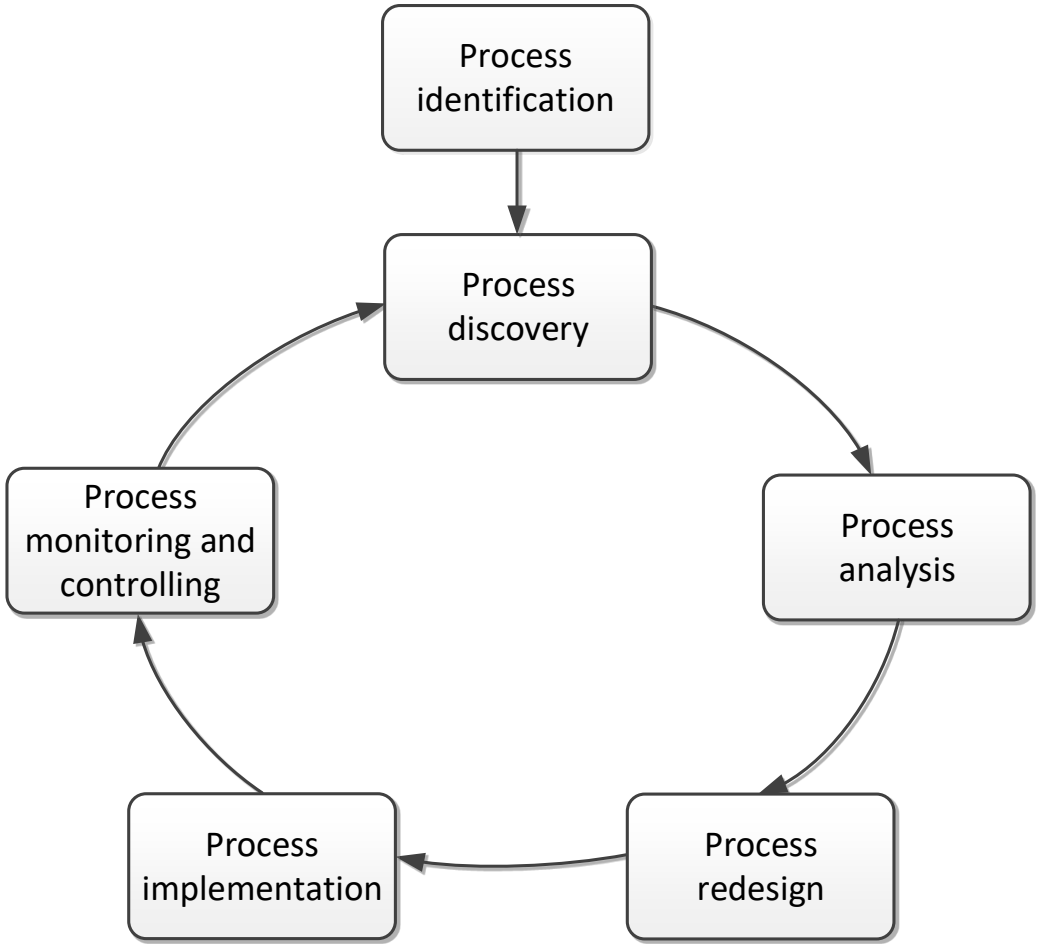
ULB

INFO-H420
Management of Data Science and Business Workflows
Part I
2. Process Modeling

Dimitris SACHARIDIS

2023-2024

BPM lifecycle



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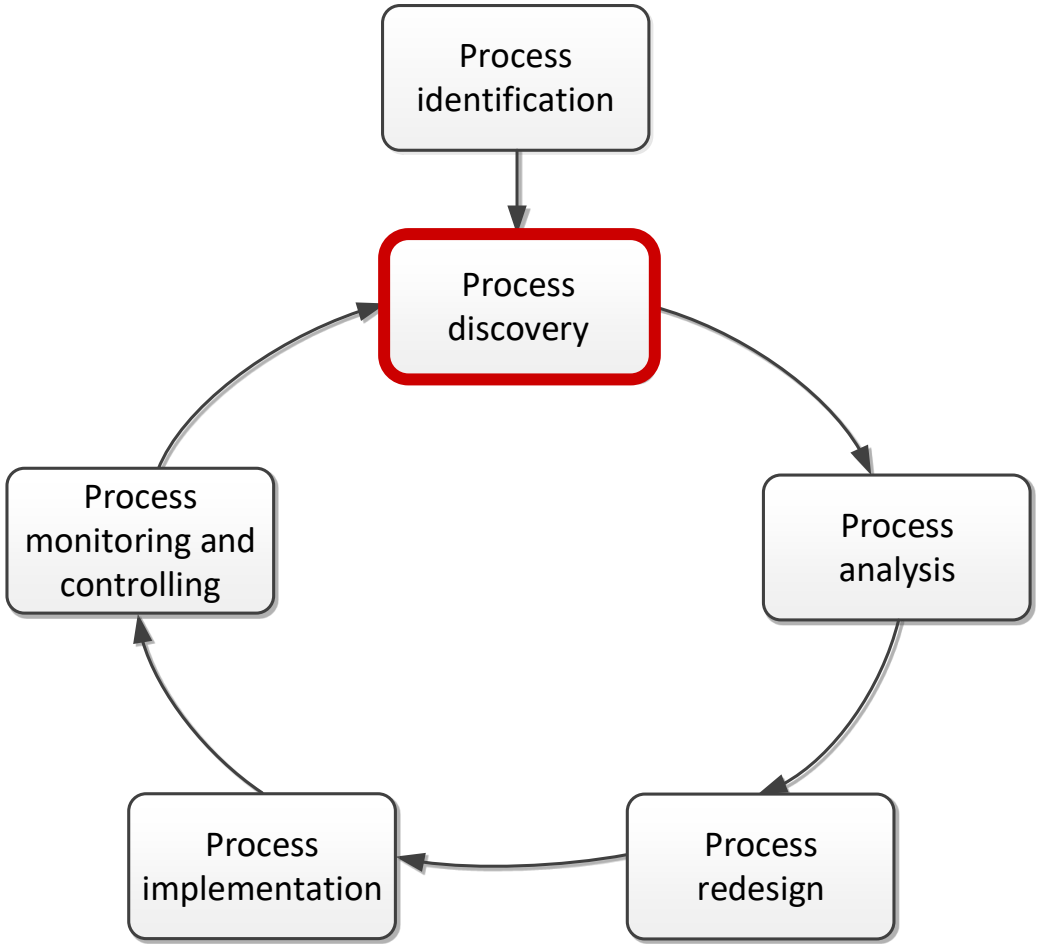

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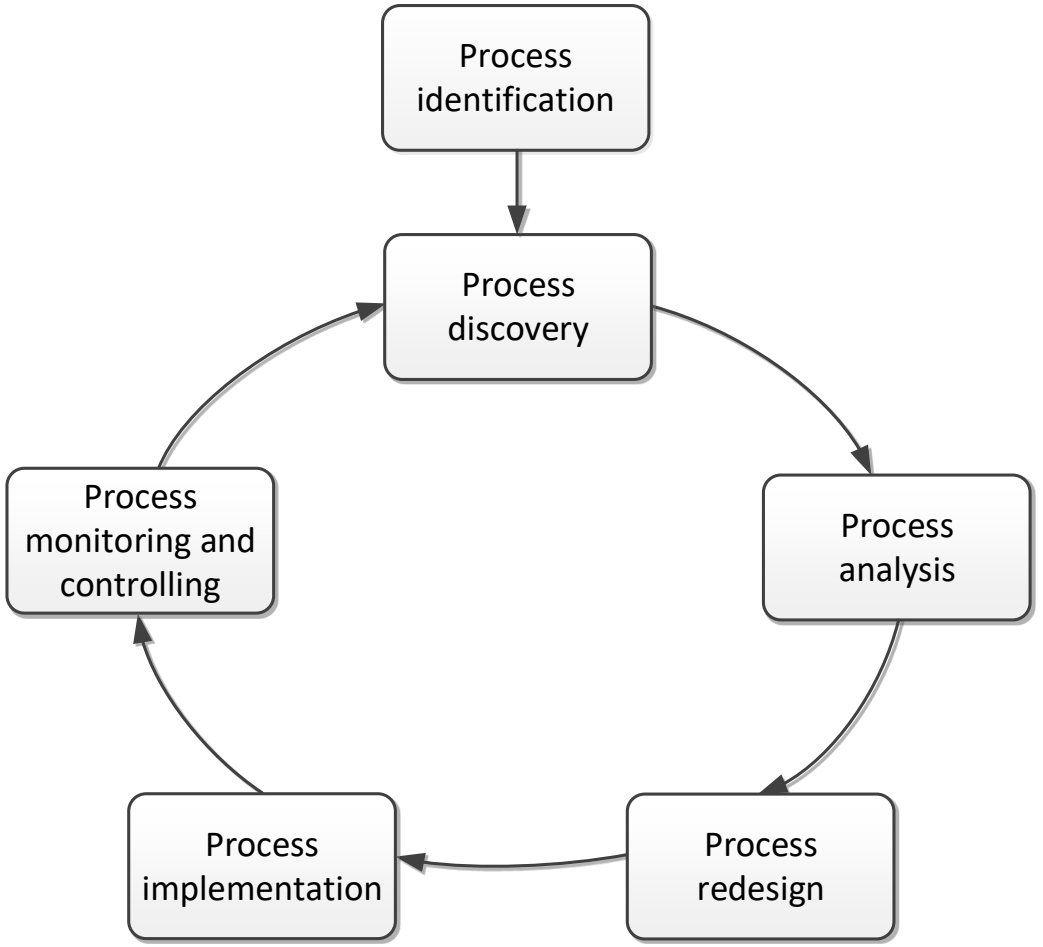
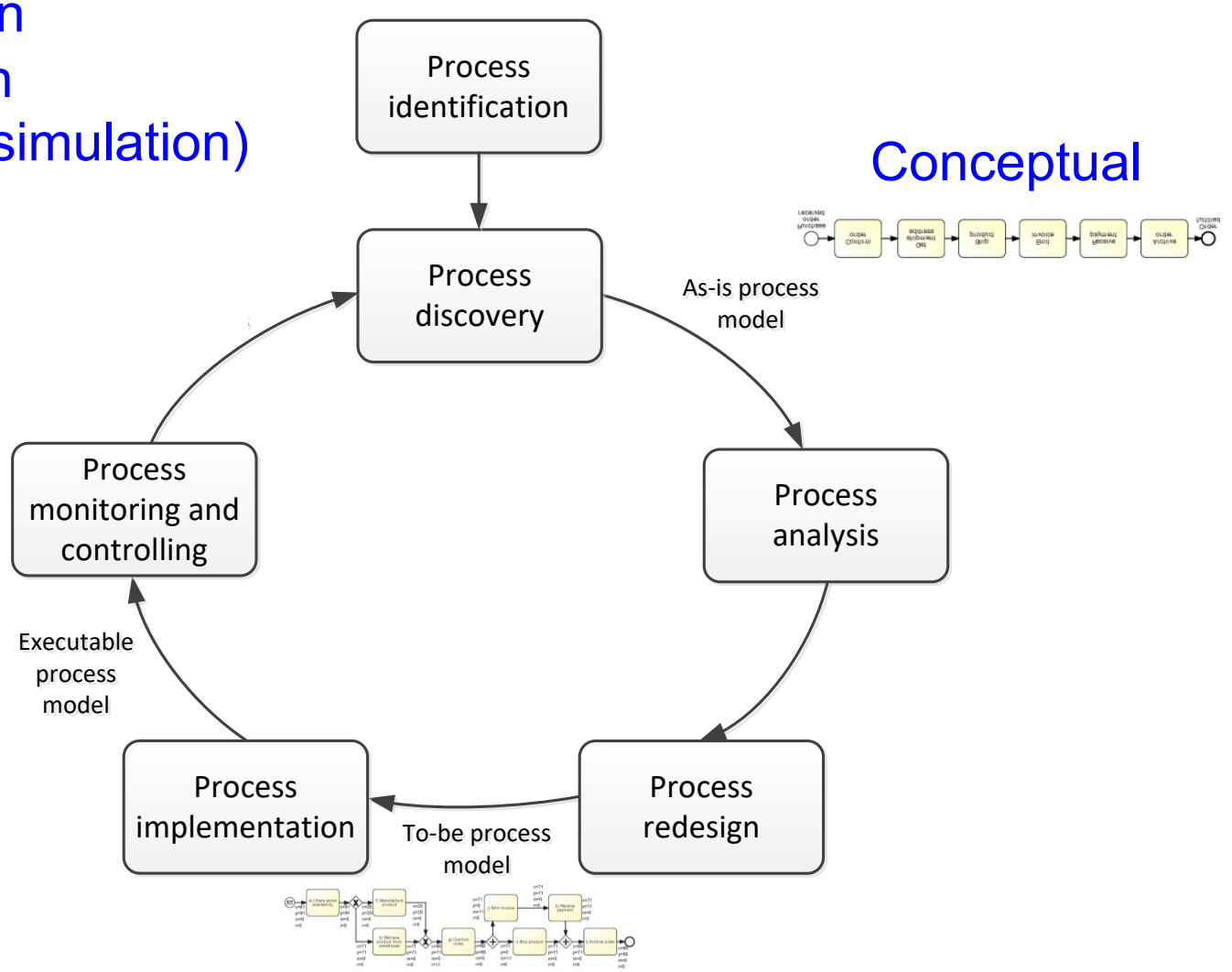


Purposes of process modeling

- Communication
- Documentation
- Analysis (e.g. simulation)



Conceptual

Executable

Conceptual

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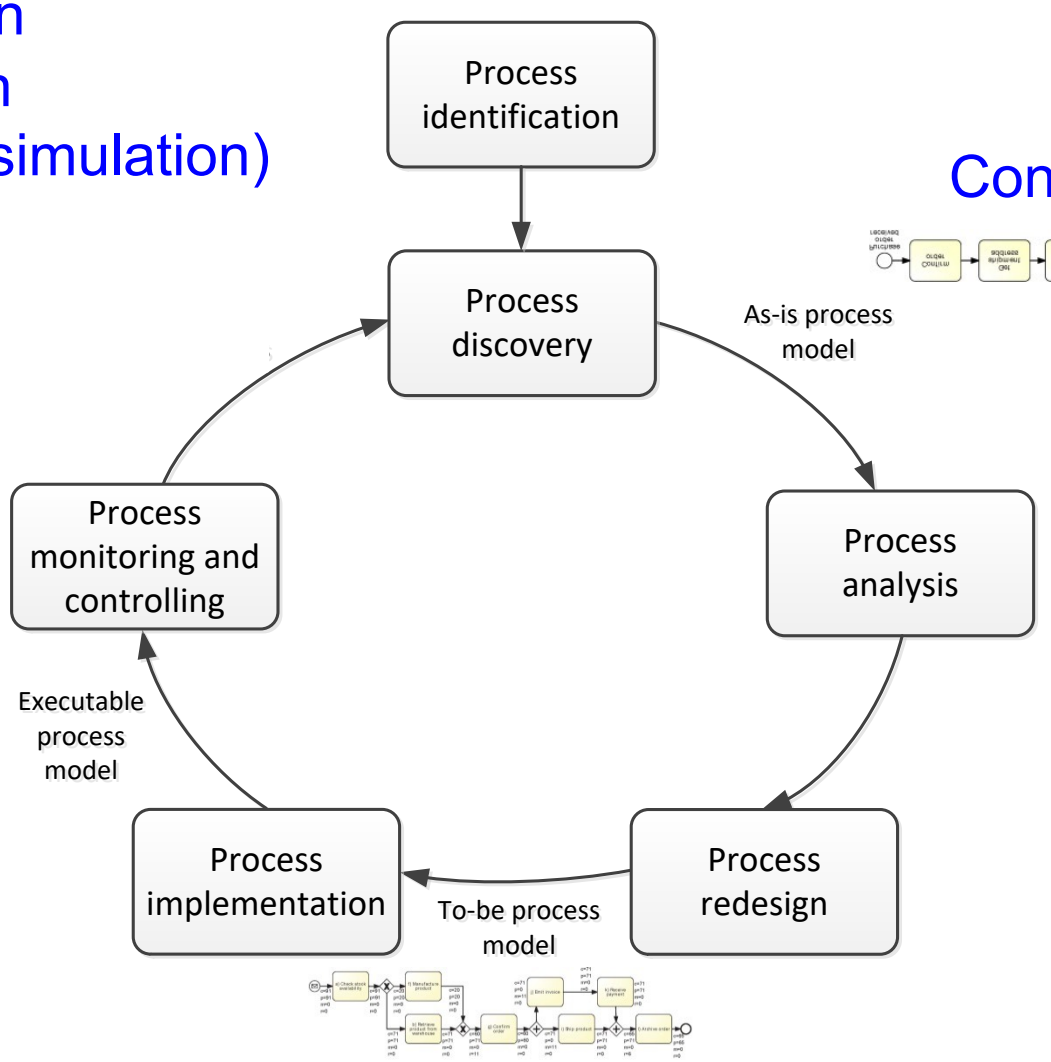
Conceptual



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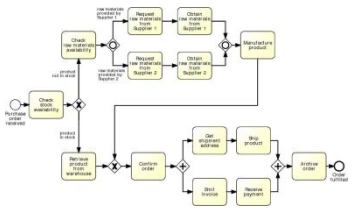

- Automation
- Testing

Conceptual

Business Process Model and Notation (BPMN)

- OMG standard (nowadays BPMN 2.0)
- Both for conceptual and executable models
- Supported by numerous tools: bpmn.org lists over 70 tools, incl.
  - **Camunda**
  - **Apromore**
  - Signavio
  - Bizagi Process Modeler
  - Cameo Business Analyst

BPMN from 10,000 miles…

A BPMN process model is a graph consisting of four types of **core elements**:

BPMN from 10,000 miles…

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activity

BPMN from 10,000 miles…

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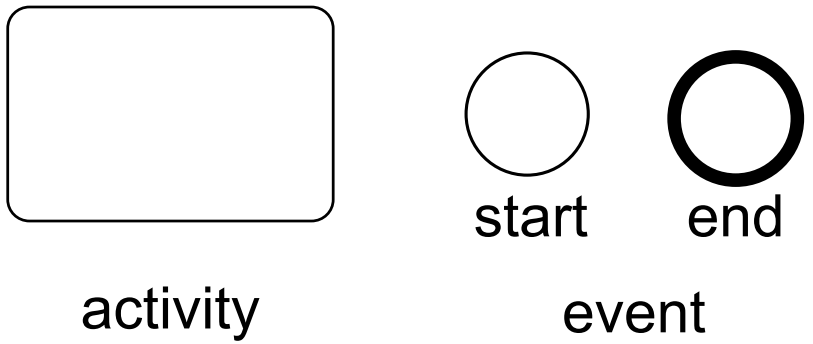

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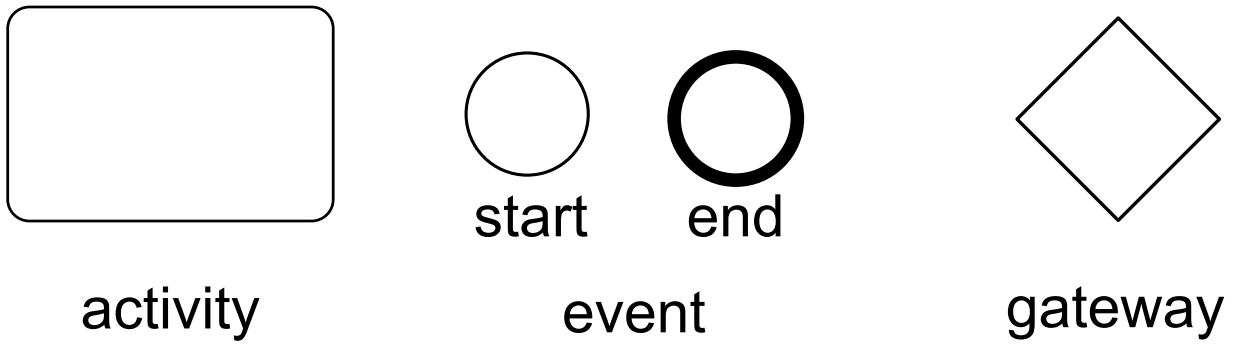

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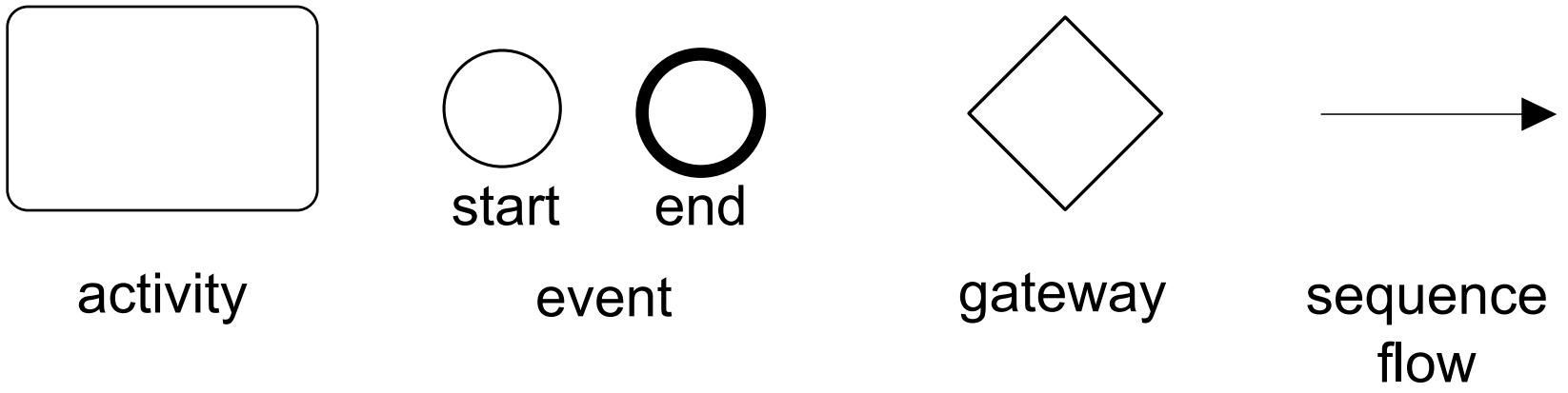

Let’s start modeling

Order-to-cash

An order-to-cash process is triggered by the receipt of a purchase order from a customer. Upon receipt, the purchase order has to be checked against the stock to determine if the the requested item(s) are available. Depending on stock availability the purchase order may be confirmed or rejected.

