flow will continue from the Error Intermediate Event.

The behavior at the end of a successful Transaction Sub-Process is slightly different than that of a normal Sub-Process. When each path of the Transaction Sub-Process reaches a non-Cancel End Event(s), the flow does not immediately move back up to the higher-level Parent Process, as does a normal Sub-Process. First, the transaction protocol must verify that all the participants have successfully completed their end of the Transaction. Most of the time this will be true and the flow will then move up to the higher-level Process. But it is possible that one of the participants may end up with a problem that causes a Cancel or a Hazard. In this case, the flow will then move to the appropriate Intermediate Event, even though it had apparently finished successfully.

Note: The exact behavior and notation for defining Transactions is still an open issue.

```
<xsd:element name="Transaction">
  <xsd:annotation>
    <xsd:documentation>BPMN: If SubProcess is a transaction then this is required.</xsd:documentation>
  </xsd:annotation>
  <xsd:complexType>
    <xsd:sequence>
      <xsd:any namespace="##other" processContents="lax" minOccurs="0" maxOccurs="unbounded"/>
    </xsd:sequence>
    <xsd:attribute name="TransactionId" type="xsd:string" use="required"/>
    <xsd:attribute name="TransactionProtocol" type="xsd:string" use="required"/>
    <xsd:attribute name="TransactionMethod" use="required">
      <xsd:simpleType>
        <xsd:restriction base="xsd:NMTOKEN">
          <xsd:enumeration value="Compensate"/>
          <xsd:enumeration value="Store"/>
          <xsd:enumeration value="Image"/>
        </xsd:restriction>
      </xsd:simpleType>
    </xsd:attribute>
    <xsd:anyAttribute namespace="##other" processContents="lax"/>
  </xsd:complexType>
</xsd:element>
```

	Description
TransactionId	The TransactionId attribute provides an identifier for the Transactions used within a package/diagram.
TransactionMethod	TransactionMethod is an attribute that defines the technique that will be used to undo a Transaction that has been cancelled. The default is Compensate, but the attribute MAY be set to Store or Image.
TransactionProtocol	This identifies the Protocol (e.g., WS-Transaction or BTP) that will be used to control the transactional behavior of the Sub-Process.

Table 75: Transaction

7.6.13. Loop

The attributes of Tasks and Sub-Processes will determine if they are repeated or performed once. There are two types of loops: Standard and Multi-Instance.

A Standard Loop activity will have a boolean expression that is evaluated after each cycle of the loop. If the expression is still True, then the loop will continue. There are two variations of the loop, which reflect the programming constructs

of while and until. That is, a while loop will evaluate the expression before the activity is performed, which means that the activity may not actually be performed. The until loop will evaluate the expression after the activity has been performed, which means that the activity will be performed at least once.

Multi-Instance loops reflect the programming construct foreach. The loop expression for a Multi-Instance loop is a numeric expression evaluated only once before the activity is performed. The result of the expression evaluation will be an integer that will specify the number of times that the activity will be repeated. There are also two variations of the Multi-Instance loop where the instances are either performed sequentially or in parallel.

```

<xsd:element name="Loop">
  <xsd:annotation>
    <xsd:documentation>BPMN (and possibly XPDL)</xsd:documentation>
  </xsd:annotation>
  <xsd:complexType>
    <xsd:choice>
      <xsd:element ref="xpdl:LoopStandard"/>
      <xsd:element ref="xpdl:LoopMultiInstance"/>
    </xsd:choice>
    <xsd:attribute name="LoopType" use="required">
      <xsd:simpleType>
        <xsd:restriction base="xsd:NMTOKEN">
          <xsd:enumeration value="Standard"/>
          <xsd:enumeration value="MultiInstance"/>
        </xsd:restriction>
      </xsd:simpleType>
    </xsd:attribute>
    <xsd:anyAttribute namespace="##other" processContents="lax"/>
  </xsd:complexType>
</xsd:element>

<xsd:element name="LoopMultiInstance">
  <xsd:annotation>
    <xsd:documentation>BPMN</xsd:documentation>
  </xsd:annotation>
  <xsd:complexType>
    <xsd:sequence>
      <xsd:element name="MI_Condition" type="xpdl:ExpressionType" minOccurs="0"/>
      <xsd:element name="ComplexMI_FlowCondition" type="xpdl:ExpressionType" minOccurs="0"/>
      <xsd:any namespace="##other" processContents="lax" minOccurs="0" maxOccurs="unbounded"/>
    </xsd:sequence>
    <xsd:attribute name="MI_Condition" type="xsd:string" use="optional"/>
    <xsd:attribute name="LoopCounter" type="xsd:integer">
      <xsd:annotation>
        <xsd:documentation> This is updated at run time to count the number of executions of the loop and is
available as a property to be used in expressions. Does this belong in the XPDL?</xsd:documentation>
      </xsd:annotation>
    </xsd:attribute>
    <xsd:attribute name="MI_Ordering" use="required">
      <xsd:simpleType>
        <xsd:restriction base="xsd:NMTOKEN">
          <xsd:enumeration value="Sequential"/>
          <xsd:enumeration value="Parallel"/>
        </xsd:restriction>
      </xsd:simpleType>
    </xsd:attribute>
    <xsd:attribute name="MI_FlowCondition" use="optional" default="All">
      <xsd:simpleType>
        <xsd:restriction base="xsd:NMTOKEN">
          <xsd:enumeration value="None"/>
          <xsd:enumeration value="One"/>
          <xsd:enumeration value="All"/>
          <xsd:enumeration value="Complex"/>
        </xsd:restriction>
      </xsd:simpleType>
    </xsd:attribute>
    <xsd:attribute name="ComplexMI_FlowCondition" type="xsd:string" use="optional"/>
    <xsd:anyAttribute namespace="##other" processContents="lax"/>
  </xsd:complexType>
</xsd:element>

<xsd:element name="LoopStandard">
  <xsd:annotation>

```

```

    <xsd:documentation>BPMN</xsd:documentation>
  </xsd:annotation>
  <xsd:complexType>
    <xsd:sequence>
      <xsd:element name="LoopCondition" type="xpd:ExpressionType" minOccurs="0"/>
      <xsd:any namespace="##other" processContents="lax" minOccurs="0" maxOccurs="unbounded"/>
    </xsd:sequence>
    <xsd:attribute name="LoopCondition" type="xsd:string" use="optional"/>
    <xsd:attribute name="LoopCounter" type="xsd:integer">
      <xsd:annotation>
        <xsd:documentation> This is updated at run time to count the number of executions of the loop and is
        available as a property to be used in expressions. Does this belong in the XPDL?</xsd:documentation>
      </xsd:annotation>
    </xsd:attribute>
    <xsd:attribute name="LoopMaximum" type="xsd:integer" use="optional"/>
    <xsd:attribute name="TestTime" use="required">
      <xsd:simpleType>
        <xsd:restriction base="xsd:NMTOKEN">
          <xsd:enumeration value="Before"/>
          <xsd:enumeration value="After"/>
        </xsd:restriction>
      </xsd:simpleType>
    </xsd:attribute>
    <xsd:anyAttribute namespace="##other" processContents="lax"/>
  </xsd:complexType>
</xsd:element>

```

	Description
LoopType	LoopType is an attribute and is by default None, but MAY be set to Standard or MultiInstance. If so, the Loop marker SHALL be placed at the bottom center of the activity shape. A Task of type Receive that has its Instantiate attribute set to True MUST NOT have a Standard or MultiInstance LoopType.
Standard	
LoopCondition	Standard Loops MUST have a boolean Expression to be evaluated, plus the timing when the expression SHALL be evaluated. LoopCondition can be either an attribute of type string or an element of type xpd:ExpressionType.
LoopCounter	This is updated at run time to count the number of executions of the loop and is available as a property to be used in expressions.
LoopMaximum	The Maximum an optional attribute that provides is a simple way to add a cap to the number of loops. This SHALL be added to the Expression defined in the LoopCondition.
TestTime	The expressions that are evaluated Before the activity begins are equivalent to a programming while function. The expression that are evaluated After the activity finishes are equivalent to a programming until function.
MultiInstance	
LoopCounter	The LoopCounter attribute is only applied for Sequential MultiInstance Loops and for processes that are being executed by a process engine. The attribute is updated at runtime by a process engine to count the number of loops as they occur. The LoopCounter attribute MUST be incremented at the start of a loop. Unlike a Standard loop, the modeler does not use this attribute in the MI_Condition Expression, but it can be used for tracking the status of a loop.
MI_Condition	MultiInstance Loops MUST have a numeric Expression to be evaluated--the Expression MUST resolve to an integer. MI_Condition can be either an attribute of type string or an element of type xpd:ExpressionType.
MI_Ordering	Sequential Parallel This applies to only MultiInstance Loops. The MI_Ordering attribute defines whether the loop instances will be performed sequentially or in parallel. Sequential MI_Ordering is a more traditional loop. Parallel MI_Ordering is equivalent to multi-instance specifications that other notations, such as UML Activity Diagrams use. If set to Parallel, the Parallel marker SHALL replace the Loop Marker at the bottom center of the activity shape.

	Description
MI_FlowCondition	<p>None One All Complex</p> <p>This attribute is equivalent to using a Gateway to control the flow past a set of parallel paths.</p> <p>An MI_FlowCondition of “None” is the same as uncontrolled flow (no Gateway) and means that all activity instances SHALL generate a token that will continue when that instance is completed.</p> <p>An MI_FlowCondition of “One” is the same as an Exclusive Gateway and means that the Token SHALL continue past the activity after only one of the activity instances has completed. The activity will continue its other instances, but additional Tokens MUST NOT be passed from the activity.</p> <p>An MI_FlowCondition of “All” is the same as a Parallel Gateway and means that the Token SHALL continue past the activity after all of the activity instances have completed.</p> <p>An MI_FlowCondition of “Complex” is similar to that of a Complex Gateway. The ComplexMI_FlowCondition attribute will determine the Token flow.</p>
ComplexMI_FlowCondition Note that the attribute with this name is deprecated and replaced by the element with the same name.	<p>If the MI_FlowCondition attribute is set to “Complex,” then an Expression Must be entered. This Expression that MAY reference Process data. The expression will be evaluated after each iteration of the Activity and SHALL resolve to a boolean. If the result of the expression evaluation is TRUE, then a Token will be sent down the activity’s outgoing Sequence Flow. Otherwise, no Token for that iteration will be sent.</p>

Table 76: Loop

7.7. Transition Information

The Transition Information describes possible transitions between activities and the conditions that enable or disable them (the transitions) during execution. Further control and structure restrictions may be expressed in the Activity definition.

Note that BPMN uses the term SequenceFlow for transition. See section 7.7.2.

A process definition is seen as a network of edges between the Activity nodes (i.e. as a process diagram). All edges are directed and given by a pair of Activities:

(From node, to node).

The edges of the Activity net may be labelled by **Transition conditions**. A Transition condition for a specific edge enables that transition if the condition evaluates to TRUE. If no routing condition is specified the Transition behaves as if a condition with value TRUE is present.

If there are multiple incoming or outgoing (“regular”, see below) Transitions of an Activity, then further options to express control flow restrictions and condition evaluation semantics are provided in the Activity entity definition (AND/XOR variants of SPLIT/JOIN). Note: BPMN uses different terminology: Parallel, Inclusive and Exclusive.

A loop may be represented via a transition that returns to an Activity that was on a path that led to the transition. Typically, at least one of the activities in the loop will have multiple outgoing transitions, one or more of which will contain an exit condition from the loop.

For the identifiers and names defined in the Transition information the scope is the surrounding Process Definition.

It is possible to define or synchronize multiple (concurrent or alternative) control threads (split, join) and sequences of Transitions between Activities (cascading Transitions/conditions).

```

<xsd:element name="Transition">
  <xsd:complexType>
    <xsd:sequence>
      <xsd:element ref="xpd:Condition" minOccurs="0"/>
      <xsd:element ref="xpd:Description" minOccurs="0"/>
      <xsd:element ref="xpd:ExtendedAttributes" minOccurs="0"/>
      <xsd:element ref="xpd:Assignments" minOccurs="0"/>
      <xsd:element ref="xpd:Object" minOccurs="0"/>
      <xsd:element ref="xpd:ConnectorGraphicsInfos" minOccurs="0"/>
      <xsd:any namespace="##other" processContents="lax" minOccurs="0" maxOccurs="unbounded"/>
    </xsd:sequence>
  </xsd:complexType>
</xsd:element>

```

```

<xsd:attribute name="Id" type="xpd:Id" use="required"/>
<xsd:attribute name="From" type="xpd:IdRef" use="required"/>
<xsd:attribute name="To" type="xpd:IdRef" use="required"/>
<xsd:attribute name="Name" type="xsd:string" use="optional"/>
<xsd:attribute name="Quantity" type="xsd:int" use="optional" default="1">
  <xsd:annotation>
    <xsd:documentation>Used only in BPMN. Specifies number of tokens on outgoing
transition.</xsd:documentation>
  </xsd:annotation>
</xsd:attribute>
<xsd:anyAttribute namespace="##other" processContents="lax"/>
</xsd:complexType>
</xsd:element>

```

	Description
Assignments	See section 7.1.7.
Condition	A Transition condition expression based on relevant data field. (E.g. 'Contract' = 'SMALL' OR 'Contract' <\$20,000). Default: TRUE
ConnectorGraphicsInfos	See section 7.1.2.4.
Description	Short textual description of the Transition.
Extended Attributes	Optional extensions to meet individual implementation needs.
From	Determines the FROM source of a Transition. (Activity Identifier).
Id	Used to identify the Transition.
Name	Text used to identify the Transition.
Object	See section 7.1.9.4.
Quantity	The default value is 1. The value MUST NOT be less than 1. This attribute defines the number of Tokens that will be generated down the Sequence Flow.
To	Determines the TO target of a Transition (Activity Identifier).

Table 77: Transition Information

7.7.1. Condition

```

<xsd:element name="Condition">
  <xsd:complexType mixed="true">
    <xsd:choice minOccurs="0">
      <xsd:element ref="deprecated:Xpression" minOccurs="0"/>
      <xsd:element name="Expression" type="xpd:ExpressionType" minOccurs="0"/>
    </xsd:choice>
    <xsd:attribute name="Type">
      <xsd:simpleType>
        <xsd:restriction base="xsd:NMTOKEN">
          <xsd:enumeration value="CONDITION"/>
          <xsd:enumeration value="OTHERWISE"/>
          <xsd:enumeration value="EXCEPTION"/>
          <xsd:enumeration value="DEFAULTEXCEPTION"/>
        </xsd:restriction>
      </xsd:simpleType>
    </xsd:attribute>
    <xsd:anyAttribute namespace="##other" processContents="lax"/>
  </xsd:complexType>
</xsd:element>

```

	Description
--	-------------

	Description
Type	<p>Define the type of transition condition, valid values are</p> <p>CONDITION Indicates that the transition is to be executed if its condition is satisfied,</p> <p>OTHERWISE Indicates that the transition is the default transition that is executed if no conditions are met.</p> <p>EXCEPTION Indicates that the transition is to be executed if there is an exception and its condition is satisfied. NOT USED IN BPMN</p> <p>DEFAULTEXCEPTION Indicates that the transition is the default transition that is executed if there is an exception and no exception conditions are met. . NOT USED IN BPMN</p>
Expression	A condition expression represented via XML markup.

Table 78: Condition

7.7.1.1. Exception Conditions

BPMN provides Intermediate Events (see 7.6.4.3) to handle exceptions. That is the preferred method.

The Exception and DEFAULTEXCEPTION types allow you to specify branches that are taken only when an Exception is raised. The EXCEPTION type is equivalent to the CONDITION type and the DEFAULTEXCEPTION matches the OTHERWISE type. The Condition may contain either the name of an Exception or a more complex expression. Except for the deadlines, exceptions are raised in an engine-specific manner. Like regular transitions, exception transitions are traversed only after the "From" activity has completed. An exception usually indicates abnormal completion. Note that BPMN provides Events to deal with Exceptions. See 7.6.4.3 Intermediate Events.

