BPMN 2.0 – The Business Process Modeling Notation

Modeling Introduction
Objectives

- Learn a standardized business process modeling notation

Scope

- BPMN elements
- Business Process diagram

Out of scope

- Correlation, composition and choreography diagrams
- BPM Methodology
- BPMN tool how to

Practices, Practices and Practices …
Organization

- BPMN Elements
  - Basic Elements
    - Start drawing business process diagrams
    - At least up to 70% of business process drawing
  - Advanced concepts
    - Elements set to complete the full business process diagrams
Basic Elements

- BPM & Modeling
- Process instances
- BPMN
- Participants (pool & lanes)
- Message
- Business process diagrams
- Activity
- Sequence flow
- Events
- Activities

- Gateways
- Artifacts
- Data objects
- Loops
- Sub-Process
The Business Process Management initiative

- **Business Process**
  - A collection of related, structured activities or tasks that produce a specific service or product for a particular customer or customers.

- **Business Process Management**
  - Focus on aligning all aspects of an organization with the wants and needs of clients.

- **Analysis/Modeling/Design**
  - Define targets and objectives
  - Representing visually the business processes tasks or activities

- **Execution**
  - Executing the modelized activities

- **Monitoring**
  - Measuring the results

- **Optimization**
  - Comparing the results with the targeted objectives
  - Defines new steps to improve the situation
Modeling

- Model
  - Anything used to represent anything else

- Conceptual model
  - Refer to models which are represented by concepts or related concepts which are formed after a conceptualization process in the mind
  - A model is not the “Reality”, but only an overview
Process Instance

- The Model describe the situation
- Each time the described situation occurs, it creates a new **process instance**
- It may have many process instances during the day
- A process instance may last for many hours/days/months/years before ending
The Business Process Modeling Notation (BPMN) is a standard for business process modeling that provides a graphical notation for specifying business processes in a Business Process Diagram (BPD).

The notation is based on a flowcharting technique.

The objective of BPMN is to support business process management, for both technical users and business users, by providing a notation that is intuitive to business users, yet able to represent complex process semantics.

The BPMN specification also provides a mapping between the graphics of the notation and the underlying constructs of execution languages.
What BPMN is not for?

- Modeling data
- Modeling organisation hierarchy
- Modeling objects in a object-oriented programming
- Modeling functionalities
- Modeling user interfaces
The Origins

- 2004 BPMN 1.0 (BPMA.org) – 48 Elements
  - Initial release
- 2008 BPMN 1.1 (OMG) – 55 Elements
  - Extends the gateways elements
  - Introduces new event triggers, signal events, rename rules to conditional events
- 2009 BPMN 1.2 (OMG) – 55 Elements
  - Minors changes (mostly addressed to the modeling tools vendors)
- 2010 BPMN 2.0 (OMG) – 116 Elements
  - Extends the scope and capabilities of the BPMN 1.2:
    - Formalizes the execution semantics for all BPMN elements
    - Composition and correlation
    - Extends the definition of human interactions
    - Defines a Choreography model
Practice

- What is a business process?
- What is a model?
- What is BPM?
- What is BPMN stands for?
- What is in the scope of BPMN?
- What is not in the scope of BPMN?
- What is a process instance?
The Participants

- **Participant**
  - A business *entity*, which executes or has responsibilities in the execution of activities
  - Represented by a **POOL**
Pool – Default pool

Activities
drawing area
Many Participants, many pools
Pool - Samples

Ops Securities

Retail Banking
The Participant’s roles

- **Lane**
  - Represents a role within a pool
  - A POOL may have 0 or more **LANEs**
Nested Lanes
Pool & Lanes Sample

One Organization

Operations

Securities

Cash

Reuters

Pool & Lanes Sample
POOL – comments

- The POOL may represent not only an entity but also the name of the business process. Eg. Process ‘Buy a Security’
Pool & Lane - Practice

- Draw your department and its neighbors (inside and outside the organization) with Pool(s) and Lanes
- Find a process in your department that requests many different roles and draw the latter with Pool and lanes
- Draw the following organisation:
  - The BMN Inc has 4 main depts: Production, Sales, R&D, Finance. The Sales contains the Accounting and Control depts. The Production has Car, Motorcycle and Scooter production lines
Message

- The way to represent the information exchange between the participants POOL
- One or more messages between POOLS
Messages and Pools
Message - Care

- Only between POOLs, never between LANEs of the same pool!
Message Object

- Represents the information itself exchanged between the pools
- Helps to represents
  - **Initiating** Participant, or the one who initiate the execution of the business Process
  - **Non-Initiating** Participant, or the one who is awakened by the initiator or then it sends back an answer
Message Object Representation

Initiating message object

Non-Initiating message object

Unfilled

Filled
Message & Pools sample

![Diagram showing a message flow between Customer and Cashier, involving Item and Invoice]
Messages & Objects - Practice