If the purchase order is confirmed, an invoice is emitted, and the goods requested are shipped. The process completes by archiving the order.

Let’s start modeling – break it down

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BPMN Model

Order-to-cash

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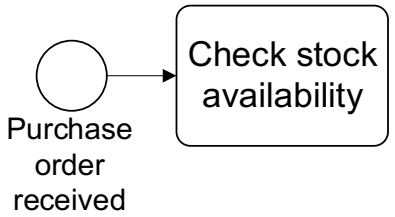
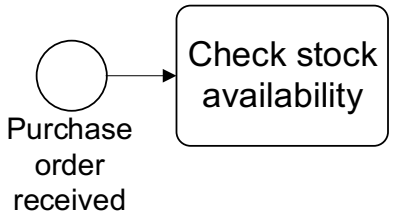
Order-to-cash



BPMN Model

Order-to-cash

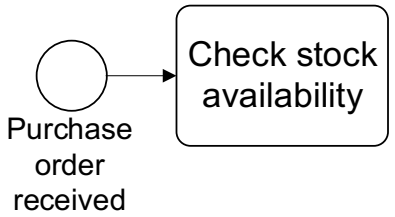


Naming conventions

- Event: noun + past-participle verb (e.g., insurance claim lodged)

BPMN Model

Order-to-cash



Naming conventions

- Event: noun + past-participle verb (e.g., insurance claim lodged)
- Activity: verb + noun (e.g., assess credit risk)

Let’s start modeling – break it down

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BPMN Model

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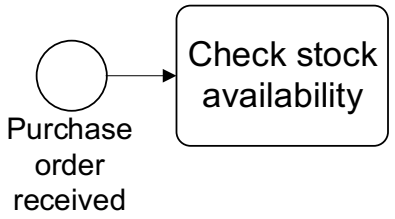

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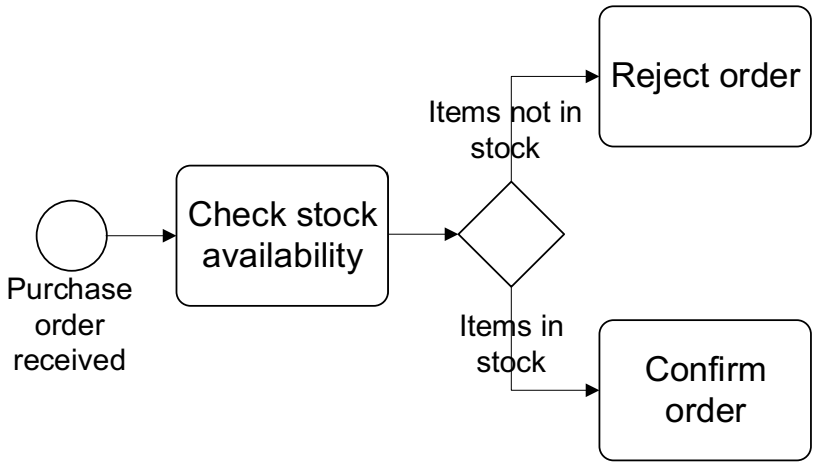

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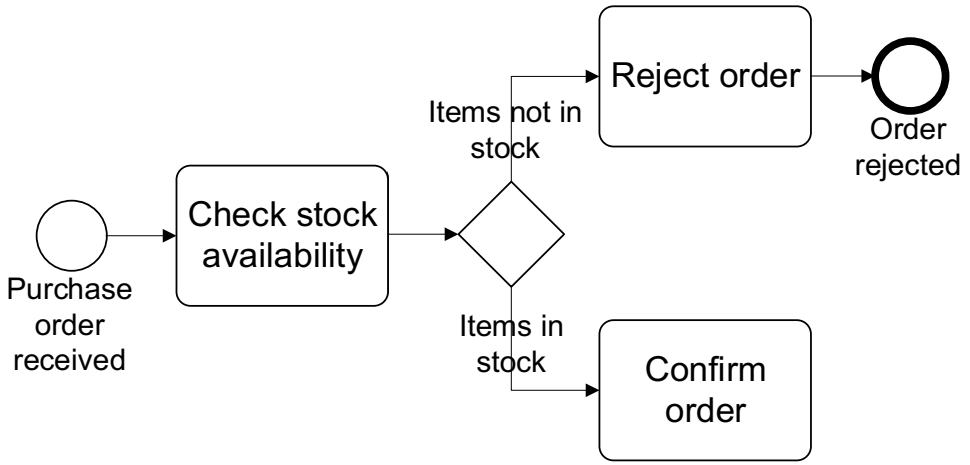

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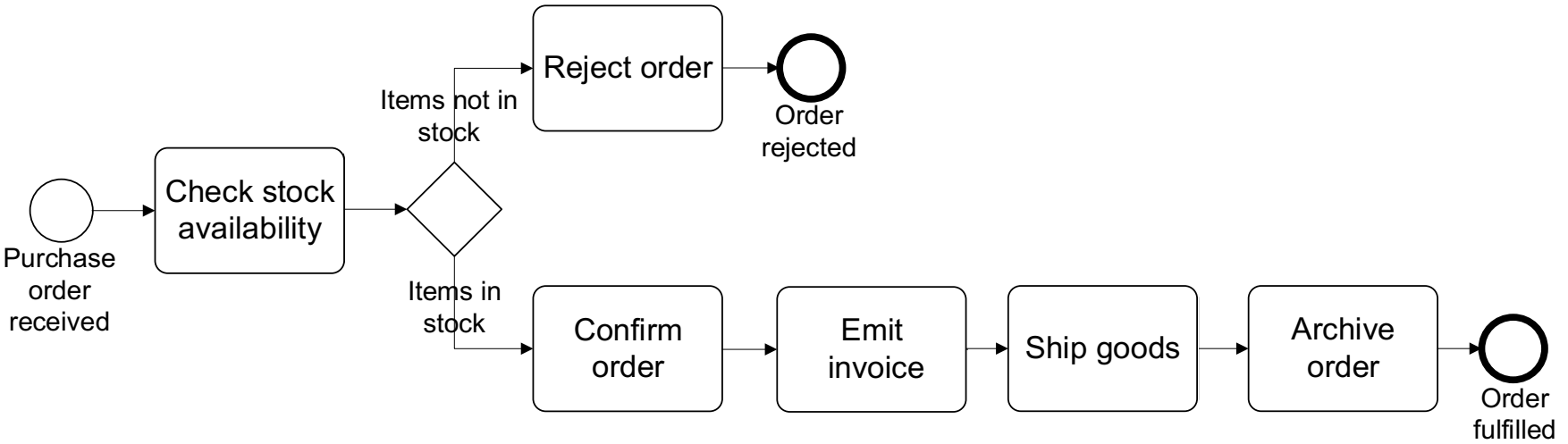

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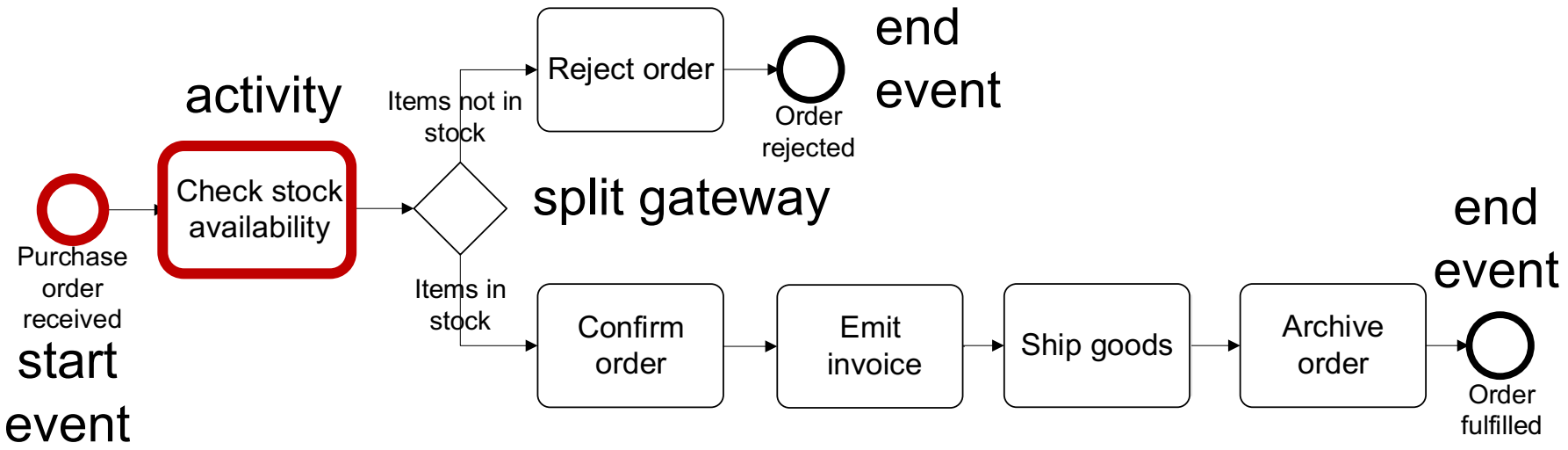
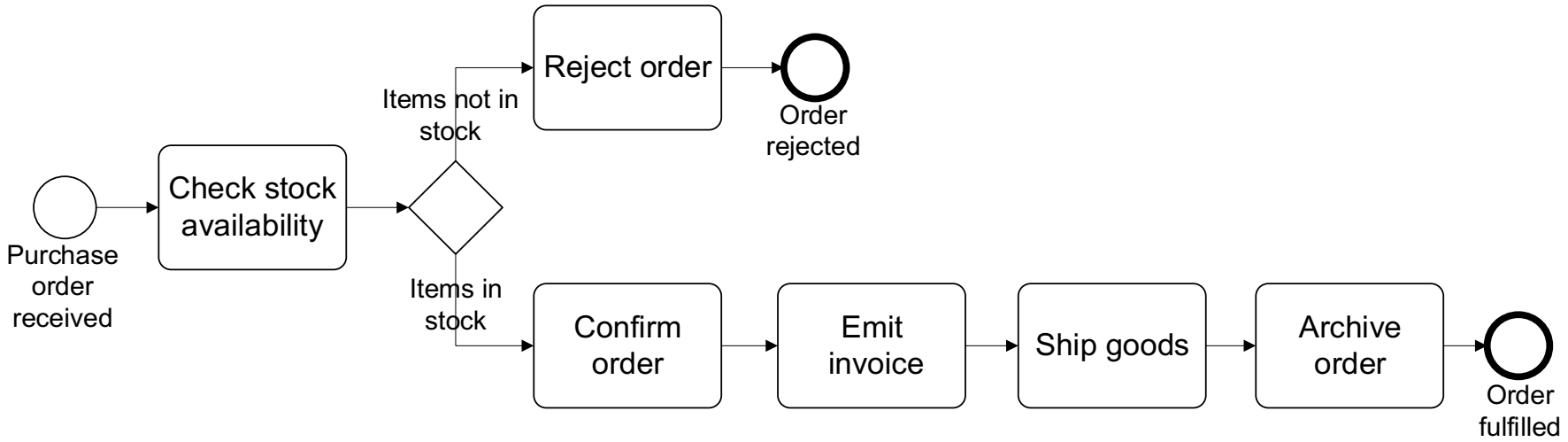


Execution of a process model
“Game of Tokens”



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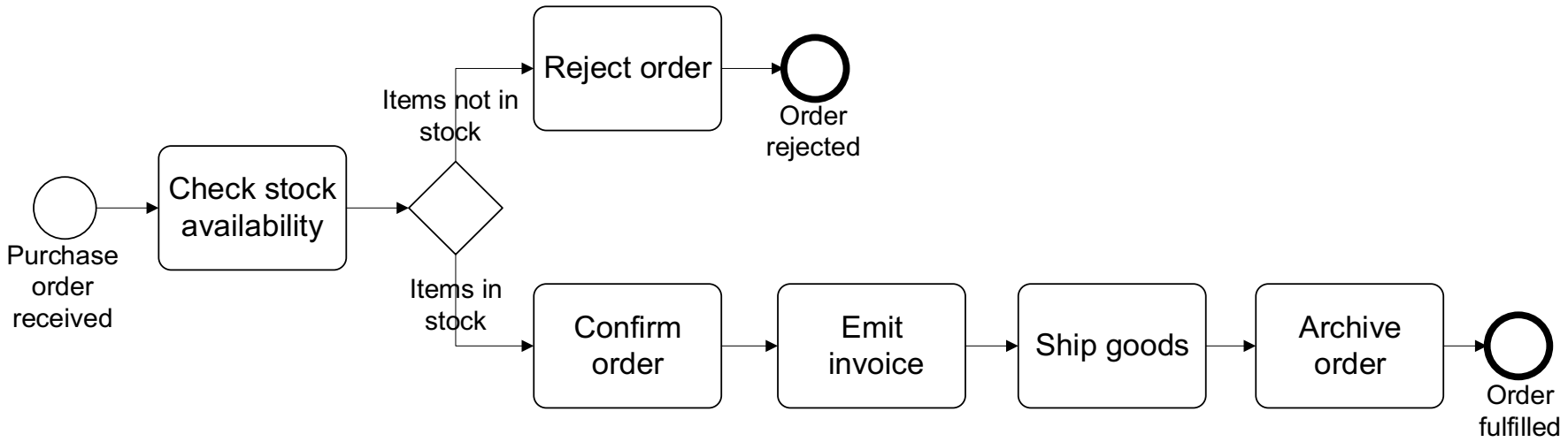

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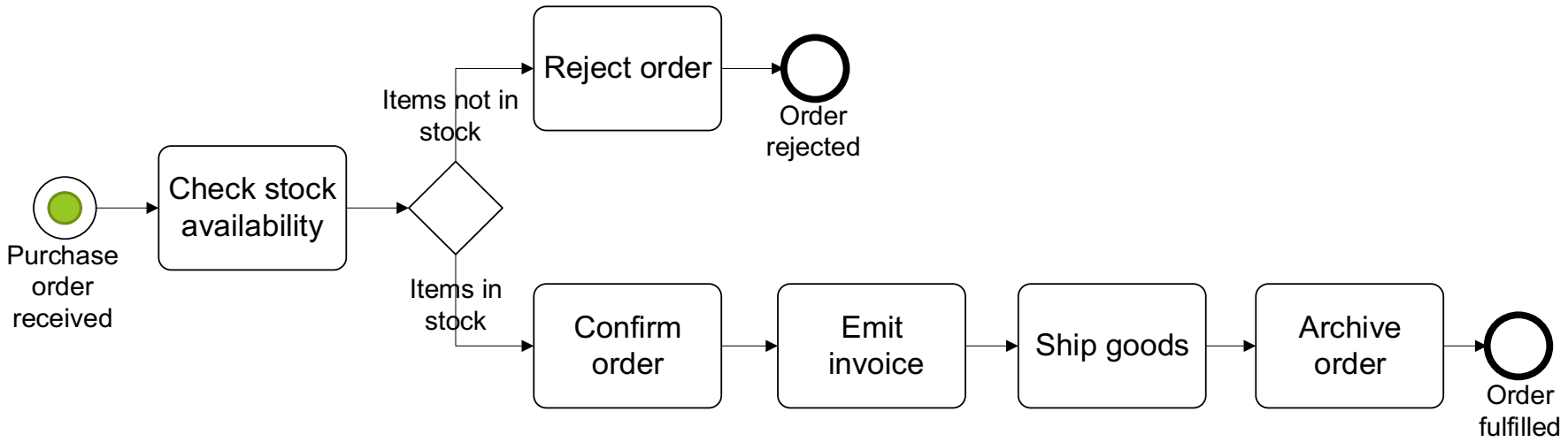

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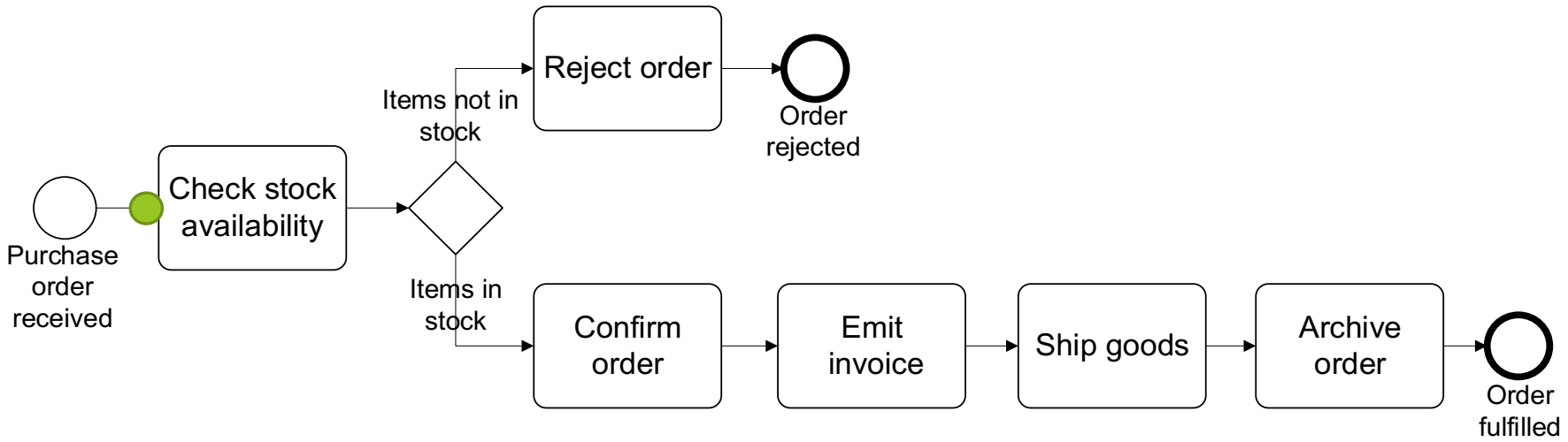

