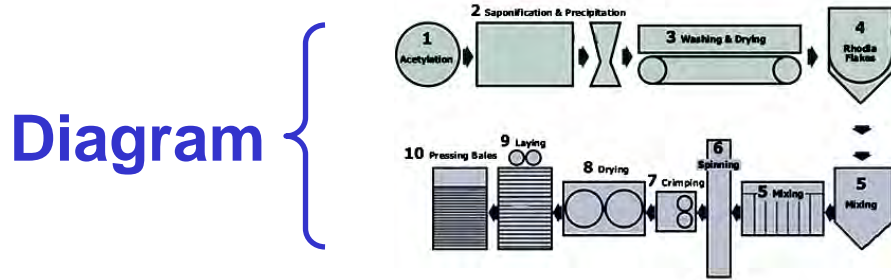


UML Profile for BPMN 2 Processes

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DPG, MSID
May 4, 2011



OMG Model Architecture



■ Graphics:

- Circles
- Lines
- Rectangles



Standardized as

■ *Concrete syntax*

■ Domain terms:

- Lathes, Feeders
- Drying, Shaping



Standardized as

■ *Abstract syntax*

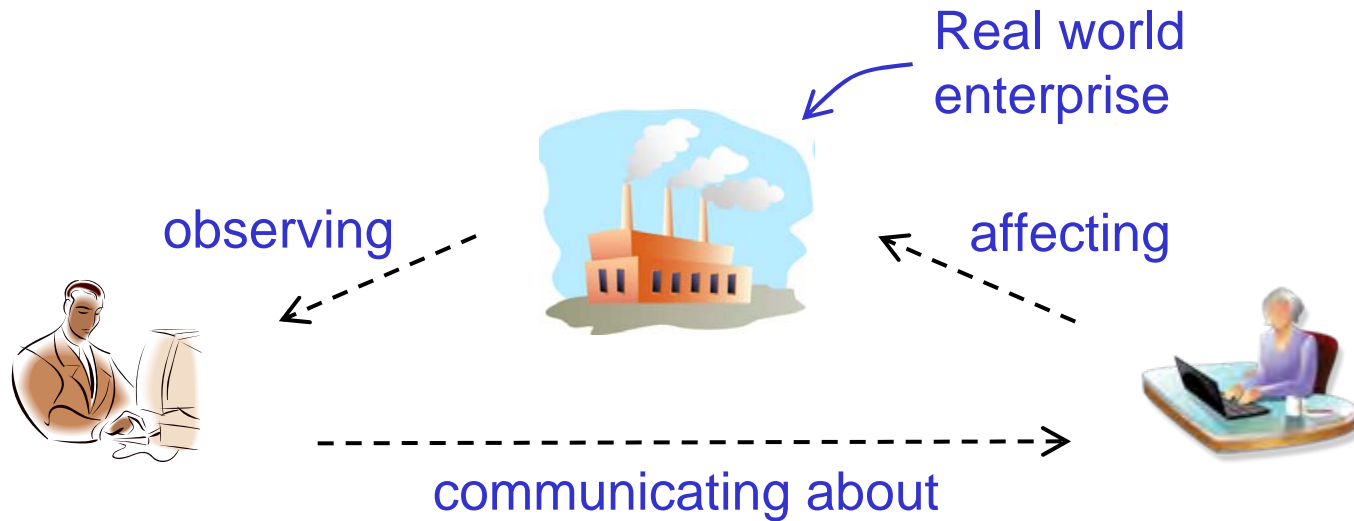
■ What happens:

- Geometry changed.
- Pieces mounted onto machine.
- Water removed.



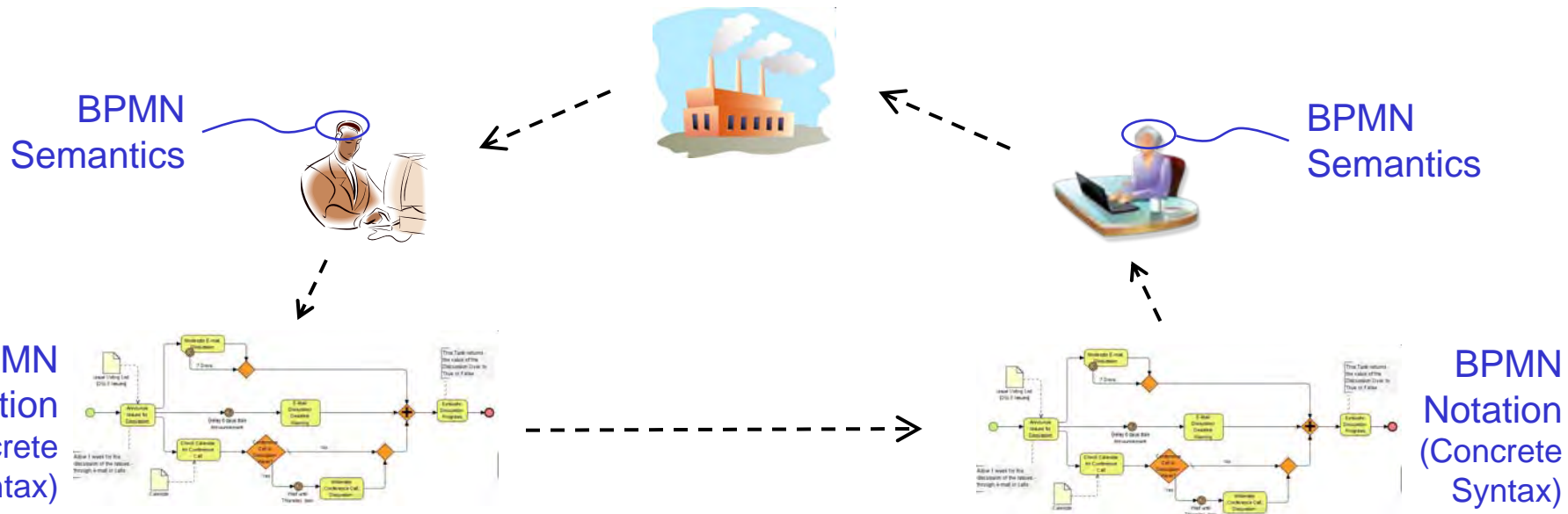
■ *Semantics*

Enterprise Workflow (No Models)