- Draw the pools, messages and messages objects between
  - A Tourist and a Cashier
  - The tourist buy one ticket with its coins
- Discussions: When to use the Pools and/or Lanes ? or both ?
Business Process Diagram principles

- Representing workflows with
  - **Activities** representing the role’s task to execute
  - **Sequence Flows** that link logically the activities
  - **Events** which represents happening condition
  - **Gateway** representing a decision
  - **Message Flow** representing the information exchange between the participants
Activity

- Describe the work to be executed within a business process
- Has one label, 0..n inputs, 0..n outputs
Activity sample

A simple business process with one activity

Customer

Fill the credit request form
Activity Practice

- Find activities among the followings:
  - Call
  - Intranet Application
  - Receive orders
  - Error raised
  - Fullfill the form
  - Upcoming message
  - MS Word
  - Close the door
Sequence Flows

- Represents the logical flow between two activities
- Can cross many LANES of the same POOL
Simple sequence flow

- The customer prints the form
- The customer fills the form
- The customer signs the form
- The customer sends the form
Token

- A conceptual principle used to analyse and define the sequence flow
- The token represents the flow, the activity is started when it receives a token, it releases the token when its execution is finished
- Only a concept, not an element of the BPMN notation
- No visual representation
Token practice – draw the token

Customer
1. Print the form
2. Fill the form
3. Sign the form
4. Send the form

Provider
1. Receive the form
2. Check the form
3. Agree
4. Archive the form

BPMN 2.0 Introduction
Sequence Flow – Additional rules

- Cannot cross many POOLS
Sequence Flow, Practice

- Draw the corresponding activities, sequence and pool of the following comment
  - “The BMN’s marketing analyse the market (Customers needs) and setup the action plan for its new Car production line. The setup of the action plan is done with the help of the R&D departement. The R&D dept advises the marketing with a solution with a pre-validated price from the financial dept. Finally, once the Car production line has started the production of the new car, the Sales department sales those new products to the Customers.”
Business Process Diagram (BPD)

- A combination of visual objects
- Depict a Business Process execution
- Each visual object has a distinctive signification
  - Visual Elements influences the process execution curse except the ‘Artifacts’
## Core elements set

<table>
<thead>
<tr>
<th>Category</th>
<th>Elements</th>
</tr>
</thead>
<tbody>
<tr>
<td>Flow objects</td>
<td>Events, Activities, Gateways</td>
</tr>
<tr>
<td>Data objects</td>
<td>Data Objects, Data Input, Data Output, Data stores</td>
</tr>
<tr>
<td>Connecting objects</td>
<td>Sequence Flow, Message Flow, Association</td>
</tr>
<tr>
<td>Swimlines</td>
<td>Pool, Lane</td>
</tr>
<tr>
<td>Artifacts</td>
<td>Group, Annotation</td>
</tr>
</tbody>
</table>
Process Diagrams specification

- The BPMN specifications describes 3 categories of BPD
  - **Private Processes**
    - Internal processes, target to be executed (BPMS)
  - **Public Processes**
    - Interactions between Participants without specification of respective internal activities implementation
  - **Collaboration Processes**
    - Communication between several Public Processes
Private Process
Public Process

Sales
- Check the customer information
- Check the order

Accountant
- Check the credit card
- Report error

Stock
- Check the item availability

BPMN 2.0 Introduction
Public and Private Processes
Collaboration Process

1) I have a problem
2) Here are the details

User:
- Declare an incident
- Receive the detail request
- Send the details
- Receive the solution

Service Desk:
- Receive an incident
- Request the details
- Receive the details
- Propose a solution
What is a BPD?

What are the 5 core elements set?

What are the 3 main categories of the BPD?

Explain the following diagram and describe the BPD category.
Flow Objects - Events

- Event: something that happened during the process execution

- 3 event categories
  - **Start** A listening Event which starts the execution flow
  - **Intermediate** Some events which may happen during the course of the execution flow
  - **End** At the end of the flow, an event can be thrown.
## Flow Objects - Events

<table>
<thead>
<tr>
<th>Event</th>
<th>Symbol</th>
</tr>
</thead>
<tbody>
<tr>
<td>Start</td>
<td><img src="image" alt="Start Symbol" /></td>
</tr>
<tr>
<td>Intermediate</td>
<td><img src="image" alt="Intermediate Symbol" /></td>
</tr>
<tr>
<td>End</td>
<td><img src="image" alt="End Symbol" /></td>
</tr>
</tbody>
</table>
Event - simple sample

The Process starts here

Customer

Print the form → Fill the form → Sign the form → Send the form

The Process stops here
Event Behaviors – general presentation

- 2 Behaviors
  - Catching
    - Wait for incoming event before continuing
  - Throwing
    - No waiting, the event is thrown while the flow continues its execution
    - The event is thrown once it receives the token, at the end of execution
Events – How it works

In one flow, an event is thrown

1. Event is thrown
2. Event information is broadcasted
3. The Event information is caught by the listener
4. The waiting token continues its course
Event, Practice I