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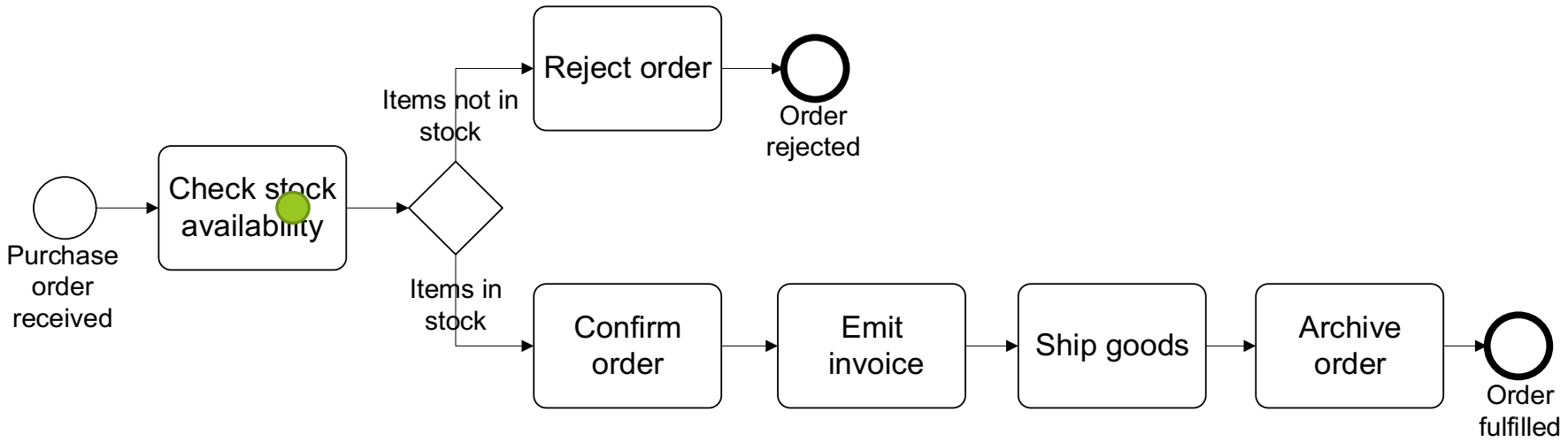

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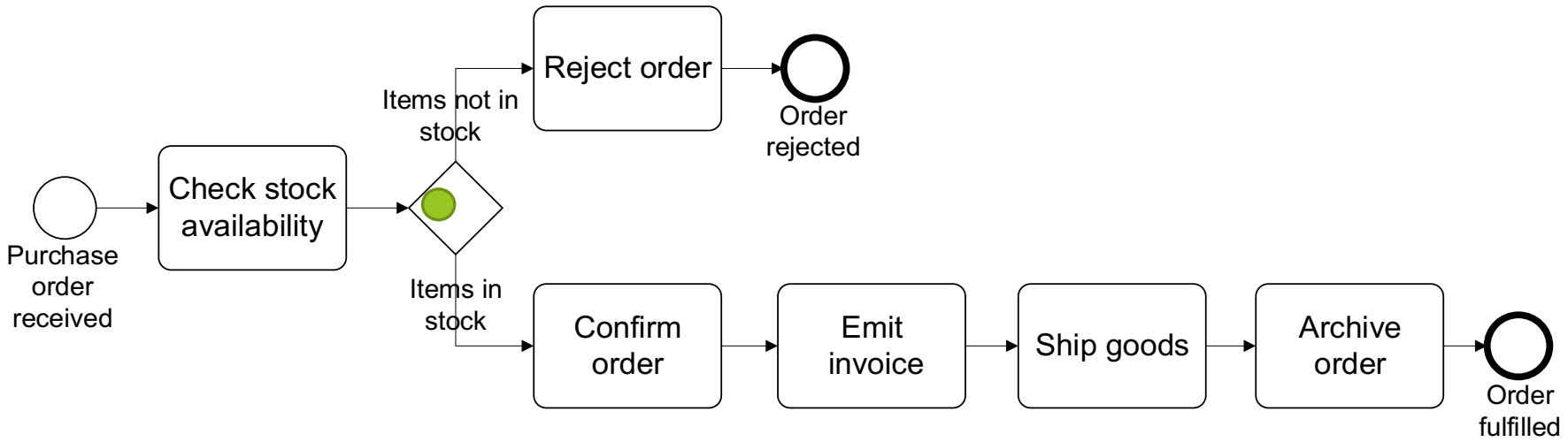

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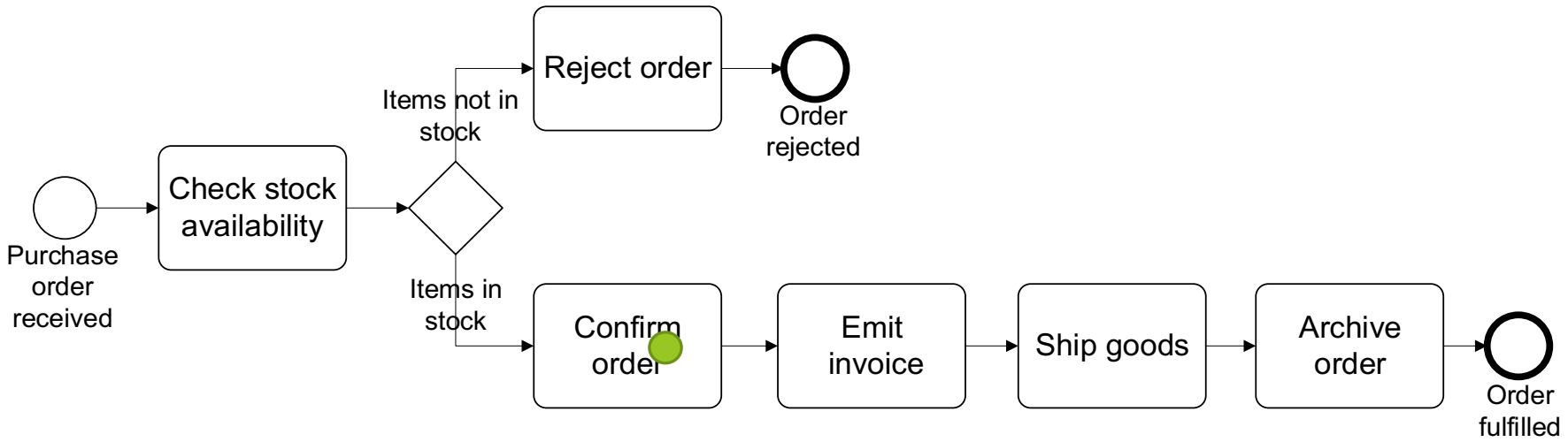

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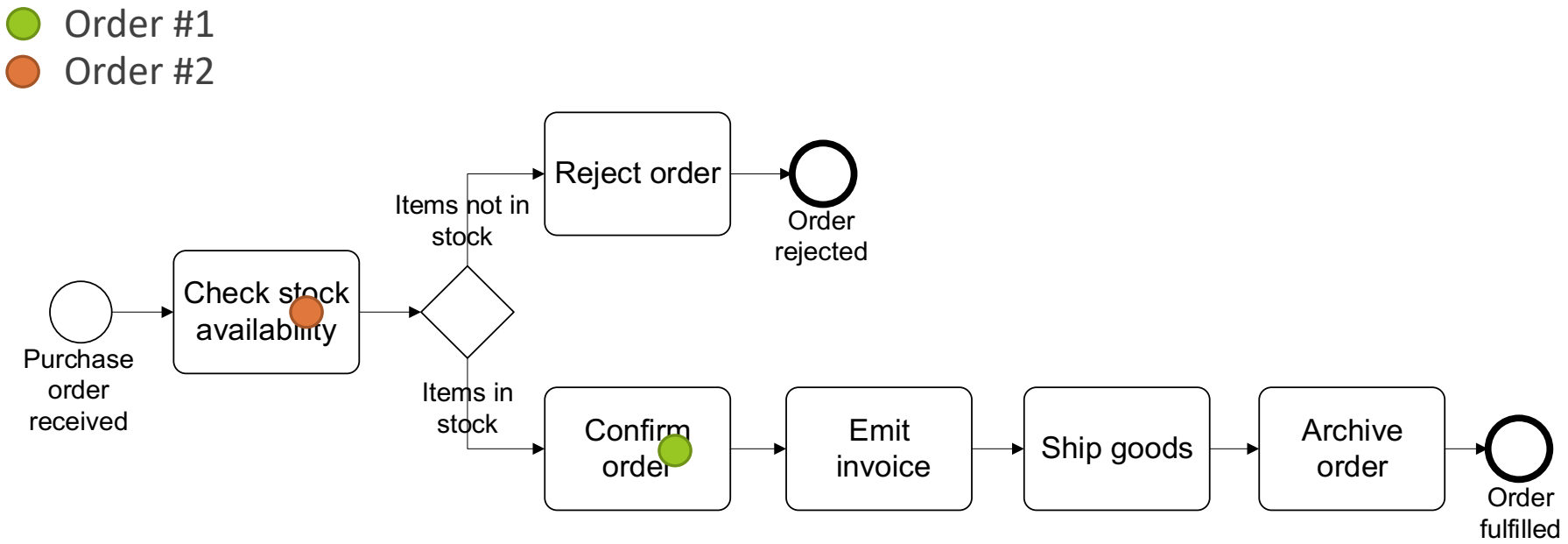

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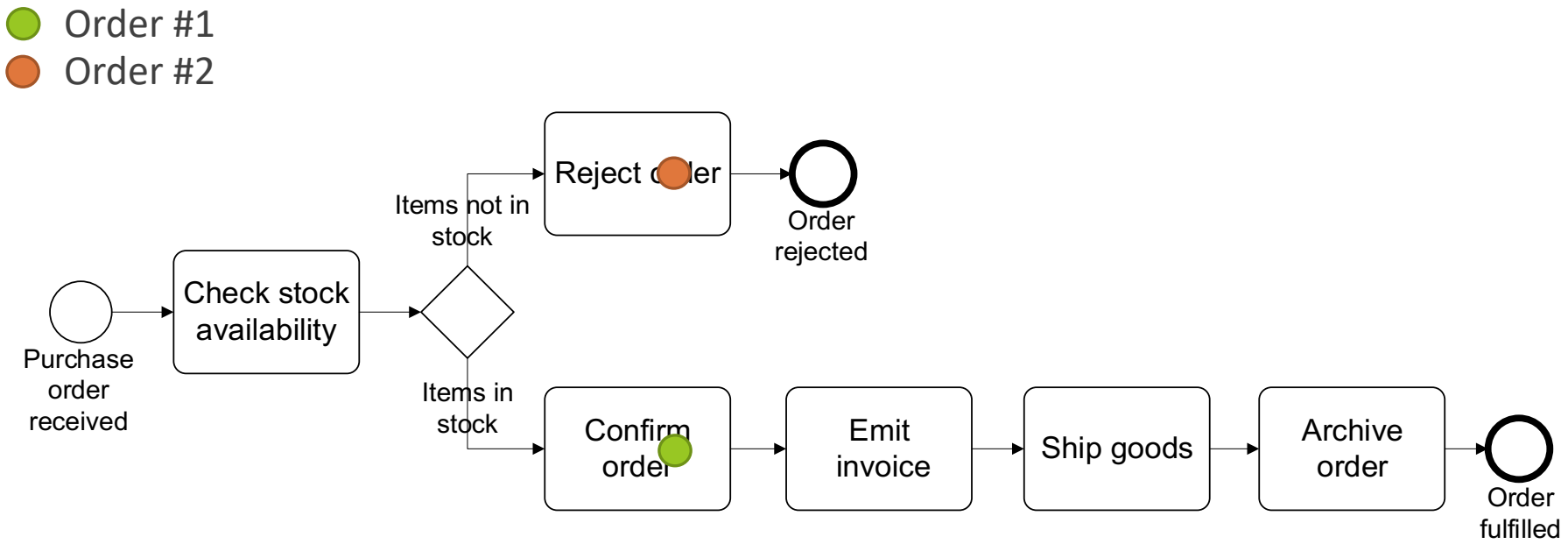

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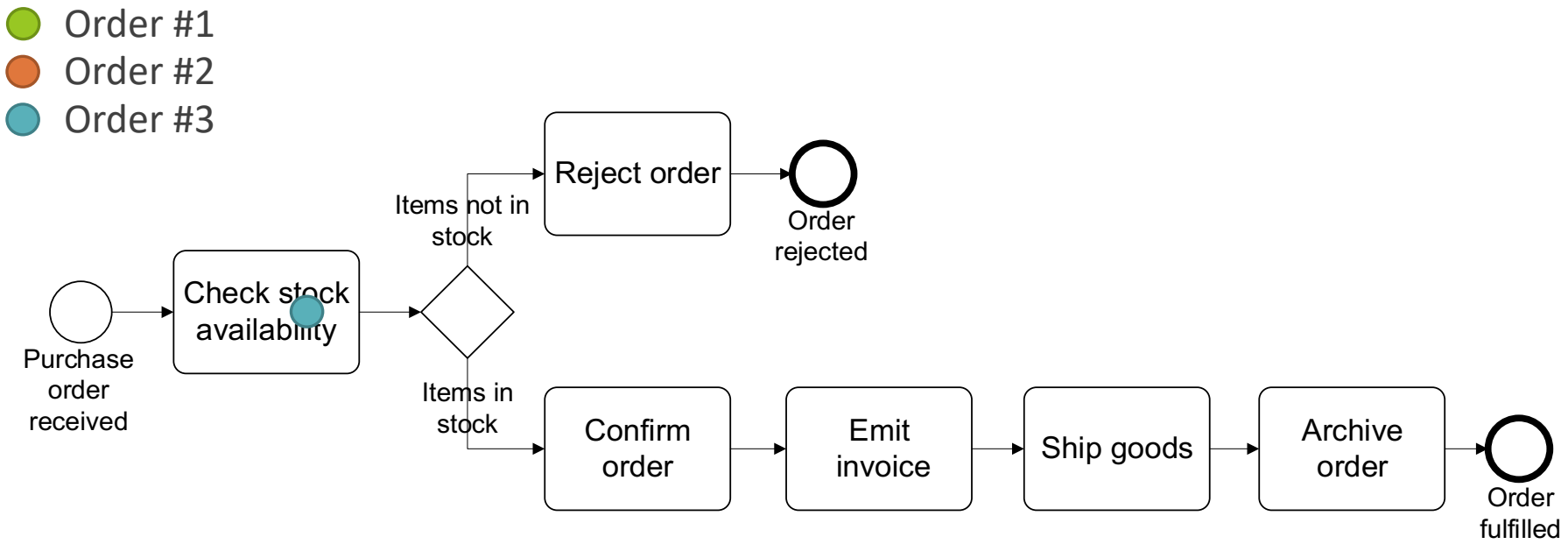


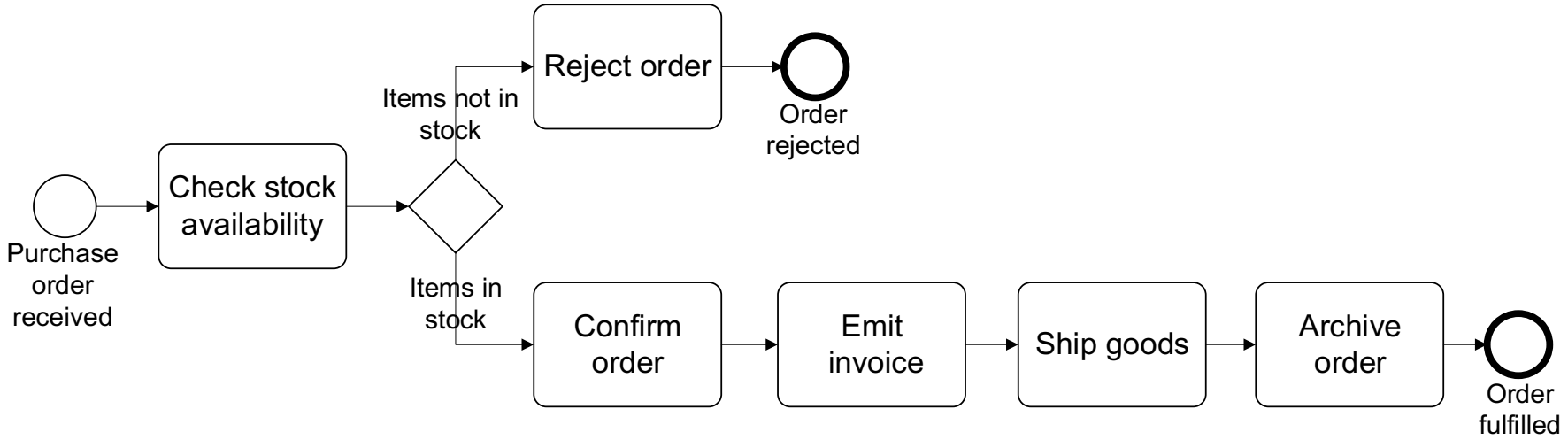
A little bit more on events…

A *start event* triggers a new process instance by generating a token that traverses the sequence flow (“tokens source”)

An *end event* signals that a process instance has completed with a given outcome by consuming a token (“tokens sink”)

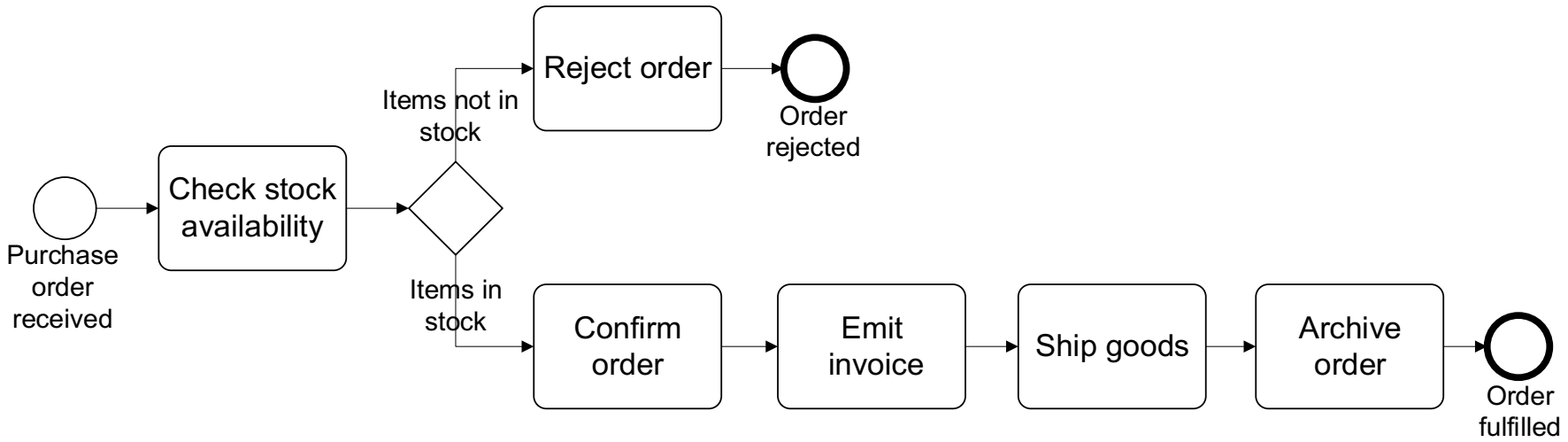
Order-to-cash example revisited…

[…] If the purchase order is confirmed, **an invoice is emitted and the goods requested are shipped (in any order)**. The process completes by archiving the order. […]