- **People communicating with each other about the real world enterprise.**
 - **Using computers without modeling (beyond typical office suites).**

Enterprise Workflow (Paper or Proprietary Electronic)



- **Using printed graphical models.**
 - Or proprietary electronic exchange
 - **BPMN 1.x**

Enterprise Workflow (Standard Electronic)



BPMN Semantics



BPMN Semantics



BPMN Notation (Concrete Syntax)



BPMN Notation (Concrete Syntax)



Metamodel / XSD (Abstract syntax)

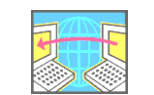


Metamodel / XSD (Abstract syntax)



Interchange file (instances of MM / XSD)

```
<?xml version="1.0" encoding="UTF-8"?>
<definitions id="def"
  targetNamespace="http://www.example.org/Proce
  typeLanguage="http://www.w3.org/2001/XMLSche
  xsi:schemaLocation="http://www.omg.org/bpmn20
  <dataPath>ins.nextTopicId</dataPath>
  </correlationPropertyBinding>
  </correlationSubscription>
  </process>
</definitions>
```



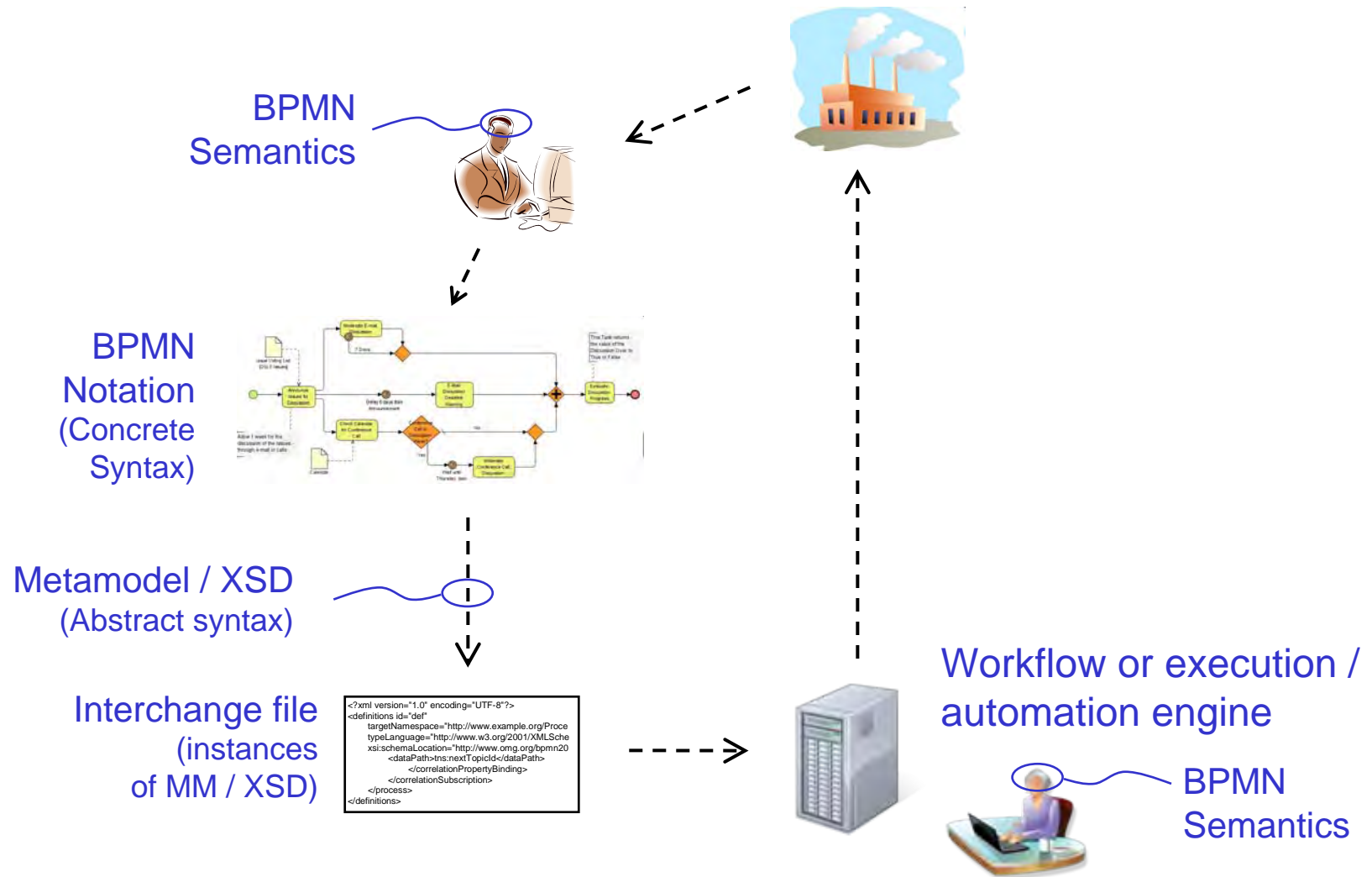
Network

```
<?xml version="1.0" encoding="UTF-8"?>
<definitions id="def"
  targetNamespace="http://www.example.org/Proce
  typeLanguage="http://www.w3.org/2001/XMLSche
  xsi:schemaLocation="http://www.omg.org/bpmn20
  <dataPath>ins.nextTopicId</dataPath>
  </correlationPropertyBinding>
  </correlationSubscription>
  </process>
</definitions>
```

Interchange file (instances of MM / XSD)

- Graphics translated to domain terminology. 5

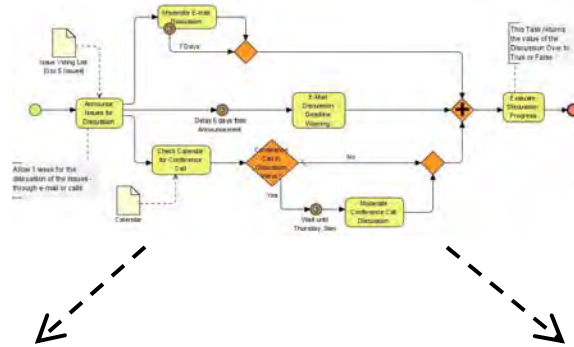
Automation Workflow



- **Machines directly affecting enterprise.**⁶

Equivalent Semantics

BPMN
Notation
(Concrete
Syntax)



Instances of BPMN 2
MM / XSD

Instances of the UML / SysML
MM with profile applied.