- What is an Event?
- What are the 3 Event’s categories?
- Describe the Event mechanism?
- Draw the following process

  “the process starts when the production dept receives the new plan, then the dept’s operator programs the robot. Once finished, he packs the result and finish the process by sending it to the sales dept.”
Events categories

- The BPMN specification defines 13 event situations
  - Each situation has a dedicated symbol placed in the center of the event symbol.
  - Each situation has a dedicated specificities

  - **Throwing**: black inner symbol
  - **Catching**: white inner symbol

  This Intermediate Event waits for an incoming message
## Events categories inner symbols

<table>
<thead>
<tr>
<th>Event</th>
<th>Catch</th>
<th>Thrown</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>None</td>
<td></td>
<td></td>
<td>Indicates the start or the end of the flow</td>
</tr>
<tr>
<td>Terminate</td>
<td>![circle]</td>
<td>![circle]</td>
<td>Immediately stops the process execution</td>
</tr>
<tr>
<td>Error</td>
<td>![triangle]</td>
<td>![triangle]</td>
<td>Indicates that an error is thrown/caught</td>
</tr>
<tr>
<td>Compensation</td>
<td>![arrow]</td>
<td>![arrow]</td>
<td>Compensate previously executed activities</td>
</tr>
<tr>
<td>Cancel</td>
<td>![cross]</td>
<td>![cross]</td>
<td>Cancel transactional activities</td>
</tr>
<tr>
<td>Signal</td>
<td>![triangle]</td>
<td>![triangle]</td>
<td>Broadcast/receive a signal</td>
</tr>
<tr>
<td>Message</td>
<td>![envelope]</td>
<td>![envelope]</td>
<td>Send/receive a message</td>
</tr>
<tr>
<td>Escalation</td>
<td>![arrow]</td>
<td>![arrow]</td>
<td>Escalation issued to an upper level</td>
</tr>
<tr>
<td>Conditional</td>
<td>![list]</td>
<td></td>
<td>React following a business rules</td>
</tr>
<tr>
<td>Timer</td>
<td>![clock]</td>
<td></td>
<td>React after a specified delay</td>
</tr>
<tr>
<td>Multiple</td>
<td>![pentagon]</td>
<td>![pentagon]</td>
<td>Catch/throw many specified events</td>
</tr>
<tr>
<td>Parallel Multiple</td>
<td>![plus]</td>
<td></td>
<td>Receive many simultaneous events</td>
</tr>
<tr>
<td>Link</td>
<td>![arrow]</td>
<td>![arrow]</td>
<td>Within a sequence flow (simplify)</td>
</tr>
</tbody>
</table>
Flow Objects – Events Sample

Customer

Print the form

Archive the form

Provider

Check the form

Agree
Flow Objects, Event, Practice II

- What are the 2 Events mechanisms?
- How is filled the icon for those ones?
- Draw the following:
  - “The R&D dept receives the new customers’ needs described in an email from the marketing dept. Then the researcher starts by analysing the needs. Once analysed, he sends its proposal to the financial department which sends back the cost price. Then the process finished when the researcher sends back the complete proposal”
- Discussion: When to use the Start and End Event regarding the pool or lane usage?
- Describe the following icons:
Flow Objects - Activities

- Activity = The generic term that defines the executed work = Task

- Each activity is connected within the Sequence flows (on the same pool/lane) or with Message Flows (between pools)
Define dedicated behaviors

- Manual handling
- User’s task
- Automated tasks

Manual task
User’s task
Service task

BPMN 2.0 Introduction
## Activity behavior Categories 1

<table>
<thead>
<tr>
<th>Task</th>
<th>Symbol</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Abstract</td>
<td><img src="image" alt="Symbol" /></td>
<td>No influence on the Process Execution (Engine). It is only used to clarify the understanding of the Process.</td>
</tr>
<tr>
<td>Service</td>
<td><img src="image" alt="Symbol" /></td>
<td>Refers to an external services execution</td>
</tr>
<tr>
<td>Receive</td>
<td><img src="image" alt="Symbol" /></td>
<td>The process execution is stopped and waits for the incoming message from another participant.</td>
</tr>
<tr>
<td>Send</td>
<td><img src="image" alt="Symbol" /></td>
<td>The task sends a message to another participant. The process execution is not stopped.</td>
</tr>
</tbody>
</table>
## Activity behavior Categories 2

<table>
<thead>
<tr>
<th>Task</th>
<th>Symbol</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>User</td>
<td>![User Icon]</td>
<td>The User participate to the business process execution</td>
</tr>
<tr>
<td>Script</td>
<td>![Script Icon]</td>
<td>The script is executed when this activity is started</td>
</tr>
<tr>
<td>Manual</td>
<td>![Manual Icon]</td>
<td>A non-automated task performed by a human</td>
</tr>
<tr>
<td>Business Rule</td>
<td>![Business Rule Icon]</td>
<td>A mechanism is called to ask a business rules engine and give back the answer.</td>
</tr>
</tbody>
</table>
Activities, Practice

- What are the 3 main Activity’s categories?
- How many categories of Activities are defined within the specification?
- This activity is related to which category?
Flow Objects - Gateway

- A process may contain several alternatives or concurrent conditional flows
- Conditions to execute something
- IF CONDITION THEN DO situation
Gateway basis – exclusive path

- IF condition=1 THEN do A ELSE do B
Exclusive Gateway sample

Check the age

Age > 50 ?