The following example illustrates a set of transitions from an activity that includes exceptions: branches 1 and 2 are processed under normal conditions; branches 3 and 4 are processed if there is an exception.

```

<Transitions>
  <Transition Id="branch1" From="CheckBalance" To="ProcessRequest">
    <Condition Type="CONDITION">Balance > 1000</Condition>
  </Transition>
  <Transition Id="branch2" From="CheckBalance" To="InsufFunds">
    <Condition Type="OTHERWISE"/>
  </Transition>
  <Transition Id="branch3" From="CheckBalance" To="MessageDisplay">
    <Condition Type="EXCEPTION">ATMDownException</Condition>
  </Transition>
  <Transition Id="branch4" From="CheckBalance" To="SendAlarm">
    <Condition Type="DEFAULTEXCEPTION"/>
  </Transition>
</Transitions>

```

7.7.2. BPMN view of Transition --- Sequence Flow

A Sequence Flow is used to show the order that activities will be performed in a Process. Each Flow has only one source and only one target. The source and target must be from the set of the following Flow Objects: Events (Start, Intermediate, and End), Activities (Task and Sub-Process), and Gateways. During performance (or simulation) of the process, a Token will leave the source Flow Object, traverse down the Sequence Flow, and enter the target Flow Object.

7.7.2.1. Uncontrolled flow



Uncontrolled flow refers to flow that is not affected by any conditions or does not pass through a gateway (7.6.2.1). The simplest example of this is a single Sequence Flow connecting two activities. This can also apply to multiple Sequence Flows that converge on or diverge from an activity. For each uncontrolled Sequence Flow a "Token" will flow from the source object to the target object.

BPMN does not use the term "Control Flow" when referring to the lines represented by Sequence Flow or Message

Flow. The start of an activity is “controlled” not only by Sequence Flow (the order of activities), but also by Message Flow (a message arriving), as well as other process factors, such as scheduled resources. Artifacts can be Associated with activities to show some of these other factors. Thus, we are using a more specific term, “Sequence Flow,” since these lines mainly illustrate the sequence that activities will be performed.

7.7.2.2. Conditional flow



A Sequence Flow MAY have a conditional expression attribute, depending on its source object. This means that the condition expression must be evaluated before a Token can be generated and then leave the source object to traverse the Flow. The conditions are usually associated with Decision Gateways, but can also be used with activities.

Condition expressions are evaluated at runtime to determine whether or not the flow will be used. If the conditional flow is outgoing from an activity, then the Sequence Flow will have a mini-diamond at the beginning of the line. If the conditional flow is outgoing from a Gateway, then the line will not have a mini-diamond (see Uncontrolled flow figure above).

7.7.2.3. Default flow



For Data-Based Exclusive Decisions or Inclusive Decisions (section 7.6.2.2.1), one type of flow is the Default condition flow. This flow will be used only if all the other outgoing conditional flows are not true at runtime. This Sequence Flow will have a diagonal slash added to the beginning of the line.

By default, the ConditionType of a Sequence Flow is None. This means that there is no evaluation at runtime to determine whether or not the Sequence Flow will be used. Once a Token is ready to traverse the Sequence Flow (i.e., the Source is an activity that has completed), then the Token will do so. The normal, uncontrolled use of Sequence Flow, in a sequence of activities, will have a ‘None’ ConditionType. A ‘None’ ConditionType MUST NOT be used if the Source of the Sequence Flow is an Exclusive Data-Based or Inclusive Gateway. The ConditionType attribute MAY be set to Expression if the Source of the Sequence Flow is a Task, a Sub-Process, or a Gateway of type Exclusive-Data-Based or Inclusive. If the ConditionType attribute is set to Expression, then a condition marker SHALL be added to the line if the Sequence Flow is outgoing from an activity. However, a condition indicator MUST NOT be added to the line if the Sequence Flow is outgoing from a Gateway. An Expression ConditionType MUST NOT be used if the Source of the Sequence Flow is an Event-Based Exclusive Gateway, a Complex Gateway, a Parallel Gateway, a Start Event, or an Intermediate Event. In addition, an Expression ConditionType MUST NOT be used if the Sequence Flow is associated with the Default Gate of a Gateway. The ConditionType attribute MAY be set to Default only if the Source of the Sequence Flow is an activity or an Exclusive Data-Based Gateway. If the ConditionType is Default, then the Default marker SHALL be displayed.

7.7.2.4. Exception flow

Exception Flow occurs outside the Normal Flow of the Process and is based upon an Intermediate Event that occurs during the performance of the Process (7.6.4.3).

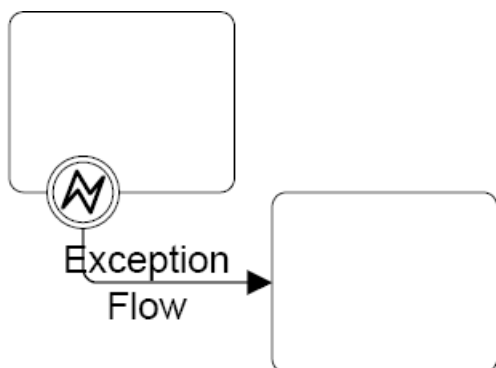


Figure 7.50: Exception Flow

7.7.2.5. Compensation Association

Compensation Association occurs outside the Normal Flow of the Process and is based upon an event (a Compensation

Intermediate Event) that is triggered through the failure of a Transaction or a Compensate Event. The target of the Association must be marked as a Compensation Activity.

{Editorial comment: We are putting this under Sequence Flow because Associations have been described in BPMN as documentation not affecting the flow, whereas this seems otherwise}.

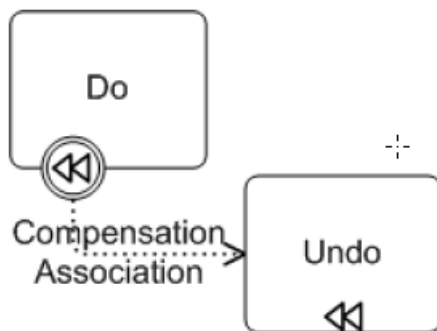


Figure 7.51: Compensation Association

7.7.2.6. Sequence Flow Rules

The Table below displays the BPMN Flow Objects and shows how these objects can connect to one another through Sequence Flow. The symbol indicates that the object listed in the row can connect to the object listed in the column. The quantity of connections into and out of an object is subject to various configuration dependencies and are not specified here. Refer to the sections for each individual object for more detailed information on the appropriate connection rules. Note that if a sub-process has been expanded within a Diagram, the objects within the sub-process cannot be connected to objects outside of the sub-process. Nor can Sequence Flow cross a Pool boundary.

From\To						
		↗	↗	↗	↗	↗
		↗	↗	↗	↗	↗
		↗	↗	↗	↗	↗
		↗	↗	↗	↗	↗
		↗	↗	↗	↗	↗

Figure 7.52: SequenceFlow Connection Rules

Note – Only those objects that can have incoming and/or outgoing Sequence Flow are shown in the table. Thus, Pool, Lane, Data Object, and Text Annotation are not listed in the table.

7.7.2.7. SequenceFlow Examples

7.7.2.7.1. Controlling Flow Across Processes

There may be situations within a Process where the flow is affected by or dependent on an activity that occurs in another Process. These events or conditions can be referred to as milestones. The process model must be able to identify and react to the milestone. That is, the continuation of a Process may be triggered by Signal Events, (see Figure below).

In this example the activity at D cannot begin until the activity at B is completed. The upper subprocess **THROWS** the trigger and the lower subprocess **CATCHES** it.

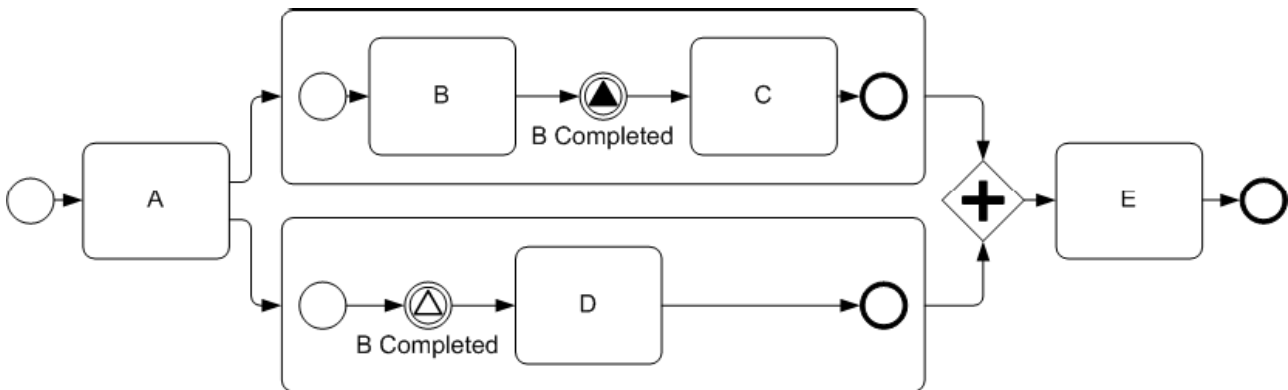


Figure 7.53 Signal Events Used to Synchronize Behavior Across Processes

7.8. Partner Links

Partner links are used to define a communication link between two parties, each assuming a role in the communication. From a modeling perspective the roles are normally, but not always, given by the name of a pool or lane. If used this way, the message flow between two pools will correspond to a partner link with each role corresponding to the name of the corresponding pool.

Partner links are optional and normally used to model the communication at an abstract level using WSDL and port types. A `WebServiceOperation` (see 7.9.6) can use a partner link for abstract modeling or service when a concrete web service is used and so port name is used instead of port type.

Partner links are defined in two levels. At the Package level, the partner link type defines a partner link name and one or two roles. The basic information about the partner link is defined at this level. At the process level, the partner link itself is defined using the partner link type. This allows partner link types to be reusable at the package level.

7.8.1. Partner Link Type

Partner link type defines the general information about a partner link at package scope. This allows multiple processes to use the same partner link type.

```

<xsd:element name="PartnerLinkType">
  <xsd:complexType>
    <xsd:sequence>
      <xsd:element name="Role" maxOccurs="2">
        <xsd:complexType>
          <xsd:sequence>
            <xsd:any namespace="##other" processContents="lax" minOccurs="0"
maxOccurs="unbounded"/>
          </xsd:sequence>
          <xsd:attribute name="portType" type="xsd:string" use="required"/>
          <xsd:attribute name="Name" type="xsd:string" use="required"/>
          <xsd:anyAttribute namespace="##other" processContents="lax"/>
        </xsd:complexType>
      </xsd:element>
      <xsd:any namespace="##other" processContents="lax" minOccurs="0" maxOccurs="unbounded"/>
    </xsd:sequence>
    <xsd:attribute name="Id" type="xsd:NMTOKEN" use="required"/>
    <xsd:attribute name="name" type="xsd:string" use="required"/>
    <xsd:anyAttribute namespace="##other" processContents="lax"/>
  </xsd:complexType>
</xsd:element>
  
```

```

<xsd:element name="PartnerLinkTypes">
  <xsd:complexType>
    <xsd:sequence>
      <xsd:element ref="xpdl:PartnerLinkType" maxOccurs="unbounded"/>
      <xsd:any namespace="##other" processContents="lax" minOccurs="0" maxOccurs="unbounded"/>
    </xsd:sequence>
    <xsd:anyAttribute namespace="##other" processContents="lax"/>
  </xsd:complexType>
</xsd:element>

```

	Description
Role	A partner link may have one or two roles. In most cases they will correspond to the name of the two pools (or lanes) that are interchanging messages.
RoleName	The name of the role.
PortType	The port type implemented by the role. Corresponds to the WSDL port type.
Name	Name of the partner link type.
Id	Id of the partner link.

Table 79: PartnerLinkType

7.8.2. Partner Link

Partner link is used in a process and refers to a partner link type. It defines the role the process will play and the role the partner will use. MyRole element defines the role the process is playing and the PartnerRole element defines the role the partner is playing.

```

<xsd:element name="PartnerLink">
  <xsd:complexType>
    <xsd:sequence>
      <xsd:element name="MyRole" minOccurs="0">
        <xsd:complexType>
          <xsd:sequence>
            <xsd:any namespace="##other" processContents="lax" minOccurs="0"
maxOccurs="unbounded"/>
          </xsd:sequence>
          <xsd:attribute name="RoleName" type="xsd:string" use="required"/>
          <xsd:anyAttribute namespace="##other" processContents="lax"/>
        </xsd:complexType>
      </xsd:element>
      <xsd:element name="PartnerRole" minOccurs="0">
        <xsd:complexType>
          <xsd:sequence>
            <xsd:element ref="xpdl:EndPoint"/>
            <xsd:any namespace="##other" processContents="lax" minOccurs="0"
maxOccurs="unbounded"/>
          </xsd:sequence>
          <xsd:attribute name="RoleName" type="xsd:string" use="required"/>
          <xsd:attribute name="ServiceName" type="xsd:string" use="optional"/>
          <xsd:attribute name="PortName" type="xsd:string" use="optional"/>
          <xsd:anyAttribute namespace="##other" processContents="lax"/>
        </xsd:complexType>
      </xsd:element>
      <xsd:any namespace="##other" processContents="lax" minOccurs="0" maxOccurs="unbounded"/>
    </xsd:sequence>
    <xsd:attribute name="name" type="xsd:string" use="required"/>
    <xsd:attribute name="Id" type="xsd:NMTOKEN" use="required"/>
    <xsd:attribute name="PartnerLinkTypeId" type="xsd:NMTOKEN" use="required"/>
    <xsd:anyAttribute namespace="##other" processContents="lax"/>
  </xsd:complexType>
</xsd:element>

<xsd:element name="PartnerLinks">
  <xsd:complexType>
    <xsd:sequence>
      <xsd:element ref="xpdl:PartnerLink" maxOccurs="unbounded"/>
      <xsd:any namespace="##other" processContents="lax" minOccurs="0" maxOccurs="unbounded"/>
    </xsd:sequence>
  </xsd:complexType>

```

```

<xsd:anyAttribute namespace="##other" processContents="lax"/>
</xsd:complexType>
</xsd:element>

```

	Description
MyRole	Defines the role the process is playing in the interaction with the partner.
MyRole RoleName	Must match one of the two roles defined in the partner link type.
PartnerRole	Defines the role the partner is playing in the interaction with this process.
EndPoint	The end point for the partner. It may be the WSDL end point or the partner service listener end point.
PartnerRole RoleName	Must match one of the two roles defined in the partner link type.
ServiceName	The service name implemented by the partner and defined in the WSDL.
PortName	The port name implemented by the partner and defined in the WSDL.
Name	Name of this partner link. It may correspond to the name of the partner link type, but it is not required to be the same.
Id	Id of the partner link.

Table 80: PartnerLink

7.9. Messaging

Messages in XPDL are based on the WSDL model, and so, are not restricted to web services. When modeling and defining messaging they can be defined abstract in which case partner links should be used, or concrete in which case service should be used (see 7.9.6).

7.9.1. Message Flow

A Message Flow is used to show the flow of messages between two entities that are prepared to send and receive them. In BPMN, two separate Pools in the Diagram will represent the two entities. Thus, Message Flow **MUST** connect two Pools, either to the Pools themselves or to Flow Objects within the Pools. They cannot connect two objects within the same Pool.

7.9.2. BPMN Graphics and Semantics for Message Flow

The Message Flow can connect directly to the boundary of a Pool (See Figure below), especially if the Pool does not have any process details within (e.g. is a “Black Box”).

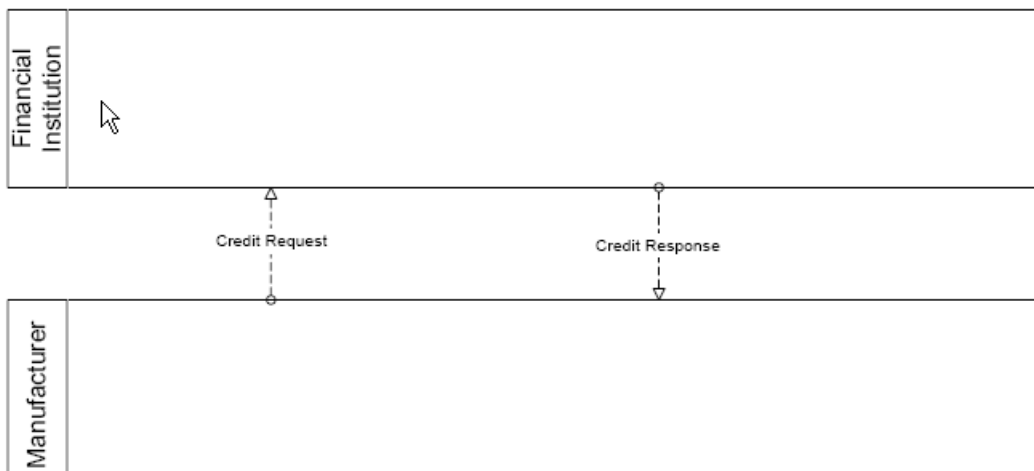


Figure 7.54: Message Flow connecting to the boundaries of two Pools

A Message Flow can also cross the boundary of a Pool and connect to a Flow Object within that Pool (see Figure below).