BPMN
semantics

UML / SysML
semantics
adapted for BPMN

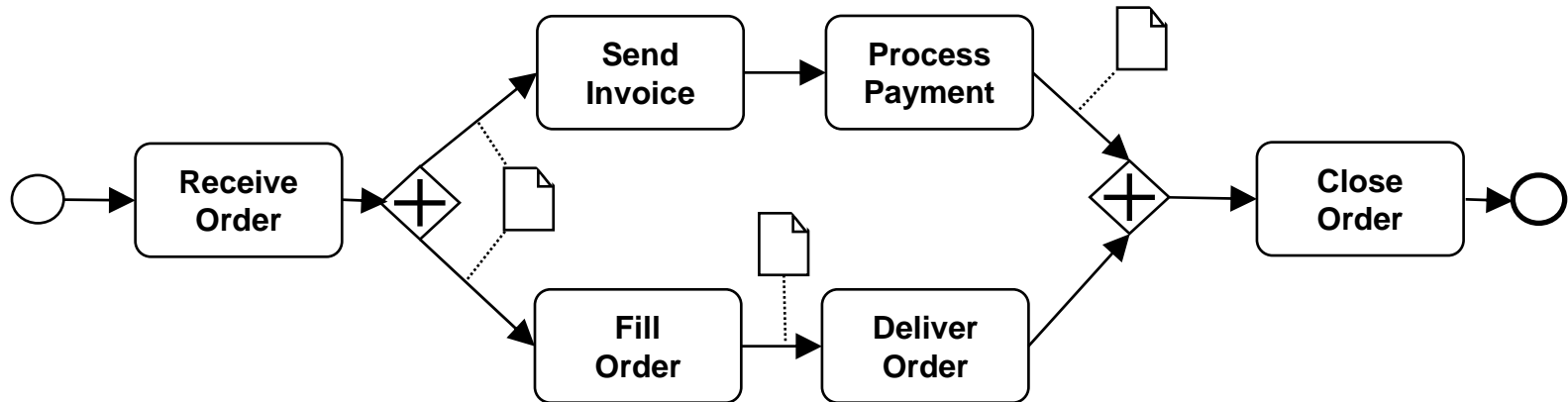


- Enterprise works the same regardless of metamodel.

OMG Requirements

- **Mapping between BPMN 2 semantics and the profiled UML / SyML semantics.**
- **XSLT and QVT transforms between BPMN and profiled UML interchange formats (abstract syntax).**
- **Scope:**
 - **Internal enterprise processes.**
 - **Interactions between enterprises.**

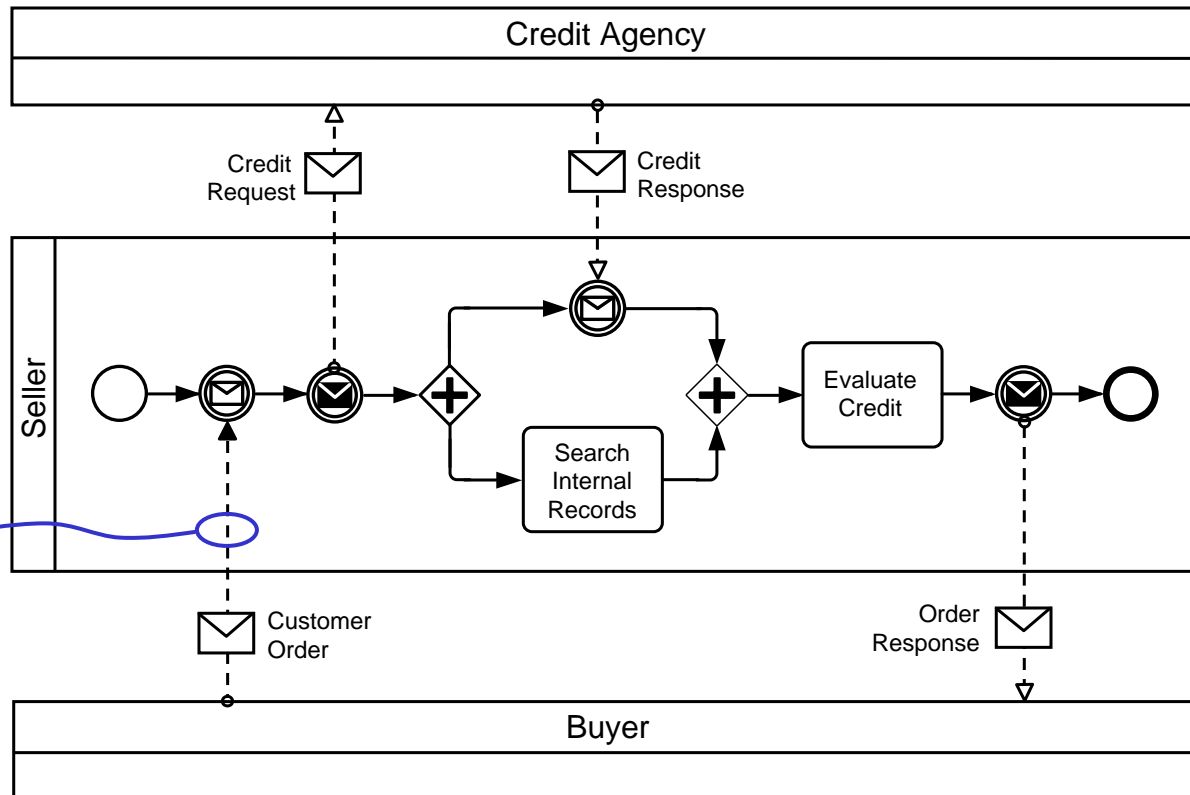
BPMN Processes



- Usually internal to enterprises.