Yes
Add one day on holidays

No

Confirm holidays

BPMN 2.0 Introduction
Exclusive Gateway sample - joining

Age > 50?

- Check the age
- Yes: Add one day on holidays
- No: No synchronisation of incoming paths

Exclusive gateway as joining symbol

Confirm holidays
Merging, equivalence

- No symbol, many inputs on the same activity
Exclusive Gateway – joining (2)

Age > 50 ?

Check the age

Yes

Add one day on holidays

No

Confirm holidays
# Gateway Categories

<table>
<thead>
<tr>
<th>Symbols</th>
<th>Category</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image" alt="Exclusive" /></td>
<td>Exclusive</td>
<td>Choice between alternatives paths. <em>IF condition THEN ELSE</em> situations</td>
</tr>
<tr>
<td><img src="image" alt="Parallel" /></td>
<td>Parallel</td>
<td>Each output path receives a token</td>
</tr>
<tr>
<td><img src="image" alt="Inclusive" /></td>
<td>Inclusive</td>
<td>All conditions are evaluated and for each that are true, the path is selected. <em>OR</em></td>
</tr>
<tr>
<td><img src="image" alt="Event Based Intermediary" /></td>
<td>Event Based Intermediary</td>
<td>The first intermediary triggered event definitely choose the path</td>
</tr>
<tr>
<td><img src="image" alt="Event Based Start" /></td>
<td>Event Based Start</td>
<td>The first triggered event choose the path.</td>
</tr>
<tr>
<td><img src="image" alt="Parallel Event Based" /></td>
<td>Parallel Event Based</td>
<td>Catch any triggered events that start the process. Many instances are created.</td>
</tr>
<tr>
<td><img src="image" alt="Complex" /></td>
<td>Complex</td>
<td>Many conditions are defined in order to define one or more output paths</td>
</tr>
</tbody>
</table>
Parallel Gateway

- Many inputs, many outputs, no conditions...
- A and B are activated on the same time
Parallel Gateway Equivalent

- No symbol, many output from the same activity
- A and B are activated on the same time
Parallel Gateway - Synchronisation

- Wait until all incoming paths.
- C is activated once A and B are both finished
Care!

- Not the same!
Inclusive Gateway

- All conditions are evaluated
- Each true condition opens the gate
- Represents the **OR** logical operator

Set $D=1$, $E=3$

D>0 ?

A

B
Inclusive Gateway - Sample

- Get Share price P
  - Every 2 sec.
  - if P=80 $, Stop Loss at P=70 $
  - if P>120 $, Sell share at market price
  - if P<60 $, Buy Share at market price
  - else
Inclusive Gateway - Synchronisation

- Wait until all incoming paths previously initiated by an Inclusive Gateway.
- C is activated depending on the first inclusive gateway true conditions
Gateway, Practice

- What is a gateway?
- What is the main gateway shape?
- Draw the following situation:
  - “if price is greater than one thousand, then we apply a 10% discount, then after we send the box to the customer”
- Draw the following situation:
  - “We produce the Car on the same time than the scooters”
- Draw the following situation:
  - “Sometimes we receive the message from the marketing dept or by the R&D, either by both. We do not read the one sent by the R&D (put in the bin).”
- Draw the following situation:
  - “We continue the production once we received both part 1 and part 2 of the wheel”
Artifacts

- The possibility to add contextual information
- Complete the process and elements understanding
- No influences on process execution
- Two artifacts categories:
  - Group
  - Annotation
Artifact - Group

- Visual representation of a set of process’ elements

Form n° XCA-346-BT_02

Customer

Print the form

Provider

Check the form

Agree

Archive the form
Artifact - Annotation

- A simple piece of textual information sets to one or more process’ element

![Diagram of process flow showing steps for Customer and Provider with annotations and BPMN 2.0 Introduction label]
Data Objects

- Represents manipulated items within the process execution
Data Object association

Directional association

Form

Print form

Scan picture

Picture
Data input – Data output

- Represents data used directly by activities
Data Input/Output - Samples

Identity card information → Fill Customer Form → Calculate Tax rebate

Tax Refill Form →
Datastore

- Activities using data or information systems
Artifacts & Data objects, Practice

- What is an artifact?
- Does artifacts modify the business process execution behavior?
- Draw the following situation:
  - “We extract the information from the database ABCDEF with MS Excel, then we produce the report saved under the file folder named /TTYUI. Finally we send the report to the customer”
Loop - Principles

