Activity Diagrams

MDT Papyrus Tutorial :
Using Activity Diagram

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Agenda.

- This tutorial contains the following sections :
  - Create a Papyrus project with an Activity Diagram.
  - Create a Papyrus model with an Activity Diagram.
  - Create an Activity Diagram in an existing Papyrus model.
  - Activity's properties.
  - Create an activity node.
  - Edit an activity node's name.
  - Create an Activity Edge.
  - Activity edges.
  - Control nodes.
  - Object nodes.
  - Actions.
  - Activity groups.
  - Exception Handlers.
  - Comments.

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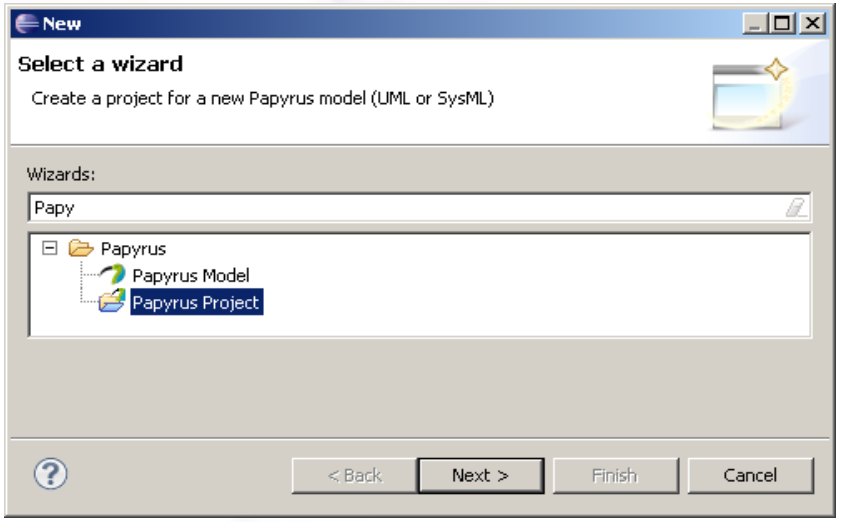
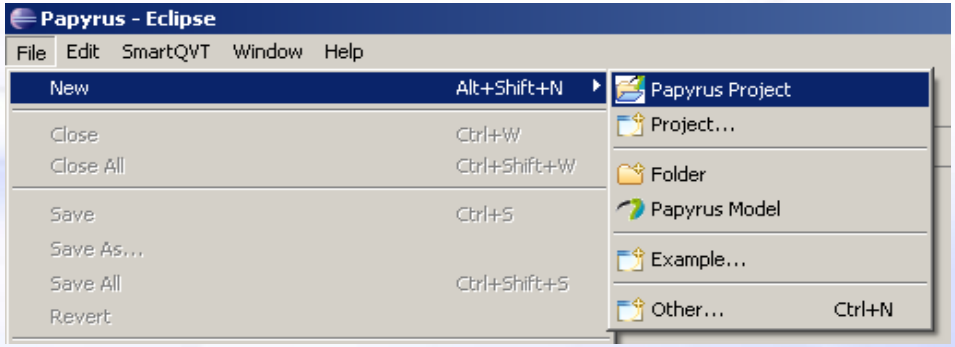
Create a Papyrus project with an Activity Diagram (1/3).

- Select the Papyrus perspective.
- Create a Papyrus project by :
  - Using the creation wizard :
    - Right click in Project Explorer view,
    - Select « New » > « Other ... »,
    - Choose « Papyrus Project »,

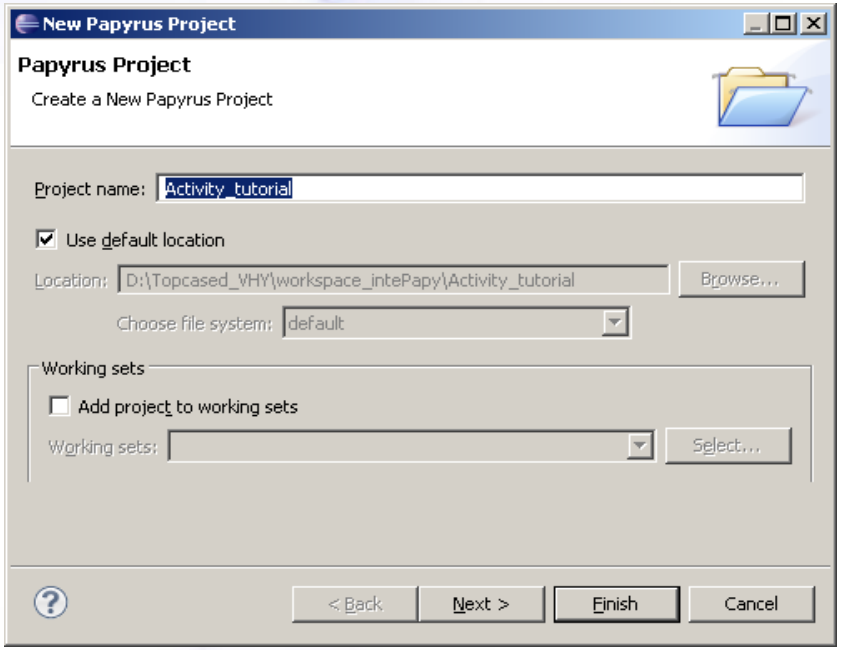


  - Or using the file menu action,

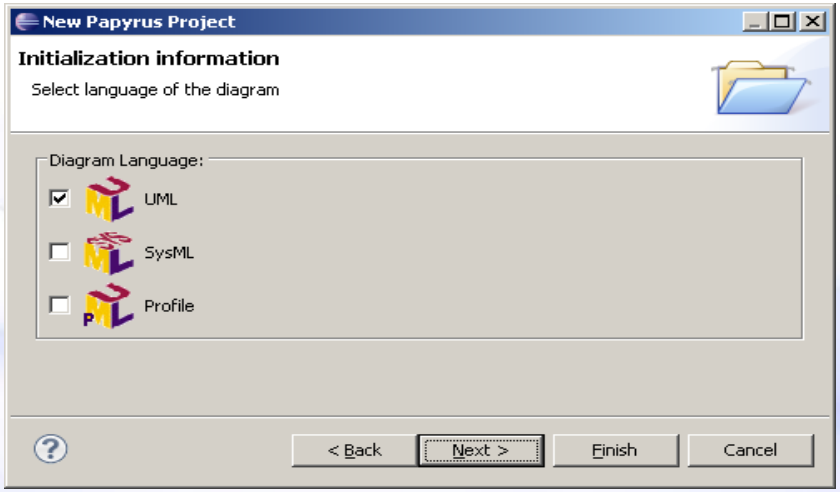


Create a Papyrus project with an Activity Diagram (2/3).

- Fill the project name,

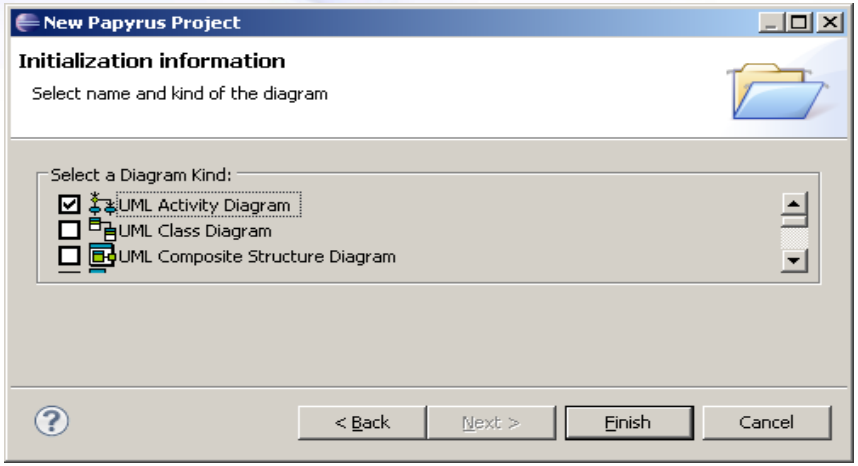


- Select UML language,

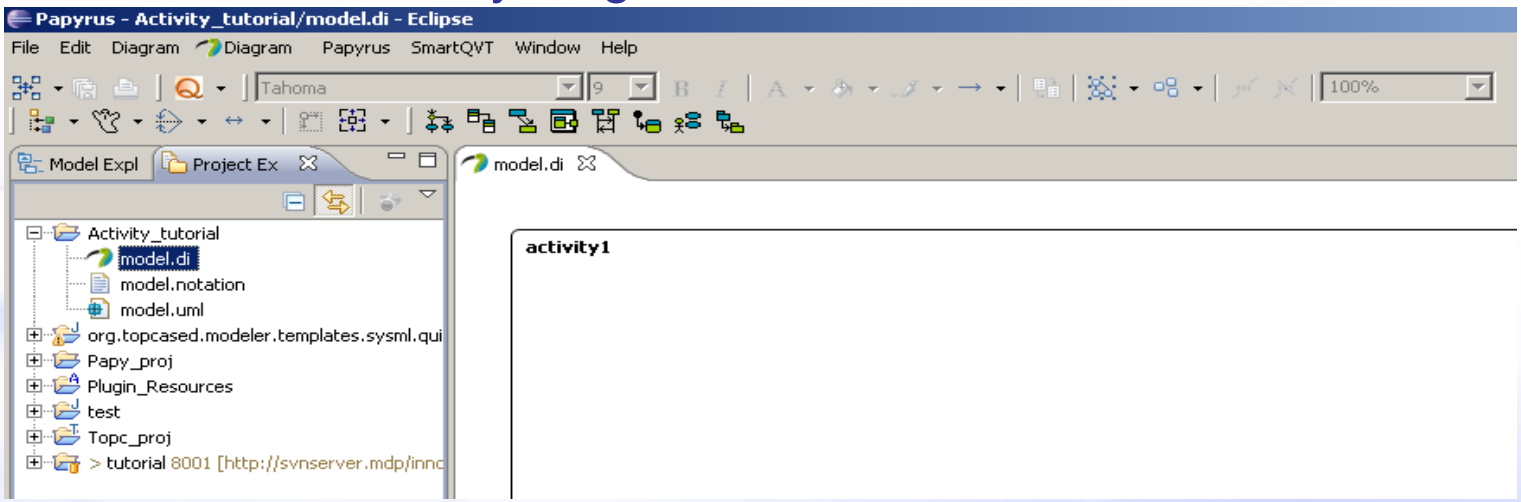


Create a Papyrus project with an Activity Diagram (3/3).