BPMN Collaborations

Participant

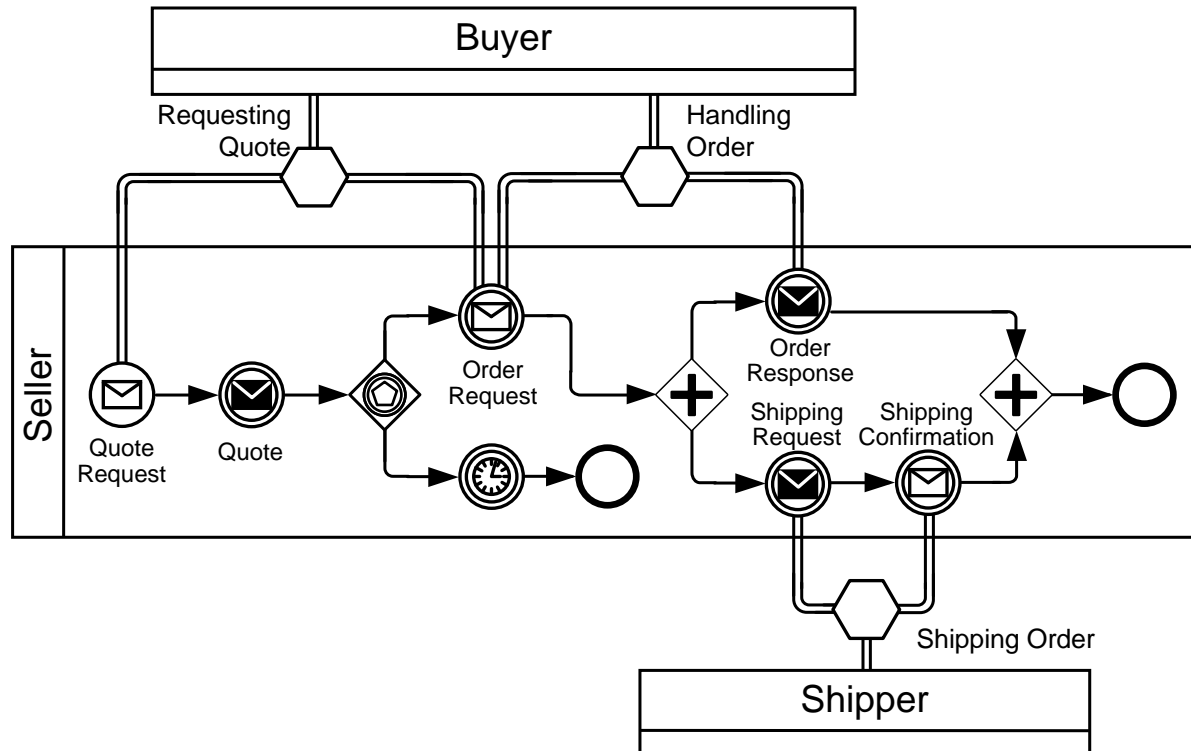


Process

Message flow

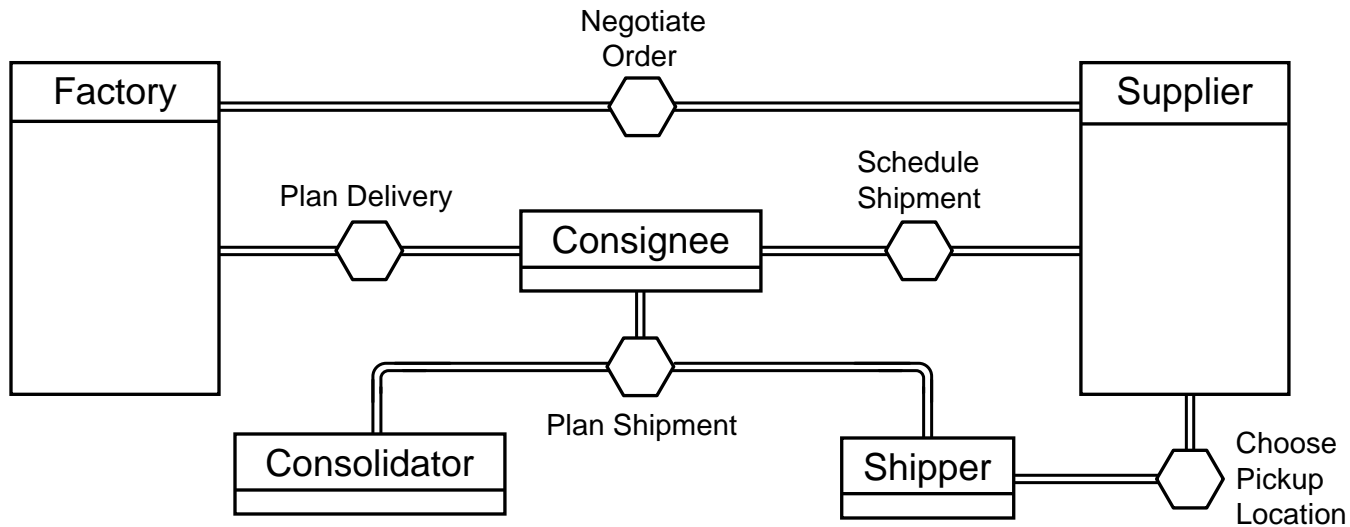
- Collaborations show message flows between participants.