First try

Order-to-cash



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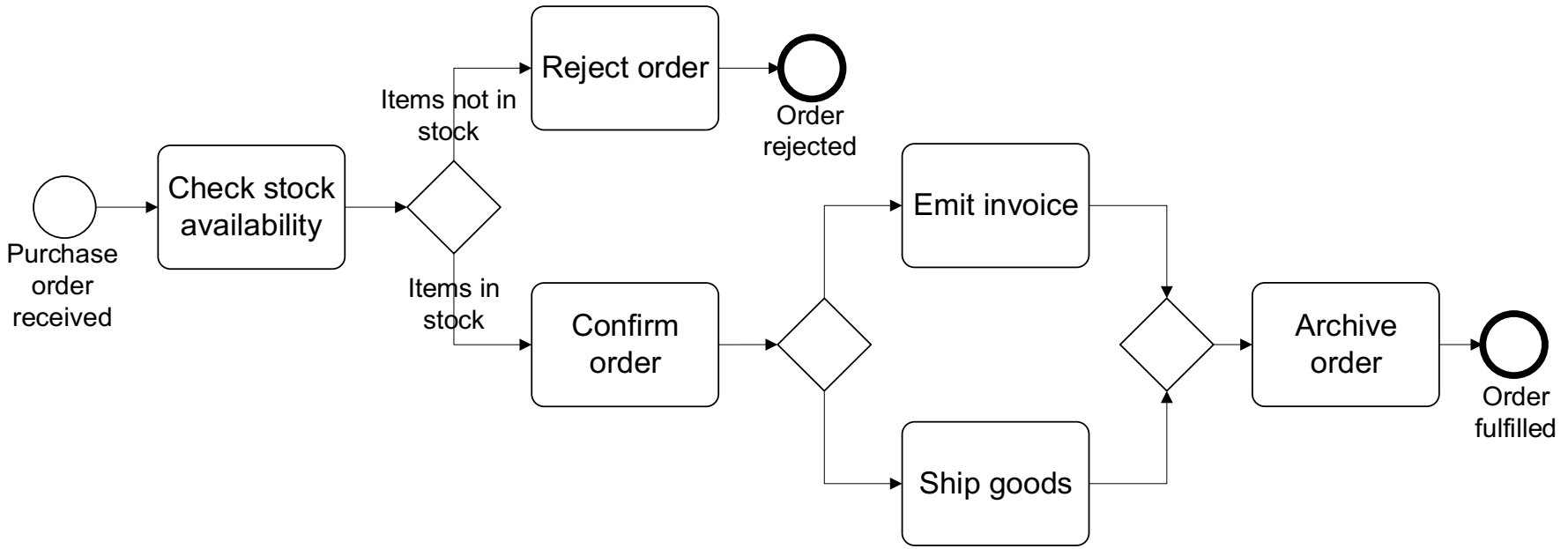

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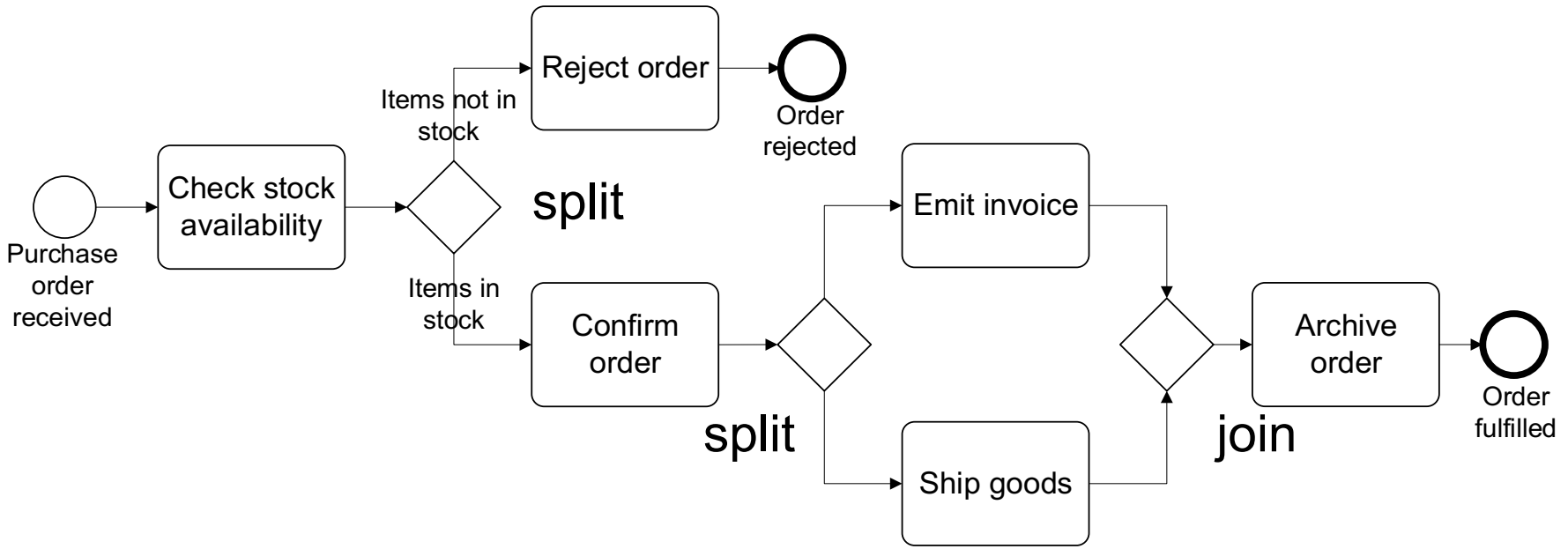
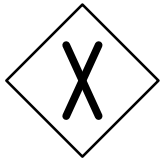
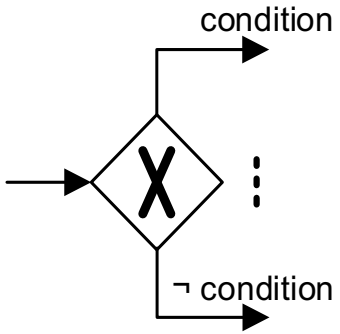


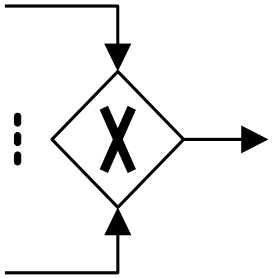
A little more on gateways: XOR Gateway



An *XOR Gateway* captures decision points (XOR-split) and points where alternative flows are merged (XOR-join)



XOR-split ➔ takes **one** outgoing branch



XOR-join ➔ proceeds when **one** incoming branch has completed

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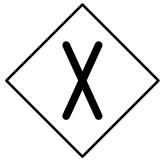

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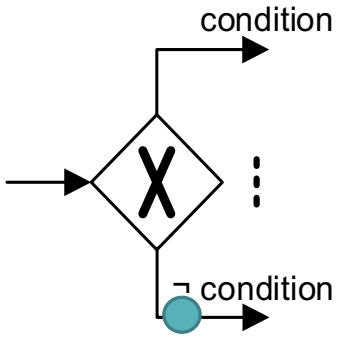

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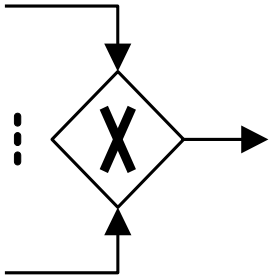

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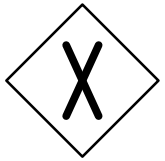

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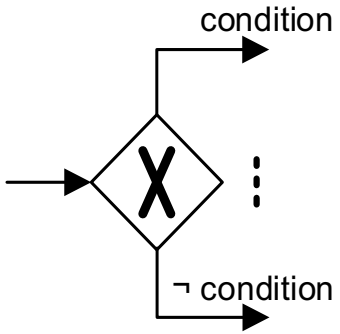

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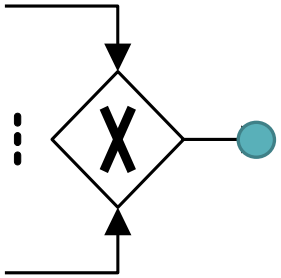

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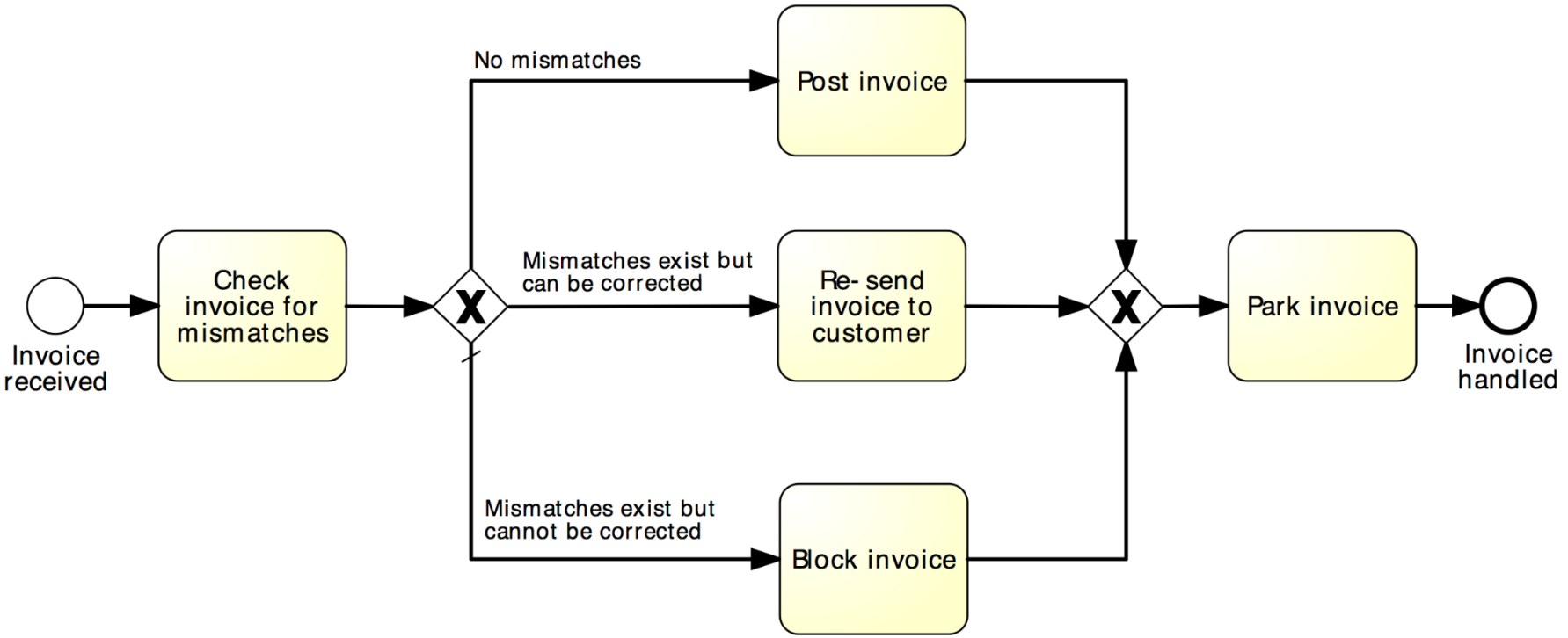
Example: XOR Gateway

Invoice checking process



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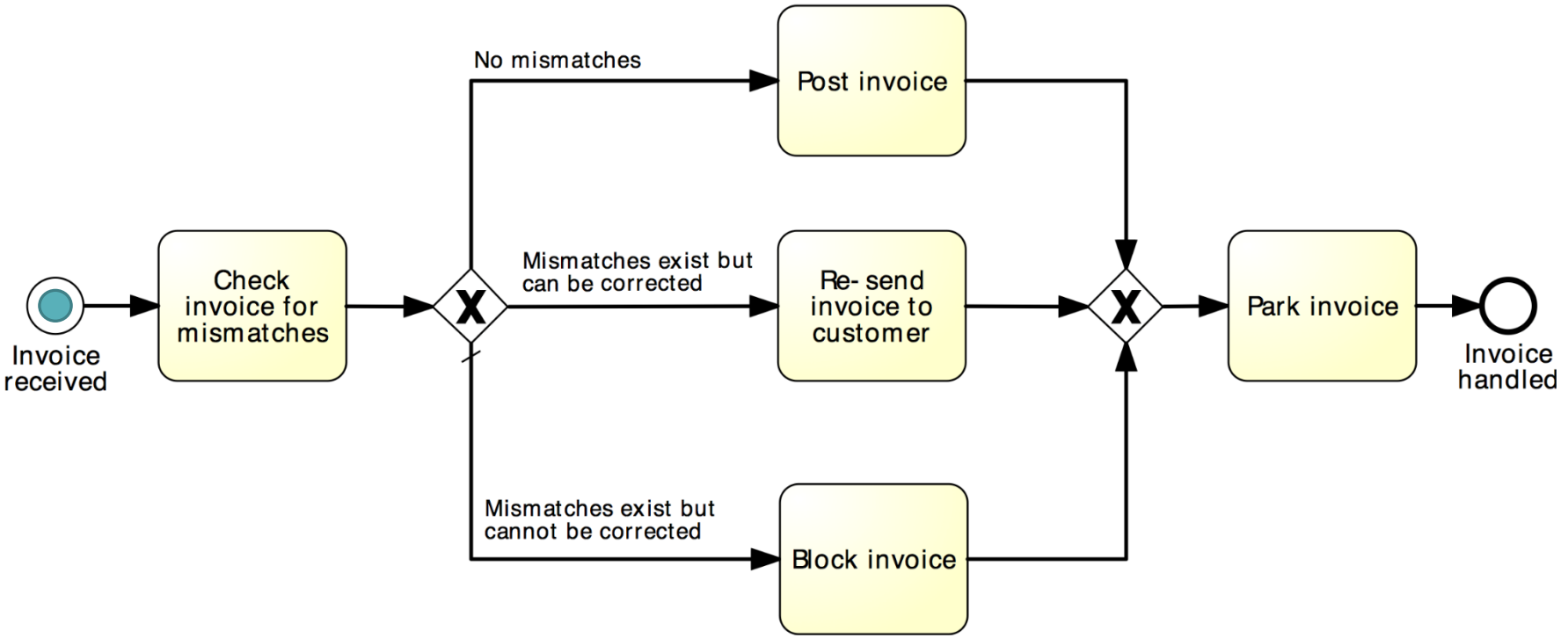

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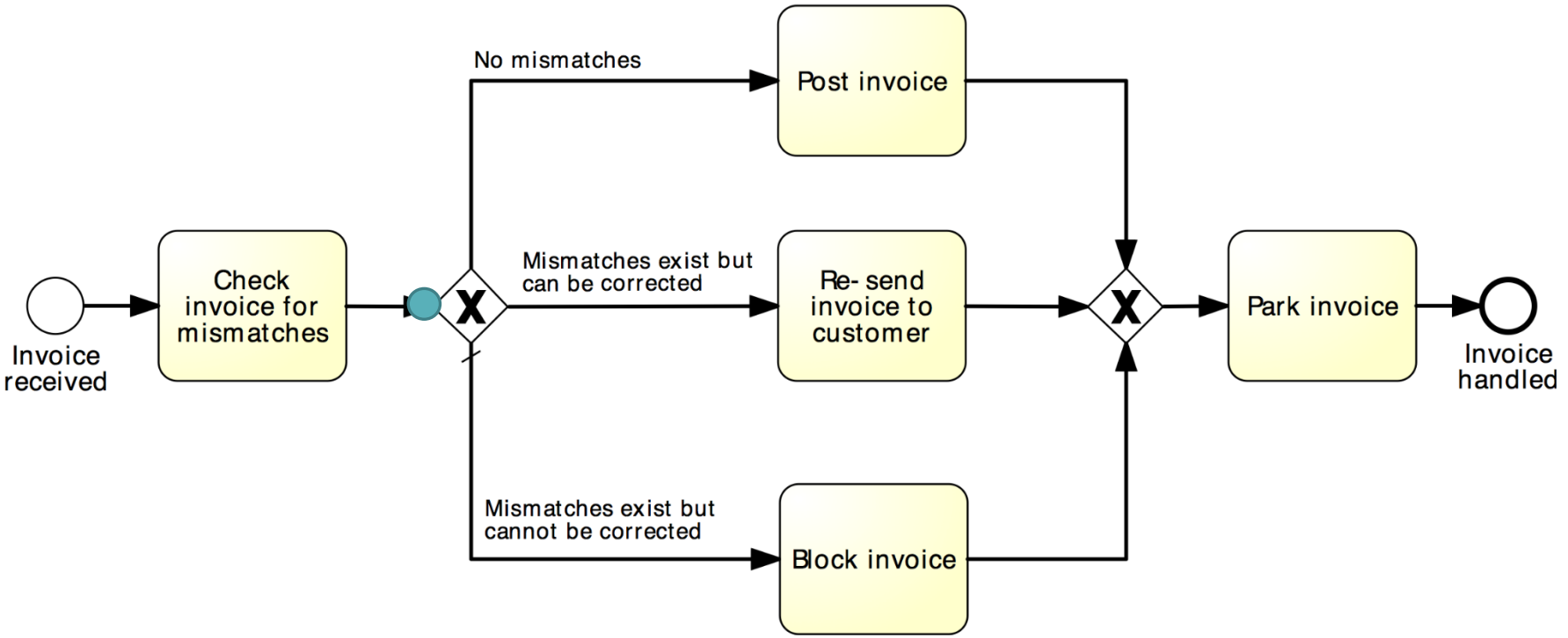