- Doing many times the same task

```plaintext
Counter = 0
Print the form
Counter = Counter + 1
Counter < 20 ?
  yes
  no
```

BPMN 2.0 Introduction
Loop - Symbol

Counter = 0 → Print the form → Counter = Counter + 1

Counter < 20? (yes/no)

The condition loop is set under the Loop Activity’s properties

Print the form
Loop, practice

- What is a loop? When to use it?
- Draw the following situation:
  - The R&D receives a set of 10 documents from the marketing department. For each document, the R&D team’s member stamp it. After that, he puts all documents in the R&D ‘s ‘incoming basket’.
Sub-Processes

- The sub-processes allow the possibility to create sets of compound activities, events, sequence flows and others sub-processes
- Introduced within the process flow like the Abstract Activity = Embedded sub-process
Sub-Process sample

1. Receive pizza order
2. Prepare the pizza
   - Prepare pizza dough
   - Add tomato
   - Add mozzarella
   - Put the pizza in the oven
3. Deliver the pizza

BPMN 2.0 Introduction
Sub-Process, practice

- What is a sub-process?
- How the sub-process is visually represented?
- Describe the sub-process mechanism with its representations?
- Draw the following situation:
  - The R&D receives a set of 10 documents from the marketing department. For each document, the R&D team’s member read it, check the name of the product, add a comment and stamp it. After that, he puts all documents in the R&D ‘s ‘incoming basket’.
Final Practice

- Read Case 1 (word file)
- Draw the depicted situation
Advanced BPMN elements

- Sub-Processes
- Multi-Instances
- Conditional Sequences
- Call Activity
- Events
- Error, Transaction and Compensation handling
- Advanced Sub-Processes
- Advanced Gateways
## Sub-Process categories

<table>
<thead>
<tr>
<th>Category</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Embedded</td>
<td>The sub-process execution is <em>embedded</em> within the parent process.</td>
</tr>
<tr>
<td>Reusable</td>
<td>The sub-process is reusable among many parent-processes.</td>
</tr>
<tr>
<td>Transaction</td>
<td>All activities contained within the sub-process are submitted to a transactional behavior. ‘All-or-nothing’. Is something wrong happened at one of these activity, all yet executed activities are rolled back.</td>
</tr>
<tr>
<td>Event</td>
<td>A specialized inner sub-process triggered exclusively by an event.</td>
</tr>
<tr>
<td>Ad-Hoc</td>
<td>The performer of the Ad-hoc suprocess defines itself the course of the sub-process’ activities.</td>
</tr>
</tbody>
</table>
Embedded Sub-Process

Parent Process

Receive pizza order

Prepare the pizza

Prepare pizza dough → Add tomato → Add mozzarella → Put the pizza in the oven → Deliver the pizza

The Parent Process waits for the completion of the sub-process in order to continue its course.
Reusable Sub-Process

- The Called Sub-Process is not caller’s context dependant
- The Sub-Process may be reused many times independently of the context
- No visual differences with the sub-process’ shape
Ad-hoc sub-process

- The perform decides itself the tasks execution order
- However, may contain some sequence flows
Sub-process (1) - Practice

- Explain the difference between:
  - Embedded sub-Process
  - Reusable Sub-Process
  - Ad-hoc Sub-Process

- Draw the following situation:
  - “In my department, the Engine Sales, once we received the completed customer’s form, we send it to the Customer Data Center which saves it and archives the document within the customer information database.
    - And what’s about the ABS Sales, are they doing the same?
    - Yes, exactly the same, they send the documentation to the Customer Data Center….”

BPMN 2.0 Introduction
Multiples instances

- During the process execution, instanciates new objects
- More than a simple loop
- Multi-instance available on the following objects:
  - Pools
  - Activities (parallel and sequential)
  - Sub-Processes (parallel and sequential)
  - Data Objects
Multi-instance pool

The Company request prices from *many* Service Providers on the same time (in parallel)
Multi-instance Activities

- Two categories
  - Parallel
  - Sequential
Multi-instance Activity Parallel

1. Prepare mail
2. Mail to customer
3. Search Counter parts
   - Mail customer 1
   - Mail Customer 2
   - Mail Customer n
Multi-instance Activity Sequential

Prepare mail

Mail to customer

Search Counter parts

Mail customer 1 → Mail Customer 2 → Mail Customer n
Sub-process multi-instances

- The Sub-process is called many times
- Be Parallel or Sequential

![Diagram](image-url)

Prepare the pizza

Receive pizza orders

Deliver the pizza

Prepare the pizza

Receive pizza orders

Deliver the pizza
Data Objects Multi-instances

- Produce or use many copy of the same Data Object (=having the same characteristics)
Multi instance- Practice