BPMN Conversations



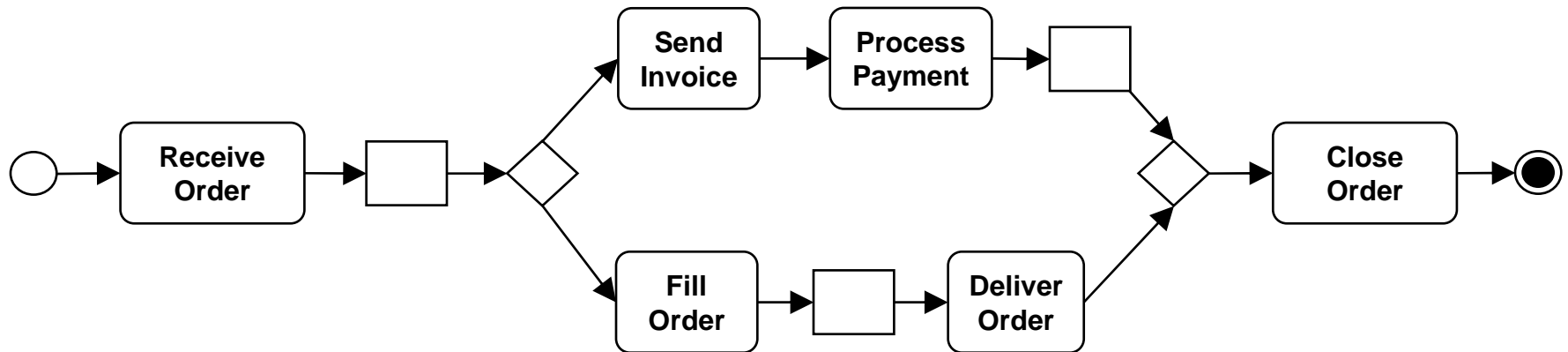
- **Conversations group message flows.**

BPMN Conversations



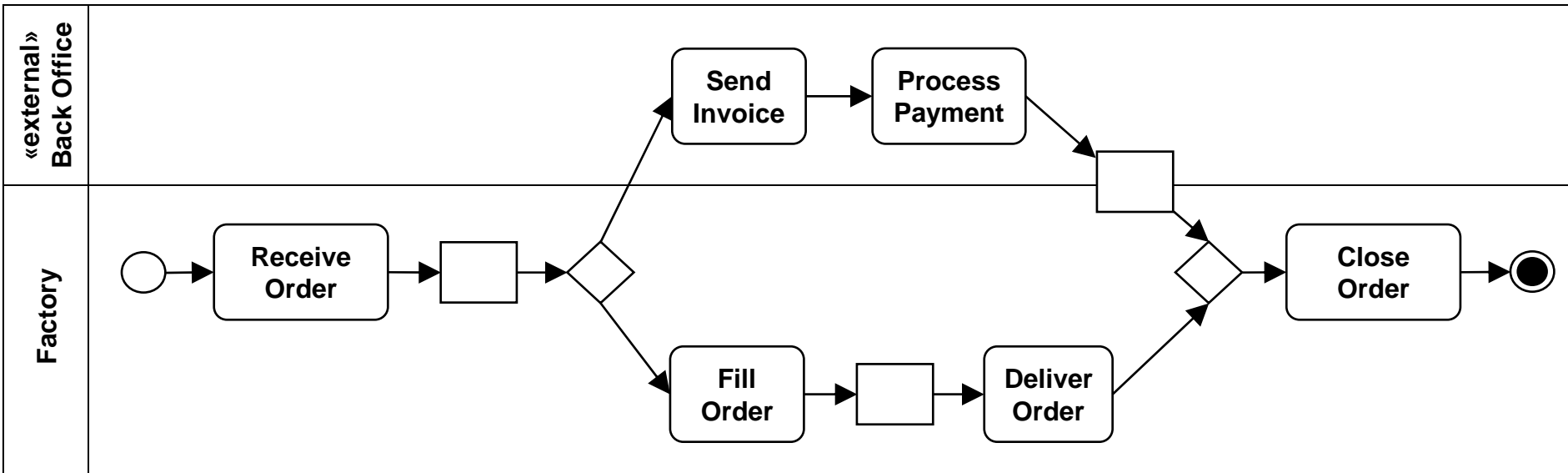
- **Collaborations can show only conversations**
 - No processes or message flow.
 - Informally called a “conversation diagram”.

UML / SysML Activities



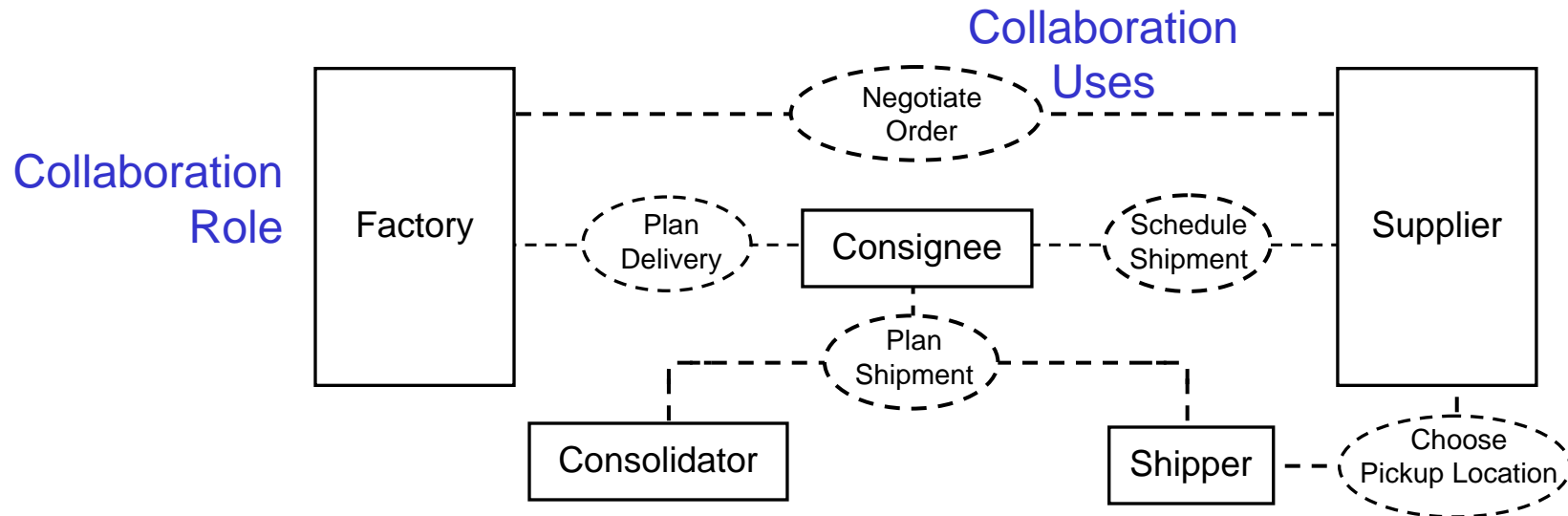
- **Very similar to BPMN processes, but some notational and semantic differences.**