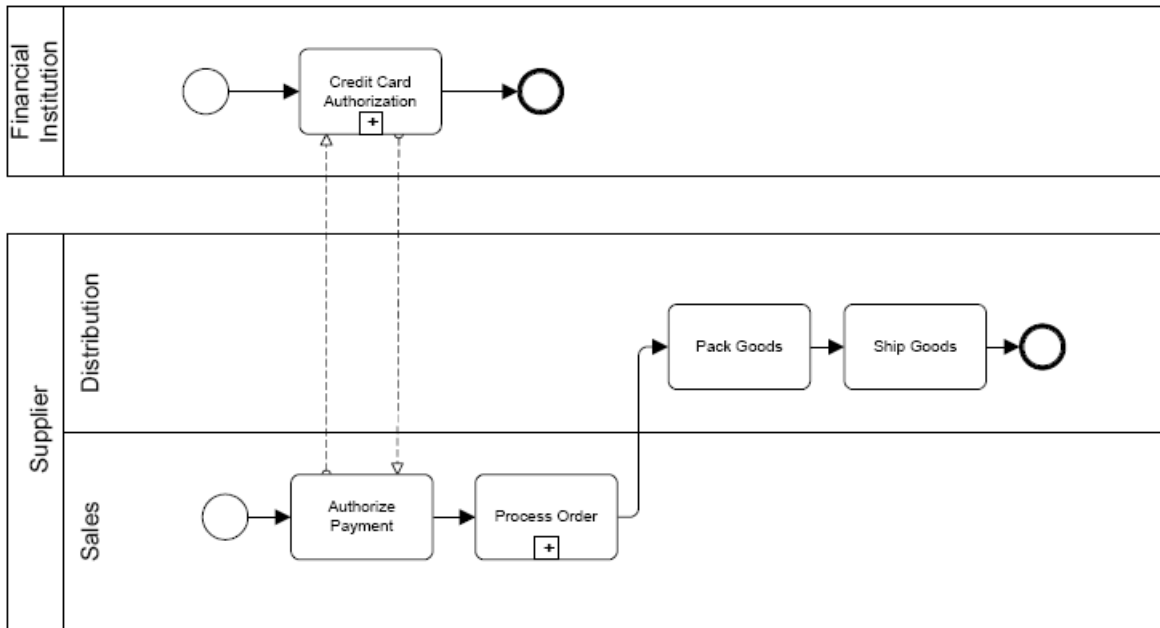


Figure 7.55: Message Flow connecting to Flow Objects within two Pools

If there is an Expanded Sub-Process in one of the Pools, then the message flow can be connected to either the boundary of the Sub-Process or to objects within the Sub-Process.

7.9.3. Schema For Message Flow.

```
<xsd:element name="MessageFlow">
  <xsd:annotation>
    <xsd:documentation>BPMN</xsd:documentation>
  </xsd:annotation>
  <xsd:complexType>
    <xsd:sequence minOccurs="0">
      <xsd:element name="Message" type="xpd:MessageType" minOccurs="0"/>
      <xsd:element ref="xpd:Object" minOccurs="0"/>
      <xsd:element ref="xpd:ConnectorGraphicsInfos" minOccurs="0"/>
      <xsd:any namespace="##other" processContents="lax" minOccurs="0" maxOccurs="unbounded"/>
    </xsd:sequence>
    <xsd:attribute name="Id" type="xsd:NMTOKEN" use="required"/>
    <xsd:attribute name="Name" type="xsd:string" use="optional"/>
    <xsd:attribute name="Source" type="xpd:IdRef" use="required"/>
    <xsd:attribute name="Target" type="xpd:IdRef" use="required"/>
    <xsd:anyAttribute namespace="##other" processContents="lax"/>
  </xsd:complexType>
</xsd:element>

<xsd:element name="MessageFlows">
  <xsd:annotation>
    <xsd:documentation>BPMN</xsd:documentation>
  </xsd:annotation>
  <xsd:complexType>
    <xsd:sequence minOccurs="0" maxOccurs="unbounded">
      <xsd:element ref="xpd:MessageFlow"/>
      <xsd:any namespace="##other" processContents="lax" minOccurs="0" maxOccurs="unbounded"/>
    </xsd:sequence>
    <xsd:anyAttribute namespace="##other" processContents="lax"/>
  </xsd:complexType>
</xsd:element>
```

	Description
--	-------------

	Description
ConnectorGraphicsInfo	See section 7.1.2.4.
Description	Short textual description of the Message.
ExtendedAttributes	Optional extensions to meet individual implementation needs
Source	Determines the source of a MessageFlow (Activity or Pool).
Id	Used to identify the MessageFlow.
Message Editors note: in BPMN1.1 MessageRef	Message is an optional attribute that identifies the Message that is being sent. See section 7.9.4.
Name	Text used to identify the MessageFlow.
Object	See section 7.1.9.4.
Target	Determines the target of a MessageFlow (Activity or Pool).

Table 81: MessageFlow

7.9.4. Message Type

The Message type element is used in the definition of attributes for a Start Event, End Event, Intermediate Event, Task, Message Flow, etc.

```

<xsd:complexType name="MessageType">
  <xsd:annotation>
    <xsd:documentation>Formal Parameters defined by WSDL. Must constraint the parameters to either all in or all out,
    because Message is in a single direction</xsd:documentation>
  </xsd:annotation>
  <xsd:sequence minOccurs="0">
    <xsd:choice minOccurs="0">
      <xsd:element ref="xpd:ActualParameters"/>
      <xsd:element ref="xpd:DataMappings"/>
    </xsd:choice>
    <xsd:any namespace="##other" processContents="lax" minOccurs="0" maxOccurs="unbounded"/>
  </xsd:sequence>
  <xsd:attribute name="Id" type="xsd:NMTOKEN" use="required"/>
  <xsd:attribute name="Name" type="xsd:string" use="optional"/>
  <xsd:attribute name="From" type="xsd:NMTOKEN" use="optional">
    <xsd:annotation>
      <xsd:documentation>This must be the name of a Participant</xsd:documentation>
    </xsd:annotation>
  </xsd:attribute>
  <xsd:attribute name="To" type="xsd:NMTOKEN" use="optional">
    <xsd:annotation>
      <xsd:documentation>This must be the name of a participant</xsd:documentation>
    </xsd:annotation>
  </xsd:attribute>
  <xsd:attribute name="FaultName" type="xsd:NMTOKEN" use="optional"/>
  <xsd:anyAttribute namespace="##other" processContents="lax"/>
</xsd:complexType>

```

	Description
Id	Id of the message.
Name	Text description of the Message.
From	Optional, but if present must be the name of a Participant (see section 7.4.1) /Process.
To	Optional, but if present must be the name of a Participant (see section 7.4.1) /Process.
Actual Parameters	A list of parameters that compose the message. See section 7.1.5.3.
DataMappings	Alternative approach to build the message. See section 7.6.5.4.7.

	Description
FaultName	When the message is an error message (for example an error response to a request), the FaultName corresponds to the fault (exception). See WebServiceFaultCatch to handle the error in the receiving end.

Table 82: Message – attributes

7.9.5. End Point

The end point can be a service (the URL of the listener implementing the service), or a WSDL (the URL of the WSDL location).

```
<xsd:element name="EndPoint">
  <xsd:complexType>
    <xsd:sequence>
      <xsd:element ref="xpd:ExternalReference"/>
      <xsd:any namespace="##other" processContents="lax" minOccurs="0" maxOccurs="unbounded"/>
    </xsd:sequence>
    <xsd:attribute name="EndPointType" use="optional" default="WSDL">
      <xsd:simpleType>
        <xsd:restriction base="xsd:NMTOKEN">
          <xsd:enumeration value="WSDL"/>
          <xsd:enumeration value="Service"/>
        </xsd:restriction>
      </xsd:simpleType>
    </xsd:attribute>
    <xsd:anyAttribute namespace="##other" processContents="lax"/>
  </xsd:complexType>
</xsd:element>
```

	Description				
ExternalReference	The URL of the end point.				
EndPointType	Type of end point: <table border="0"> <tr> <td>WSDL</td><td>When the end point corresponds to the location of a WSDL file.</td></tr> <tr> <td>Service</td><td>When the end point corresponds to the address of a listener implementing the service.</td></tr> </table>	WSDL	When the end point corresponds to the location of a WSDL file.	Service	When the end point corresponds to the address of a listener implementing the service.
WSDL	When the end point corresponds to the location of a WSDL file.				
Service	When the end point corresponds to the address of a listener implementing the service.				

Table 83: End Point

7.9.6. Web ServiceOperation

A web services operation is defined by using a partner link or alternative describing the service.

```
<xsd:element name="WebServiceOperation">
  <xsd:annotation>
    <xsd:documentation>BPMN: If the Implementation is a WebService this is required.</xsd:documentation>
  </xsd:annotation>
  <xsd:complexType>
    <xsd:sequence>
      <xsd:choice>
        <xsd:element name="Partner">
          <xsd:complexType>
            <xsd:sequence>
              <xsd:any namespace="##other" processContents="lax" minOccurs="0"
maxOccurs="unbounded"/>
            </xsd:sequence>
            <xsd:attribute name="PartnerLinkId" type="xsd:NMTOKEN" use="required"/>
            <xsd:attribute name="RoleType" use="required">
              <xsd:simpleType>
                <xsd:restriction base="xsd:NMTOKEN">
                  <xsd:enumeration value="MyRole"/>
                  <xsd:enumeration value="PartnerRole"/>
                </xsd:restriction>
              </xsd:simpleType>
            </xsd:attribute>
          </xsd:complexType>
        </xsd:element>
      </xsd:choice>
    </xsd:sequence>
  </xsd:complexType>
</xsd:element>
```

```

        <xsd:anyAttribute namespace="##other" processContents="lax"/>
      </xsd:complexType>
    </xsd:element>
    <xsd:element name="Service">
      <xsd:complexType>
        <xsd:sequence>
          <xsd:element ref="xpd:EndPoint"/>
          <xsd:any namespace="##other" processContents="lax" minOccurs="0"
maxOccurs="unbounded"/>
        </xsd:sequence>
        <xsd:attribute name="ServiceName" type="xsd:string" use="required"/>
        <xsd:attribute name="PortName" type="xsd:string" use="required"/>
        <xsd:anyAttribute namespace="##other" processContents="lax"/>
      </xsd:complexType>
    </xsd:element>
  </xsd:choice>
  <xsd:any namespace="##other" processContents="lax" minOccurs="0" maxOccurs="unbounded"/>
</xsd:sequence>
<xsd:attribute name="OperationName" type="xsd:string" use="required"/>
<xsd:anyAttribute namespace="##other" processContents="lax"/>
</xsd:complexType>
</xsd:element>

```

	Description
Partner	Included only when a partner link is used to define this operation.
PartnerLinkId	Partner link to be used.
RoleType	The role in the partner link that is being used MyRole Using the process role PartnerRole Using the partner role
OperationName	The name of the operation implemented by the service as it is defined in the WSDL.
Service	Included only when a concrete service operation is being defined.
ServiceName	The name of the service implementing the operation.
PortName	The port name in which the service is implementing the operation.
EndPoint	The end point implementing the service.

Table 84: Web Service Operation

7.9.7. Web Service Fault Catch

Used to catch web services faults and to either execute a block activity or a transition.

```

<xsd:element name="WebServiceFaultCatch">
  <xsd:complexType>
    <xsd:sequence>
      <xsd:element name="Message" type="xpd:MessageType" minOccurs="0"/>
      <xsd:choice>
        <xsd:element ref="xpd:BlockActivity"/>
        <xsd:element ref="xpd:TransitionRef"/>
      </xsd:choice>
      <xsd:any namespace="##other" processContents="lax" minOccurs="0" maxOccurs="unbounded"/>
    </xsd:sequence>
    <xsd:attribute name="FaultName" type="xsd:NMTOKEN" use="optional"/>
    <xsd:anyAttribute namespace="##other" processContents="lax"/>
  </xsd:complexType>
</xsd:element>

```

	Description
Message	Optional message that may contain information about the fault.
BlockActivity	Block activity that will be executed if the WebServiceFaultCatch is activated by a fault.

	Description
TransitionRef	TransitionRef that will be executed if the WebServiceFaultCatch is activated by a fault.
FaultName	Name of the fault that will be caught by this WebServiceFaultCatch. If the name is not provided, then the WebServiceFaultCatch will catch any fault generated by the web service.

Table 85: Web Service Fault Catch

7.9.8. Message Flow Rules

The Table below displays the BPMN modeling objects and shows how these objects can connect to one another through Message Flow. The symbol indicates that the object listed in the row can connect to the object listed in the column. The quantity of connections into and out of an object is subject to various configuration dependencies that are not specified here. Refer to the sections for each individual object for more detailed information on the appropriate connection rules. Note that Message Flow cannot connect to objects that are within the same Pool.






































From\To						
						
						
						
						
						
						

Figure 7.56: Message Flow Connection Rules

Note – Only those objects that can have incoming and/or outgoing Message Flow are shown in the table. Thus, Lane, Gateway, Data Object, and Text Annotation are not listed in the table.

7.10. Association

An Association is used to associate information and Artifacts with Flow Objects. Text and graphical non-Flow Objects can be associated with the Flow Objects and Flow. An Association is also used to show the activities used to compensate for an activity.

An Association is also used to associate Data Objects with other objects. A Data Object is used to show how documents are used throughout a Process. Refer to section 7.1.9.5 for more information on Data Objects.

7.10.1. BPMN Graphics and Semantics

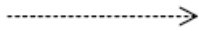
An Association

If there is a reason to put directionality on the association then:

- A line arrowhead MAY be added to the Association line. (see Figure below).

A directional Association is often used with Data Objects to show that a Data Object is either an input to or an output

from an activity.



A directional Association

An Association is used to connect user-defined text (an Annotation) with a Flow Object (see Figure below).

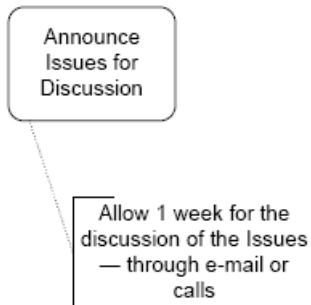


Figure 7.57: An Association of Text Annotation

An Association is also used to associate Data Objects with other objects (see Figure below). A Data Object is used to show how documents are used throughout a Process.