- Draw the following situations:
  - The Front Office send many documents to all of its customers.
  - Once we receive the form, we forward it to all of ours local providers, once we’ve received the an answer, we just continue the buying process with the chosen partner.
  - We sends twice the same document to the printing process as requested.
  - On the same times, we send the form to the customer from one side and on the other side, we are waiting for proposal of our many external providers.
Conditional Sequence Flow

- The order of task execution
- There are two more sequence flows categories:
  - Conditional sequence flow
  - Default sequence flow
- Draw a second way of Exclusive Gateway representation
Conditional Sequence Flow - Sample

- Get the number of guest
- Change meeting room
- Cancel the meeting
- Check gift number

Decision paths:
- Guest > 12
- Guest < 2
Conditional Sequence Flow - Practice

- Draw the following process by using the Gateway symbol:

1. Get the number of guest
2. Check gift number
3. Cancel the meeting
4. Change meeting room

- If Guest > 12, go to Change meeting room.
- If Guest < 2, go to Cancel the meeting.
Call Activity

- Identifies a point in the process where a global process or a global task is used
- It acts as a wrapper for the invocation of a global process or a global task within the execution
- The Control is transferred to the called Process
Call activity sample

1) Receive the contract → Sign the contract → Document management → Send back the contract

2) Receive the mail → Document management

The name of the called process as the activity's label

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Call activity- Practice

- Draw the following situations:
  - The Printing process is used within the Customer Invoicing process, Customer Request Management process, Order Management process and Accounting process.
  - What is the difference between a Call Activity and a Reusable Sub-Process?
## Events Categories

<table>
<thead>
<tr>
<th>Category</th>
<th>“ Catching”</th>
<th>“Throwing”</th>
<th>Non-Interrupting</th>
</tr>
</thead>
<tbody>
<tr>
<td>Message</td>
<td><img src="image" alt="Message" /></td>
<td><img src="image" alt="Message" /></td>
<td><img src="image" alt="Message" /></td>
</tr>
<tr>
<td>Timer</td>
<td><img src="image" alt="Timer" /></td>
<td><img src="image" alt="Timer" /></td>
<td><img src="image" alt="Timer" /></td>
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<tr>
<td>Error</td>
<td><img src="image" alt="Error" /></td>
<td><img src="image" alt="Error" /></td>
<td><img src="image" alt="Error" /></td>
</tr>
<tr>
<td>Escalation</td>
<td><img src="image" alt="Escalation" /></td>
<td><img src="image" alt="Escalation" /></td>
<td><img src="image" alt="Escalation" /></td>
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<tr>
<td>Cancel</td>
<td><img src="image" alt="Cancel" /></td>
<td><img src="image" alt="Cancel" /></td>
<td><img src="image" alt="Cancel" /></td>
</tr>
<tr>
<td>Compensation</td>
<td><img src="image" alt="Compensation" /></td>
<td><img src="image" alt="Compensation" /></td>
<td><img src="image" alt="Compensation" /></td>
</tr>
<tr>
<td>Conditional</td>
<td><img src="image" alt="Conditional" /></td>
<td><img src="image" alt="Conditional" /></td>
<td><img src="image" alt="Conditional" /></td>
</tr>
<tr>
<td>Link</td>
<td><img src="image" alt="Link" /></td>
<td><img src="image" alt="Link" /></td>
<td><img src="image" alt="Link" /></td>
</tr>
<tr>
<td>Signal</td>
<td><img src="image" alt="Signal" /></td>
<td><img src="image" alt="Signal" /></td>
<td><img src="image" alt="Signal" /></td>
</tr>
<tr>
<td>Terminate</td>
<td><img src="image" alt="Terminate" /></td>
<td><img src="image" alt="Terminate" /></td>
<td><img src="image" alt="Terminate" /></td>
</tr>
<tr>
<td>Multiple</td>
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<td><img src="image" alt="Multiple" /></td>
<td><img src="image" alt="Multiple" /></td>
</tr>
<tr>
<td>Parallel Multiple</td>
<td><img src="image" alt="Parallel Multiple" /></td>
<td><img src="image" alt="Parallel Multiple" /></td>
<td><img src="image" alt="Parallel Multiple" /></td>
</tr>
</tbody>
</table>

BPMN 2.0 Introduction
Intermediate Event

- Events occurred during the process execution
- Between the start and end events
- Four categories:
  - Catch
  - Throw
  - Boundary Interrupting
  - Boundary Non-Interrupting
Catching and Throwing Events

- Reminder
  - Catching: the process execution is stopped and wait the reception of the corresponding event then continues the process execution
  - Throwing, the event is thrown and the process continues its execution
Boundary Event

- The event is placed directly to the Activity’s boundary
- Catching events only!
- It means: if something happened, it stops the activity execution ... and execution continues within the event flow
While the **Writer** is currently reviewing the letter, if he receives on the same time the **reviewer's corrections**, the **Writer** stops reviewing, and **apply the corrections** else he sends the letter.
Simple boundary Event - Practice

- Explain the difference between these two flows:
Interrupting and non-interrupting

- By default, boundary event interrupts the activity execution, the normal sequence flow is interrupted.
- There is a second possibility to avoid the interruption: non-interrupting boundary event.
Non Interrupting Event sample

If the Writer receives a coffee cup, he drinks it, but this event does not avoid to send the letter.