- Select the UML Activity Diagram.

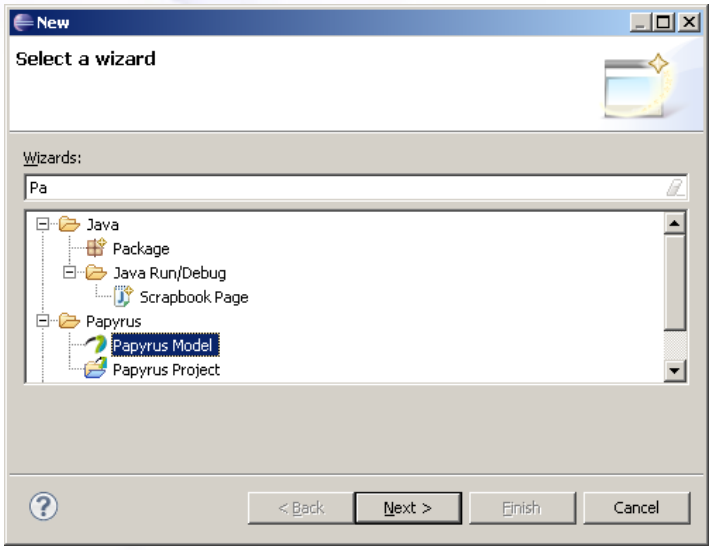


- A new project is initialized with a model and an Activity diagram.

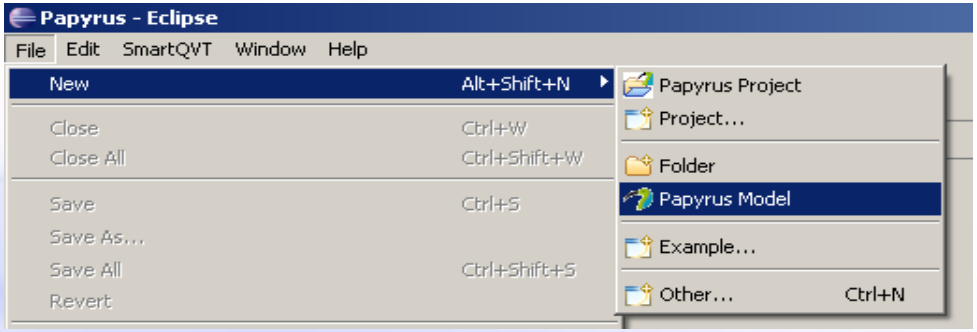


Create a Papyrus model with an Activity Diagram.

- You may also create a new Papyrus model in an existing project :
  - Using the creation wizard :
    - Right click in Project Explorer view,
    - Select « New » > « Other... »,
    - Choose « Papyrus Model »,



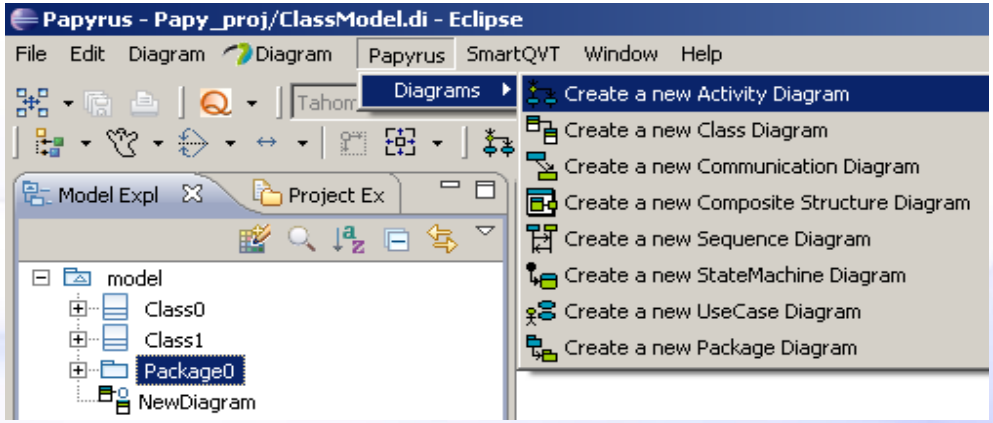
  - Or using the file menu action.

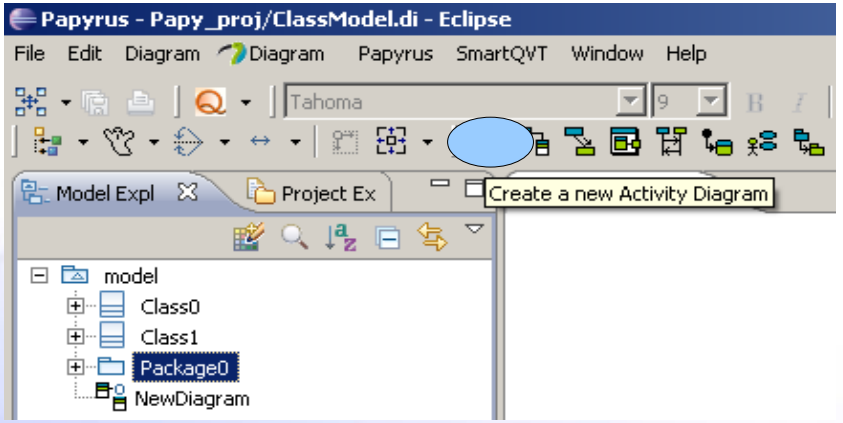


- Then, fill the model name,
- Then follow the same steps as in the project creation.

Create an Activity Diagram in an existing Papyrus model.

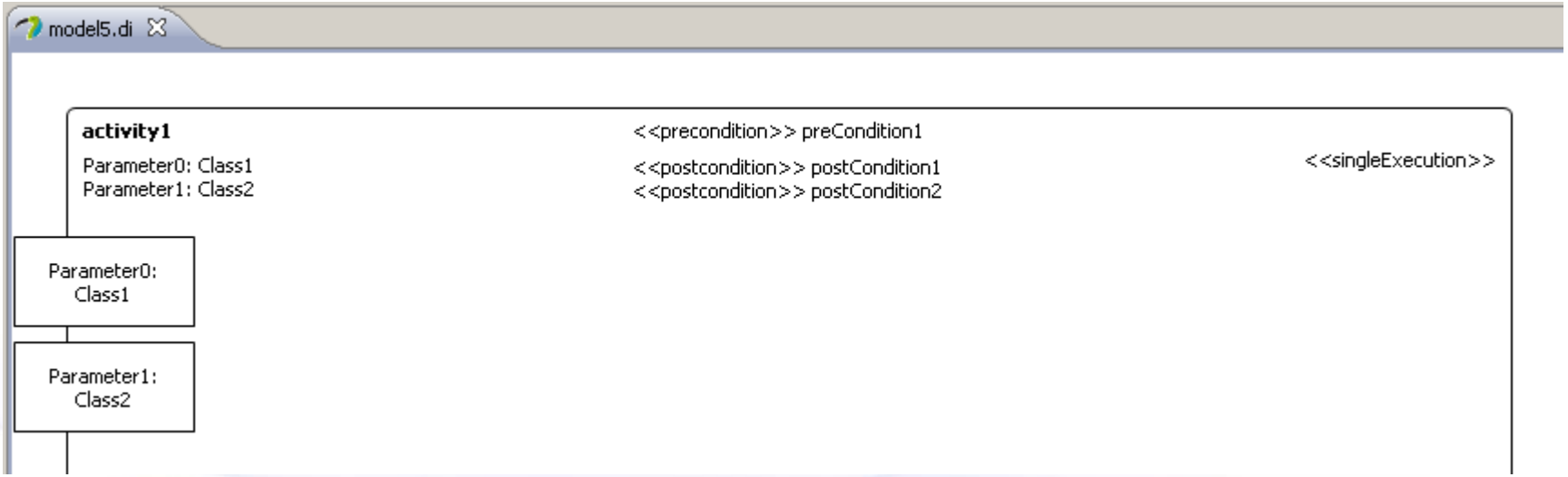
- You may also add an Activity Diagram to an existing model :
  - In the Model Explorer view, select the place where to add your diagram
  - Select the Activity Diagram menu or click on the corresponding toolbar action.