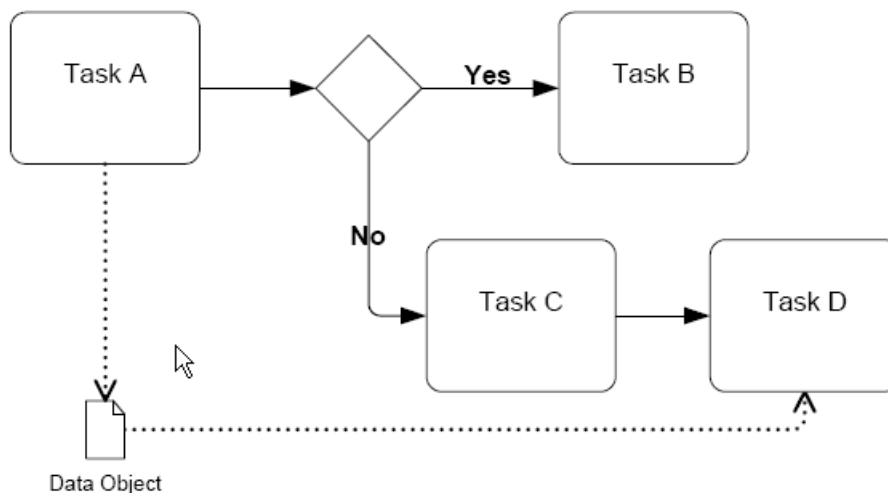


Figure 7.58: An Association connecting a Data Object with a Flow

7.10.2. Schema for Association

```
<xsd:element name="Association">
  <xsd:annotation>
    <xsd:documentation>BPMN</xsd:documentation>
  </xsd:annotation>
  <xsd:complexType>
    <xsd:sequence minOccurs="0">
      <xsd:element ref="xpd:Object"/>
      <xsd:element ref="xpd:ConnectorGraphicsInfos" minOccurs="0"/>
      <xsd:any namespace="##other" processContents="lax" minOccurs="0" maxOccurs="unbounded"/>
    </xsd:sequence>
    <xsd:attribute name="Id" type="xsd:NMTOKEN" use="required"/>
    <xsd:attribute name="Source" type="xsd:NMTOKEN" use="required"/>
    <xsd:attribute name="Target" type="xsd:NMTOKEN" use="required"/>
    <xsd:attribute name="Name" type="xsd:string" use="optional"/>
    <xsd:attribute name="AssociationDirection" use="optional" default="None">
      <xsd:simpleType>
        <xsd:restriction base="xsd:NMTOKEN">
          <xsd:enumeration value="None"/>
        </xsd:restriction>
      </xsd:simpleType>
    </xsd:attribute>
  </xsd:complexType>
</xsd:element>
```

```

        <xsd:enumeration value="To"/>
        <xsd:enumeration value="From"/>
        <xsd:enumeration value="Both"/>
      </xsd:restriction>
    </xsd:simpleType>
  </xsd:attribute>
  <xsd:anyAttribute namespace="##other" processContents="lax"/>
</xsd:complexType>
</xsd:element>

<xsd:element name="Associations">
  <xsd:annotation>
    <xsd:documentation>BPMN</xsd:documentation>
  </xsd:annotation>
  <xsd:complexType>
    <xsd:sequence maxOccurs="unbounded">
      <xsd:element ref="xpd:Association"/>
      <xsd:any namespace="##other" processContents="lax" minOccurs="0" maxOccurs="unbounded"/>
    </xsd:sequence>
    <xsd:anyAttribute namespace="##other" processContents="lax"/>
  </xsd:complexType>
</xsd:element>

```

	Description
Association Direction	None To From Both
Connector Graphics Info	See section 7.1.2.4.
Description	Short textual description of the Association.
Source	Determines the source of an Association (any graphical object).
Id	Used to identify the Association.
Name	Text used to identify the Association.
Object	See section 7.1.9.4.
Target	Determines the target of an Association (any graphical object).

Table 86: Association

7.11. Participants

The Participant is one of the following types: resource set, resource, organizational unit, role, human, or system. A role and a resource are used in the sense of abstract actors. . This definition is an abstraction level between the real performer and the activity, which has to be performed. During run time these abstract definitions are evaluated and assigned to concrete human(s) and/or program(s).

Note that this notion of Participant differs from the BPMN term (see section 7.4.1).

The scope of the identifier of a participant entity declaration in a minimal resource repository or organizational model is the surrounding entity (Process Definition or Process Model Definition) in which it is defined.

An external resource repository or organizational model may contain substantial additional information that complements the basic participant types presented in here.

```

<xsd:element name="Participant">
  <xsd:complexType>
    <xsd:sequence>
      <xsd:element ref="xpd:ParticipantType"/>
      <xsd:element ref="xpd:Description" minOccurs="0"/>
      <xsd:element ref="xpd:ExternalReference" minOccurs="0"/>
      <xsd:element ref="xpd:ExtendedAttributes" minOccurs="0"/>
      <xsd:any namespace="##other" processContents="lax" minOccurs="0" maxOccurs="unbounded"/>
    </xsd:sequence>
    <xsd:attribute name="Id" type="xsd:NMTOKEN" use="required"/>
    <xsd:attribute name="Name" type="xsd:string" use="optional"/>
    <xsd:anyAttribute namespace="##other" processContents="lax"/>
  </xsd:complexType>
</xsd:element>

```

```

    </xsd:complexType>
  </xsd:element>

  <xsd:element name="Participants">
    <xsd:complexType>
      <xsd:sequence>
        <xsd:element ref="xpd:Participant" minOccurs="0" maxOccurs="unbounded"/>
        <xsd:any namespace="##other" processContents="lax" minOccurs="0" maxOccurs="unbounded"/>
      </xsd:sequence>
      <xsd:anyAttribute namespace="##other" processContents="lax"/>
    </xsd:complexType>
  </xsd:element>

```

	Description
Description	Short textual description of a participant.
ExternalReference	A reference to an external specification of a participant. See section 7.1.6.
ExtendedAttributes	Optional extensions to meet individual implementation needs.
Id	Used to identify the participant definition.
Name	Text used to identify a performer.
ParticipantType	Definition of the type of participant entity.

Table 87: Participant

7.11.1. Participant Entity Types

The Participant entity type attribute characterises the participant to be an individual, an organisational unit or an abstract resource such as a machine.

```

<xsd:element name="ParticipantType">
  <xsd:complexType>
    <xsd:sequence>
      <xsd:any namespace="##other" processContents="lax" minOccurs="0" maxOccurs="unbounded"/>
    </xsd:sequence>
    <xsd:attribute name="Type" use="required">
      <xsd:simpleType>
        <xsd:restriction base="xsd:NMTOKEN">
          <xsd:enumeration value="RESOURCE_SET"/>
          <xsd:enumeration value="RESOURCE"/>
          <xsd:enumeration value="ROLE"/>
          <xsd:enumeration value="ORGANIZATIONAL_UNIT"/>
          <xsd:enumeration value="HUMAN"/>
          <xsd:enumeration value="SYSTEM"/>
        </xsd:restriction>
      </xsd:simpleType>
    </xsd:attribute>
    <xsd:anyAttribute namespace="##other" processContents="lax"/>
  </xsd:complexType>
</xsd:element>

```

	Description
--	-------------

	Description
Type	RESOURCE_SET A set of resources.
	RESOURCE A specific resource agent.
	ROLE This type allows performer addressing by a role or skill set. A role in this context is a function a human has within an organization. As a function isn't necessarily unique, a coordinator may be defined (for administrative purposes or in case of exception handling) and a list of humans the role is related to.
	ORGANIZATIONAL_UNIT A department or any other unit within an organizational model.
	HUMAN A human interacting with the system via an application presenting a user interface to the participant.
	SYSTEM An automatic agent.

Table 88: Participant Entity Type

7.12. Relevant data field/Property

Relevant data fields represent the variables of a process or Package Definition. They are typically used to maintain decision data (used in conditions) or reference data values (parameters), which are passed between activities or subflow. This may be differentiated from application data, which is data managed or accessed wholly by the invoked applications and which is not accessible to the process or workflow management system. The relevant data field list defines all data objects which are required by the process. The attribute `Data Type` explicitly specifies all information needed for a process or workflow management system to define an appropriate data object for storing data, which is to be handled by an active instance of the process.

Relevant data field can be defined in a process and in a Package. The scopes differ in that the former may only be accessed by entities defined inside that process, while the latter may be used also e.g. to define the parameters of a process entity.

Where parameters are passed to a called subflow outside the current model definition (e.g. to support remote process invocation) it is the responsibility of the process designer(s) to ensure that data type compatibility exists across the parameter set.

```

<xsd:element name="DataField">
  <xsd:complexType>
    <xsd:sequence>
      <xsd:element ref="xpd:DataType"/>
      <xsd:element name="InitialValue" type="xpd:ExpressionType" minOccurs="0"/>
      <xsd:element ref="xpd:Length" minOccurs="0"/>
      <xsd:element ref="xpd:Description" minOccurs="0"/>
      <xsd:element ref="xpd:ExtendedAttributes" minOccurs="0"/>
      <xsd:any namespace="##other" processContents="lax" minOccurs="0" maxOccurs="unbounded"/>
    </xsd:sequence>
    <xsd:attribute name="Id" type="xsd:NMTOKEN" use="required"/>
    <xsd:attribute name="Name" type="xsd:string" use="optional"/>
    <xsd:attribute name="ReadOnly" type="xsd:boolean" use="optional" default="false"/>
    <xsd:attribute name="IsArray" type="xsd:boolean" use="optional" default="false"/>
    <xsd:attribute name="Correlation" type="xsd:boolean" use="optional" default="false"/>
    <xsd:annotation>
      <xsd:documentation>Used in BPMN to support mapping to BPEL</xsd:documentation>
    </xsd:annotation>
  </xsd:complexType>
</xsd:element>

<xsd:element name="DataFields">
  <xsd:complexType>
    <xsd:sequence>

```

```

        <xsd:element ref="xpd:DataField" minOccurs="0" maxOccurs="unbounded"/>
        <xsd:any namespace="##other" processContents="lax" minOccurs="0" maxOccurs="unbounded"/>
    </xsd:sequence>
    <xsd:anyAttribute namespace="##other" processContents="lax"/>
</xsd:complexType>
</xsd:element>

```

	Description
DataType	Data type of the process variable. See Section 7.13.
Description	Short textual description of the data defined.
ExtendedAttributes	Optional extensions to meet individual implementation needs.
Id	Used to identify the relevant data field.
InitialValue	Pre-assignment of data for run time.
IsArray	Indicates if it is an array.
Length	The length of the data.
Name	Text used to identify the relevant data field.
ReadOnly	The datafield or formal parameter is described as readOnly or as a constant and its value cannot be changed.
Correlation	Used in BPMN mapping to BPEL.

Table 89: Relevant data field

7.13. Data Types

Data types consist of a set of standard types that may be used as part of the data specification of relevant data field, formal parameters, and Processes. You can also declare a new data type within a TypeDeclaration and use it wherever the standard data types are used. A data type may be selected from the following set of types.

```

<xsd:element name="DataType">
  <xsd:complexType>
    <xsd:group ref="xpd:DataTypes"/>
    <xsd:anyAttribute namespace="##other" processContents="lax"/>
  </xsd:complexType>
</xsd:element>

<xsd:group name="DataTypes">
  <xsd:choice>
    <xsd:element ref="xpd:BasicType"/>
    <xsd:element ref="xpd:DeclaredType"/>
    <xsd:element ref="xpd:SchemaType"/>
    <xsd:element ref="xpd:ExternalReference"/>
    <xsd:element ref="xpd:RecordType"/>
    <xsd:element ref="xpd:UnionType"/>
    <xsd:element ref="xpd:EnumerationType"/>
    <xsd:element ref="xpd:ArrayType"/>
    <xsd:element ref="xpd:ListType"/>
  </xsd:choice>
</xsd:group>

```

	Description
ArrayType	A fixed size set of data all of the same data type (deprecated).
BasicType	A simple type: STRING, INTEGER, FLOAT, DATETIME, DATE, TIME, REFERENCE, BOOLEAN, or PERFORMER.
DeclaredType	A reference to a data type declared in a TypeDeclaration element.
EnumerationType	A set of legal values of a variable or parameter (deprecated).

	Description
ExternalReference	A reference to a type defined in an external document. See Section 7.1.6.
ListType	An unbounded set of data all of the same data type (deprecated).
RecordType	A set of members that may be of different types (deprecated).
SchemaType	A data type defined using an XML schema.
UnionType	A set of members only one of which will be used for an instance of the data (deprecated).

Table 90: Standard Data Types

7.13.1. Basic Data Types

```

<xsd:element name="BasicType">
  <xsd:complexType>
    <xsd:sequence>
      <xsd:element ref="xpd:Length" minOccurs="0"/>
      <xsd:element ref="xpd:Precision" minOccurs="0"/>
      <xsd:element ref="xpd:Scale" minOccurs="0"/>
      <xsd:any namespace="##other" processContents="lax" minOccurs="0" maxOccurs="unbounded"/>
    </xsd:sequence>
    <xsd:attribute name="Type" use="required">
      <xsd:simpleType>
        <xsd:restriction base="xsd:NMTOKEN">
          <xsd:enumeration value="STRING"/>
          <xsd:enumeration value="FLOAT"/>
          <xsd:enumeration value="INTEGER"/>
          <xsd:enumeration value="REFERENCE"/>
          <xsd:enumeration value="DATETIME"/>
          <xsd:enumeration value="DATE"/>
          <xsd:enumeration value="TIME"/>
          <xsd:enumeration value="BOOLEAN"/>
          <xsd:enumeration value="PERFORMER"/>
        </xsd:restriction>
      </xsd:simpleType>
    </xsd:attribute>
    <xsd:anyAttribute namespace="##other" processContents="lax"/>
  </xsd:complexType>
</xsd:element>

```

	Description
STRING Type	A finite-length sequence of characters.
FLOAT Type	A floating point or double precision number. The maximum size of the number is not specified in XPDL.
INTEGER Type	A number represented by an optional sign followed by a finite-length sequence of decimal digits. The maximum size of the integer is not specified in XPDL.
REFERENCE Type	A reference to an external data type – now deprecated. The ExternalReference is the recommended way to refer to an external data type.
DATETIME Type	A specific instance of time. The date format is not specified within XPDL.
DATE Type	A specific date instance. This differs from DATETIME in that there is no time component.
TIME Type	A specific time instance. This differs from DATETIME in that there is no date component.
BOOLEAN Type	A data instance of a Boolean type is one having one of the values TRUE or FALSE. The internal representation of these values is not defined in the XPDL.
PERFORMER Type	A data instance of a performer type is one having a value of a declared participant.

Table 91: Basic Data Types

7.13.2. Complex Data Types

XPDL permits the definition of complex data types such as arrays, records, unions, enumerations, and lists. Complex data types are defined using the SchemaType. The RecordType, UnionType, EnumerationType, ArrayType, and ListType, which were used in the past to define complex data, are now deprecated. They have been left in the XPDL schema for compatibility with previous versions.

7.13.2.1. Schema Type

The SchemaType allows users to define a data type using XML schema syntax. It may also be used to define an XML string that should conform to the schema.

```
<xsd:element name="SchemaType">
  <xsd:complexType>
    <xsd:sequence>
      <xsd:any namespace="##other" processContents="lax" minOccurs="0" maxOccurs="unbounded"/>
    </xsd:sequence>
    <xsd:anyAttribute namespace="##other" processContents="lax"/>
  </xsd:complexType>
</xsd:element>
```

The following, for example, could describe a C++ or Java class, a C structure, or an XML string:

```
<SchemaType>
  <schema xmlns="http://www.w3.org/2000/10/XMLSchema">
    <element name="PO">
      <complexType>
        <sequence>
          <element name="CustomerName" type="string"/>
          <element name="Address" type="string"/>
          <element name="OrderNumber" type="string"/>
        </sequence>
      </complexType>
    </element>
  </schema>
</SchemaType>
```

7.13.2.2. Record Type

```
<xsd:element name="RecordType">
  <xsd:complexType>
    <xsd:sequence>
      <xsd:element ref="xpd:Member" maxOccurs="unbounded"/>
      <xsd:any namespace="##other" processContents="lax" minOccurs="0" maxOccurs="unbounded"/>
    </xsd:sequence>
    <xsd:anyAttribute namespace="##other" processContents="lax"/>
  </xsd:complexType>
</xsd:element>

<xsd:element name="Member">
  <xsd:complexType>
    <xsd:group ref="xpd:DataTypes"/>
    <xsd:anyAttribute namespace="##other" processContents="lax"/>
  </xsd:complexType>
</xsd:element>
```

	Description
Member	A field in the record.
DataTypes	Data type of a member. See Table 90: Standard Data Types.

Table 92: Record Type

7.13.2.3. Union Type

```
<xsd:element name="UnionType">
```

```

<xsd:complexType>
  <xsd:sequence>
    <xsd:element ref="xpd:Member" maxOccurs="unbounded"/>
    <xsd:any namespace="##other" processContents="lax" minOccurs="0" maxOccurs="unbounded"/>
  </xsd:sequence>
  <xsd:anyAttribute namespace="##other" processContents="lax"/>
</xsd:complexType>
</xsd:element>

<xsd:element name="Member">
  <xsd:complexType>
    <xsd:group ref="xpd:DataTypes"/>
    <xsd:anyAttribute namespace="##other" processContents="lax"/>
  </xsd:complexType>
</xsd:element>

```

	Description
Member	A field in the union.
DataTypes	Data type of a member. See Table 90: Standard Data Types.