The normal sequence flow is not interrupted!
Non-Interrupting Event - Practice

- Draw the same behavior with the corresponding boundary event:
Event Sub-Process

- A specialized inline Sub-Process triggered by an event
- *Interrupting* and *Non-Interrupting*
- Interruption behavior is defined by its *starting event*
If the Writer receives a Message “PC error”, he stops its process execution and restarts its computer.
If the Writer receives a call from its boss, he can continue its process and answer its boss.
Event Sub-Process- Practice

- Draw the following situation:
  - “The production line starts when we receive the raw material. Then we follow some steps to produce the good:
    - unpack the raw material
    - fill the tank with the raw powder
    - open the water tap
    - push the start button
    - put the piece on the treadmill
    - go to the other side of the machine
    - receipt the painted piece
  However, if something goes wrong, we are warned with the red light. If this happen, we push immediately the stop button. A message is then automatically sent to the Support team. The latter comes and diagnose, and repair the equipment failure.”
None Event

- Indicates Start, End and Change states
- Only as Start, End and Intermediate Throwing Event

![Diagram showing BPMN 2.0 None Event types](image)
None Event Sample

Set $A = 0$

States the $A = 0$ status

Display where to start...

$A = A + 1$

Process stops, the $A$ has the 1 value
Message Event

- Message exchange, almost between process participants
- All event’s categories are covered
Message Event - Sample
Send-Receive Tasks (i)

- Receive tasks, two possibilities
  - 1. Wait for an incoming message and execute directly the task
  - 2. Instantiate a new process execution each time a message arrives
Send-Receive Tasks (ii)

- Send
  - After execution of the task, a message is directly send
Timer Event

- Cyclic timer events
- Points in time
- Time spans
- Timeouts

- Only catching event!
Timer Event

[Diagram of process flow]
Error Event

- Catching or throwing named errors.
- Throwing is done at the end of a process sequence flow.
- Always interrupt a process or activity.
Rising an Error

- If something wrong, then rise an error
- Two ways:
  - Explicit Error rising
  - Implicit Error rising

The error is set to its properties and may be raised if something happened during the A activity execution.
Handling error

With a Boundary Interrupting Event

…..Or With a Interrupting Event-Sub Process

Handling error (Event sub-Process)
Error Event Sample
Escalation Event

- Escalating to a higher level of responsibility
- Throwing as Intermediate or End Event
- Only caught within an Event-Sub Process or Intermediate Boundary Event
Escalation situations

- Typically used when:
  - A deadline is not respected and the course of activities must be escalated to another level
  - Setting a priority execution among the activities ‘emergency case’
  - An incident must be raised since it happens many times
Escalation sample

- Analyse the incident
- Yes → Esc.1
- No → Solve the incident
- Recurrent error?
- Yes → Esc.1
- No → Manage Problem
- Manage the incident
- Esc.1
Cancel Event

- Reacting to cancelled transactions or triggering cancellation.
- Request a Transaction
- Cancel thrown at the end of the sequence flow
Transaction handling

- A Transaction is a set of activities that logically belong together; it might follow a specified transaction protocol.
The activities *Book Flight* and *Book Hotel* are linked... if one is not possible, it will necessary to cancel all bookings.
Cancel Event Sample

If a message is received, it cancels the travel booking by executing the Cancel the Bookings sub-process.
Cancel Event

Cancellation (transaction is rolled back)

1. These tasks are done concurrently but one of them fails

2. Failure in booking one of them does not terminate the process, so the end event is reached anyway

3. Jumps to activities associated with compensation for each activity

4. Jumps to cancellation event

BPMN 2.0 Introduction
Compensation Event

- Handling or triggering compensation

![Diagram showing various compensation event types]

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Compensation usage

- The Compensation mechanism is used when it is necessary to cancel in order a set of activities.

- Like an ‘undo’ in order to:
  - Restore a copy of the initial data values
  - Overwriting changes
  - Invoking some defined activities to remove the effects of the finished activities
Compensation mechanism

- Performed by a *compensation handler*
  - Performs the steps to reverse the effects on activities’ execution
Compensation handler as Sub-Process
Compensation Sample
Conditional Event

- Reacting to changed business conditions or integrating business rules.
- No Throwing
- Prior to BPMN 2.0, this was named ‘Business Rule’

<table>
<thead>
<tr>
<th>Start</th>
<th>Intermediate</th>
<th>End</th>
</tr>
</thead>
<tbody>
<tr>
<td>Standard</td>
<td>Event Sub-Process Non-Interrupting</td>
<td>Throwing</td>
</tr>
<tr>
<td>Event Sub-Process Interrupting</td>
<td>Boundary Non-Interrupting</td>
<td>Standard</td>
</tr>
<tr>
<td>Catching</td>
<td>Boundary Interrupting</td>
<td></td>
</tr>
</tbody>
</table>
Conditional Event sample