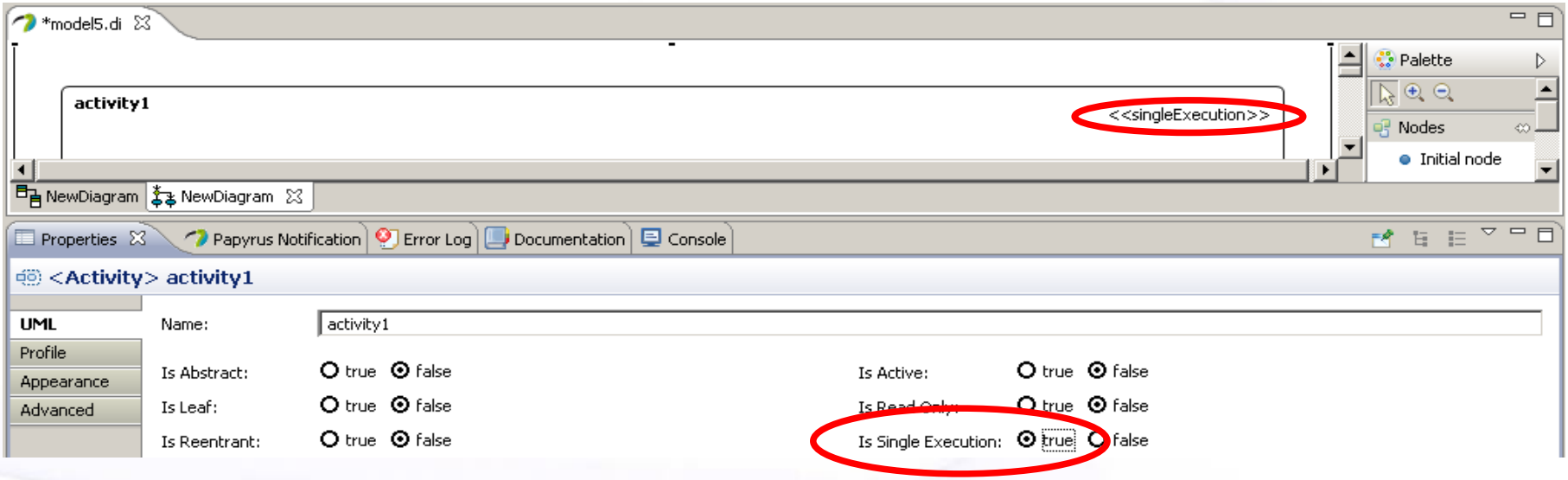
Activity's properties (1/4).

- An activity displays several properties in its heading part.
  Here is an example with all these properties displayed :



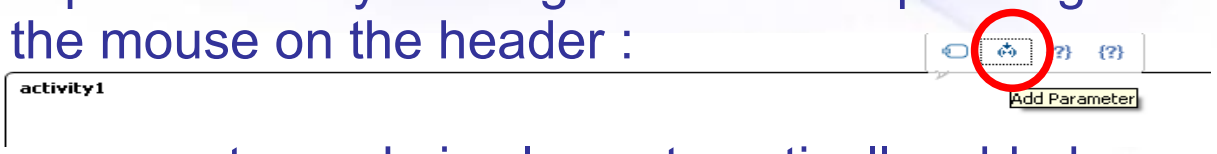
Activity's properties (2/4).

- The « singleExecution » label appears when the corresponding properties is activated in the Properties view.

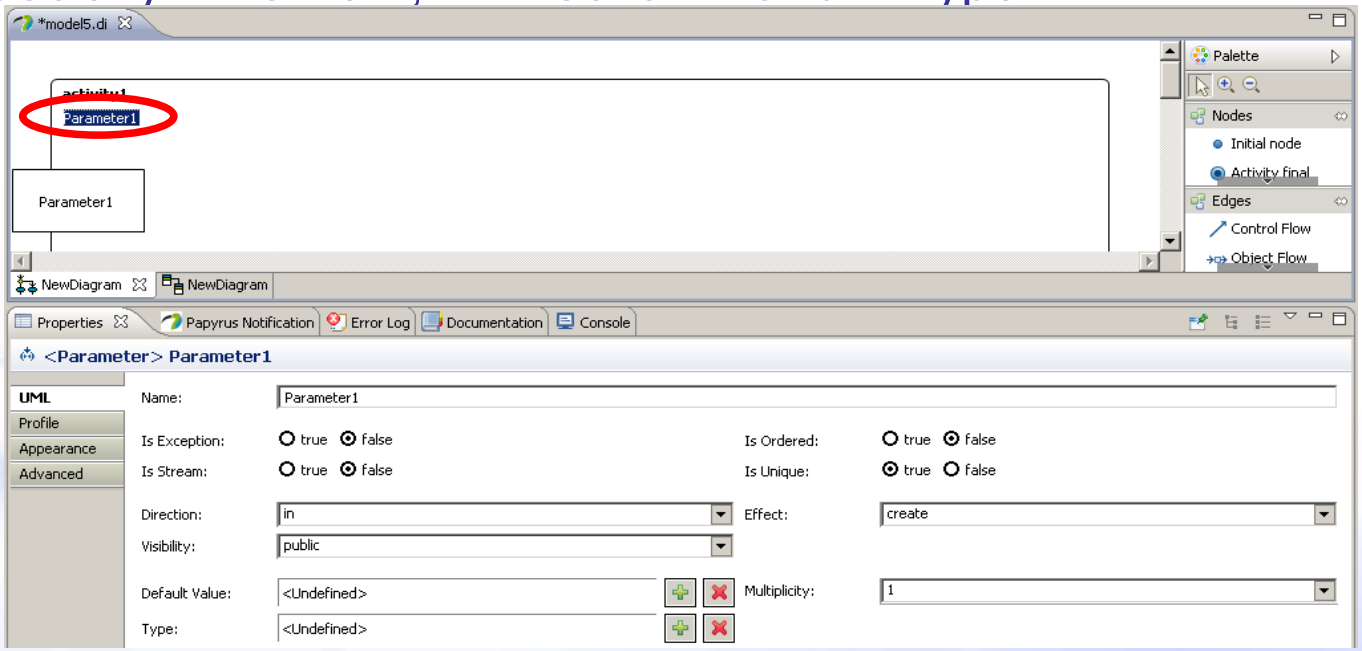


Activity's properties (3/4).

- You can add a parameter by clicking on the corresponding tooltip action, after leaving the mouse on the header :

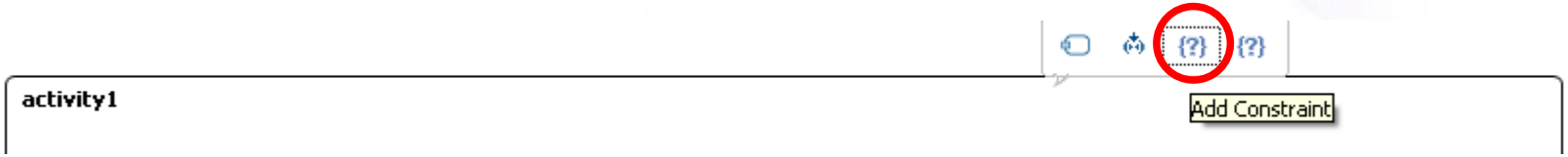


  - An activity parameter node is also automatically added.
  - Select the parameter and use the Properties view to edit its properties, especially « Name », « Direction » and « Type ».

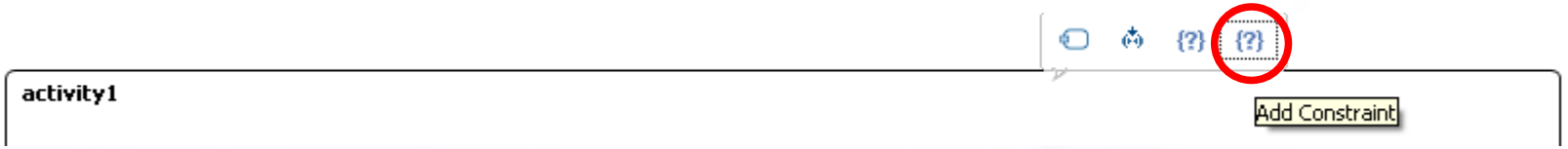


Activity's properties (4/4).