Table 93: Union Type

7.13.2.4.Enumeration Type

```

<xsd:element name="EnumerationType">
  <xsd:complexType>
    <xsd:sequence>
      <xsd:element ref="xpd:EnumerationValue" maxOccurs="unbounded"/>
      <xsd:any namespace="##other" processContents="lax" minOccurs="0" maxOccurs="unbounded"/>
    </xsd:sequence>
    <xsd:anyAttribute namespace="##other" processContents="lax"/>
  </xsd:complexType>
</xsd:element>

<xsd:element name="EnumerationValue">
  <xsd:complexType>
    <xsd:sequence>
      <xsd:any namespace="##other" processContents="lax" minOccurs="0" maxOccurs="unbounded"/>
    </xsd:sequence>
    <xsd:attribute name="Name" type="xsd:NMTOKEN" use="required"/>
    <xsd:anyAttribute namespace="##other" processContents="lax"/>
  </xsd:complexType>
</xsd:element>

```

	Description
Enumeration Value	An element that represents one of the values in an enumeration.
Name	The name of the value.

Table 94: Enumeration Type

7.13.2.5.Array Type

```

<xsd:element name="ArrayType">
  <xsd:complexType>
    <xsd:group ref="xpd:DataTypes"/>
    <xsd:attribute name="LowerIndex" type="xsd:NMTOKEN" use="required"/>
    <xsd:attribute name="UpperIndex" type="xsd:NMTOKEN" use="required"/>
    <xsd:anyAttribute namespace="##other" processContents="lax"/>
  </xsd:complexType>
</xsd:element>

```

	Description
DataTypes	The data type of array entries. See Table 90: Standard Data Types.

	Description
LowerIndex	The lower bound of an ArrayType.
UpperIndex	The upper bound of an ArrayType.

Table 95: Array Type

7.13.2.6.List Type

```

<xsd:element name="ListType">
  <xsd:complexType>
    <xsd:group ref="xpdl:DataTypes"/>
    <xsd:anyAttribute namespace="##other" processContents="lax"/>
  </xsd:complexType>
</xsd:element>

```

	Description
DataTypes	The data type of list entries. See Table 90: Standard Data Types.

Table 96: List Type

7.13.3. Declared Data Types

It is possible to reuse a complex data definition wherever you can use a standard XPDL type. Define the data type under a TypeDeclaration and then refer to it using the DeclaredType data type.

7.13.3.1.Type Declaration

```

<xsd:element name="TypeDeclaration">
  <xsd:complexType>
    <xsd:sequence>
      <xsd:group ref="xpdl:DataTypes"/>
      <xsd:element ref="xpdl:Description" minOccurs="0"/>
      <xsd:element ref="xpdl:ExtendedAttributes" minOccurs="0"/>
      <xsd:any namespace="##other" processContents="lax" minOccurs="0" maxOccurs="unbounded"/>
    </xsd:sequence>
    <xsd:attribute name="Id" type="xsd:ID" use="required"/>
    <xsd:attribute name="Name" type="xsd:string" use="optional"/>
    <xsd:anyAttribute namespace="##other" processContents="lax"/>
  </xsd:complexType>
</xsd:element>

<xsd:element name="TypeDeclarations">
  <xsd:complexType>
    <xsd:sequence>
      <xsd:element ref="xpdl:TypeDeclaration" minOccurs="0" maxOccurs="unbounded"/>
      <xsd:any namespace="##other" processContents="lax" minOccurs="0" maxOccurs="unbounded"/>
    </xsd:sequence>
    <xsd:anyAttribute namespace="##other" processContents="lax"/>
  </xsd:complexType>
</xsd:element>

```

	Description
DataTypes	The data type. See Table 90: Standard Data Types.
Description	An informal description of the data type.
ExtendedAttributes	Optional extensions to meet individual implementation needs.
Id	An identifier for the TypeDeclaration.
Name	The name of the TypeDeclaration.

Table 97: Type Declaration

Example to reuse a SchemaType to define a purchase order:

```
<TypeDeclarations>
  <TypeDeclaration Id="POType" Name="PurchaseOrder">
    <SchemaType>
      <schema xmlns="http://www.w3.org/2000/10/XMLSchema">
        <element name="PO">
          <complexType>
            <sequence>
              <element name="CustomerName" type="string"/>
              <element name="Address" type="string"/>
              <element name="OrderNumber" type="string"/>
            </sequence>
          </complexType>
        </element>
      </schema>
    </SchemaType>
  </TypeDeclaration>
</TypeDeclarations>
```

7.13.3.2.Declared Type

```
<xsd:element name="DeclaredType">
  <xsd:complexType>
    <xsd:sequence>
      <xsd:any namespace="##other" processContents="lax" minOccurs="0" maxOccurs="unbounded"/>
    </xsd:sequence>
    <xsd:attribute name="Id" type="xsd:IDREF" use="required"/>
    <xsd:attribute name="Name" type="xsd:string" use="optional"/>
    <xsd:anyAttribute namespace="##other" processContents="lax"/>
  </xsd:complexType>
</xsd:element>
```

	Description
Id	A reference to a data type declared in a TypeDeclaration.
Name	A name for the declared type

Table 98: Declared Data Type

Example of using the DeclaredType type to define a number of POType variables.

```
<DataFields>
  <DataField Id="newPO">
    <DataType>
      <DeclaredType Id="POType"/>
    </DataType>
  </DataField>
  <DataField Id="checkedPO">
    <DataType>
      <DeclaredType Id="POType"/>
    </DataType>
  </DataField>
</DataFields>
```

8. Samples

8.1. Sample Process

This sample process was created to illustrate some of the features of XPDL and does not represent any real processes or necessarily the best way to accomplish the process. The XPDL in the example was generated by an Open Source Java Application that was created by Global 360/CapeVisions and edited to incorporate unsupported features and improve readability.

The process represents an order entry system in which an order enters the system as a formatted string. The Package is composed of a main process and two subprocesses. The following discussion includes a brief overview of these processes along with a discussion of some of the data types, extended attributes, and external references used in the sample. Finally the XPDL is displayed.

8.1.1. The Processes

8.1.1.1. The EOrder Main Process

The main process takes a formatted string as an input and returns a string that indicates whether the order was confirmed or rejected. It contains the following steps:

- The string is first converted to a complex data object. If an exception is caught (indicating that the string is incorrectly formatted), an alarm is raised and the order is rejected.
- The data is checked for accuracy.
- The process determines whether payment is via a purchase order or a credit card.
- Credit card orders are sent to a subprocess that authorizes the credit purchase.
- Purchase orders are validated by an application that checks the vendor's record and authorizes the purchase amount.
- The order is entered into the database and an order number is issued.
- The next three activities happen in parallel:
 - An acceptance message is composed to return to the end user.
 - A subprocess is invoked asynchronously to fill the order.
 - An order confirmation email is sent to the end user. This activity is a special activity that is managed by the system. It uses ExtendedAttributes to specify the information the system needs for the email.
- If an order is rejected, either because it is inaccurate or cannot obtain authorization, a rejection message is composed, to return to the customer.

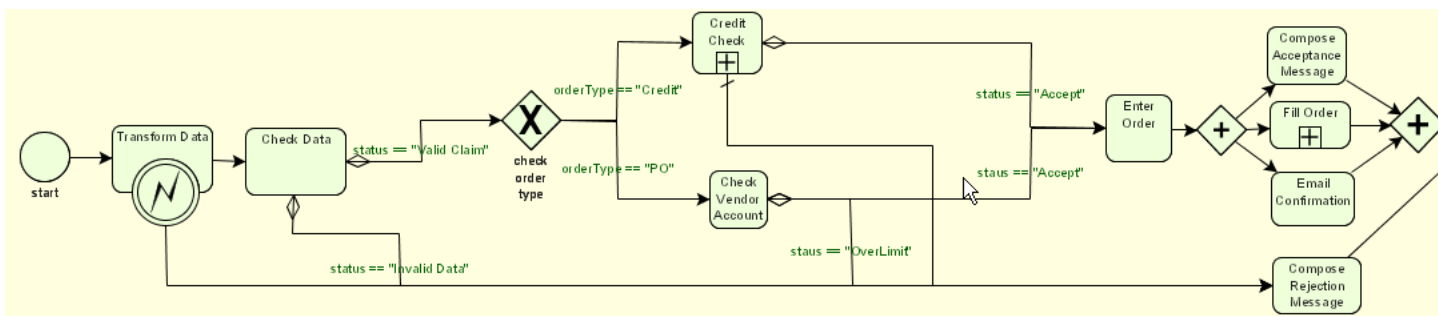


Figure 8.1: EOrder Main Process

8.1.1.2. The CreditCheck Subprocess

The CreditCheck subprocess sets up a CreditInfo object from the input parameters and then sends the information to a credit card web service for authorization. The web service returns a status string that is converted to an OrderStatus string and returned to the calling process.



Figure 8.2: CreditCheck Subprocess

8.1.1.3. The FillOrder Subprocess

This subprocess handles the shipping and billing of the order. This process includes a participant called a “Shipper”

- The first activity displays the order information to a Shipper who ships the items in the order and records the status of the line items. The application returns the status of the order -- whether it is complete or backordered. This activity includes some deadlines. If the activity is not completed within 3 days, a notifyException is thrown an alarm is raised. If the activity is still not completed within 5 days, a timeoutException is thrown and the order is canceled.
- The process then determines if it is a PO or credit order.
- PO orders are sent to the billing system and then an electronic invoice is created and stored on a server.
- Credit card orders are sent to the credit card web service for charging and then an electronic receipt is created and stored on a server.
- The last step sends the invoice or receipt to the customer as an attachment to an email message. It uses ExtendedAttributes to specify the information needed for the email.

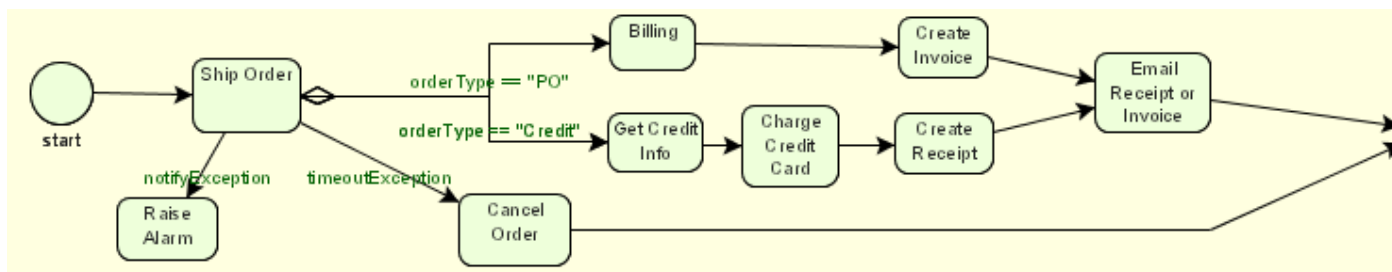


Figure 8.3: FillOrder Subprocess

8.1.2. Type Declarations

A number of data types are defined for the process.

- An Order is defined in a separate schema document and declared using an ExternalReference.

```

<TypeDeclaration Id="Order" Name="Order">
  <ExternalReference location="http://wfmc.org/standards/docs/xpdl_sample/orderschema.xsd"/>
</TypeDeclaration>
  
```

The schema is:

```

<?xml version="1.0" encoding="UTF-8"?>
<xsd:schema xmlns:xsd="http://www.w3.org/2001/XMLSchema" elementFormDefault="qualified" attributeFormDefault="unqualified">
  <xsd:element name="Order">
    <xsd:complexType>
  
```

```

<xsd:sequence>
  <xsd:element name="Items">
    <xsd:complexType>
      <xsd:sequence>
        <xsd:element name="Item" maxOccurs="unbounded">
          <xsd:complexType>
            <xsd:attribute name="itemNumber"
              type="xsd:integer" use="required"/>
            <xsd:attribute name="itemQty"
              type="xsd:integer" use="required"/>
          </xsd:complexType>
        </xsd:element>
      </xsd:sequence>
    </xsd:complexType>
  </xsd:element>
  <xsd:attribute name="accountNumber" type="xsd:integer" use="required"/>
  <xsd:attribute name="totalAmount" type="xsd:float" use="required"/>
  <xsd:attribute name="emailAddress" type="xsd:string" use="required"/>
  <xsd:attribute name="orderType" use="required">
    <xsd:simpleType>
      <xsd:restriction base="xsd:NMTOKEN">
        <xsd:enumeration value="PO"/>
        <xsd:enumeration value="Credit"/>
      </xsd:restriction>
    </xsd:simpleType>
  </xsd:attribute>
  <xsd:attribute name="cardType" use="required">
    <xsd:simpleType>
      <xsd:restriction base="xsd:NMTOKEN">
        <xsd:enumeration value="MC-VISA"/>
        <xsd:enumeration value="Discover"/>
        <xsd:enumeration value="AMEX"/>
      </xsd:restriction>
    </xsd:simpleType>
  </xsd:attribute>
</xsd:complexType>
</xsd:element>
</xsd:schema>

```

- An OrderStatus is directly defined using a SchemaType. It uses an XML schema to enumerate the valid strings that can represent the status.

```

<TypeDeclaration Id="OrderStatus" Name="OrderStatus">
  <SchemaType>
    <xsd:schema xmlns:xsd="http://www.w3.org/2001/XMLSchema"
      elementFormDefault="qualified" attributeFormDefault="unqualified">
      <xsd:element name="Status">
        <xsd:simpleType>
          <xsd:restriction base="xsd:NMTOKEN">
            <xsd:enumeration value="ValidData"/>
            <xsd:enumeration value="InvalidData"/>
            <xsd:enumeration value="Accept"/>
            <xsd:enumeration value="BadCredit"/>
            <xsd:enumeration value="OverLimit"/>
            <xsd:enumeration value="BadDataFormat"/>
          </xsd:restriction>
        </xsd:simpleType>
      </xsd:element>
    </xsd:schema>
  </SchemaType>
</TypeDeclaration>

```

- A CardType type uses an ExternalReference to the cardType attribute within the Order schema.

```

<TypeDeclaration Id="CardType" Name="CardType">
  <ExternalReference location="http://wfmc.org/standards/docs/xpdl_sample/orderschema.xsd" xref="cardType"
    namespace="orderschema/Order"/>
</TypeDeclaration>

```


- A CreditInfo type uses an ExternalReference to a data type defined within a WSDL document.

```
<TypeDeclaration Id="CreditInfo" Name="CreditInfo">
  <ExternalReference location="http://wfmc.org/standards/docs/xpdl_sample/creditService.wsdl" xref="CreditInfo"/>
</TypeDeclaration>
```

Within the WSDL document, the type is defined as follows:

```
<types>
  <schema xmlns="http://www.w3.org/2001/XMLSchema">
    <element name="CreditInfo">
      <complexType>
        <sequence>
          <element name="MerchantNumber"/>
          <element name="AccountNumber"/>
          <element name="Amount"/>
          <element name="CardType"/>
        </sequence>
      </complexType>
    </element>
  </schema>
</types>
```

8.1.3. ExtendedAttributes

The process vendor defines several ExtendedAttributes to extend XPDL. The namespace, `xmlns:xyz="http://www.xyzeorder.com/workflow"`, is designated for the ExtendedAttribute XML.