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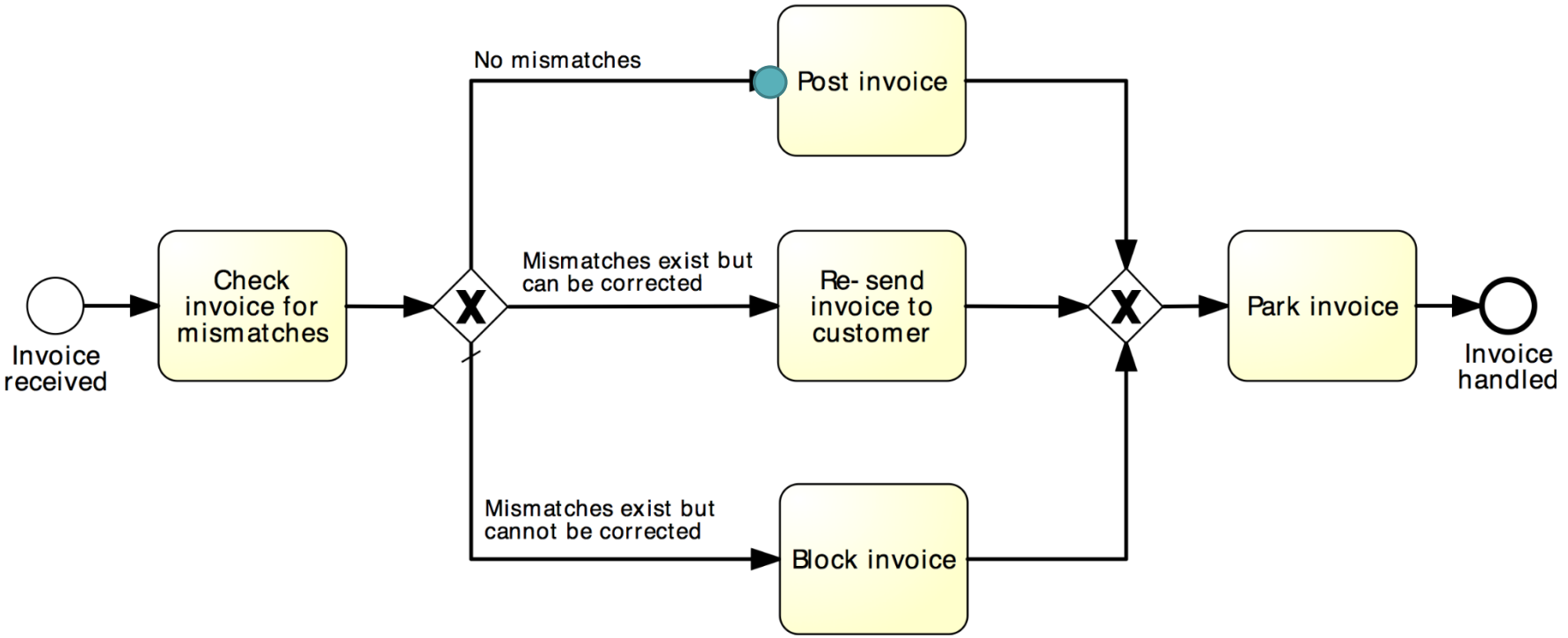
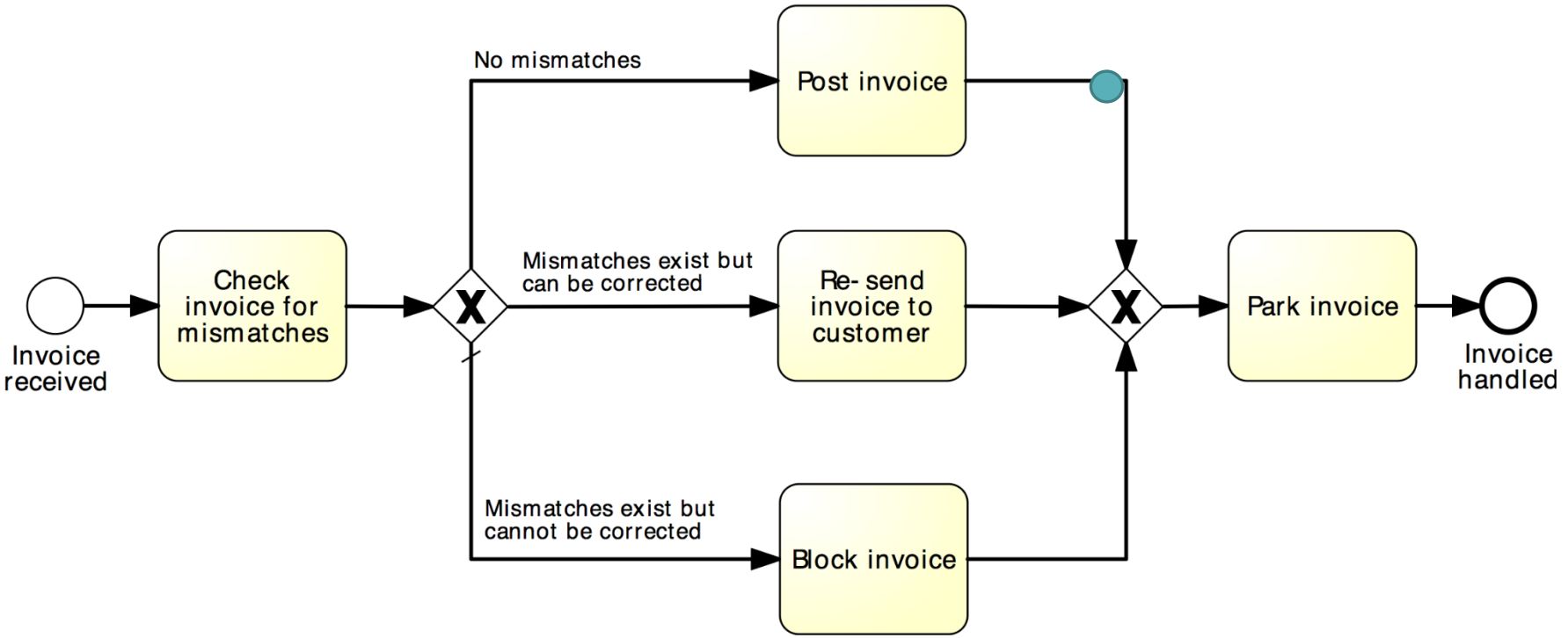


Example: XOR Gateway

Invoice checking process



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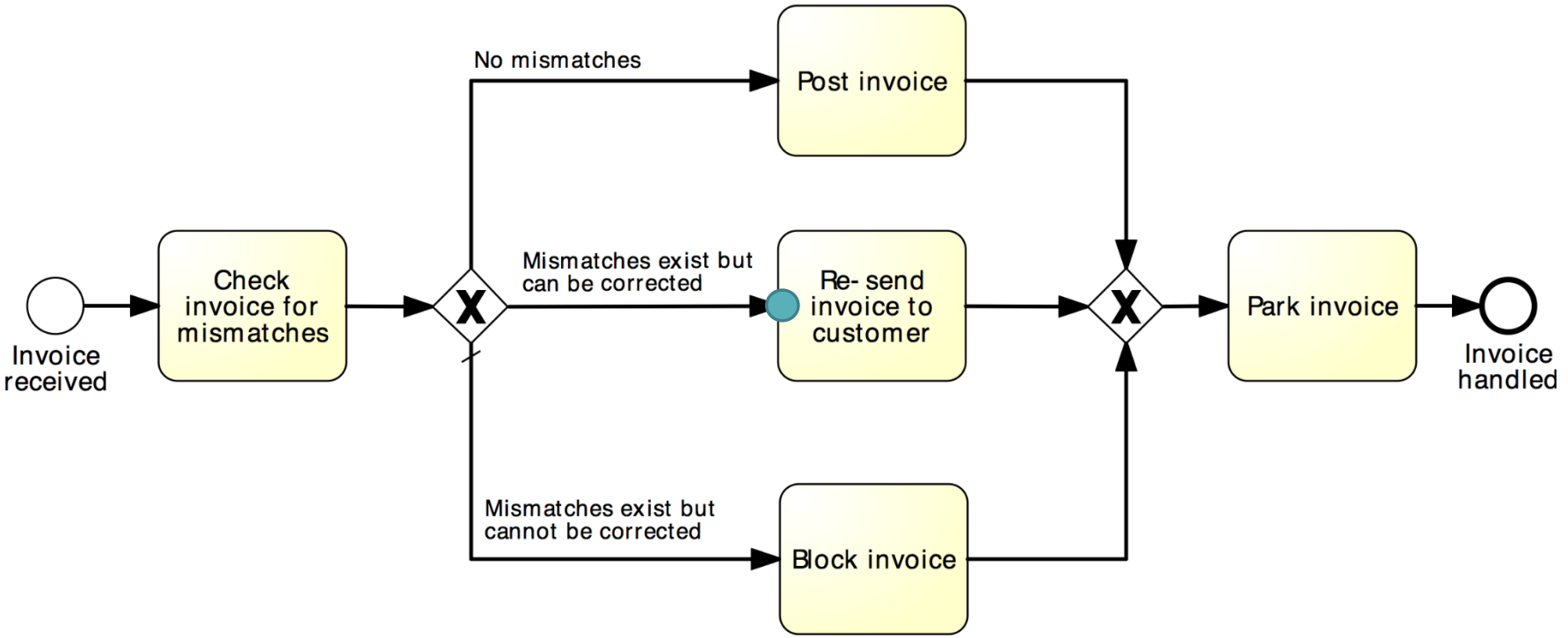

Example: XOR Gateway

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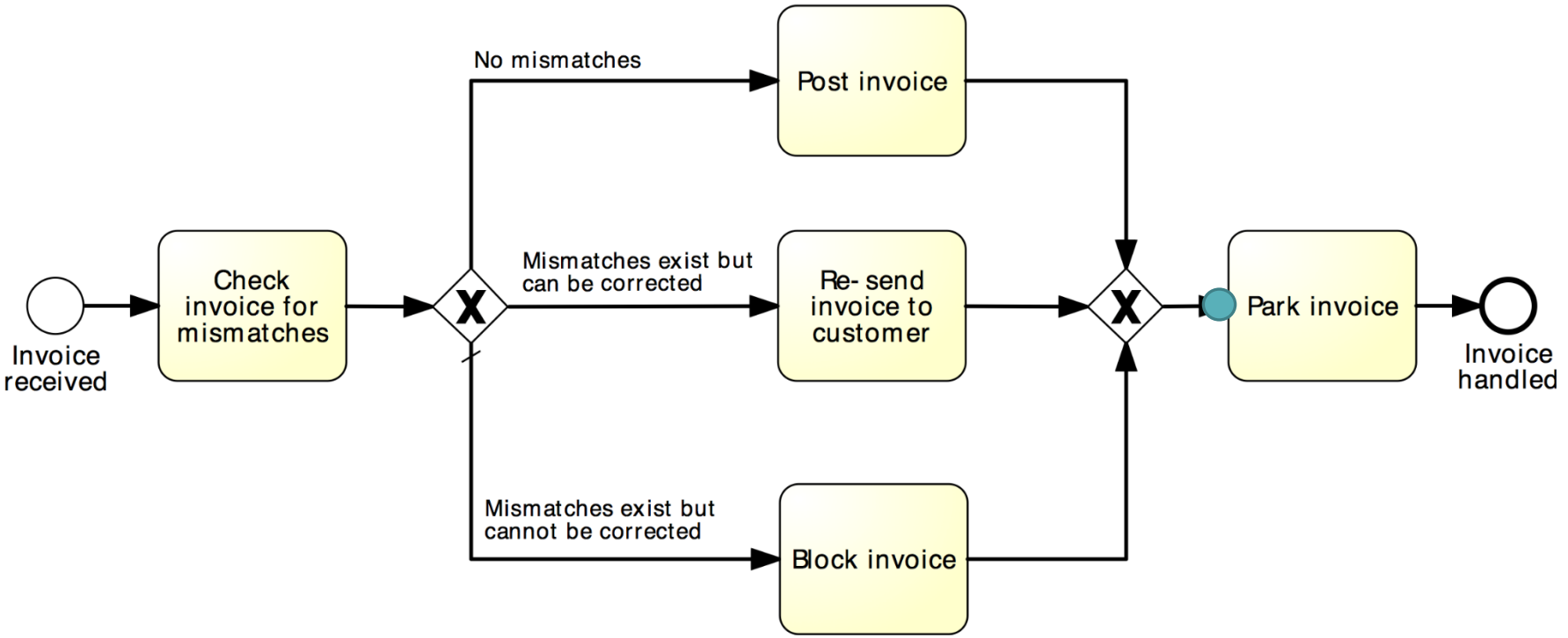

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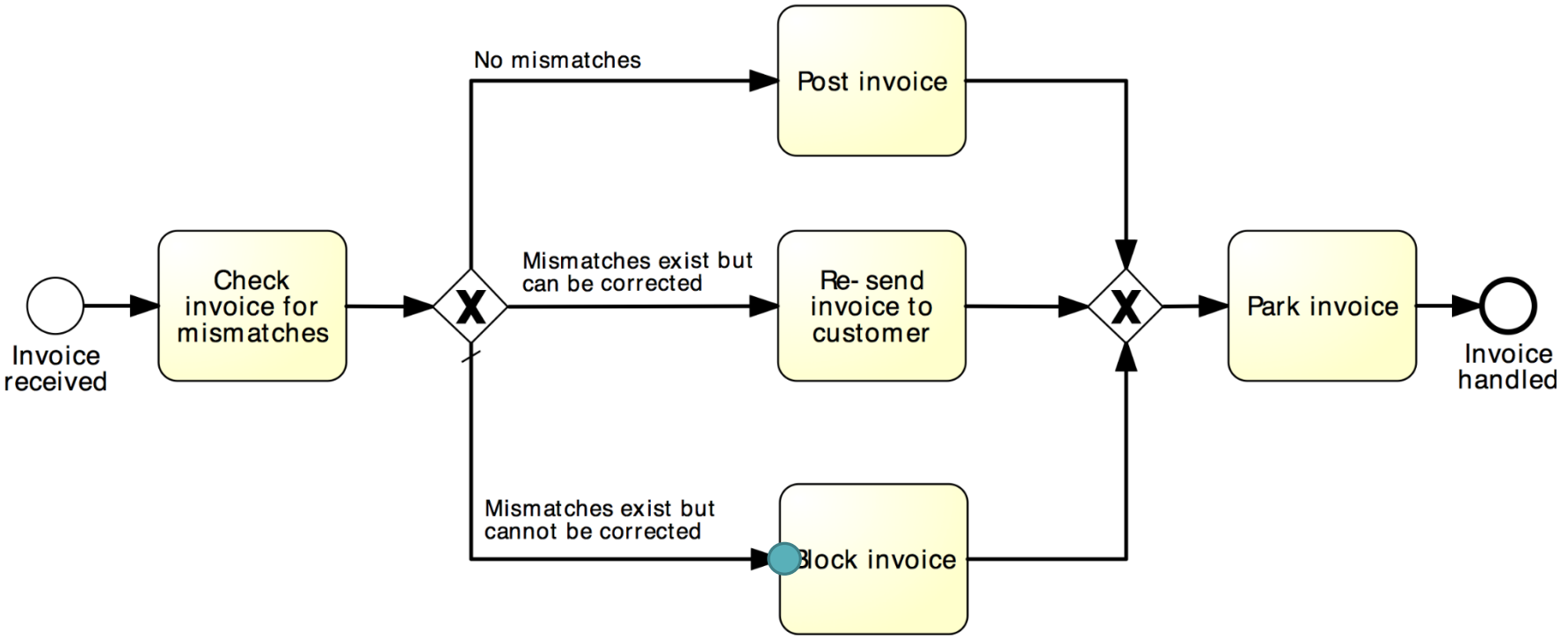

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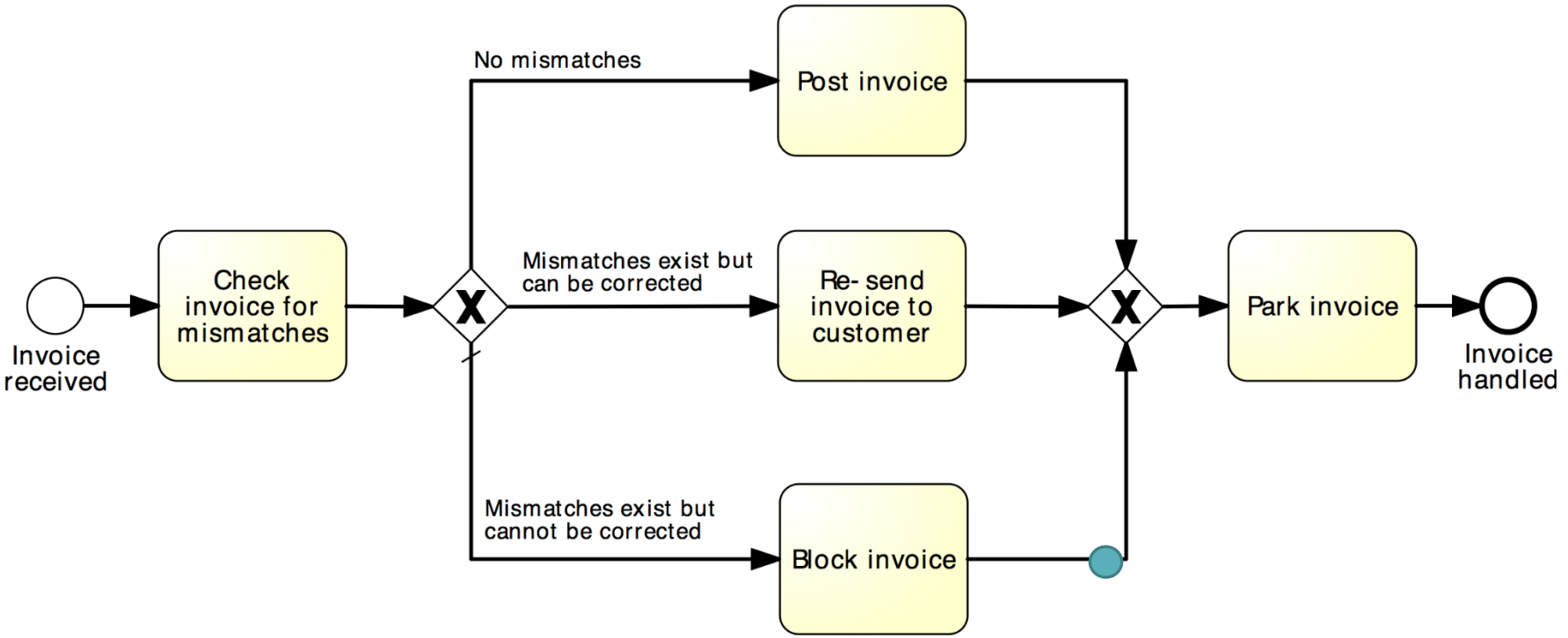

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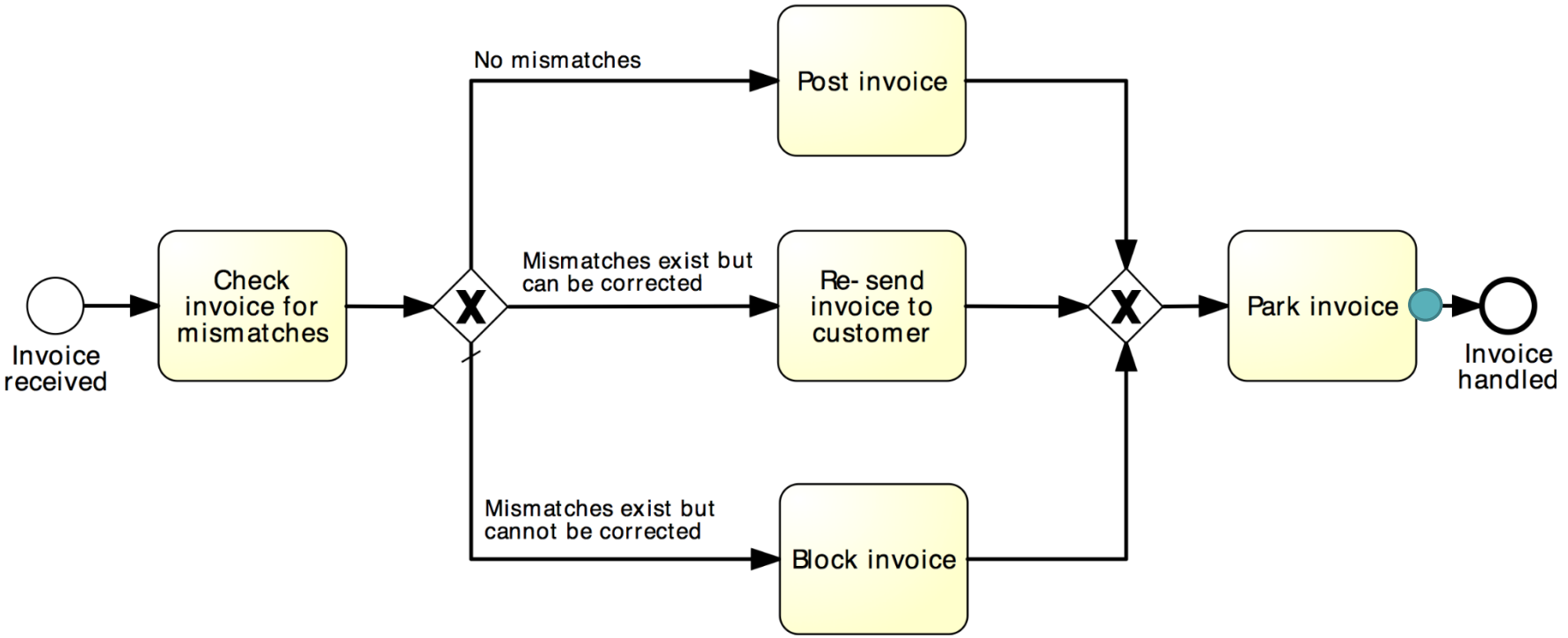