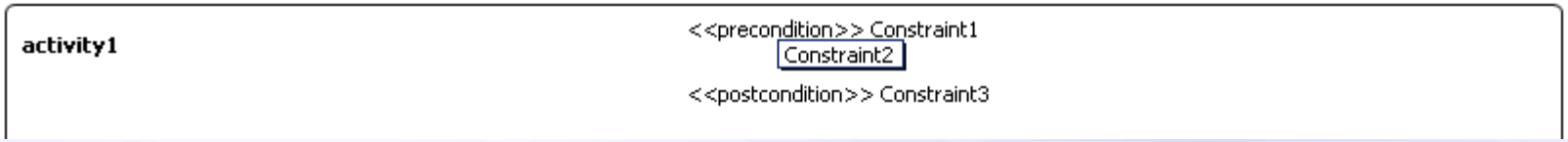
- You can add a precondition by clicking on the corresponding tooltip action, after leaving the mouse on the header :



- You can add a postcondition by clicking on the corresponding tooltip action, after leaving the mouse on the header :

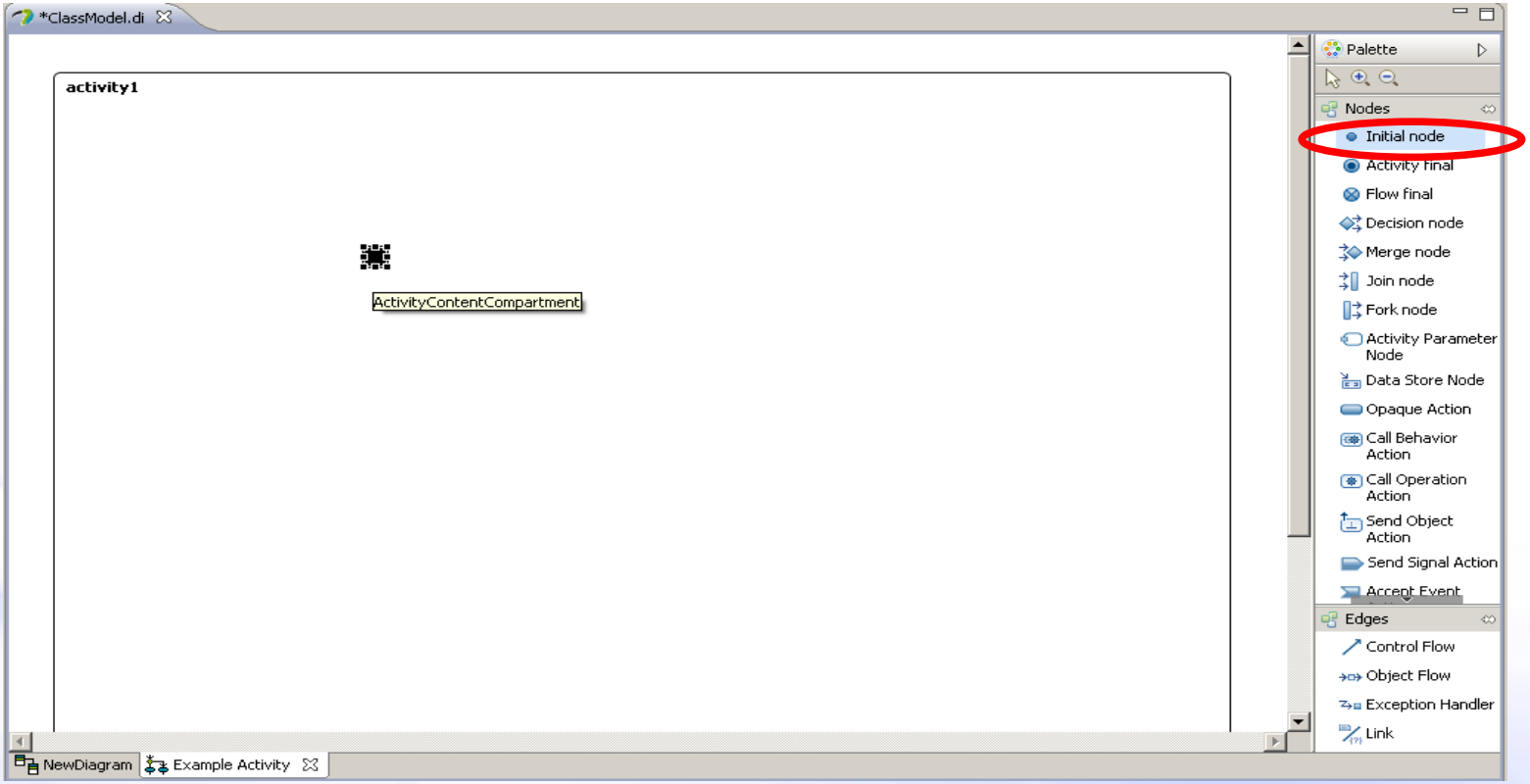


  - Select the added constraint label to edit its name.



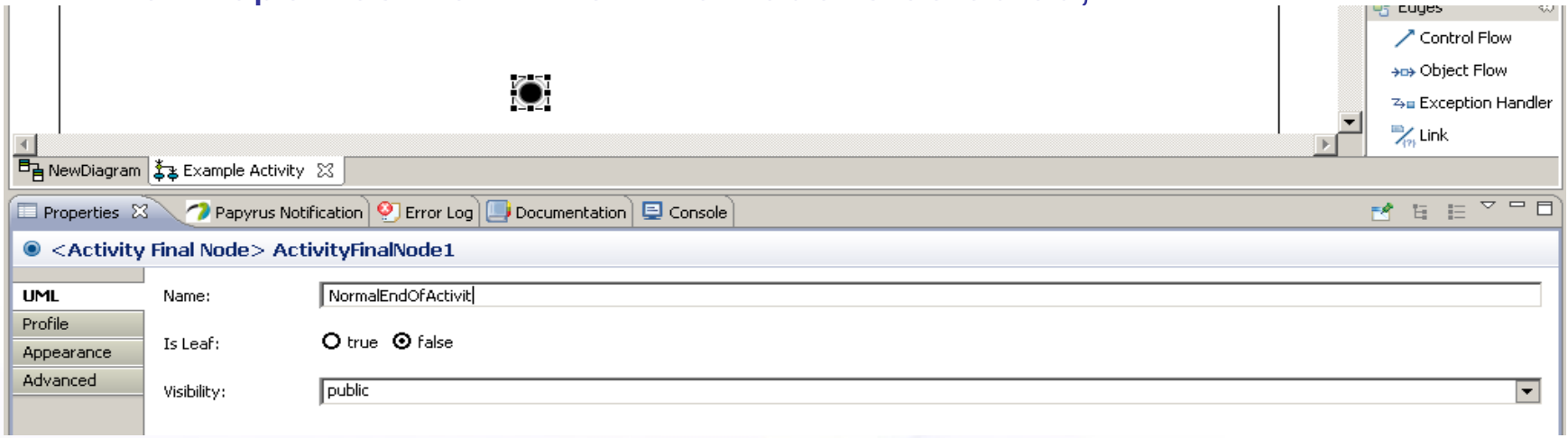
Create an activity node.

- You may create nodes in the activity :
  - Select the appropriated node in the Palette,
  - Click in the activity where you want to draw it.



Edit an activity node's name.

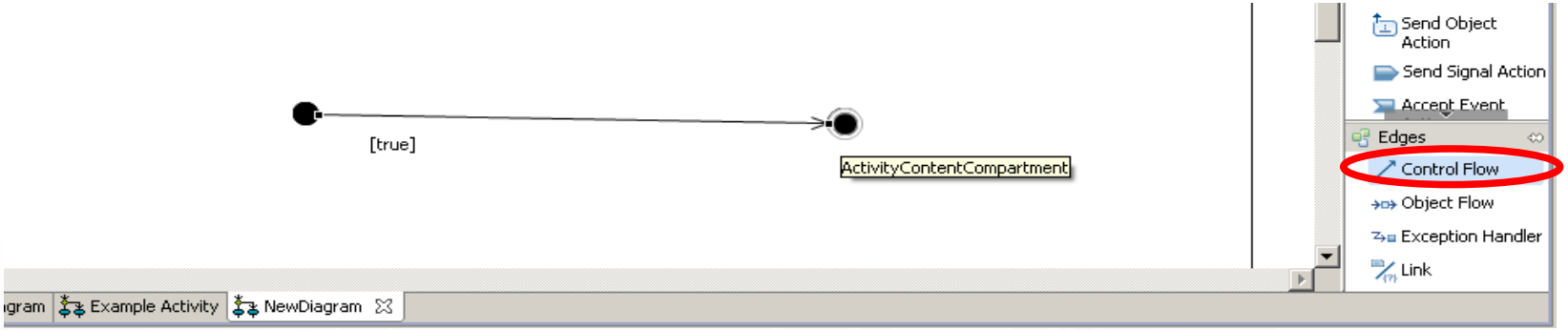
- You may edit the name of an activity node :
  - In the Properties view when the node is selected,



  - Directly by editing the label if it displays one.

Create an Activity Edge.

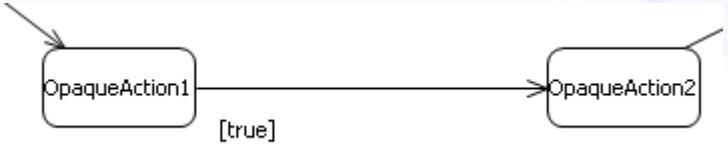
- You may create an activity edge between two activity nodes :
  - Select the appropriated edge in the Palette,
  - Click in the activity, from the source node to the target node, without releasing the mouse button.



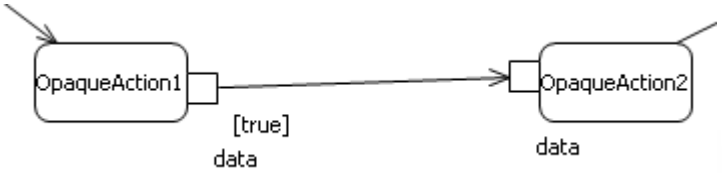
- Then, you may edit the edge's name in the properties view (see previous slide for activity nodes).

Activity edges.

- There are two kinds of activity edges :
  - Control flow :



    - This kind of edge passes control tokens which allow an activity node to start after another one. They can not carry objects nor data.
  - Object flow :



    - This kind of edge passes object and data tokens.
    - When it links two object nodes, these must have compatible types, in order that the tokens can pass from one to another through the object flow.
- Most activity nodes have restrictions on the kind of their incoming and outgoing edges. If you can not draw an edge between two nodes, check whether there are specific restrictions.