- There is an ExtendedAttribute to mark an activity as a SystemActivity, or one implemented by the process or workflow system. Three activities in the sample are so marked: email activities, alarm activities, and web service activities.
- ```
<ExtendedAttribute Name="SystemActivity" Value="WebService"/>
<ExtendedAttribute Name="SystemActivity" Value="Email"/>
<ExtendedAttribute Name="SystemActivity" Value="Alarm"/>
```
- There is an ExtendedAttribute to provide information for the email activity. It should be assumed that some of this information is supplied in the process modeling tool.

```
<ExtendedAttribute Name="Email">
 <xyz:Email to="emailAddress" subject="orderStatus">
 <xyz:Attachments>
 <xyz:Attachment>%% docURI</xyz:Attachment>
 </xyz:Attachments>
 <xyz:MessageText>Order number %%orderNumber is %%orderStatus. Thank-you for ordering from PQR Products, Inc.</xyz:MessageText>
 </xyz:Email>
</ExtendedAttribute>
```

### 8.1.4. External References

The sample process makes an external reference to a WSDL document, `creditService.wsdl`, to define the applications used for processing a credit card purchase. (Section 8.1.2 illustrates the use of the ExternalReference element to import data types from external documents.)

```
<Application Id="getCreditAuthorization">
 <ExternalReference location="http://wfmc.org/standards/docs/xpdl_sample/creditService.wsdl" xref="GetCreditAuthorization"/>
</Application>
```

Within the WSDL document the applications are defined as operations:

```
<message name="creditInput">
 <part name="CreditInfo" element="tns:CreditInfo"/>
</message>
<message name="creditOutput">
 <part name="status" type="string"/>
</message>
<portType name="CreditPortType">
 <operation name="GetCreditAuthorization">
 <input message="tns:creditInput"/>
 <output message="tns:creditOutput"/>
 </operation>
 <operation name="ChargeCreditAccount">
 <input message="tns:creditInput"/>
 <output message="tns:creditOutput"/>
 </operation>
</portType>
```

### 8.1.5. Sample XPDL

*Please note this was generated by an XPDL 2.0 tool and does not reflect any changes in XPDL 2.1.*

```
<?xml version="1.0" encoding="UTF-8"?>
<!-- edited with XML Spy v4.0 U (http://www.xmlspy.com) by Robert M Shapiro (Cape Visions) -->
<Package xmlns:xyz="http://www.xyzeorder.com/workflow" Id="1" Name="sample process" xmlns:deprecated="http://www.wfmc.org/2002/XPD1.0"
xmlns="http://www.wfmc.org/2004/XPD2.0alpha" xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
xsi:schemaLocation="http://www.wfmc.org/2004/XPD2.0alpha
```

```
C:\DOCUME~1\ROBERT~1\MYDOCU~1\capevisions\bpnm\schema\bpnmxpdl_20.xsd">
<PackageHeader>
 <XPDLVersion>2.0</XPDLVersion>
 <Vendor>Global 360</Vendor>
 <Created>06/04/2005 14:50:58 PM</Created>
</PackageHeader>
<ConformanceClass GraphConformance="NON_BLOCKED"/>
<Script Type="text/javascript"/>
<TypeDeclarations>
 <TypeDeclaration Id="Order" Name="Order">
 <ExternalReference location="http://wfmc.org/standards/docs/xpdl_sample/orderschema.xsd"/>
 </TypeDeclaration>
 <TypeDeclaration Id="OrderStatus" Name="OrderStatus">
 <SchemaType>
 <xsd:schema xmlns:xsd="http://www.w3.org/2001/XMLSchema" elementFormDefault="qualified" attributeFormDefault="unqualified">
 <xsd:element name="Status">
 <xsd:simpleType>
 <xsd:restriction base="xsd:NMTOKEN">
 <xsd:enumeration value="ValidData"/>
 <xsd:enumeration value="InvalidData"/>
 <xsd:enumeration value="Accept"/>
 <xsd:enumeration value="BadCredit"/>
 <xsd:enumeration value="OverLimit"/>
 <xsd:enumeration value="BadDataFormat"/>
 </xsd:restriction>
 </xsd:simpleType>
 </xsd:element>
 </xsd:schema>
 </SchemaType>
 </TypeDeclaration>
 <TypeDeclaration Id="CardType" Name="CardType">
 <ExternalReference location="http://wfmc.org/standards/docs/xpdl_sample/orderschema.xsd" xref="cardType" namespace="orderschema/Order"/>
 </TypeDeclaration>
 <TypeDeclaration Id="CreditInfo" Name="CreditInfo">
 <ExternalReference location="http://wfmc.org/standards/docs/xpdl_sample/creditService.wsdl" xref="CreditInfo"/>
 </TypeDeclaration>
</TypeDeclarations>
<Participants>
 <Participant Id="DBConnection">
 <ParticipantType Type="SYSTEM"/>
 <Description>Reference to Database Resource</Description>
 </Participant>
</Participants>
<Pools>
 <Pool Process="1" Id="2" BoundaryVisible="false">
 <Lanes>
 <NodeGraphicsInfos>
 <NodeGraphicsInfo Page="1"/>
 </NodeGraphicsInfos>
 </Pool>
 <Pool Process="2" Id="3" Name="" BoundaryVisible="true">
 <Lanes>
 <Lane Id="0" Name="Lane-0" ParentLane="3">
 <NodeGraphicsInfos>
 <NodeGraphicsInfo Page="1" Width="1176.0" Height="239.0" BorderColor="-16777216" FillColor="-32">
 <Coordinates XCoordinate="22.0" YCoordinate="4.0"/>
 </NodeGraphicsInfo>
 </NodeGraphicsInfos>
 </Lane>
 </Lanes>
 <NodeGraphicsInfos>
 <NodeGraphicsInfo Page="1" Width="1200.0" Height="247.0" BorderColor="-16777216" FillColor="-32">
 <Coordinates XCoordinate="0.0" YCoordinate="0.0"/>
 </NodeGraphicsInfo>
 </NodeGraphicsInfos>
 </Pool>
 <Pool Process="3" Id="5" Name="" BoundaryVisible="true">
 <Lanes>
 <Lane Id="1" Name="Lane-1" ParentLane="5">
 <NodeGraphicsInfos>
 <NodeGraphicsInfo Page="1" Width="1176.0" Height="80.0" BorderColor="-16777216" FillColor="-32">
 <Coordinates XCoordinate="22.0" YCoordinate="252.0"/>
 </NodeGraphicsInfo>
 </NodeGraphicsInfos>
 </Lane>
 </Lanes>
 <NodeGraphicsInfos>
 <NodeGraphicsInfo Page="1" Width="1200.0" Height="88.0" BorderColor="-16777216" FillColor="-32">
 <Coordinates XCoordinate="0.0" YCoordinate="248.0"/>
 </NodeGraphicsInfo>
 </NodeGraphicsInfos>
 </Pool>
 <Pool Process="4" Id="7" Name="" BoundaryVisible="true">
 <Lanes>
 <Lane Id="2" Name="Lane-2" ParentLane="7">
 <NodeGraphicsInfos>
 <NodeGraphicsInfo Page="1" Width="1176.0" Height="156.0" BorderColor="-16777216" FillColor="-32">
 <Coordinates XCoordinate="22.0" YCoordinate="342.0"/>
 </NodeGraphicsInfo>
 </NodeGraphicsInfos>
 </Lane>
 </Lanes>
```

```

 <NodeGraphicsInfos>
 <NodeGraphicsInfo Page="1" Width="1200.0" Height="164.0" BorderColor="-16777216" FillColor="-32">
 <Coordinates XCoordinate="0.0" YCoordinate="338.0"/>
 </NodeGraphicsInfo>
 </NodeGraphicsInfos>
 </Pool>
</Pools>
<WorkflowProcesses>
 <WorkflowProcess Id="2" Name="EORDER">
 <ProcessHeader/>
 <FormalParameters>
 <FormalParameter Id="orderString" Mode="IN">
 <DataType>
 <BasicType Type="STRING"/>
 </DataType>
 </FormalParameter>
 <FormalParameter Id="returnMessage" Mode="OUT">
 <DataType>
 <BasicType Type="STRING"/>
 </DataType>
 </FormalParameter>
 </FormalParameters>
 <Applications>
 <Application Id="transformData">
 <FormalParameters>
 <FormalParameter Id="orderStringIn" Mode="IN">
 <DataType>
 <BasicType Type="STRING"/>
 </DataType>
 </FormalParameter>
 <FormalParameter Id="orderInfo" Mode="OUT">
 <DataType>
 <DeclaredType Id="Order"/>
 </DataType>
 </FormalParameter>
 </FormalParameters>
 </Application>
 <Application Id="checkData">
 <FormalParameters>
 <FormalParameter Id="orderInfo" Mode="IN">
 <DataType>
 <DeclaredType Id="Order"/>
 </DataType>
 </FormalParameter>
 <FormalParameter Id="statusOut" Mode="OUT">
 <DataType>
 <DeclaredType Id="OrderStatus"/>
 </DataType>
 </FormalParameter>
 </FormalParameters>
 </Application>
 <Application Id="checkVendor">
 <FormalParameters>
 <FormalParameter Id="accountNumberIn" Mode="IN">
 <DataType>
 <BasicType Type="INTEGER"/>
 </DataType>
 </FormalParameter>
 <FormalParameter Id="amountIn" Mode="IN">
 <DataType>
 <BasicType Type="FLOAT"/>
 </DataType>
 </FormalParameter>
 <FormalParameter Id="statusOut" Mode="OUT">
 <DataType>
 <DeclaredType Id="OrderStatus"/>
 </DataType>
 </FormalParameter>
 </FormalParameters>
 </Application>
 <Application Id="enterOrder">
 <FormalParameters>
 <FormalParameter Id="orderInfoIn" Mode="IN">
 <DataType>
 <DeclaredType Id="Order"/>
 </DataType>
 </FormalParameter>
 <FormalParameter Id="orderNumber" Mode="OUT">
 <DataType>
 <BasicType Type="INTEGER"/>
 </DataType>
 </FormalParameter>
 </FormalParameters>
 </Application>
 <Application Id="composeMessage">
 <FormalParameters>
 <FormalParameter Id="statusIn" Mode="IN">
 <DataType>
 <DeclaredType Id="OrderStatus"/>
 </DataType>
 </FormalParameter>
 <FormalParameter Id="orderNumber" Mode="IN">

```

```

 <DataType>
 <BasicType Type="INTEGER"/>
 </DataType>
 </FormalParameter>
</FormalParameters>
</Application>
</Applications>
<DataFields>
 <DataField Id="1" Name="orderNumber" IsArray="FALSE">
 <DataType>
 <BasicType Type="INTEGER"/>
 </DataType>
 <Length>0</Length>
 <Description/>
 </DataField>
 <DataField Id="3" Name="status" IsArray="FALSE">
 <DataType>
 <BasicType Type="STRING"/>
 </DataType>
 <Length>0</Length>
 <Description/>
 </DataField>
 <DataField Id="4" Name="orderInfo" IsArray="FALSE">
 <DataType>
 <BasicType Type="STRING"/>
 </DataType>
 <Length>0</Length>
 <Description/>
 </DataField>
</DataFields>
<ActivitySets/>
<Activities>
 <Activity Id="10" Name="Transform Data">
 <Implementation>
 <Task>
 <TaskApplication Id="transformData">
 <ActualParameters>
 <ActualParameter>orderString</ActualParameter>
 <ActualParameter>orderInfo</ActualParameter>
 </ActualParameters>
 </TaskApplication>
 </Task>
 </Implementation>
 </Activity>
 <NodeGraphicsInfos>
 <NodeGraphicsInfo Page="1" LaneId="0" Width="75.0" Height="50.0" BorderColor="-16777216" FillColor="-1114150">
 <Coordinates XCoordinate="128.0" YCoordinate="96.0"/>
 </NodeGraphicsInfo>
 </NodeGraphicsInfos>
 <Activity Id="12" Name="Check Data">
 <Implementation>
 <Task>
 <TaskApplication Id="checkData">
 <ActualParameters>
 <ActualParameter>orderInfo</ActualParameter>
 <ActualParameter>status</ActualParameter>
 </ActualParameters>
 </TaskApplication>
 </Task>
 </Implementation>
 <TransitionRestrictions>
 <TransitionRestriction>
 <Split Type="XOR">
 <TransitionRefs>
 <TransitionRef Id="17"/>
 <TransitionRef Id="23"/>
 </TransitionRefs>
 </Split>
 </TransitionRestriction>
 </TransitionRestrictions>
 </Activity>
 <NodeGraphicsInfos>
 <NodeGraphicsInfo Page="1" LaneId="0" Width="75.0" Height="50.0" BorderColor="-16777216" FillColor="-1114150">
 <Coordinates XCoordinate="228.0" YCoordinate="98.0"/>
 </NodeGraphicsInfo>
 </NodeGraphicsInfos>
 <Activity Id="13" Name="check order type">
 <Route GatewayType="XOR" MarkerVisible="true"/>
 <TransitionRestrictions>
 <TransitionRestriction>
 <Split Type="XOR">
 <TransitionRefs>
 <TransitionRef Id="18"/>
 <TransitionRef Id="20"/>
 </TransitionRefs>
 </Split>
 </TransitionRestriction>
 </TransitionRestrictions>
 </Activity>
 <NodeGraphicsInfos>
 <NodeGraphicsInfo Page="1" LaneId="0" Width="44.0" Height="44.0" BorderColor="-16777216" FillColor="-1114150">
 <Coordinates XCoordinate="420.0" YCoordinate="70.0"/>
 </NodeGraphicsInfo>
 </NodeGraphicsInfos>