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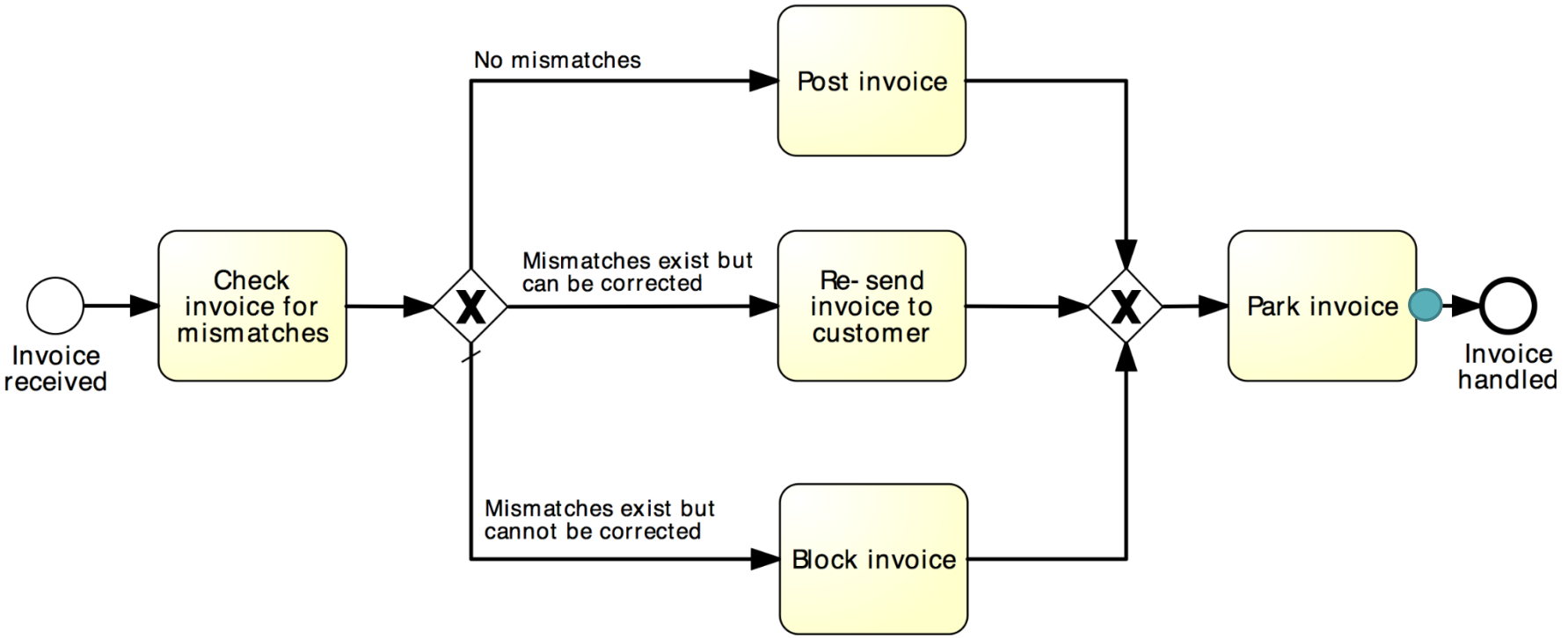

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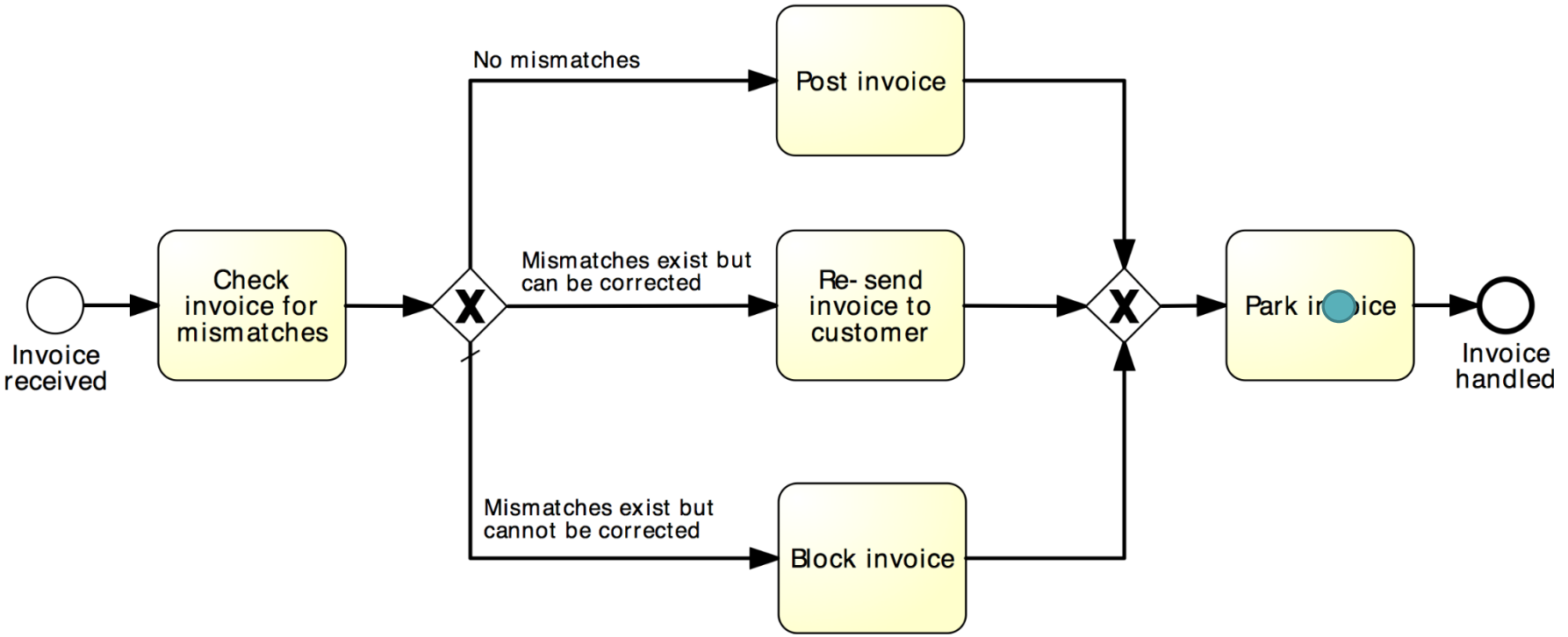

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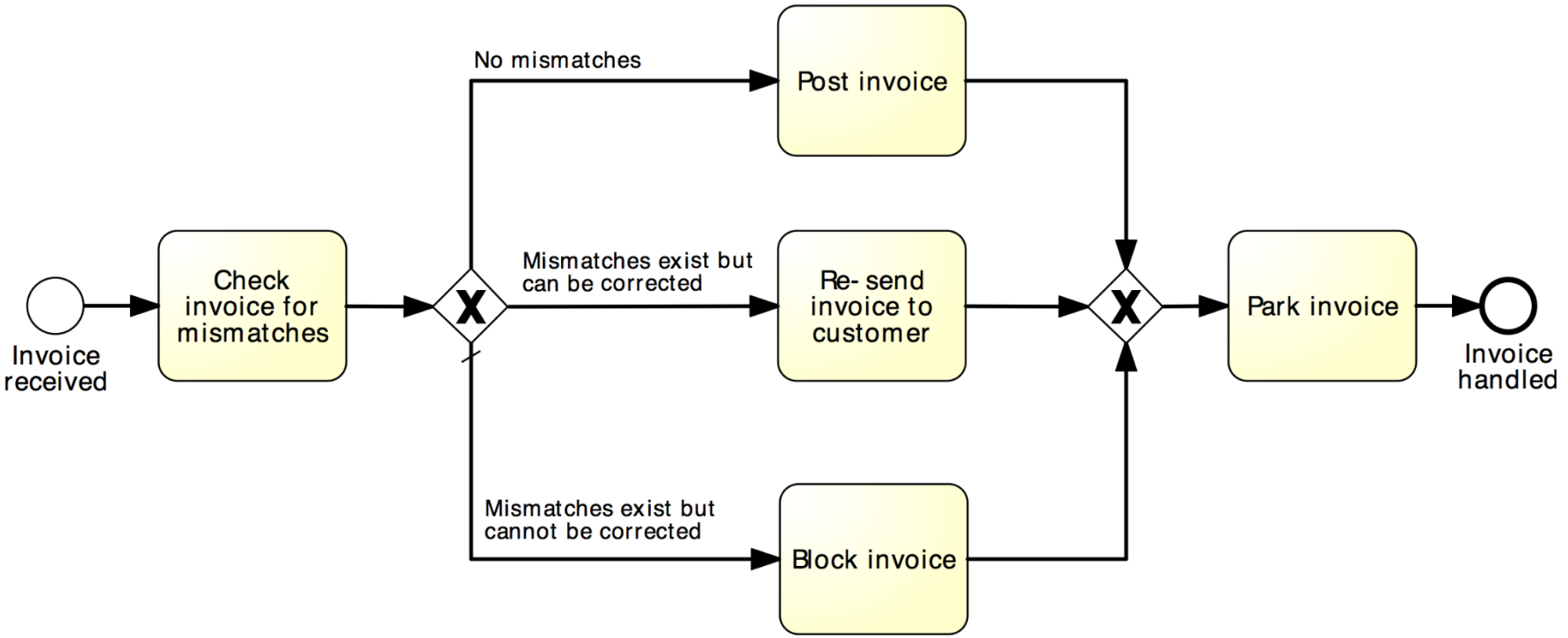

A little more on gateways: AND Gateway

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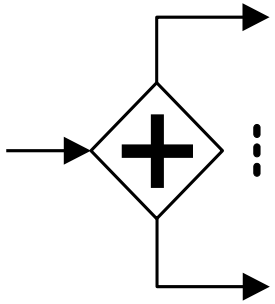
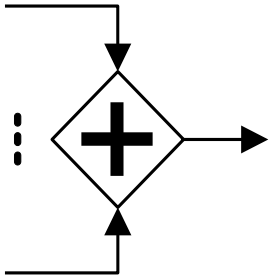


AND-split ➔ takes **all** outgoing branches



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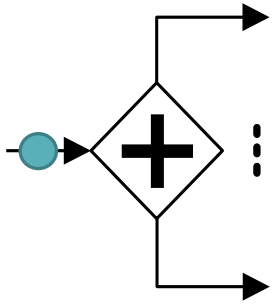

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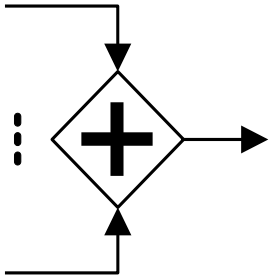

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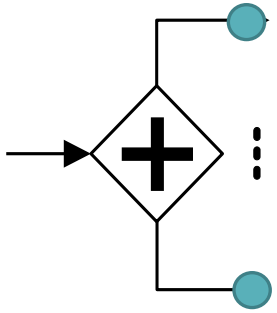

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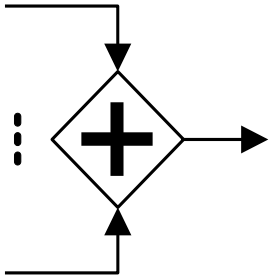

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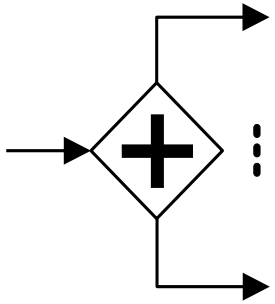

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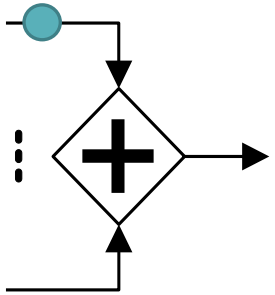

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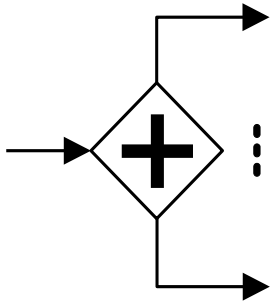

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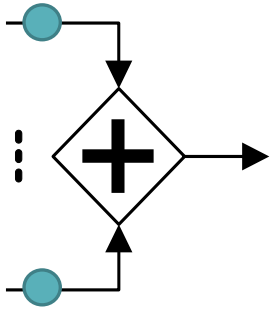

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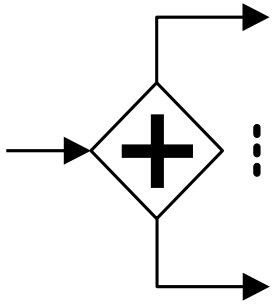

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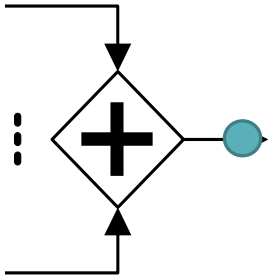

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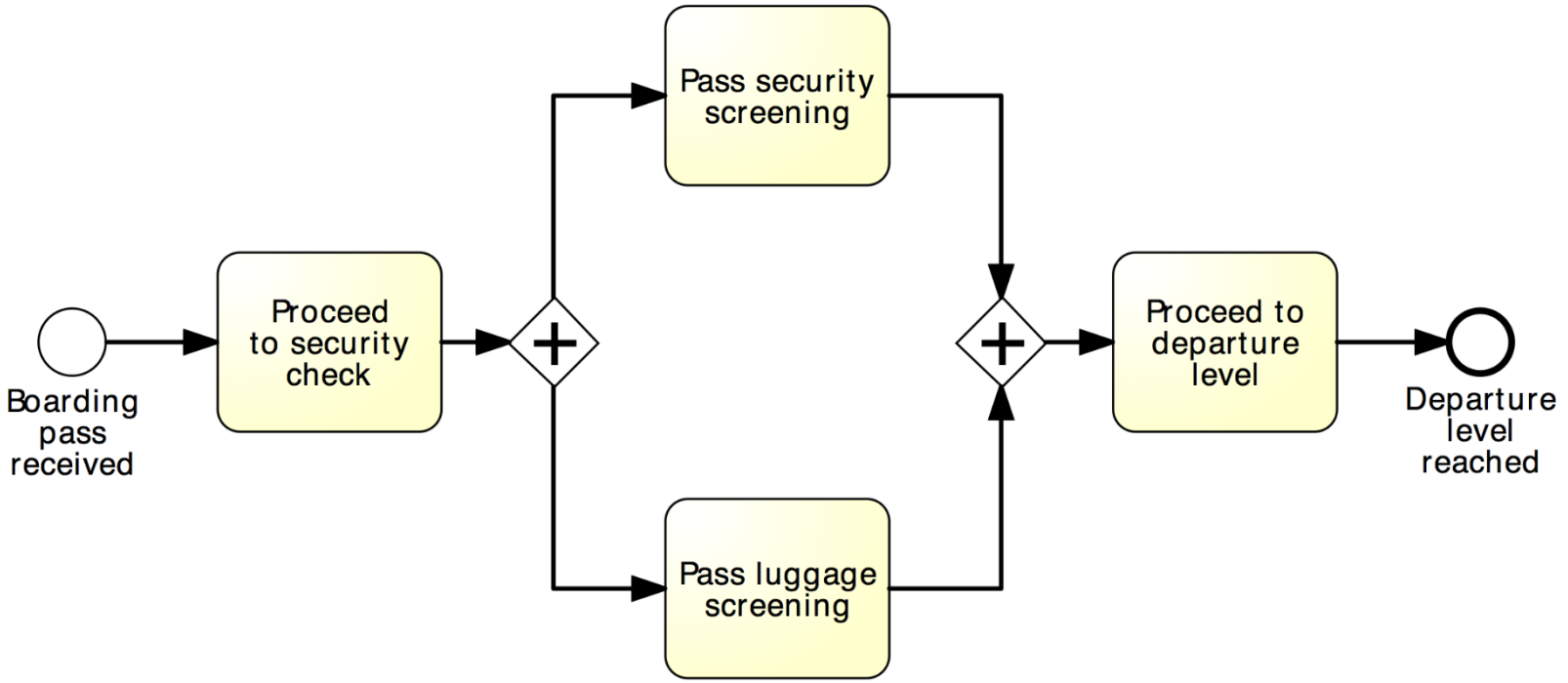
Example: AND Gateway

Airport security check



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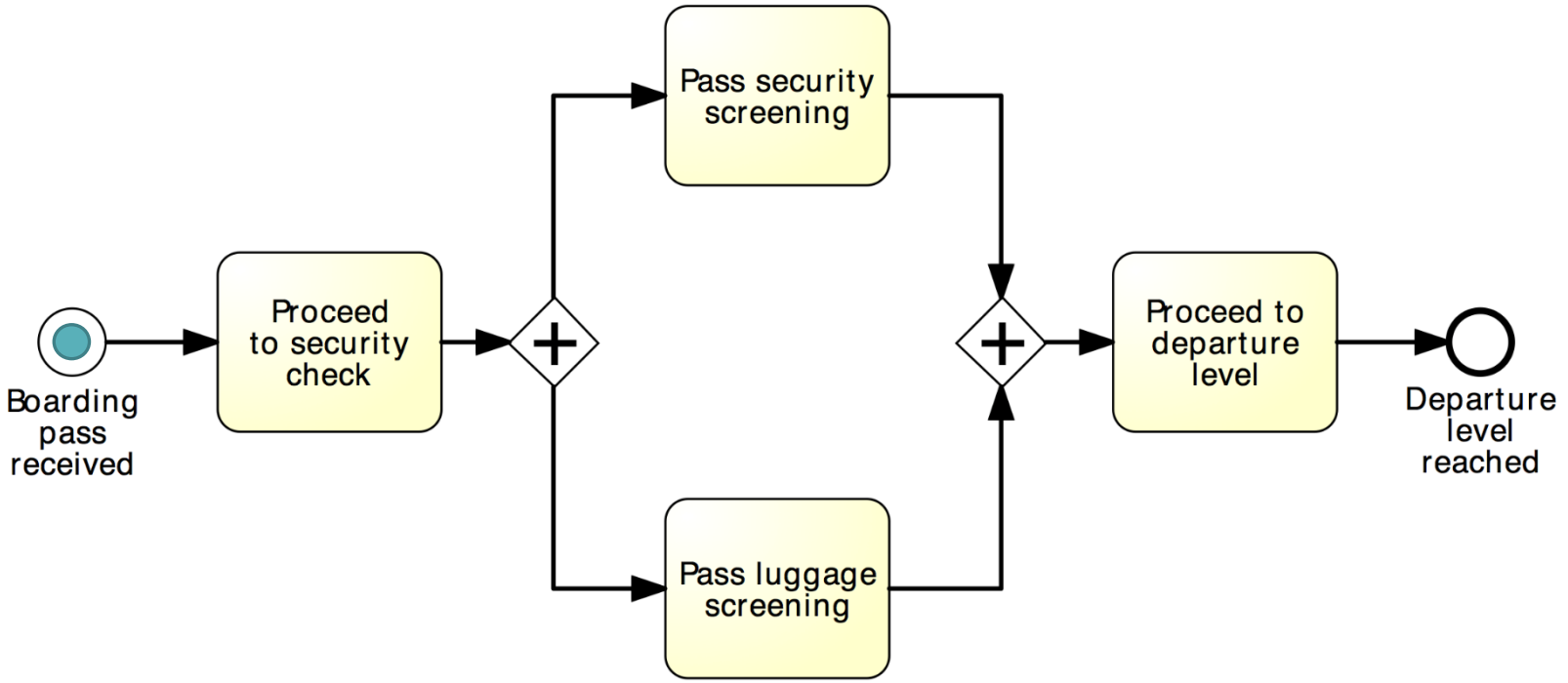