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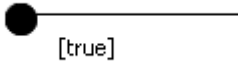
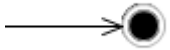
Control nodes (1/4).

- Control nodes allow to structure the activity. These are :
  - Initial node : allows to start the activity.



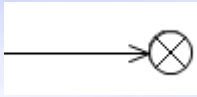
    - No edge can be drawn to an initial node, and only control flows can be drawn from an initial node.

  - Activity final node : allows to end immediately the activity.



    - No edge can be drawn from an activity final node.

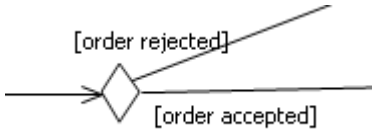
  - Flow final node : allows to destroy all incoming token (the activity is not ended if other tokens still exist in other flows)

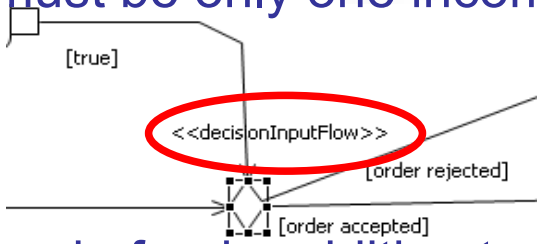


    - No edge can be drawn from a flow final node.

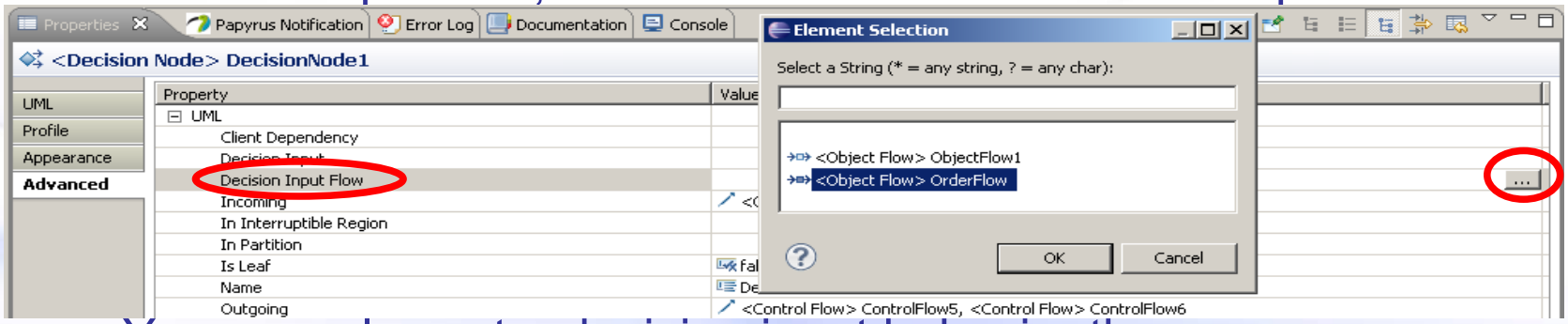
Control nodes (2/4).

- Decision node : allow to choose one among several outgoing edges.
  - Generally, incoming and outgoing edges must be of the same kind (object XOR control flows) and there must be only one incoming edge.





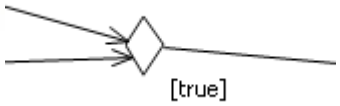
  - There may be an input object flow, used as an input for the decision, instead of or in addition to the usual incoming edge. This one has a specific label. To set this decision input flow, use the Advanced tab of the Properties view :



  - You may also set a decision input behavior the same way.
    - (see UML specification for more details on the semantic)

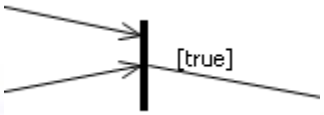
Control nodes (3/4).

- Merge node : allow to transfer tokens coming from several edges.



  - Incoming and outgoing edges must be of the same kind (object XOR control flows).
  - There must be only one outgoing activity edge.

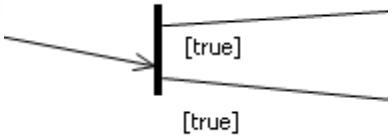
- Join node : allow to wait for all incoming token before processing.



  - There must be only one outgoing activity edge.
  - The outgoing edge is an object flow when there is at least one incoming object flow (to accept incoming data token carried by object flows).

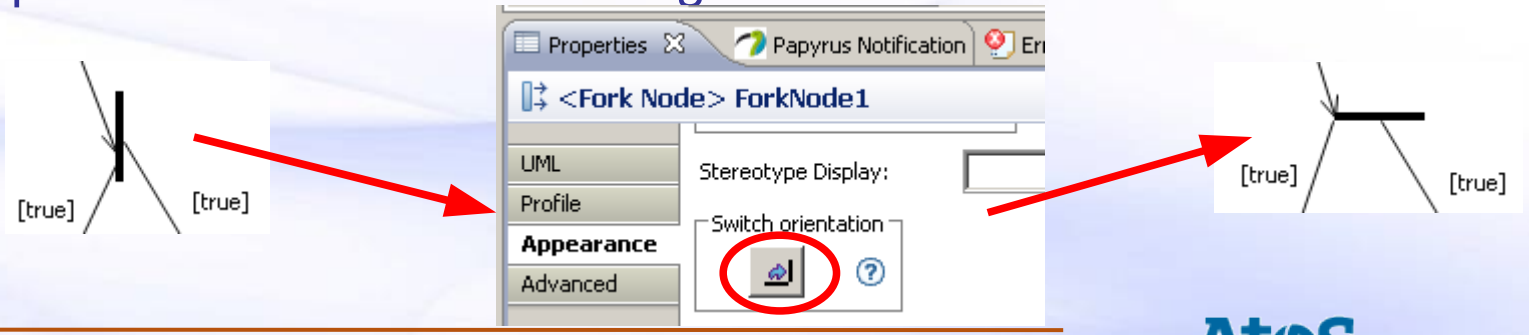
Control nodes (4/4).

- Fork node : allow to duplicate a token on all outgoing edges.



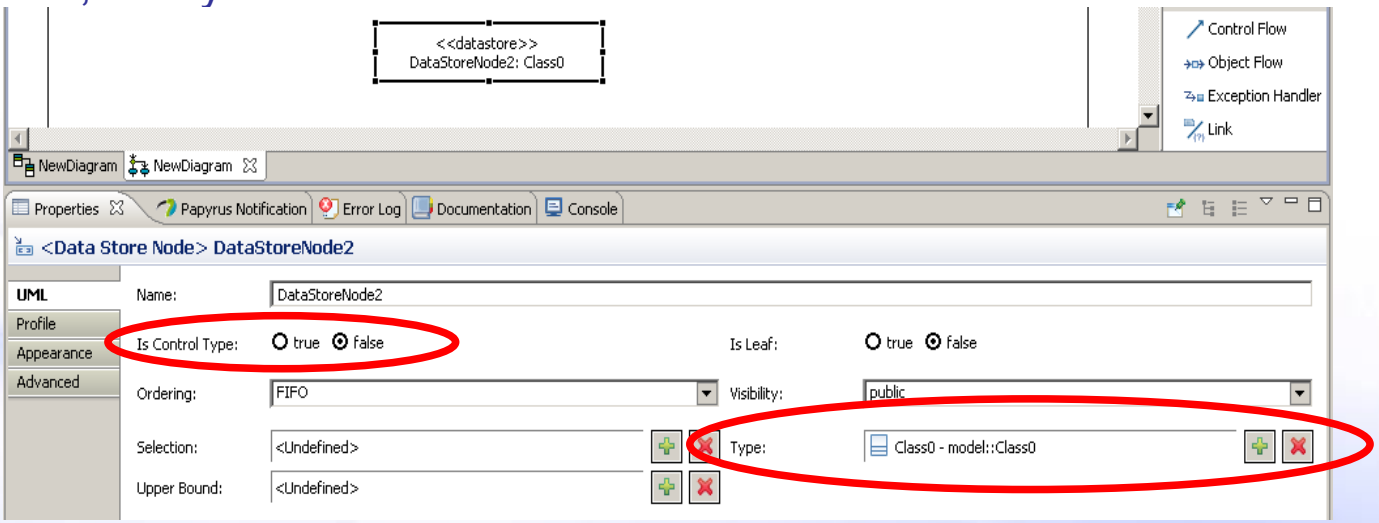
  - incoming and outgoing edges must be of the same kind (object XOR control flows).
  - There must be only one incoming activity edge.