Activities ≠ BPMN Collaborations



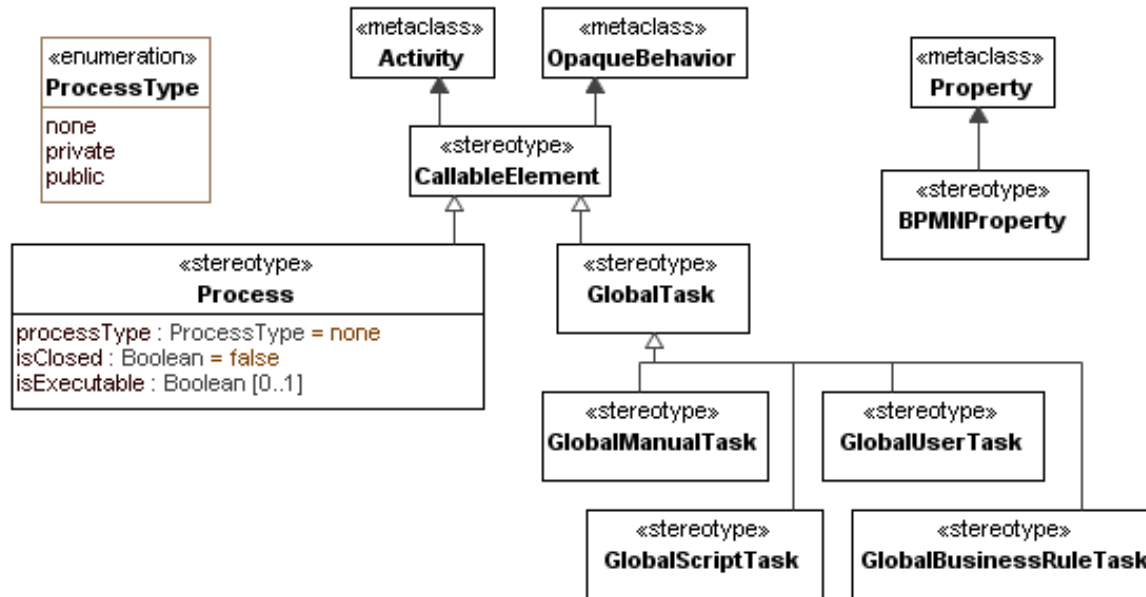
- **Activities model a single process.**
 - Not interactions between processes.
 - Same for BPMN processes.

UML Collaborations



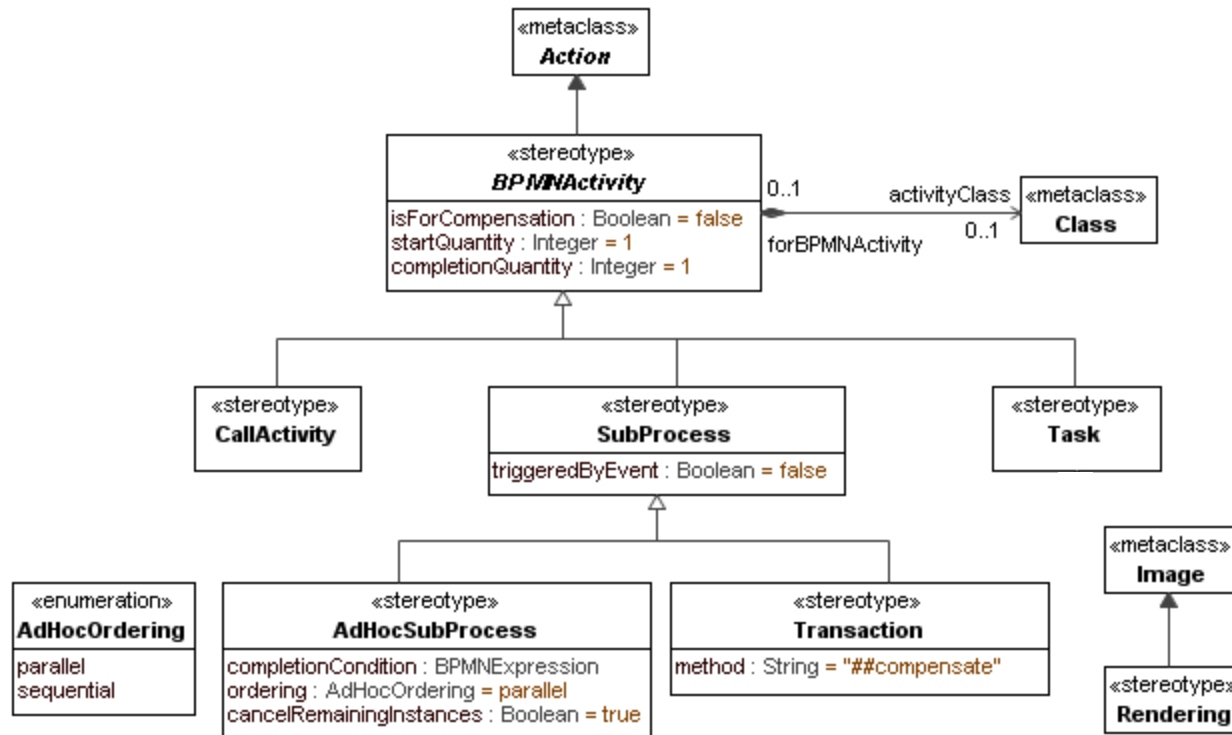
- **Similar to conversation-only BPMN Collaboration.**
- **Does not have notation for activities inside collaboration roles.**
 - **But the UML metamodel supports roles referring to activities, so the profile can support BPMN notation.**