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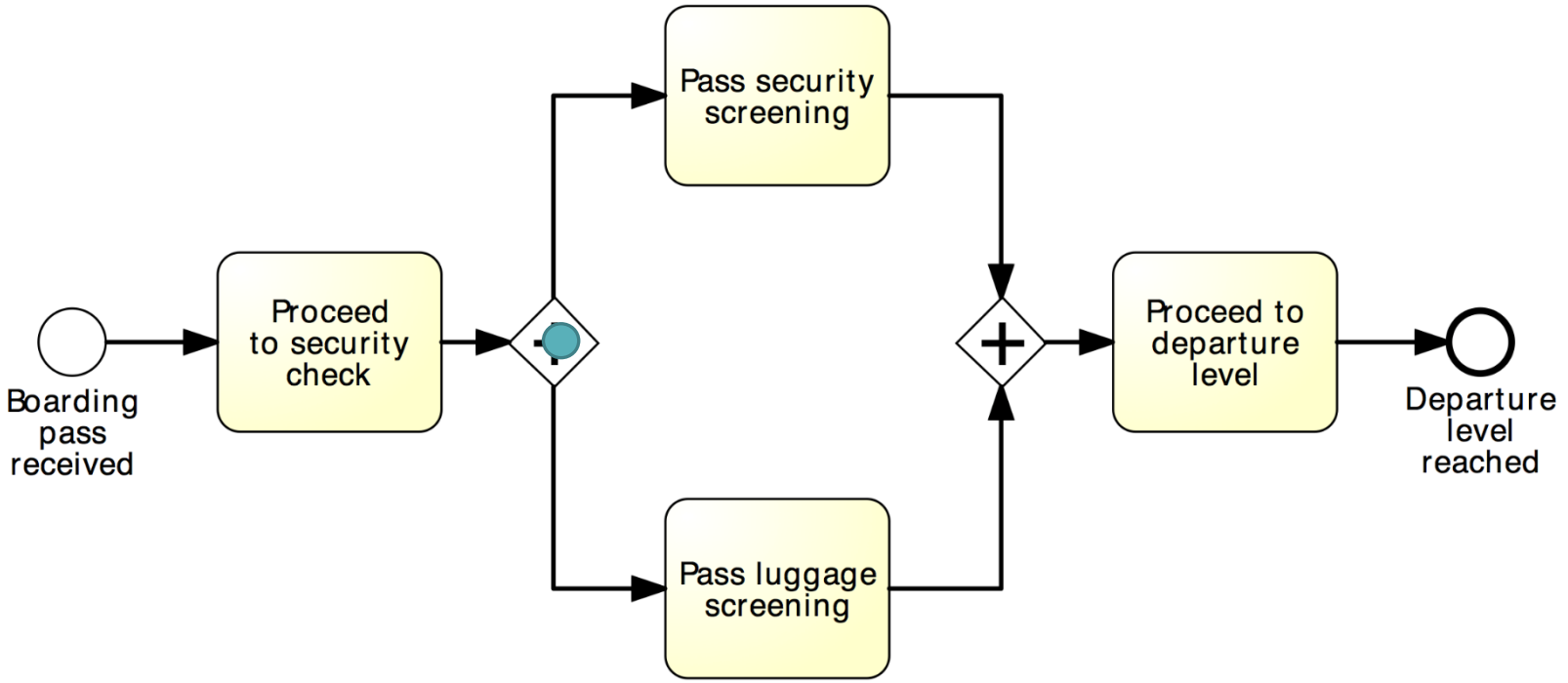

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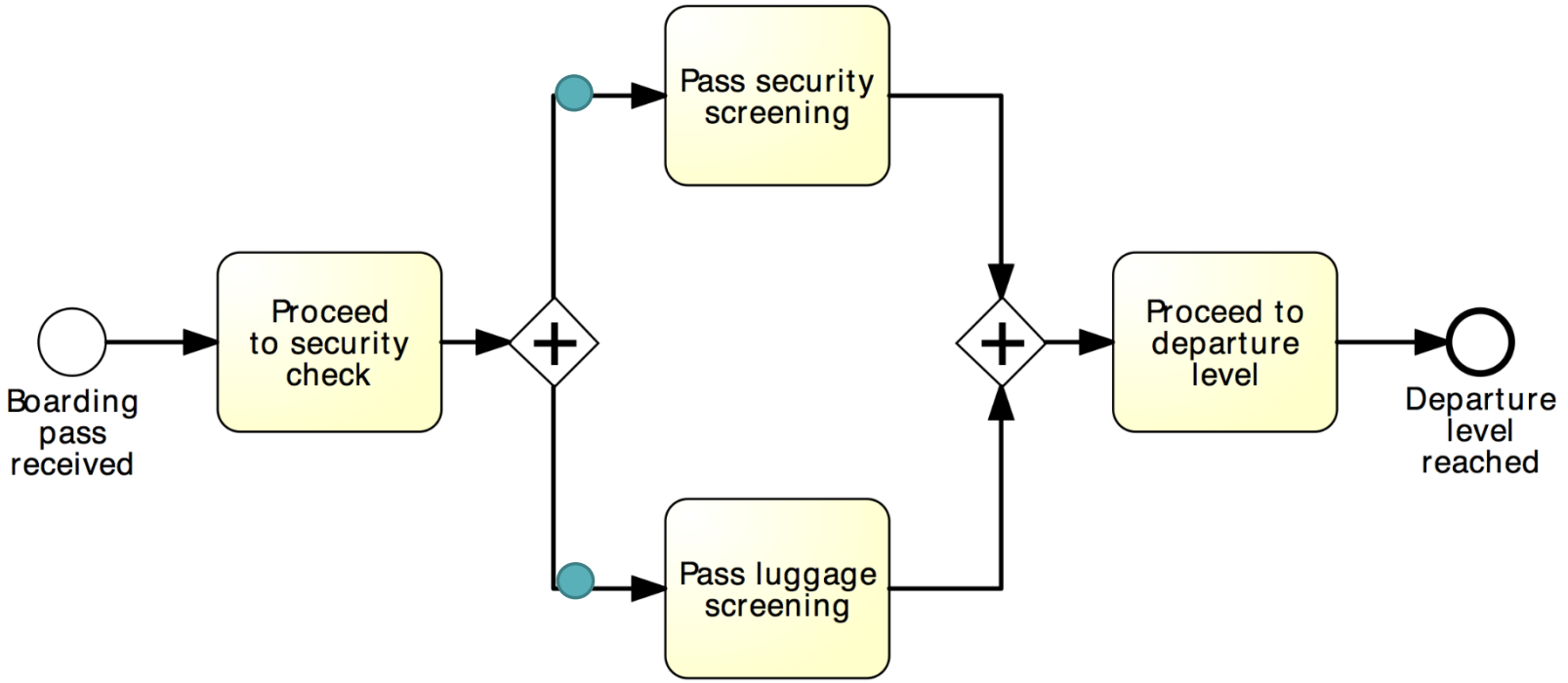

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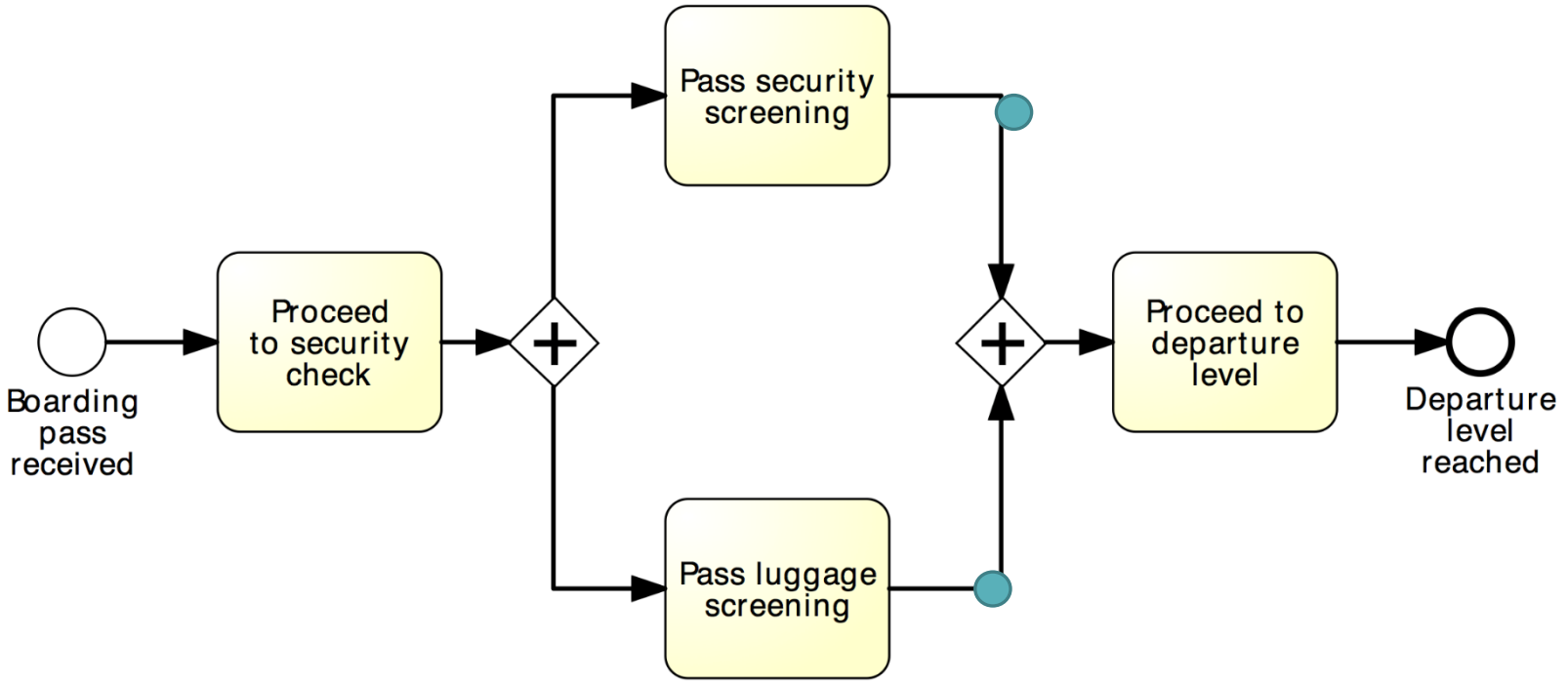

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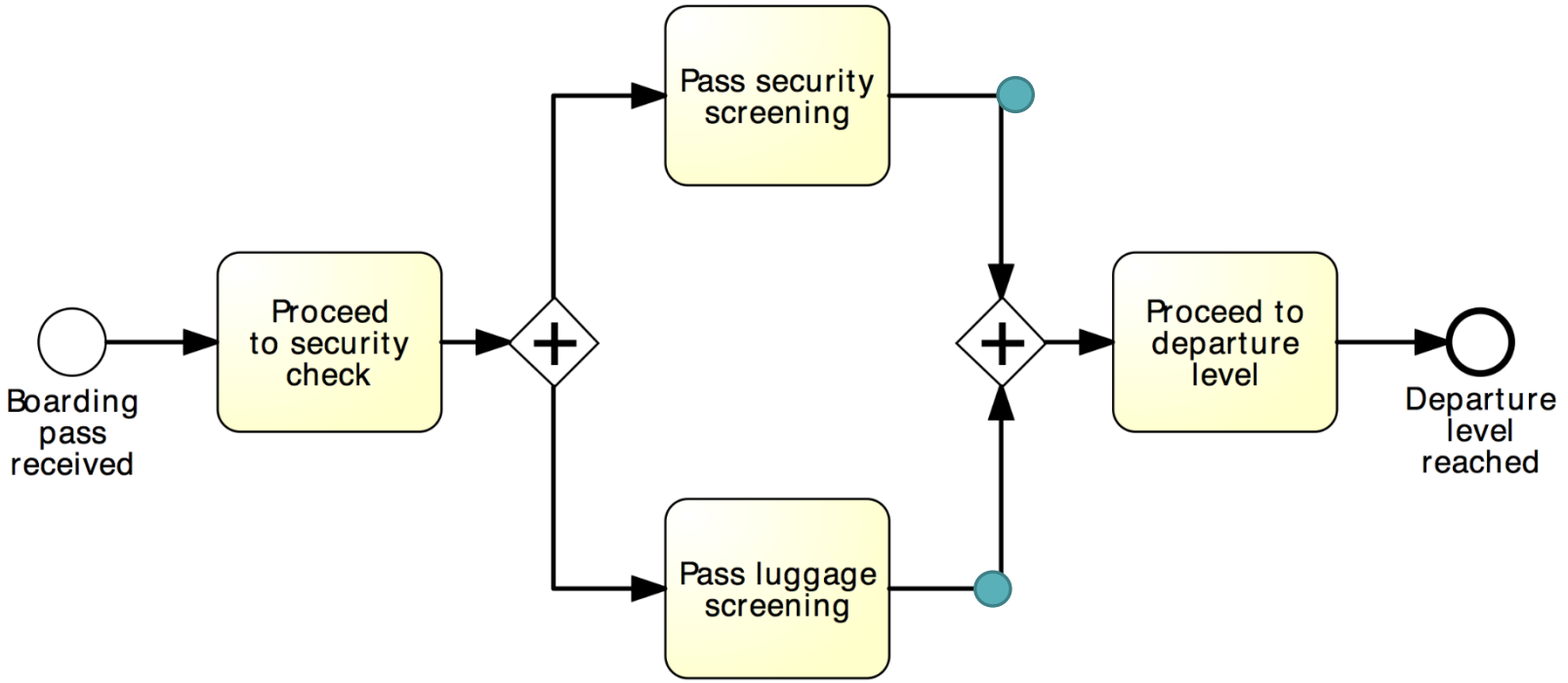

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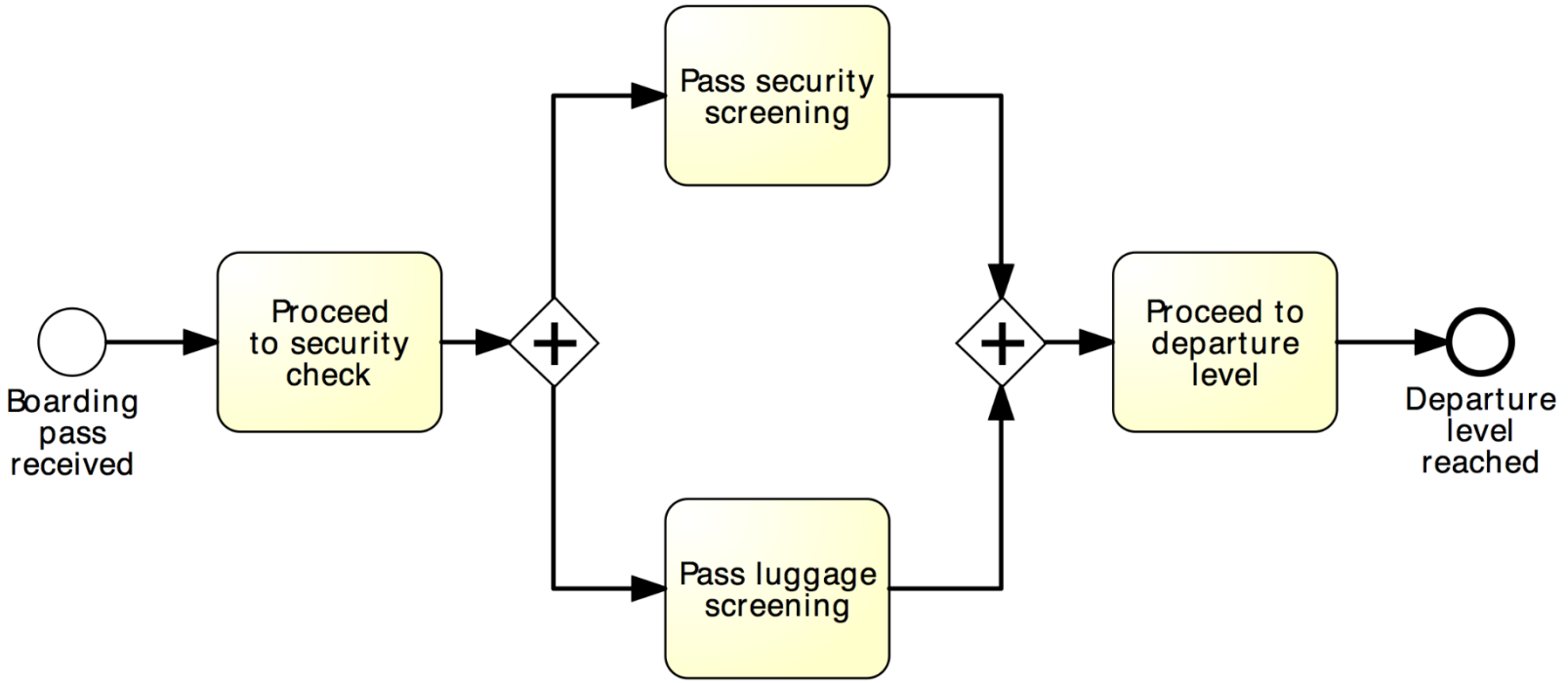
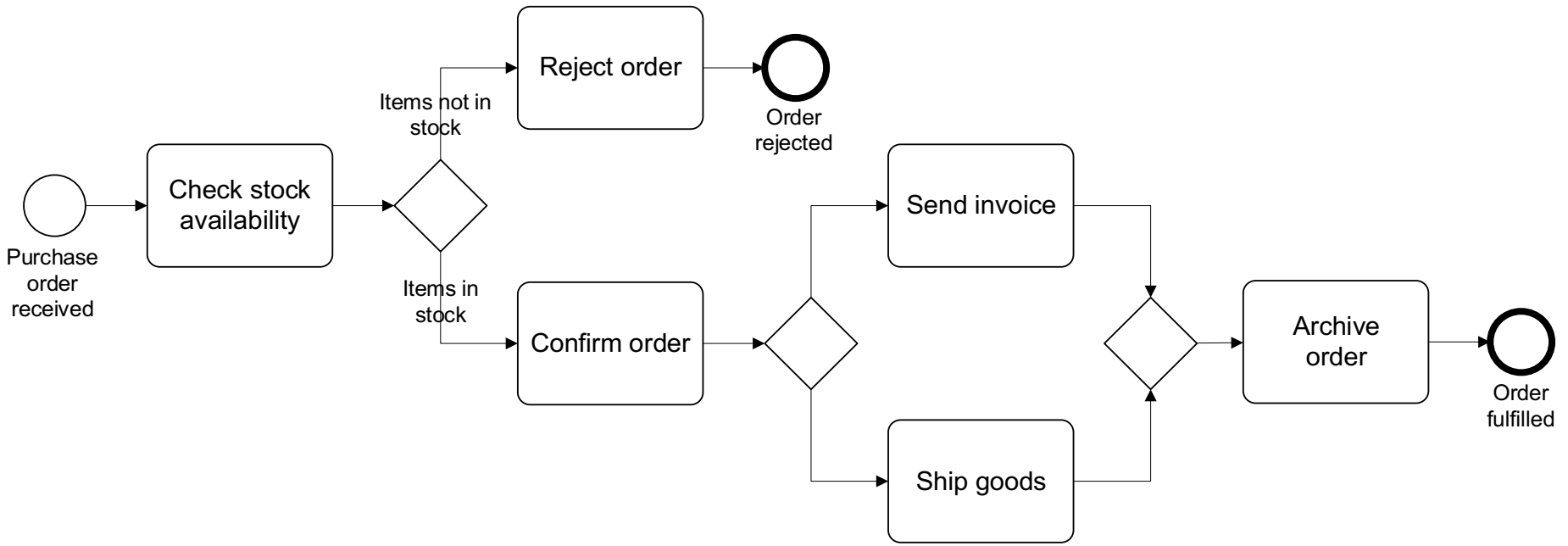