- On join and fork nodes, you can use a button in the Appearance tab of the Properties view to switch the segment's orientation :



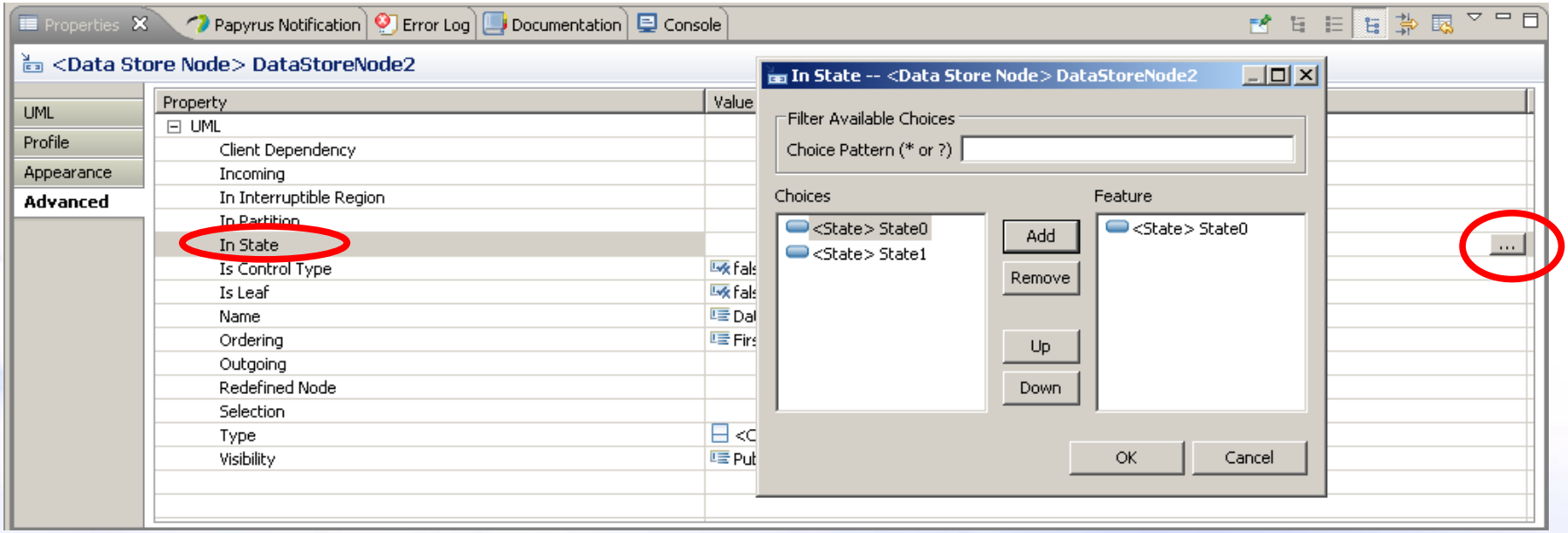
Object nodes (1/4).

- Object nodes indicate an instance of a particuliar classifier may be available at a particular point in the activity.
- Since object nodes handle data or object token, you can generally only draw object flows from or to it.
- In the Properties view, you can edit the object node's properties.
  - « Type » specifies the classifier.
  - « Is Control Type » specifies that tokens will be handled like control tokens. Hence, that you can draw control flows.



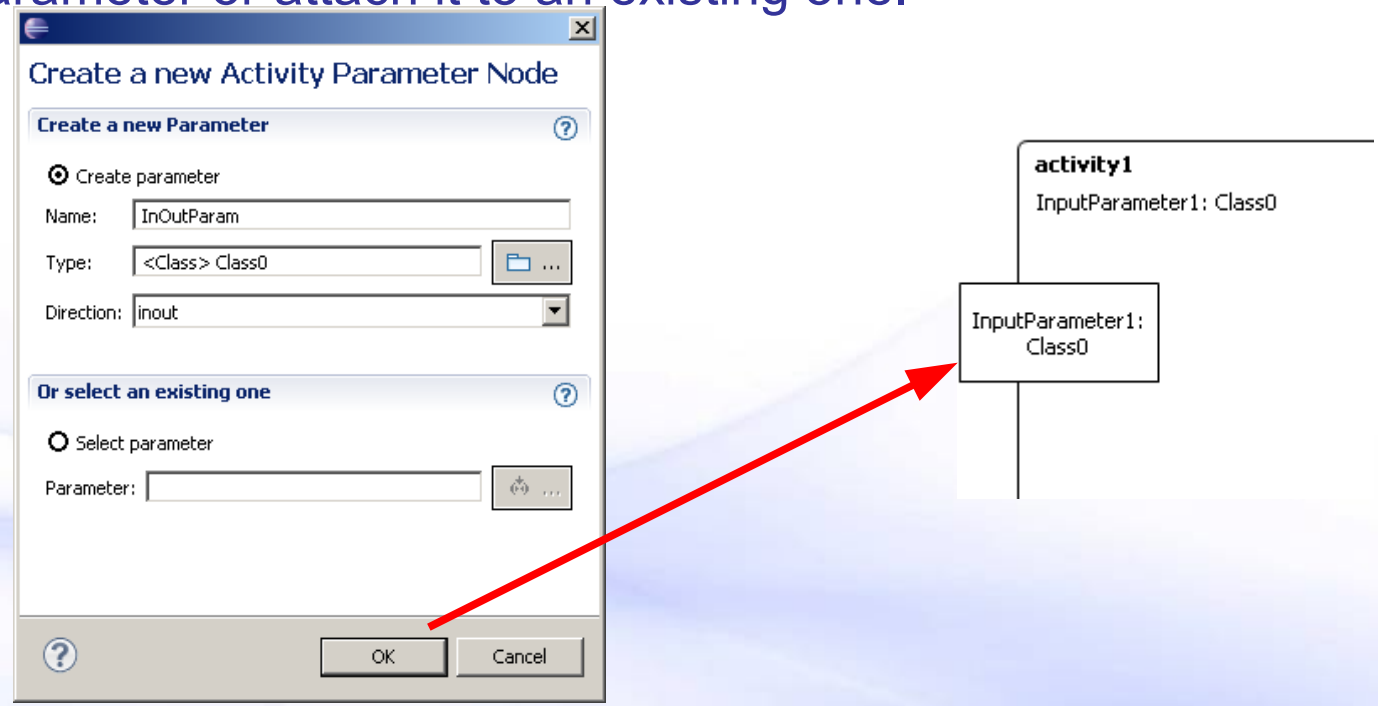
Object nodes (2/4).

- In the Advanced tab of the Properties view, you can edit the « In State » property.
  - The assigned states must have been previously created in a state machine.
  - This indicates the required states for the object handled by the object node.



Object nodes (3/4).

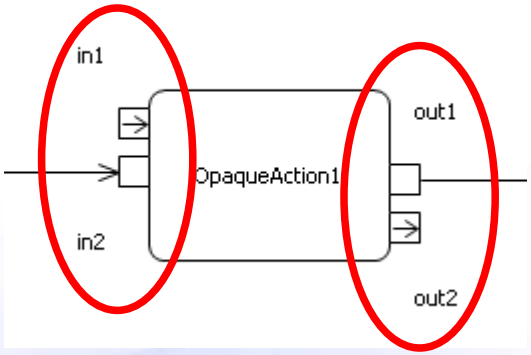
- These object nodes are available in the activity diagram :
  - Activity parameter node : provides inputs and outputs to the activity.
    - Activity parameter nodes are mapped on the activity's parameters. When creating a new one, you will be asked to either create a new parameter or attach it to an existing one.



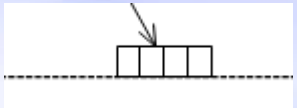
Object nodes (4/4).

- Data store node : stores incoming values before sending a copy of them on outgoing edges.

- Pin (output pin, input pin, action input pin, value pin) : provides inputs and outputs to an action. These may be constrained by the owning action.



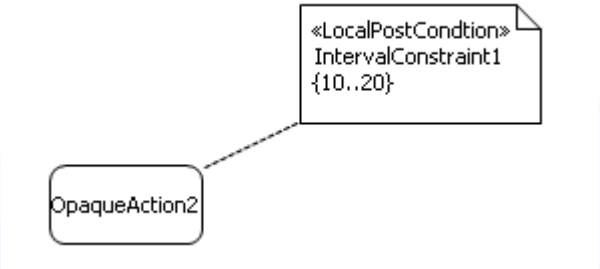
- Expansion node : provides inputs and outputs to an expansion region.



Actions (1/7).

- Actions are activity nodes representing an individual step within an activity.

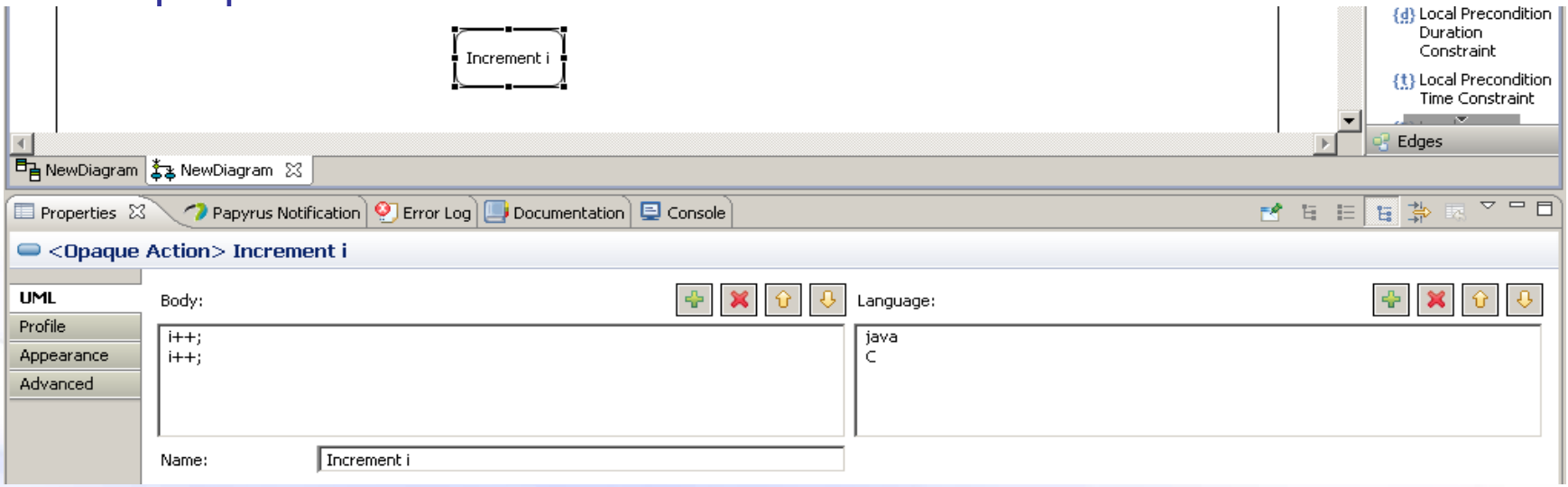
- Local pre and post conditions can be created on an action :
  - Select the appropriate local condition tool in the palette,
  - Click on the action,



  - You can then edit the condition's name and expression.