BPMN Processes in Profile



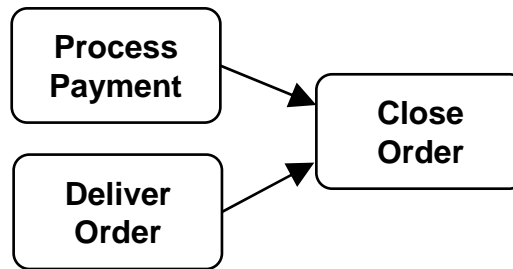
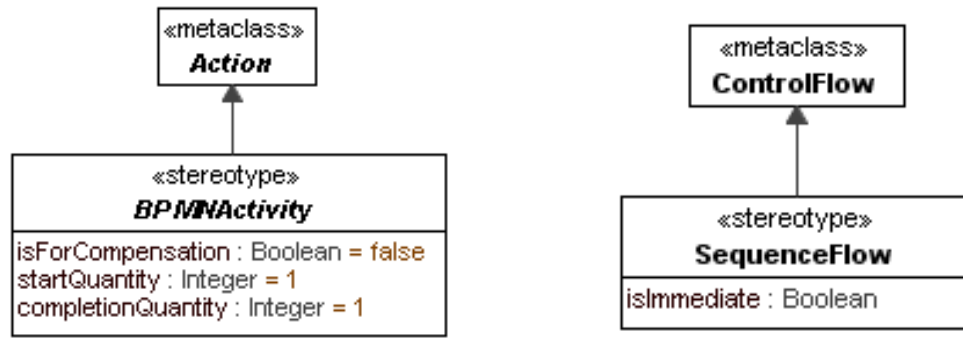
- **Stereotypes introduced generally, then restricted.**
 - Process stereotype applies to UML Activity, global task stereotypes to UML OpaqueBehavior.
- **Semantic constraint:**
 - `isClosed` prevents actions taken that are not in the model.
- **Application constraints: BPMN specifies how the various global tasks are to be used.**
 - Affect modeler, not language semantics.

BPMN Activities in Profile



- **Syntactic extension:**
 - BPMN supports properties on activities.
 - Profile extends UML actions with classes.
- **Semantic constraint:**
 - Properties of AdHocProcesses constrain execution of UML Activities that do not have flows between actions.
- **Renaming: UML Image => BPMN Rendering**

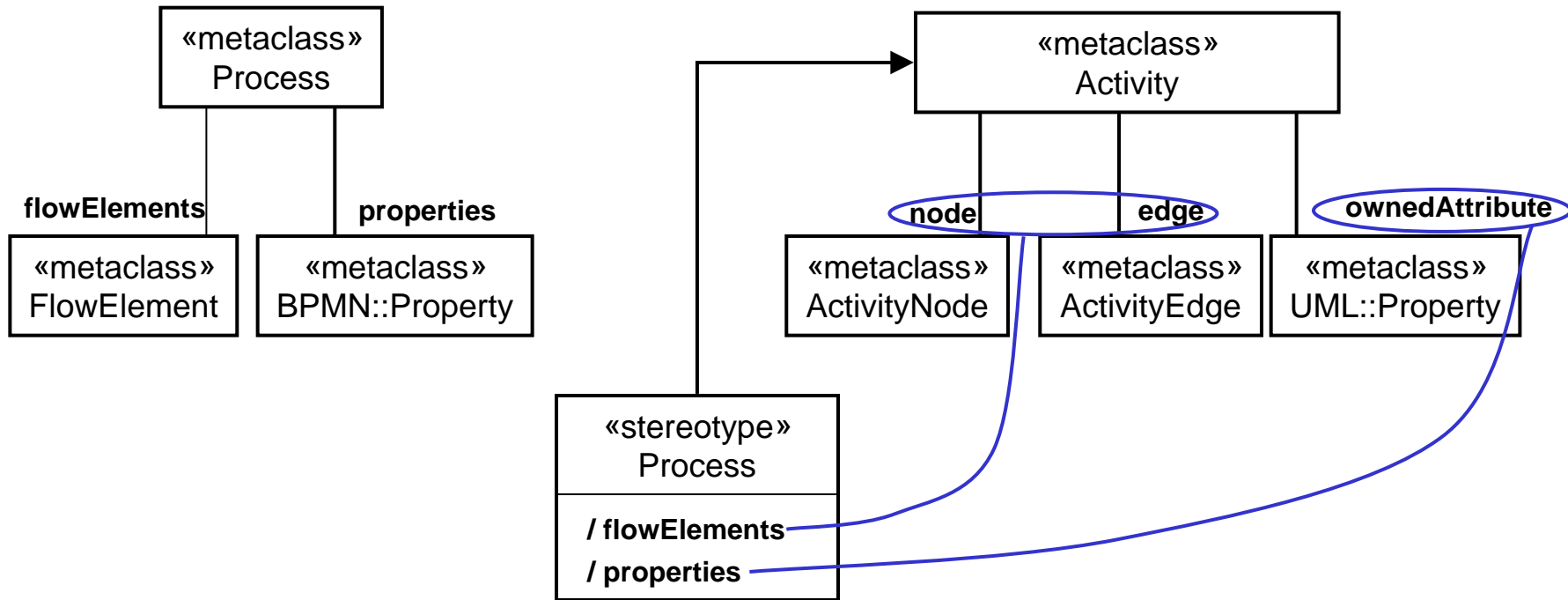
BPMN Activities in Profile



Close Order will happen twice in BPMN, once in UML

- **Semantic modification:**
 - BPMN normally starts activities when one incoming sequence flow provides input.
 - UML normally starts actions when all incoming control flows provide input.
 - BPMNActivity stereotype modifies UML semantics for the models it is applied to.