```

```

</NodeGraphicsInfos>
</Activity>
<Activity Id="14" Name="Check Vendor Account">
 <Implementation>
 <Task>
 <TaskApplication Id="checkVendor">
 <ActualParameters>
 <ActualParameter>orderInfo.AccountNumber</ActualParameter>
 <ActualParameter>orderInfo.TotalAmount</ActualParameter>
 <ActualParameter>status</ActualParameter>
 </ActualParameters>
 </TaskApplication>
 </Task>
 </Implementation>
 <TransitionRestrictions>
 <TransitionRestriction>
 <Split Type="XOR">
 <TransitionRefs>
 <TransitionRef Id="24"/>
 <TransitionRef Id="28"/>
 </TransitionRefs>
 </Split>
 </TransitionRestriction>
 </TransitionRestrictions>
</NodeGraphicsInfos>
<NodeGraphicsInfo Page="1" LaneId="0" Width="43.0" Height="43.0" BorderColor="-16777216" FillColor="-1114150">
 <Coordinates XCoordinate="576.0" YCoordinate="130.0"/>
</NodeGraphicsInfo>
</NodeGraphicsInfos>
</Activity>
<Activity Id="19" Name="Credit Check">
 <Implementation>
 <SubFlow Id="3" Execution="SYNCHR">
 <ActualParameters>
 <ActualParameter>orderInfo.accountNumber</ActualParameter>
 <ActualParameter>orderInfo.cardType</ActualParameter>
 <ActualParameter>orderInfo.emailAddress</ActualParameter>
 <ActualParameter>status</ActualParameter>
 </ActualParameters>
 </SubFlow>
 </Implementation>
 <TransitionRestrictions>
 <TransitionRestriction>
 <Split Type="XOR">
 <TransitionRefs>
 <TransitionRef Id="27"/>
 <TransitionRef Id="25"/>
 </TransitionRefs>
 </Split>
 </TransitionRestriction>
 </TransitionRestrictions>
</NodeGraphicsInfos>
<NodeGraphicsInfo Page="1" LaneId="0" Width="52.0" Height="46.0" BorderColor="-16777216" FillColor="-1114150">
 <Coordinates XCoordinate="563.0" YCoordinate="11.0"/>
</NodeGraphicsInfo>
</NodeGraphicsInfos>
</Activity>
<Activity Id="21" Name="Compose Rejection Message">
 <Implementation>
 <Task>
 <TaskApplication Id="composeMessage">
 <ActualParameters>
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 <ActualParameter>orderInfo.emailAddress</ActualParameter>
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 <Implementation>
 <No/>
 </Implementation>
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 <ExtendedAttribute Name="SystemActivity" Value="Email"/>
 <ExtendedAttribute Name="Email">
 <xyz:Email to="orderInfo.emailAddress" subject="Order orderNumber">
 <xyz:MessageText>Order number orderNumber is being processed.
 Thank-you for ordering from PQR Products, Inc</xyz:MessageText>
 </xyz:Email>
 </ExtendedAttribute>
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 <Coordinates XCoordinate="203.5" YCoordinate="122.82308197021484"/>
 <Coordinates XCoordinate="228.5" YCoordinate="123.2227783203125"/>
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 <Condition Type="CONDITION">orderType == "Credit"</Condition>
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 <Coordinates XCoordinate="464.1615295410156" YCoordinate="92.83846282958984"/>
 <Coordinates XCoordinate="506.0" YCoordinate="93.0"/>
 <Coordinates XCoordinate="507.0" YCoordinate="93.0"/>
 <Coordinates XCoordinate="563.5" YCoordinate="32.13414764404297"/>
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 <Transition Id="18" Name="" From="13" To="14">
 <Condition Type="CONDITION">orderType == "PO"</Condition>
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 <Coordinates XCoordinate="507.0" YCoordinate="151.0"/>
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 <Condition Type="CONDITION">staus == "Accept"</Condition>
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 <Coordinates XCoordinate="619.450927734375" YCoordinate="151.95091247558594"/>
 <Coordinates XCoordinate="816.0" YCoordinate="151.0"/>
 <Coordinates XCoordinate="817.0" YCoordinate="98.0"/>
 <Coordinates XCoordinate="853.5" YCoordinate="96.11983489990234"/>
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 <Transition Id="24" Name="" From="14" To="21">
 <Condition Type="CONDITION">staus == "OverLimit"</Condition>
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 <ConnectorGraphicsInfo Page="1" BorderColor="-16777216" FillColor="-1114150">
 <Coordinates XCoordinate="619.3720092773438" YCoordinate="151.8720245361328"/>
 <Coordinates XCoordinate="681.0" YCoordinate="151.0"/>
 <Coordinates XCoordinate="683.0" YCoordinate="216.0"/>
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 <Condition Type="OTHERWISE"/>
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 <Coordinates XCoordinate="939.65673828125" YCoordinate="97.15673828125"/>
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 <Coordinates XCoordinate="998.5" YCoordinate="216.5"/>
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</Transition>
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 </ConnectorGraphicsInfos>
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 <Coordinates XCoordinate="343.0" YCoordinate="177.0"/>
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 <Coordinates XCoordinate="873.5" YCoordinate="98.19938659667969"/>
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 <DataType>
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 </FormalParameter>
 <FormalParameter Id="amount" Mode="IN">
 <DataType>
 <BasicType Type="FLOAT"/>
 </DataType>
 </FormalParameter>
 <FormalParameter Id="cardType" Mode="IN">
 <DataType>
 <DeclaredType Id="CardType"/>
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 <FormalParameter Id="status" Mode="OUT">
 <DataType>
 <DeclaredType Id="OrderStatus"/>
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 </FormalParameter>
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 <Applications>
 <Application Id="setCreditInfo">
 <Description>Creates and initializes a CreditInfo object.</Description>
 <FormalParameters>
 <FormalParameter Id="accountNumber" Mode="IN">
 <DataType>
 <BasicType Type="INTEGER"/>
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 </FormalParameter>
 <FormalParameter Id="amount" Mode="IN">
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 <FormalParameter Id="cardType" Mode="IN">
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 <FormalParameter Id="creditInfo" Mode="OUT">
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 </FormalParameter>
 </FormalParameters>
 </Application>
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</WorkflowProcess>

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</Application>
<Application Id="getCreditAuthorization">
 <Description>Gets credit authorization from a charge card web service.</Description>
 <ExternalReference location="http://wfmc.org/standards/docs/xpdl_sample/creditService.wsdl" xref="GetCreditAuthorization"/>
</Application>
<Application Id="setOrderStatus">
 <Description>Converts status returned by credit check to OrderStatus.</Description>
 <FormalParameters>
 <FormalParameter Id="creditStatus" Mode="IN">
 <DataType>
 <BasicType Type="STRING"/>
 </DataType>
 </FormalParameter>
 <FormalParameter Id="orderStatus" Mode="OUT">
 <DataType>
 <DeclaredType Id="OrderStatus"/>
 </DataType>
 </FormalParameter>
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</Application>
</Applications>
<DataFields>
 <DataField Id="creditStatus" IsArray="FALSE">
 <DataType>
 <BasicType Type="STRING"/>
 </DataType>
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<Activities>
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 <Activity Id="53" Name="Set Credit Info">
 <Implementation>
 <Task>
 <TaskApplication Id="setCreditInfo">
 <ActualParameters>
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 <ActualParameter>amount</ActualParameter>
 <ActualParameter>cardType</ActualParameter>
 <ActualParameter>creditInfo</ActualParameter>
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 </Task>
 </Implementation>
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 </NodeGraphicsInfo>
 </NodeGraphicsInfos>
 <Activity>
 <Activity Id="54" Name="Get Credit Authorization">
 <Implementation>
 <Task>
 <TaskApplication Id="getCreditAuthorization">
 <ActualParameters>
 <ActualParameter>creditInfo</ActualParameter>
 <ActualParameter>creditStatus</ActualParameter>
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 </TaskApplication>
 </Task>
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 </NodeGraphicsInfos>
 <Activity>
 <Activity Id="55" Name="Set Order Status">
 <Implementation>
 <Task>
 <TaskApplication Id="setOrderStatus">
 <ActualParameters>
 <ActualParameter>creditStatus</ActualParameter>
 <ActualParameter>status</ActualParameter>
 </ActualParameters>
 </TaskApplication>
 </Task>
 </Implementation>
 </Activity>
 </NodeGraphicsInfos>
 </Activity>
 </Activities>

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 </Task>
 </Implementation>
 </NodeGraphicsInfos>
 <NodeGraphicsInfo Page="1" LaneId="1" Width="75.0" Height="50.0" BorderColor="-16777216" FillColor="-1114150">
 <Coordinates XCoordinate="412.0" YCoordinate="267.0"/>
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 <Activity Id="56" Name="end">
 <Event>
 <EndEvent Result="None"/>
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</NodeGraphicsInfos>
</Activity>
</Activities>
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 <Coordinates XCoordinate="162.5" YCoordinate="293.7554016113281"/>
 </ConnectorGraphicsInfo>
 </ConnectorGraphicsInfos>
 </Transition>
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 <ConnectorGraphicsInfo Page="1" BorderColor="-16777216" FillColor="-1114150">
 <Coordinates XCoordinate="237.5" YCoordinate="294.14959716796875"/>
 <Coordinates XCoordinate="286.5" YCoordinate="294.507080078125"/>
 </ConnectorGraphicsInfo>
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 </Transition>
 <Transition Id="59" Name="" From="54" To="55">
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 <Coordinates XCoordinate="361.5" YCoordinate="295.1332092285156"/>
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 </Transition>
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 </Transition>
</Transitions>
</WorkflowProcess>
<WorkflowProcess Id="4" Name="Fill Order" AccessLevel="PRIVATE">
 <ProcessHeader/>
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 <FormalParameter Id="orderNumber" Mode="IN">
 <DataType>
 <BasicType Type="INTEGER"/>
 </DataType>
 <Description>Order number assigned to the order.</Description>
 </FormalParameter>
 <FormalParameter Id="orderType" Mode="IN">
 <DataType>
 <ExternalReference location="http://wfmc.org/standards/docs/xpdl_sample/orderschema.xsd" xref="orderType"
namespace="orderschema/Order"/>
 </DataType>
 </FormalParameter>
 <FormalParameter Id="emailAddress" Mode="IN">
 <DataType>
 <BasicType Type="STRING"/>
 </DataType>
 </FormalParameter>
 </FormalParameters>
 <Participants>
 <Participant Id="Shipper">
 <ParticipantType Type="ROLE"/>
 <Description>Order shipper</Description>
 </Participant>
 </Participants>
 <Applications>
 <Application Id="shipOrder">
 <Description>This application presents a screen that presents order information
for the order identified by shipOrder. The user may update the order with
any changes such as back order information. It returns a string indicating
whether the order is complete or on back order.</Description>
 <FormalParameters>
 <FormalParameter Id="OrderNumberParam" Mode="IN">
 <DataType>
 <BasicType Type="INTEGER"/>
 </DataType>
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 </FormalParameters>
 </Application>
 </Applications>

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 </FormalParameter>
 <FormalParameter Id="Status" Mode="OUT">
 <DataType>
 <BasicType Type="STRING"/>
 </DataType>
 <Description>The String that describes the status -- either "Complete"
 or "Backorder"</Description>
 </FormalParameter>
 </FormalParameters>
</Application>
<Application Id="charge">
 <Description>Charges the credit card and prepares a receipt for a credit order</Description>
 <ExternalReference location="http://wfmc.org/standards/docs/xpdl_sample/creditService.wsdl" xref="ChargeCreditAccount"/>
</Application>
<Application Id="billAccount">
 <Description>Bills the vendor account</Description>
 <FormalParameters>
 <FormalParameter Id="orderNumberParam" Mode="IN">
 <DataType>
 <BasicType Type="INTEGER"/>
 </DataType>
 </FormalParameter>
 </FormalParameters>
</Application>
<Application Id="createInvoice">
 <Description>Creates an invoice using the order information and stores it on a
 server.</Description>
 <FormalParameters>
 <FormalParameter Id="orderNumber" Mode="IN">
 <DataType>
 <BasicType Type="INTEGER"/>
 </DataType>
 </FormalParameter>
 <FormalParameter Id="docURI" Mode="OUT">
 <DataType>
 <BasicType Type="STRING"/>
 </DataType>
 </FormalParameter>
 </FormalParameters>
</Application>
<Application Id="createReceipt">
 <Description>Creates a receipt using the order information and stores it on a
 server.</Description>
 <FormalParameters>
 <FormalParameter Id="orderNumber" Mode="IN">
 <DataType>
 <BasicType Type="INTEGER"/>
 </DataType>
 </FormalParameter>
 <FormalParameter Id="docURI" Mode="OUT">
 <DataType>
 <BasicType Type="STRING"/>
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## 8.2. The BPMN E-Mail Voting Process

### 8.2.1. The main process: EMailVotingProcess

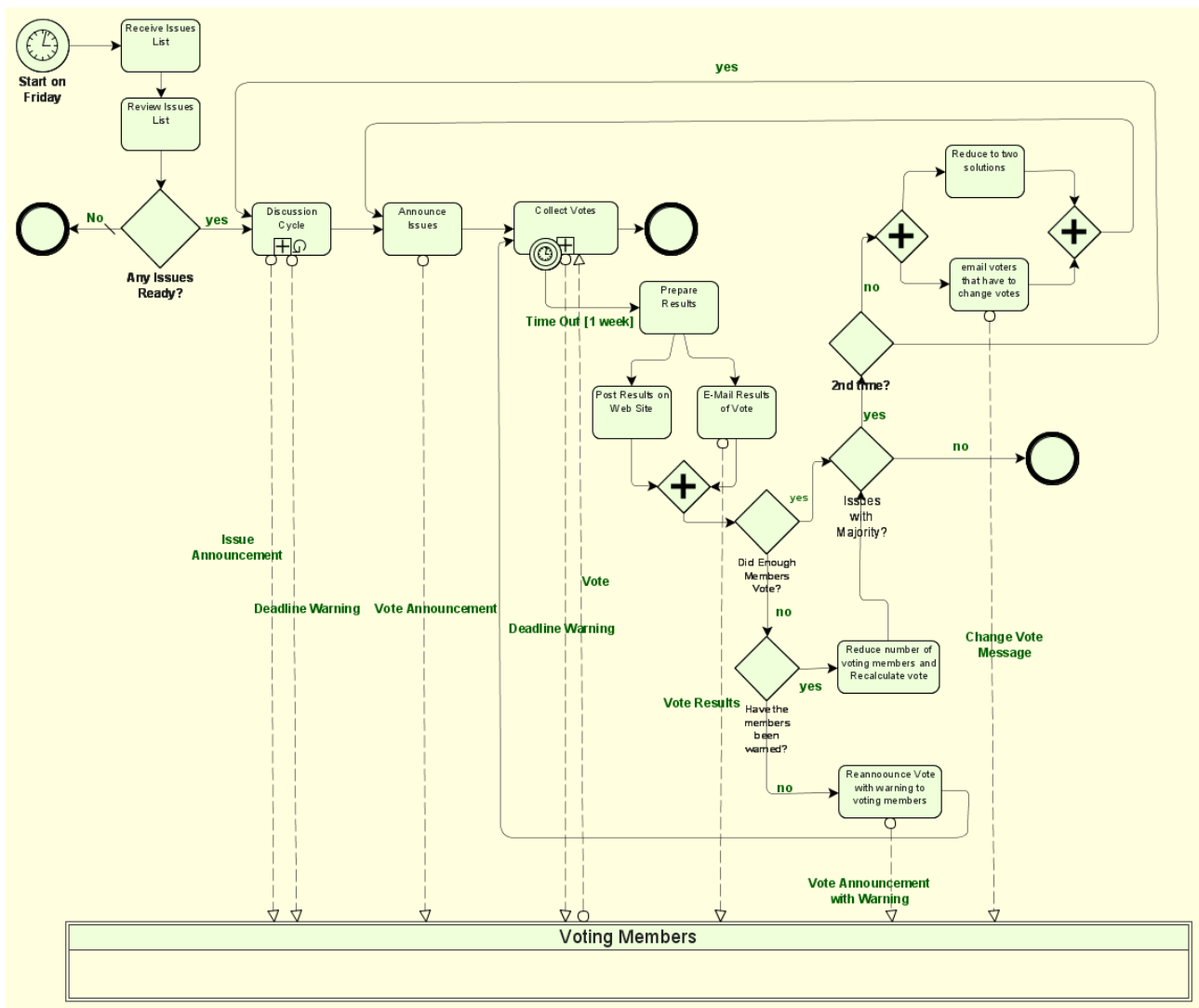


Figure 8.4: Email Voting Process – The main process

The Process has a point of view that is from the perspective of the manager of the Issues List and the discussion around this list. From that point of view, the voting members of the working group are considered as external Participants who will be communicated with by messages (shown as Message Flow).

The Process starts with Timer Start Event that is set to trigger the Process every Friday.

The Issue List Manager will review the list and determine if there are any issues that are ready for going through the discussion and voting cycle. Then a Decision must be made. If there are no issues ready, then the Process is over for that week--to be taken up again the following week. If there are issues ready, then the Process will continue with the discussion cycle. The “Discussion Cycle” Sub-Process is the first activity after the “Any issues ready?” Decision and this Sub-Process has two incoming Sequence Flows, one of which originates from a downstream Decision and is thus part of a loop. It is one of a set of five complex loops that exist in the Process. The contents of the “Discussion Cycle” Sub-Process and the activities that follow will be described below.

## 8.2.2. Discussion Cycle Subprocess

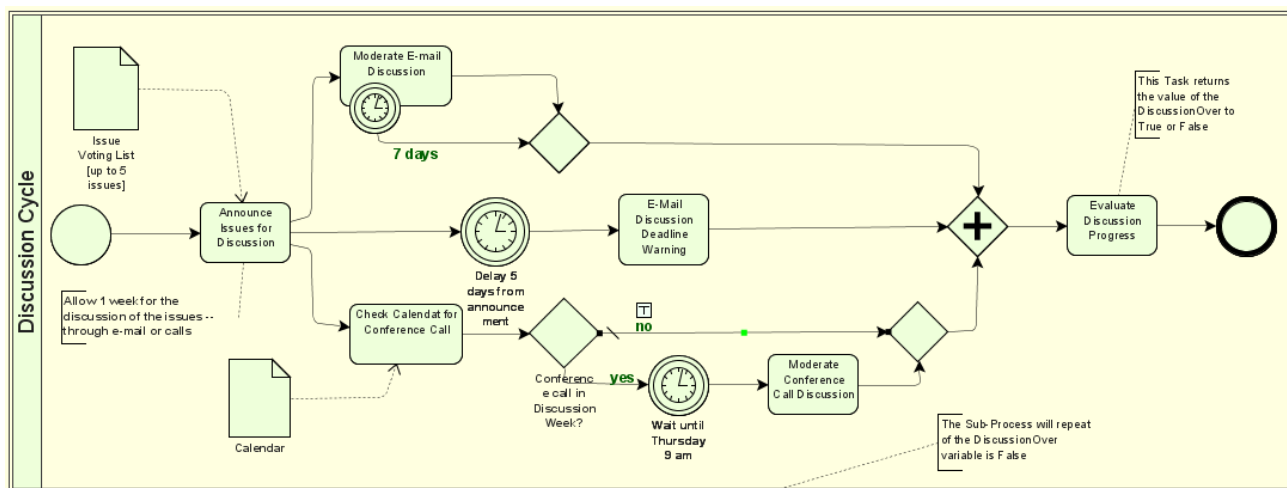


Figure 8.5: Discussion Cycle SubProcess

The Sub-Process starts off with a Task for the Issue List Manager to send an e-mail to the working group that a set of Issues are now open for discussion through the working group's message board. Since this Task sends a message to an outside Participant (the working group members), an outgoing Message Flow is sent from the "Discussion Cycle" Sub-Process to the "Voting Members" Pool in the main process. Basically, the working group will be discussing the issues for one week and proposing additional solutions to the issues. After the first Task, three separate parallel paths are followed, which are synchronized downstream. This is shown by the three outgoing Sequence Flow for that activity.

The top parallel path in the figure starts with a long-running Task, "Moderate E-mail Discussion," that has a Timer Intermediate Event attached to its boundary. Although the "Moderate E-Mail Discussion" Task will never actually be completed normally in this model, there must be an outgoing Sequence Flow for the Task since Start and End Events are being used within the Process. This Sequence Flow will merge with the Sequence Flow that comes from the Timer Intermediate Event. A merging Exclusive Gateway is used in this situation because the next object is a joining Parallel Gateway (the diamond with the cross in the center) that is used to synchronize the three parallel paths. If the merging Gateway was not used and both Sequence Flows connected to the joining Gateway, the Process would have been stuck at the joining Gateway that would wait for a Token to arrive from each of the incoming Sequence Flows.

The middle parallel path of the fork contains an Intermediate Event and a Task. A Timer Intermediate Event used in the middle of the Process flow (not attached to the boundary of an activity) will cause a delay. This delay is set to 6 days. The "E-Mail Discussion Deadline Warning" Task will follow. Again, since this Task sends a message to an outside Participant, an outgoing Message Flow is seen from the "Discussion Cycle" Sub-Process to the "Voting Members" Pool in the main process.

The bottom parallel path of the fork contains more than one object, the first of which is a Task where the issue list manager checks the calendar to see if there is a conference call this week. The output of the Task will be an update to the variable "ConCall," which will be true or false. After the Task, an Exclusive Gateway with its two Gates follows. The Gate for "default" flows directly to an merging Exclusive Gateway, for the same reason as in the top parallel path. The Gate for the "Yes" Sequence Flow will have a condition that checks the value of the "ConCall" variable (set in the previous Task) to see if there will be a conference call during the coming week. If so, the Timer Intermediate Event indicates delay, since all conference calls for the working group start at 9am PDT on Thursdays. The Task for moderating the conference call follows the delay, which is followed by the merging Gateway.

The merging Gateways in the top and bottom paths and the "E-Mail Discussion Deadline Warning" Task all flow into a joining Gateway. This Gateway waits for all three paths to complete before the Process Flow to the next Task, "Evaluate Discussion Progress." The issue list manager will review the status of the issues and the discussions during the past week and decide if the discussions are over. The DiscussionOver variable will be set to TRUE or FALSE, depending on this evaluation. If the variable is set to FALSE, then the whole Sub-Process will be repeated, since it has looping set and the loop condition will test the DiscussionOver variable.

### 8.2.3. Collect Votes Subprocess

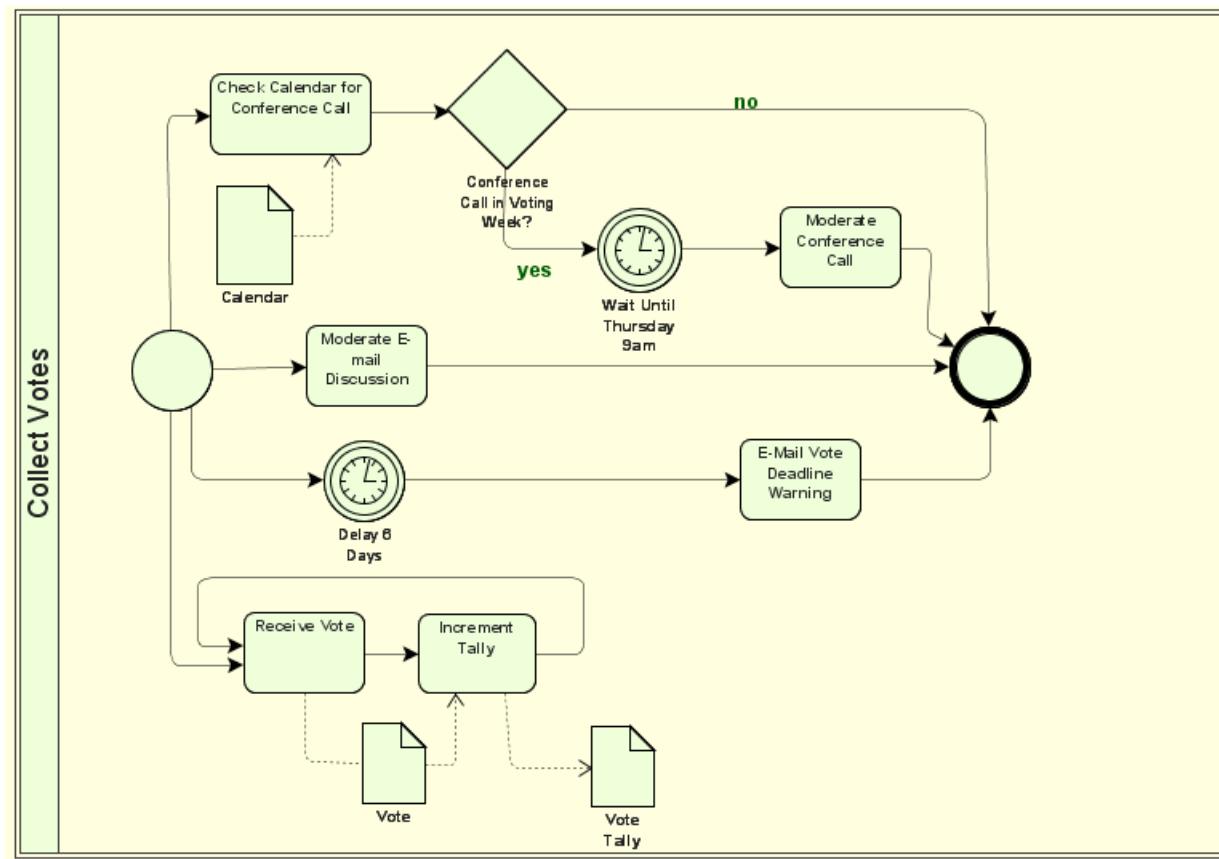


Figure 8.6: Collect Votes Subprocess

This part of the process starts out with a Task for the issue list manager to send out an e-mail to announce to the working group, and the voting members in particular, which lets them know that the issues are now ready for voting. Since this Task sends a message to an outside Participant (the working group members), an outgoing Message Flow is seen from the “Announce Issues” Task to the “Voting Members” Pool in the main process. This Task is also a target for one of the complex loops in the Process.

The “Collect Votes” Sub-Process follows the Task, and is also a target of one of the looping Sequence Flow. This Sub-Process is basically a set of four parallel paths that extend from the beginning to the end of the Sub-Process.

The first branch of the fork leads to a Decision that determines whether or not a conference call will occur during the upcoming week, after the Working Group’s schedule has been checked. Basically, if there was a call last week, then there will not be a call this week and vice versa. The appropriate variable that was updated in the “Discussion Cycle” Process will be used again.

The second and third branches work the same way as the similar activities in the “Discussion Cycle” Sub-Process, except that the “Moderate E-Mail Discussion” Task does not have a Timer Intermediate Event attached. This is not necessary since the whole Sub-Process is interrupted after 7 days through the Intermediate Event attached to the Sub-Process boundary. The “E-Mail Vote Deadline Warning” Task sends a message to an outside Participant (the working group members), thus, an outgoing Message Flow is seen from the “Collect Votes” Sub-Process to the “Voting Members” Pool in the main process.

The fourth branch of the fork is rather unique in that the Diagram uses a loop that does not utilize a Decision. Thus, it is, as it is intended to be, an infinite loop. The policy of the working group is that voting members can vote more than once on an issue; that is, they can change their mind as many times as they want throughout the entire week. The first Task in the loop receives a message from the outside Participant (the working group members), thus, an incoming Message Flow is seen from the “Voting Members” Pool to the “Collect Votes” Sub-Process in the main process. The Timer Intermediate Event attached to the boundary of the Sub-Process is the mechanism that will end the infinite loop, since all work inside the Sub-Process will be ended when the time-out is triggered. All the remaining work of the Process is conducted after the time-out and Flow from the Timer Intermediate Event.

### 8.2.4. Back to the Main Process

Two Tasks follow the time-out. First, a Task will prepare all the voting results, then a Task will send the results to the voting members. A Document Object, "Issue Votes," is shown in the Diagram to illustrate how one might be used, but it will not map to anything in the execution languages.

The last segment of the main process contains four Decisions that interact with each other and create loops to upstream activities.

The first Decision, "Did Enough Members Vote?," is necessary since two-thirds of the voting members are required to approve any solution to an issue. If less than two-thirds of the voting members cast votes, which sometimes happens, the issues can't be resolved. This Decision flows to another Decision for both of its Alternatives. The "No" Alternative is followed by the "Have the Members been Warned?" Decision. If voting members miss a vote, they are warned. If they miss a second vote, they lose their status as a voting member and the voting percentages are recalculate through a Task ("Reduce number of Voting Members and Recalculate Vote"). If they haven't yet been warned, then a warning is sent and the voting week is repeated.

If all issues are resolved, then the Process is done. If not, then another Decision is required. The voting is given two chances before it goes back to another cycle of discussion. The first time will see a reduction of the number of solutions to the two most popular based on the vote (more if there are ties). Some voting members will have to change their votes just because their solution is no longer valid. The process depicts these two activities as if they could be performed in parallel, but in fact that is wrong, since the reduction to two solutions must take place first in order to know which voters have to change their votes. After the pair of parallel activities, the flow loops back to "Collect Votes" Sub-Process. If there already has been two cycles of voting, then the process flows back to the "Decision Cycle" Sub-Process.

### 8.2.5. The complete XML for this example.

*Please note this was generated by an XPD 2.0 tool and does not reflect any changes in XPD 2.1.*

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 <RedefinableHeader>
 <Author>SYSADM</Author>
 <Version>1</Version>
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 </ConnectorGraphicsInfos>
</Transition>
<Transition Id="311" Name="yes" From="298" To="300">
 <ConnectorGraphicsInfos>
 <ConnectorGraphicsInfo ToolId="G360_PMAE" IsVisible="true" Page="2">
 <Coordinates XCoordinate="326.6685485839844" YCoordinate="534.6685180664062"/>
 <Coordinates XCoordinate="325.0" YCoordinate="585.0"/>
 <Coordinates XCoordinate="384.0018005371094" YCoordinate="585.6941528320312"/>
 <g360:Font g360:Domain="Java" g360:Family="SansSerif" g360:Size="12" g360:Style="1"/>
 <g360:NameOffset>
 <Coordinates XCoordinate="-21.50091552734375" YCoordinate="-6.3470458984375"/>
 </g360:NameOffset>
 </ConnectorGraphicsInfo>
 </ConnectorGraphicsInfos>
</Transition>
<Transition Id="310" Name="no" From="298" To="299">
 <ConnectorGraphicsInfos>
 <ConnectorGraphicsInfo ToolId="G360_PMAE" IsVisible="true" Page="2">
 <Coordinates XCoordinate="364.3766784667969" YCoordinate="498.6233215332031"/>
 <Coordinates XCoordinate="626.0" YCoordinate="499.0"/>
 <Coordinates XCoordinate="628.5313110351562" YCoordinate="634.00439453125"/>
 <g360:Font g360:Domain="Java" g360:Family="SansSerif" g360:Size="12" g360:Style="1"/>
 <g360:NameOffset>
 <Coordinates XCoordinate="-162.265625" YCoordinate="-92.502197265625"/>
 </g360:NameOffset>
 </ConnectorGraphicsInfo>
 </ConnectorGraphicsInfos>
</Transition>
</Transitions>
</WorkflowProcess>
```



```

</WorkflowProcesses>
<ExtendedAttributes>
 <ExtendedAttribute Name="System" Value="Global 360"/>
 <ExtendedAttribute Name="Creator" Value="Sketchpad Prototype 2"/>
</ExtendedAttributes>
</Package>