Actions (2/7).

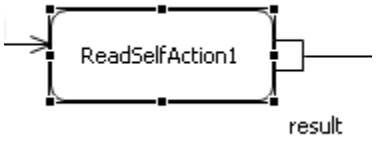
- You may create the following actions :
  - Opaque action : specifies an action with implementation-specific semantics.
    - Use the Properties view to set the « Body » and « Language » properties.



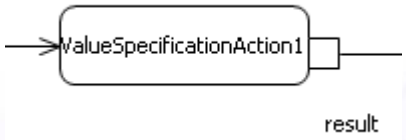
    - You may also use an opaque action if you do not want to specify the action's implementation.

Actions (3/7).

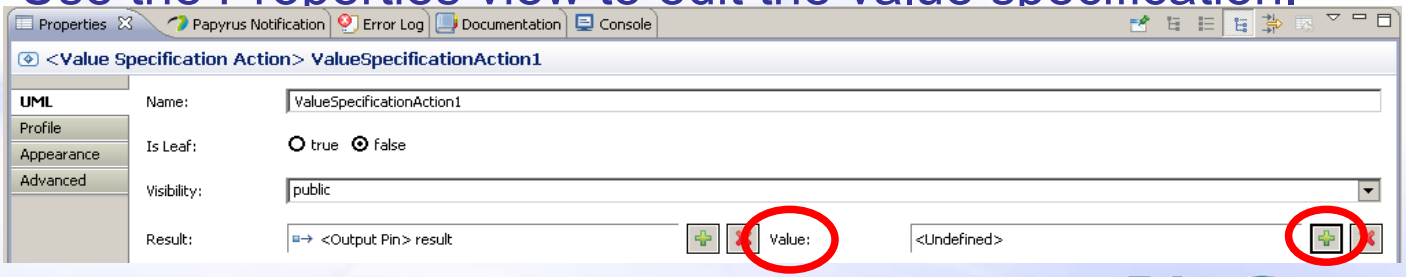
- Read self action : retrieves the host object.
  - This action always has a result output pin to return the hosting object.



- Value specification action : returns the result of evaluating a value specification.
  - This action always has a result output pin to return the evaluation result.

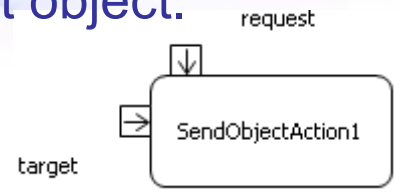


  - Use the Properties view to edit the value specification.

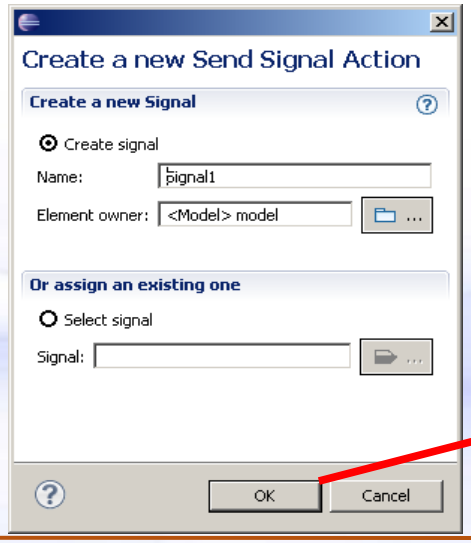


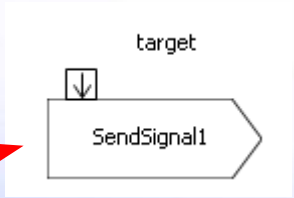
Actions (4/7).

- Send object action : sends a request to a target object.
  - This action always have target and request input pins.



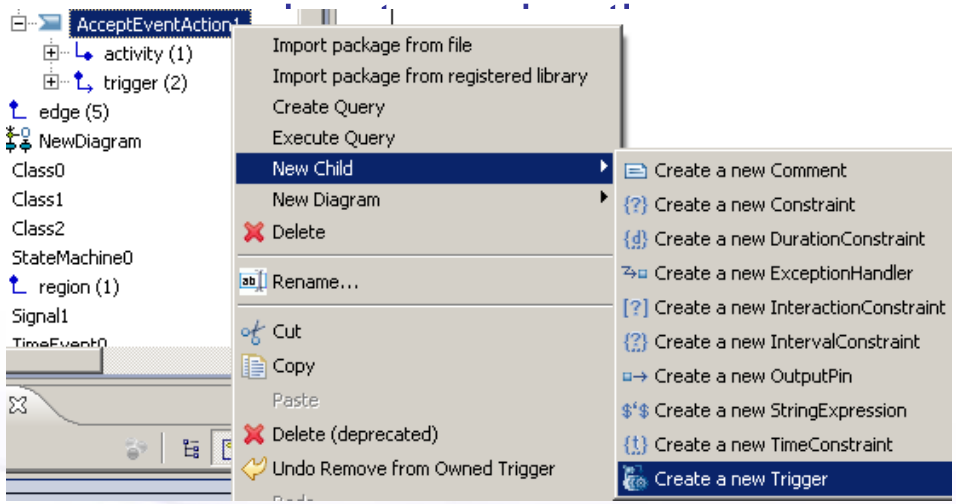
- Send signal action : sends a signal to a target object.
  - This action always has a target input pin.
  - When creating the action, you will be asked to either create a new signal or assign an existing signal to send.



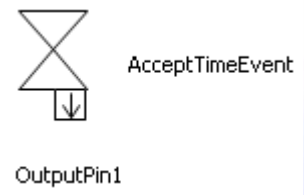


Actions (5/7).

- Accept event Action : waits for a particular event.
  - This action may not have any input pin.
  - Create triggers from the Model Explorer view or use the Properties

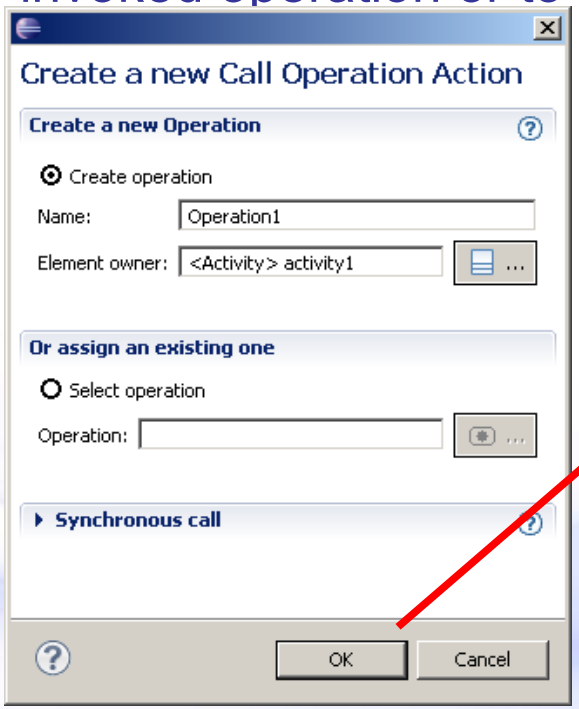


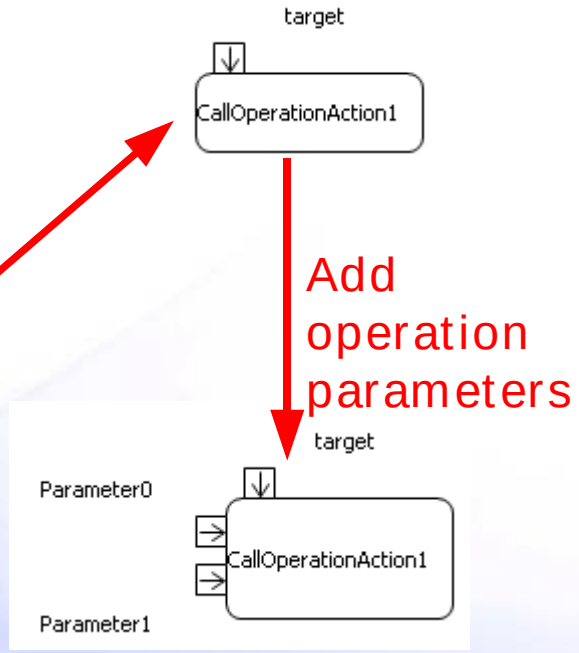
  - The number of output pins must depend on the assigned triggers.
    - (see UML specification)
  - If the triggers all have time events, the figure will change.