BPMN Metamodel Navigation

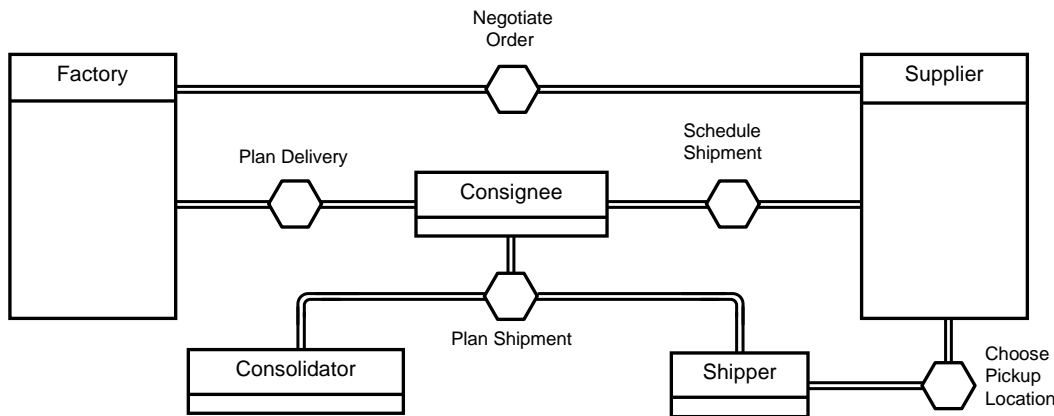


- **Stereotypes have properties for BPMN derived from UML properties.**
- **Can navigate a profiled UML model as if it were a BPMN model.**

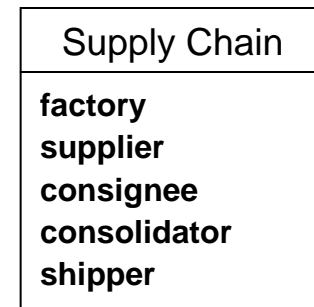
Other Process Elements

		BPMN	UML
Events		Catch Events	Accept Event Actions, Initial Nodes
		Throw Events	Call Operation Actions, Activity Final Nodes
		Event Definitions	Events
Gateways		Exclusive Gateways	DecisionNodes, MergeNodes
		Parallel, Complex, Inclusive Gateways	JoinNodes, ForkNodes
		Event-based Gateways	ForkNodes + Interruptible Regions
Data		Data Inputs, Data Outputs	Input Pins, Activity Parameter Nodes, Output Pins
		Data Associations	Object Flows
		Data Objects	Data Store Nodes
Lanes & Resources		Input Sets, Output Sets	Parameter Sets
		Lanes, LaneSets	Activity Partitions
		Resources, Item Definitions	Classes
		Resource Roles / Parameters / Bindings	Properties, Slots

Collaborations in Profile

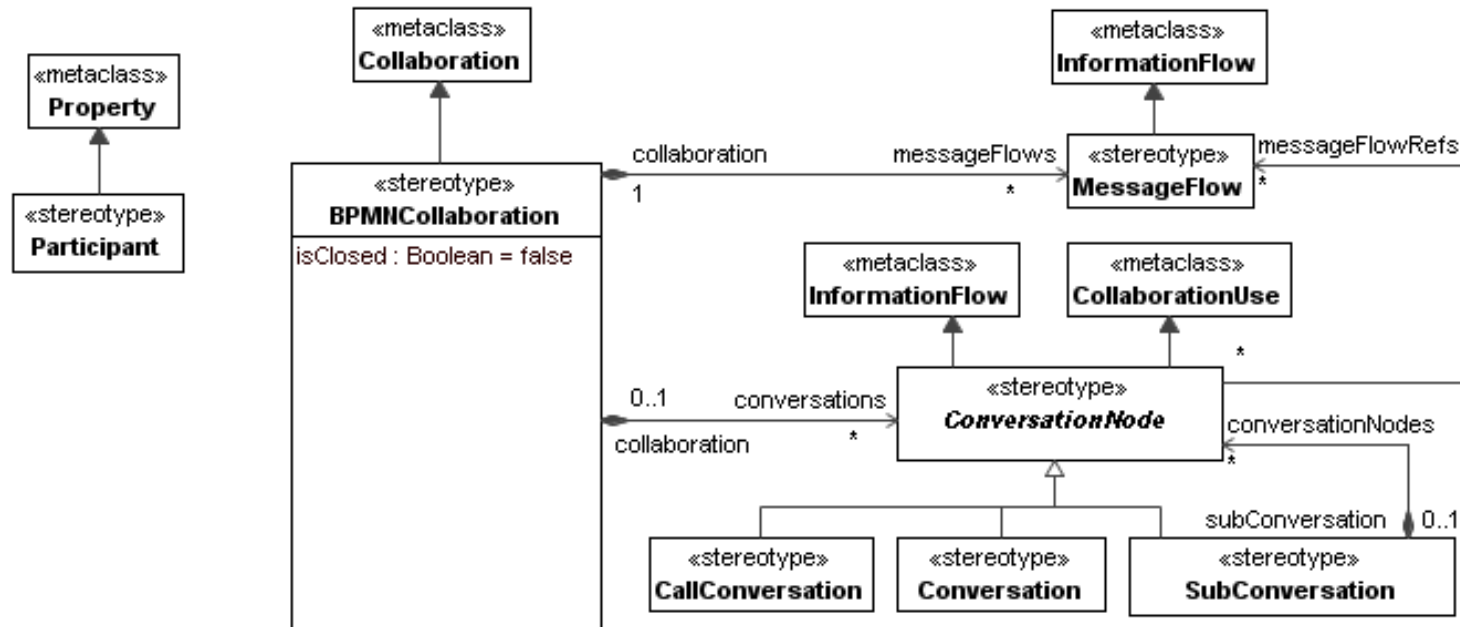


UML Collaboration
in underlying model



- **UML Collaborations are Classifiers.**
- **Collaboration roles are properties.**

Collaborations in Profile



- **Participants are UML Properties.**
 - Typed by Classes or Activities.
- **Message Flow are constrained UML Information Flows.**
 - Link actions in separate activities of the participants.
- **Conversations are UML CollaborationUses, or Information Flow is locally defined.**

Summary

- **Profile extends UML / SysML with BPMN terminology, syntax, and equivalent semantics.**
 - **Profiled UML / SysML model can be navigated as if it were a BPMN model.**
 - **UML / SysML semantics is constrained, extended or modified as needed for equivalence.**
- **BPMN Processes => UML / SysML Activities**
- **BPMN Collaborations => UML Collaborations**
- **BPMN Message Flow => UML / SysML Information Flow**