Check country

Get Tax rate

Apply taxes

Defines the conditions for each countries
Link Event

- Off-page connectors. Two corresponding link events equal a sequence flow.
- Intermediate Event only
Link sample

Activity 1

Activity 2

BPMN 2.0 Introduction
Signal Event

- Signalling across different processes. A signal thrown can be caught multiple times.
- Broadcasting information
Signal Sample

- Generate the report
- Publish the report
- Print the report
- Open an account
- Print and archive the report
- Read the report

BPMN 2.0 Introduction
Terminate Event

- Triggering the immediate termination of a process.
- Termination of all executing activities!
- Emergency situations
Terminate sample

If an exception is caught here, what will happen?
Events - Practice

- Draw the following situation:
  
  “Every week, I receive a mail from the R&D department, then I start the Transactional Automatic Processing engine. Sometimes an error occurs within that engine and we are immediately notified. After a short analysis and if the issue is critical, we decide to cancel the transaction, reverse the process, broadcast to all entreprise’s users the incident message and stop immediately all processes. Otherwise, if it is not critical, we check the rule to apply accordingly to the Error ID found in the Error Rule Table. If the Error code is equal to 0, we escalate it to our manager, but we do not stop the engine in such case.”
Multiple Event

- Catching one out of a set of events. Throwing all events defined.
Multiple Event Sample

S1

A1

A2

A3

S1 + Esc
I + E1

S2

B1

Starts the process execution if S1 OR Esc I OR E1 are thrown

BPMN 2.0 Introduction
Parallel Multiple

- Catching all out of a set of parallel events.
- Many triggers assigned to the Event
- All events must be triggered!
- Catching only
Parallel Multiple Sample

Starts the process execution if S1 AND Esc1 AND E1 ARE thrown.
Events – Practice (2)

- Explain the differences between:
  - Multiple
  - Parallel Multiple
Advanced Sub-Processes

- Sub-Process are activities
- They can also combine dedicated behaviors:
  - Loop
  - Serial execution
  - Parallel execution
  - Ad hoc
  - Compensation
## Advanced Sub-Processes I

<table>
<thead>
<tr>
<th>Task</th>
<th>Symbol</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Loop</td>
<td><img src="image" alt="Activity1" /></td>
<td>The sub-processes’ activities are reiterated many times</td>
</tr>
<tr>
<td>Multiple Instance Parallel</td>
<td><img src="image" alt="Activity1" /></td>
<td>Creates concurrent sub-processes accordingly to the specified instance number</td>
</tr>
<tr>
<td>Multiple Instance Serial</td>
<td><img src="image" alt="Activity1" /></td>
<td>Creates sequential sub-processes accordingly to the specified instance number</td>
</tr>
<tr>
<td>Ad-hoc</td>
<td><img src="image" alt="Activity1" /></td>
<td>The sub-Process’ activities are executed without either a specific order or sequence</td>
</tr>
</tbody>
</table>
# Advanced Sub-Process II

<table>
<thead>
<tr>
<th>Task</th>
<th>Symbol</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Compensation</td>
<td><img src="image" alt="Compensation Symbol" /></td>
<td>Contains the activities launched when the compensation mechanism is triggered</td>
</tr>
<tr>
<td>Compensation and Ad-hoc</td>
<td><img src="image" alt="Ad-hoc Symbol" /></td>
<td>Contains the unordered activities launched when the compensation mechanism is triggered</td>
</tr>
</tbody>
</table>
Advanced Gateways

- Event Based
  - Multiple Start
  - Multiple Intermediate
  - Parallel Start

- Complex
Event Based Gateways

- The Event Based Gateway is not based on *process data*, but rather on *external messages or events*
- Ever followed by an event or a reception task
- The sequence flow is passed to the event/task which runs first, the other is not activated even if the corresponding event is thrown
Multiple Start Gateway

- The process’ execution starts when a dedicated event is thrown among many possibilities

The process may start with an incoming signal event OR by a message event
Multiple Intermediate Gateway

- The process’ execution continues when a dedicated event is thrown among many possibilities.

  The process may continue with an incoming signal event OR by a message event.
Parallel Event Based Gateway

- All events have the possibility to start a new process instance. Starting from the corresponding event thrown.

The process may start with an incoming signal event OR by a message event.

BUT, there is still the possibility to start a new instance from other events.
Complex gateway

- Support situations that are not easily handled by all other gateways
- Output gate selection is done by the gateway’s expression evaluation
- Many gates may be activated
- At least one gate must be chosen
Complex gateway sample

The expression is set under the gateway property. Ex. IF A=[2;5[ THEN G1, ELSE IF A<2 THEN G2, ELSE G3

Implicitely written within the gateway's properties

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