```

## 8.3. Extending XPDL Schema

As described in section 7.1.4.2 Namespace Qualified Extensions, the XPDL schema allow for extensions. The following example, show how a vendor can add elements and attributes. For the example, vendor Xyz will enhance the Participant element by adding an attribute called Organization, and an element called Address. The enhancement will be done in a way that vendor xyz, and any other party, can validate an XPDL file containing vendor Xyz extensions.

### 8.3.1. Xyz Schema

Xyz vendor creates the following schema file to extend the XPDL schema. Note that XyzExtensions element is only needed to disambiguate the schema in the case Address is optional (like in this particular case); otherwise, no separation element is required.

```

<!-- Must import the XPDL schema -->
<xsd:import namespace="http://www.wfmc.org/2004/XPDL2.0alpha"
 schemaLocation="file:bpmnxml_23.xsd"/>

<?xml version="1.0" encoding="UTF-8"?>
<xsd:schema xmlns:xyz="http://www.xyz.com/2005/XYZ.XPDL2"
 xmlns:xpdl="http://www.wfmc.org/2004/XPDL2.0alpha"
 xmlns:deprecated="http://www.wfmc.org/2002/XPDL1.0"
 xmlns:xsd="http://www.w3.org/2001/XMLSchema"
 targetNamespace="http://www.xyz.com/2005/XYZ.XPDL2"
 elementFormDefault="qualified" attributeFormDefault="unqualified">

 <!-- Start Xyz's XPDL extensions -->
 <!-- (only include XPDL elements that will be extended) -->
 <xsd:element name="Participant">
 <xsd:complexType>
 <xsd:sequence>
 <xsd:element ref="xpdl:ParticipantType"/>
 <xsd:element ref="xpdl:Description" minOccurs="0"/>
 <xsd:element ref="xpdl:ExternalReference" minOccurs="0"/>
 <xsd:element ref="xpdl:ExtendedAttributes" minOccurs="0"/>

 <!-- Add Xyz new Participant Elements -->
 <xsd:element name="XyzExtensions"/>
 <xsd:element ref="xyz:Address" minOccurs="0"/>
 <xsd:any namespace="##other" processContents="lax"
 minOccurs="0" maxOccurs="unbounded"/>
 </xsd:sequence>
 <xsd:attribute name="Id" type="xsd:NMTOKEN" use="required"/>
 <xsd:attribute name="Name" type="xsd:string" use="optional"/>

 <!-- Add Xyz new Participant Attributes -->
 <xsd:attribute name="Organization" type="xsd:string" form="qualified"/>
 <xsd:anyAttribute namespace="##other" processContents="lax"/>
 </xsd:complexType>
 </xsd:element>

 <!-- End Xyz's XPDL extensions -->

 <!-- ===== -->
 <!-- Start Xyz Definitions -->
 <xsd:element name="Address">
 <xsd:complexType>
 <xsd:sequence>
 <xsd:element name="Street" type="xsd:string"/>
 <xsd:element name="City" type="xsd:string"/>
 <xsd:element name="State" type="xsd:string"/>
 <xsd:element name="Zip" type="xsd:int"/>

```

```

 </xsd:sequence>
 </xsd:complexType>
</xsd:element>

<!-- End Xyz Definitions -->

</xsd:schema>

```

### 8.3.2. Xyz Test XPDL Document

The following XPDL 2.0 compliant test file validates against the XPDL 2.0 schema, using the Xyz schema as an external schema. Note that vendor Xyz includes a vendor extension section to provide the location of the Xyz schema, and a document describing the extensions. The vendor extension information can be useful for other vendors that may want to interchange XPDL files with Xyz.

```

<?xml version="1.0" encoding="UTF-8"?>
<Package xmlns="http://www.wfmc.org/2004/XPDL2.0alpha"
 xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
 xmlns:xyz="http://www.xyz.com/2005/XYZ.XPDL2"
 xmlns:xpdl="http://www.wfmc.org/2004/XPDL2.0alpha"
 xsi:schemaLocation="http://www.wfmc.org/2004/XPDL2.0alpha
 file:bpmnxdpl_23.xsd" Id="testFile">

 <PackageHeader>
 <XPDLVersion>2.0</XPDLVersion>
 <Vendor>Xyz</Vendor>
 <Created>9/5/2005</Created>
 <VendorExtensions>
 <VendorExtension ToolId="XyzTool"
 schemaLocation="http://www.xzy.sample/xyz.xsd"
 extensionDescription="http://www.xyz.sample/Description.html"/>
 </VendorExtensions>
 </PackageHeader>

 <Participants>
 <Participant Id="testParticipant" xyz:Organization="Test Organization">
 <ParticipantType Type="HUMAN">
 <xyz:XyzExtensions/>
 <xyz:Address>
 <xyz:Street>123 My House Street</xyz:Street>
 <xyz:City>Big City</xyz:City>
 <xyz:State>California</xyz:State>
 <xyz:Zip>92626</xyz:Zip>
 </xyz:Address>
 </ParticipantType>
 </Participant>
 </Participants>
</Package>

```



## **9. XPDL Schema**

The full Schema for XPDL is contained in a separate document.

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