Actions (6/7).

- Call operation action : transmits an operation call request to a target.
  - This action always has a target input pins.
  - When creating the action, you will be asked either to create the new invoked operation or to assign an existing one.

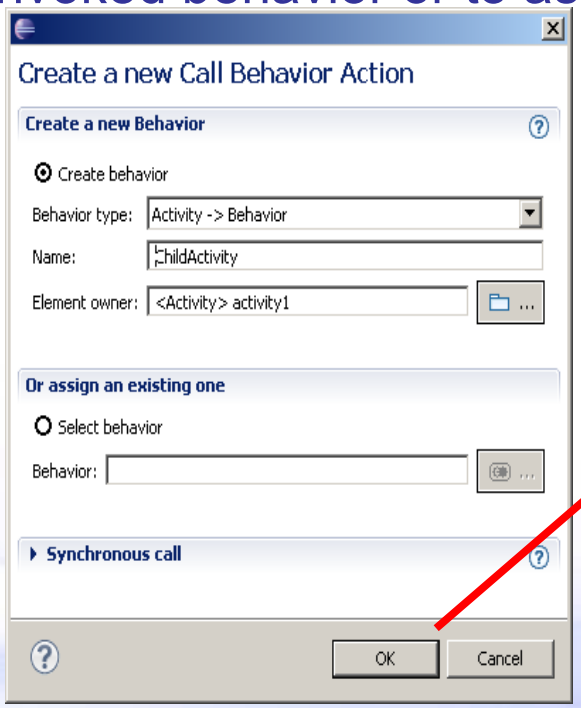


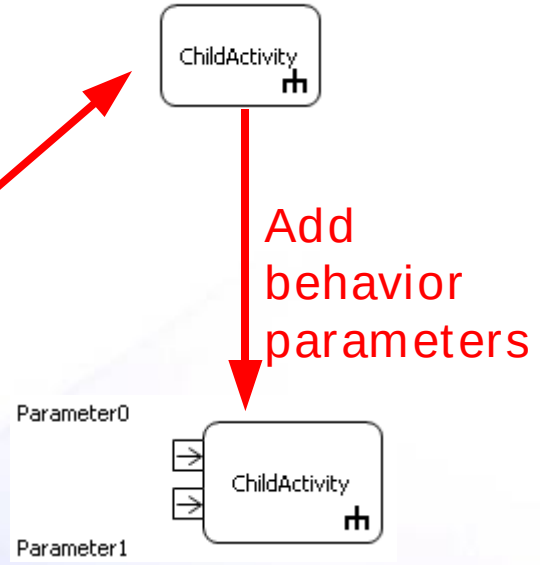


  - The action's pins are synchronized with the operation's parameters.

Actions (7/7).

- Call behavior action : invokes a behavior.
  - When creating the action, you will be asked either to create a new invoked behavior or to assign an existing one.

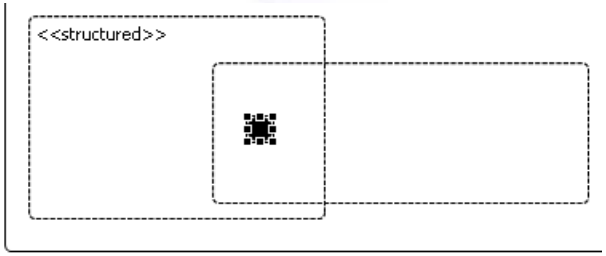




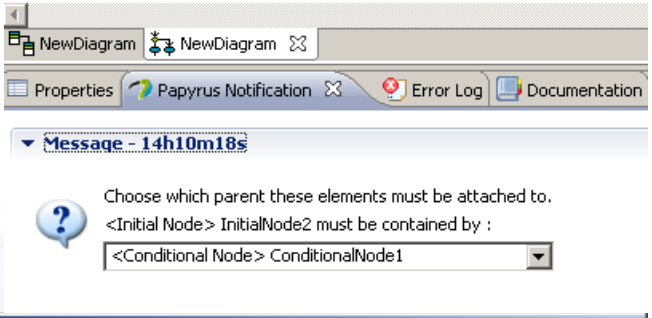
  - The action's pins are synchronized with the behavior's parameters.
  - The rake symbol indicates that the called behavior is an activity.

Activity groups (1/3).

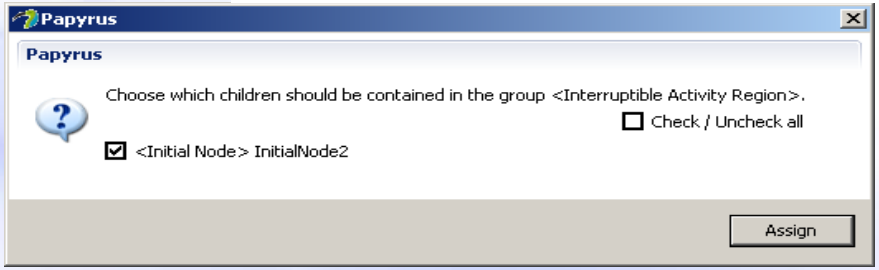
- Activity groups define sets of nodes and edges. Nodes and edges can belong to several groups. Yet, the graphical figure moves with the group which graphically contains it.



- When a node is placed in the intersection of several groups, you will be asked which group the figure shall graphically belong to.



- When a group is drawn over nodes already belonging to a group, you will be asked which nodes shall graphically belong to it.



Activity groups (2/3).

- You may create the following activity groups :
  - Activity partition : identifies nodes with a common characteristic.
    - Activity partitions can share some content with any group.

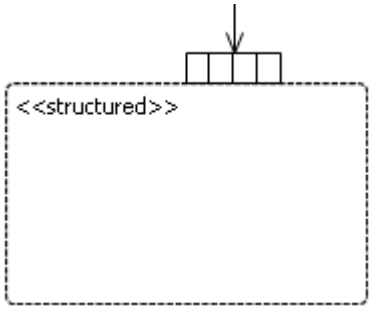
  - Interruptible activity region : terminates as soon as one a token leaves it through one of its interrupting edges.
    - Interruptible activity regions can share some content with any group.

  - Structured activity node : is an action with structured content.
    - Structured activity nodes can not share some content with each other.

Activity groups (3/3).

- Conditional node : a structured activity node representing an exlusive choice among several alternatives.

- Expansion region : a structured activity node that executes multiple times, once for each element of an input collection.
  - The input collection ugh an expansion node.

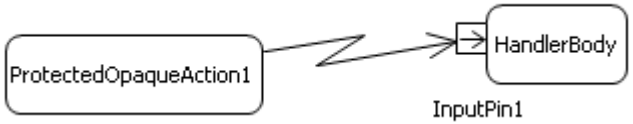


- Loop node : a structured activity node representing a loop with setep, test and body sections.

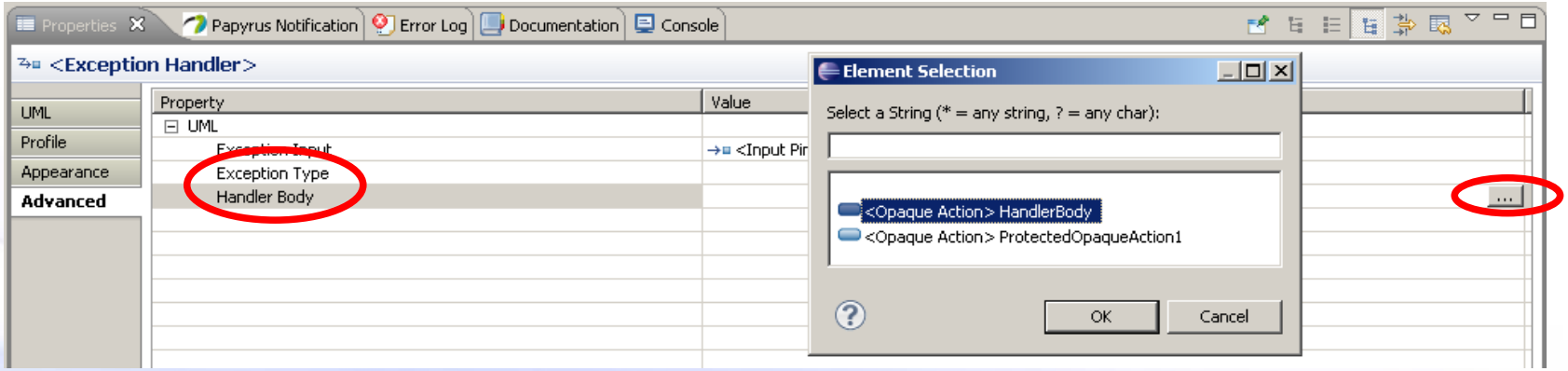
- Sequence node : a structured activity node that executes its actions in

Exception handlers.

- An exception handler is used to catch an exception.
  - Draw it from the palette, from the protected node to an input pin,



  - Then, in the Advanced tab of the Properties view, assign the « Handler Body » and the « Exception Type » properties.



  - The handler body must have only the exception input as input pin.
  - The handler body must have result output pins corresponding to the result output pins of the protected node.

Comments.

- You can create comments with the appropriate tools in the palette.
  - Select the « Comment » tool and click on the diagram to create a comment node.
  - Select the « Link » too and attach it to the commented element.
  - Fill the text in the comment node.