Revised order-to-cash process model



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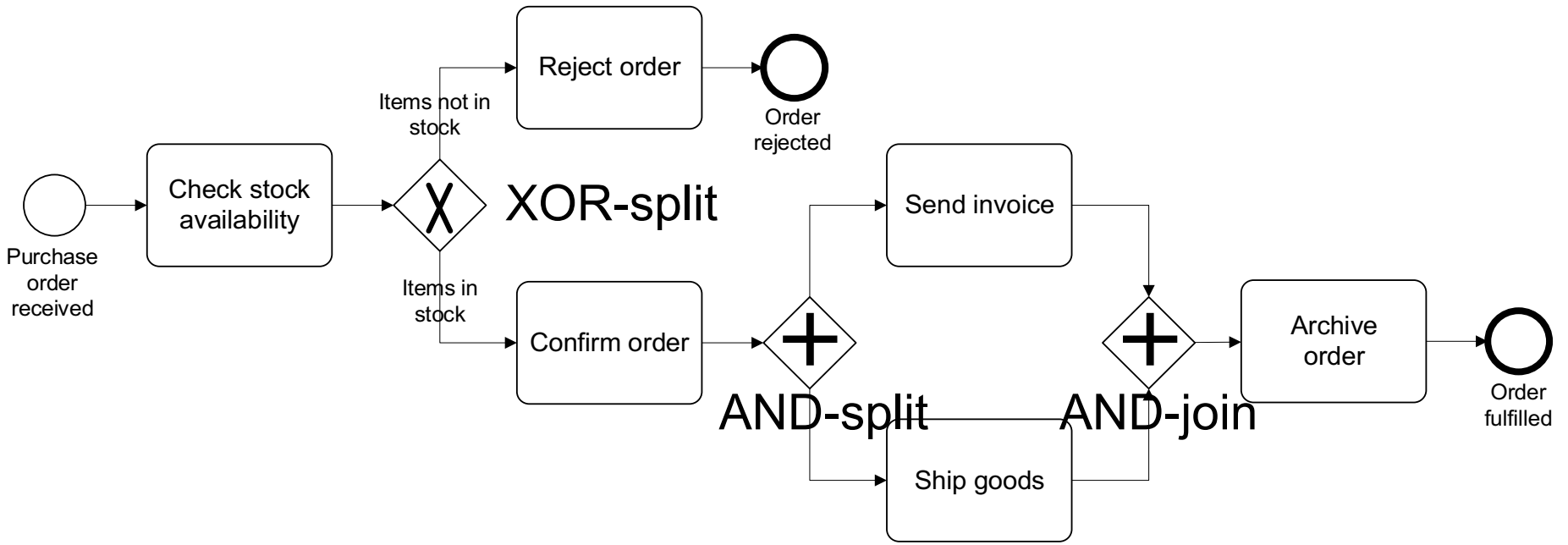


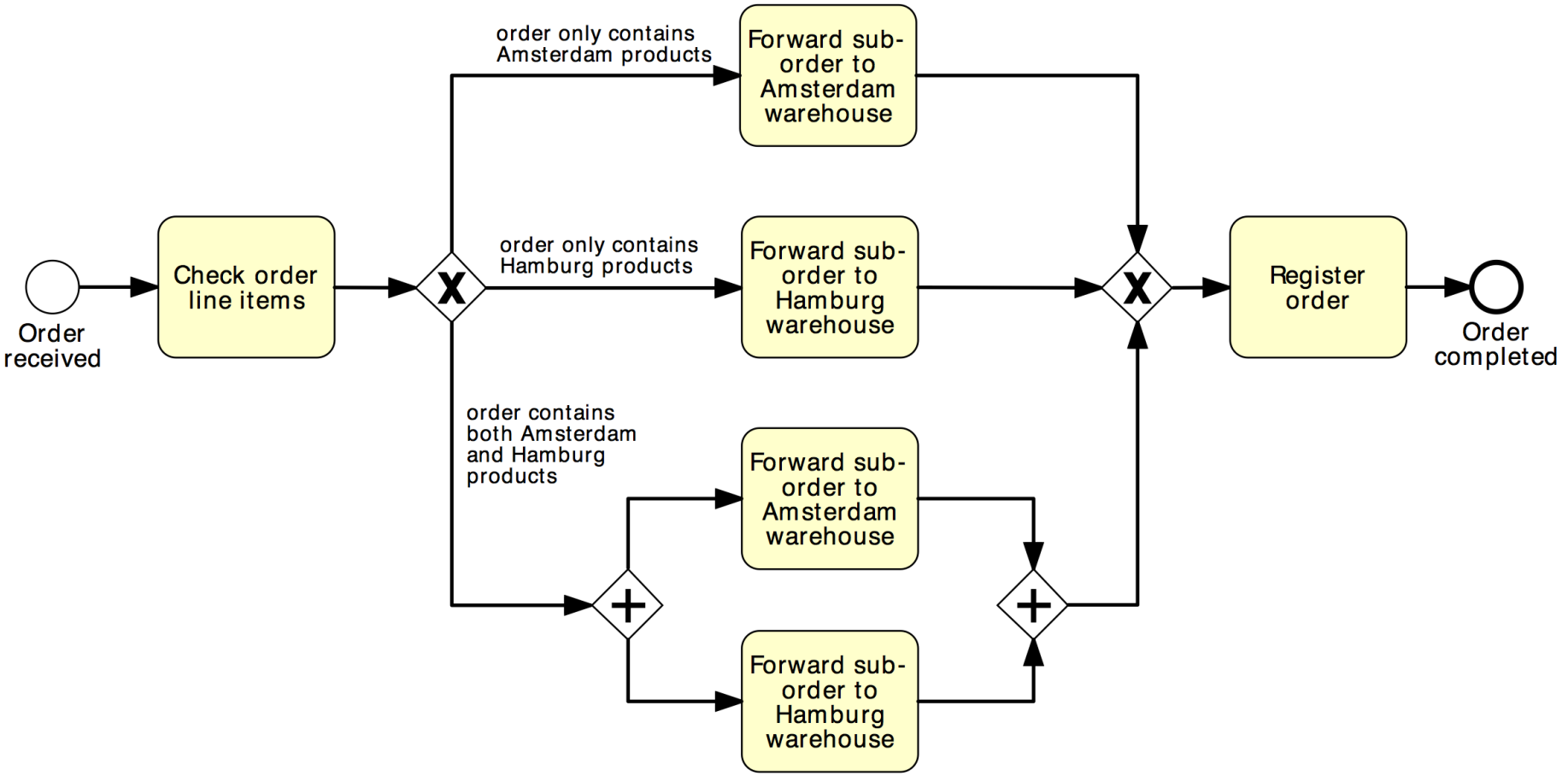
Between XOR and AND

Order distribution process

A company has two warehouses that store different products: Amsterdam and Hamburg. When an order is received, it is distributed across these warehouses: if some of the relevant products are maintained in Amsterdam, a sub-order is sent there; likewise, if some relevant products are maintained in Hamburg, a sub-order is sent there. Afterwards, the order is registered and the process completes.

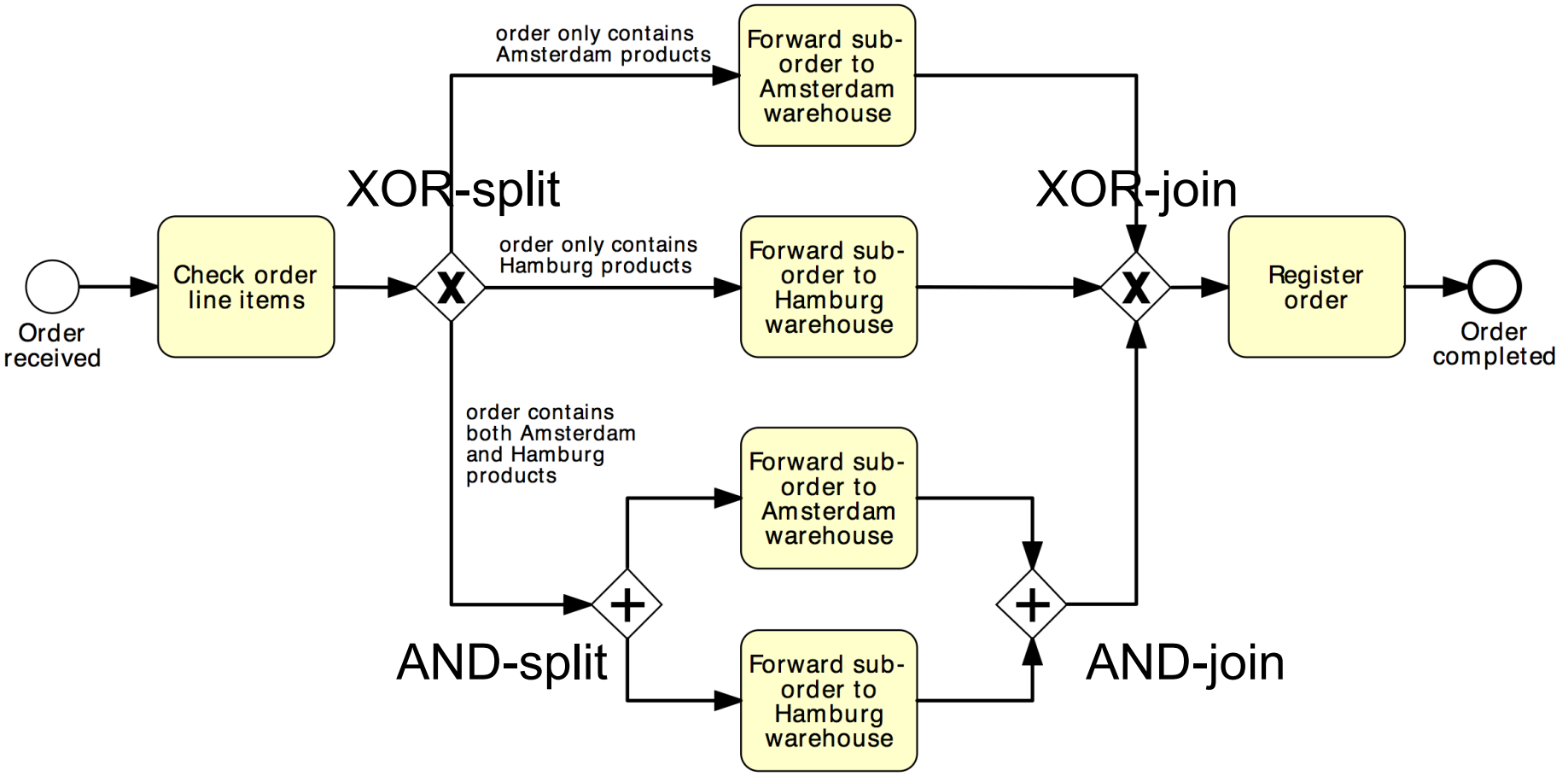
Solution 1

Order distribution process



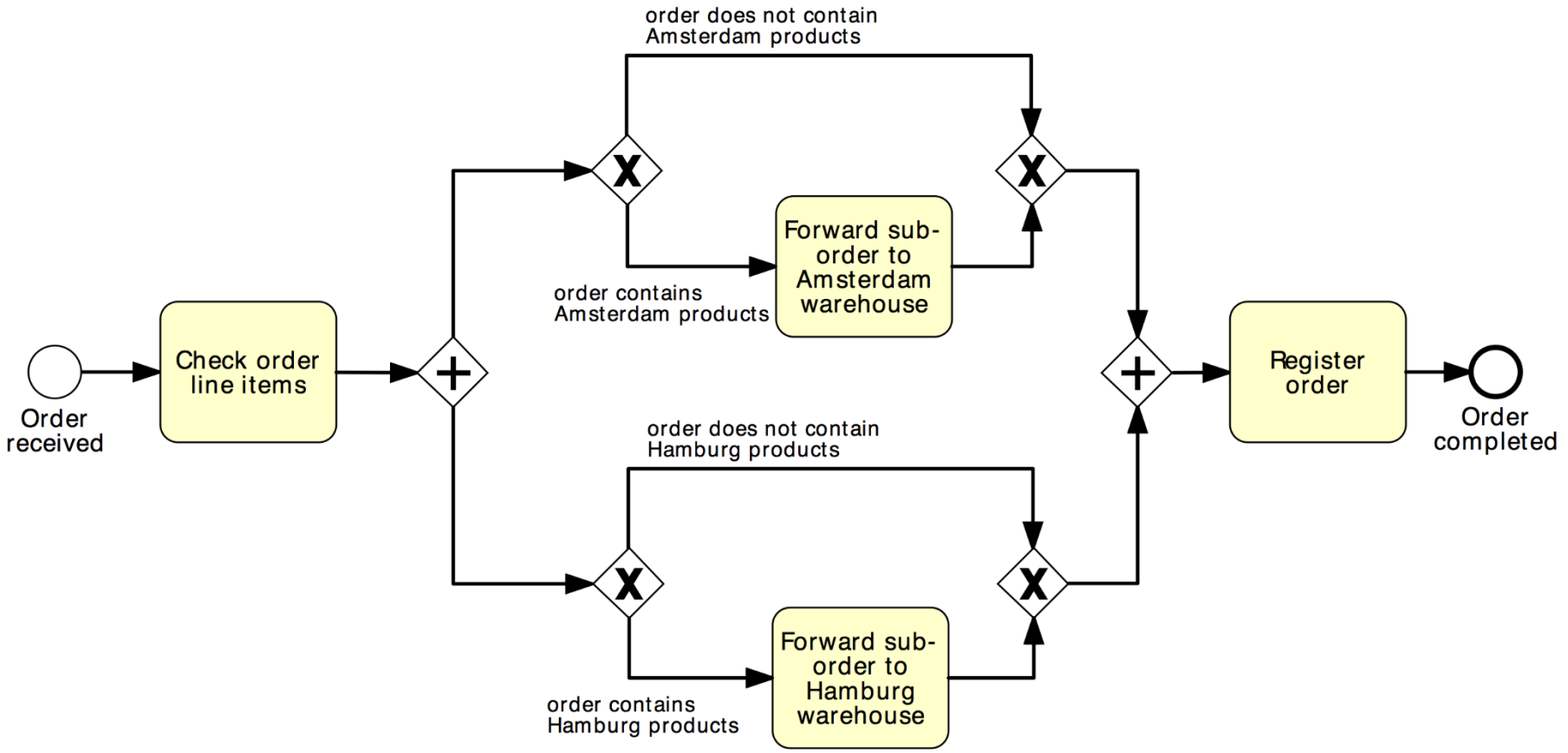
Solution 1

Order distribution process



Solution 2

Order distribution process



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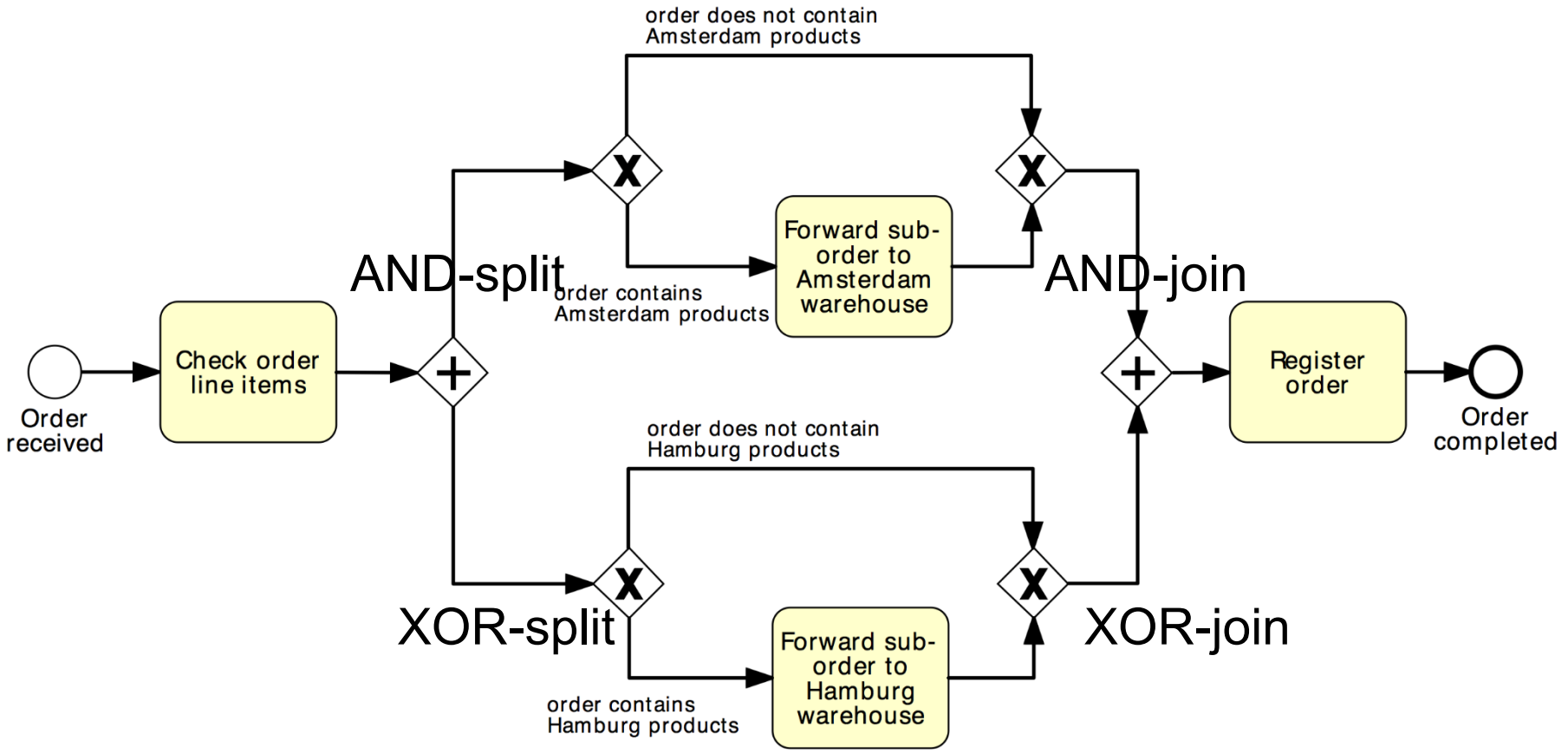
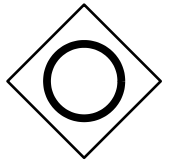
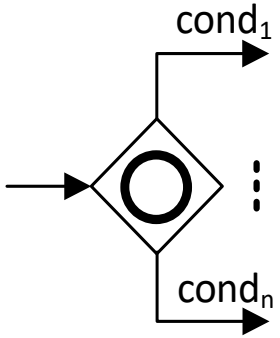


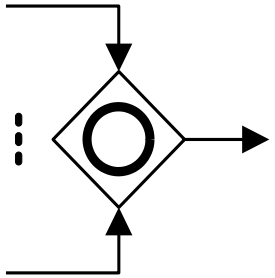
OR Gateway



An *OR Gateway* provides a mechanism to create and synchronize n out of m parallel flows.

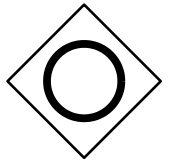


OR-split ➔ takes one or more branches depending on conditions



OR-join ➔ proceeds when all **active** incoming branches have completed

OR Gateway



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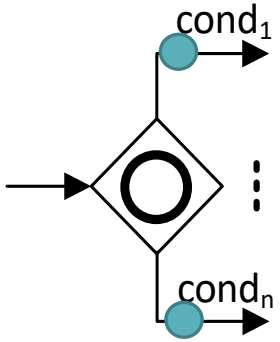

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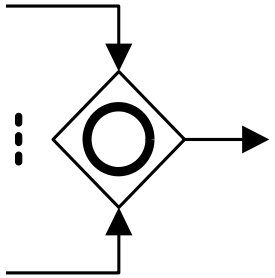

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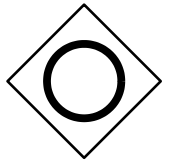

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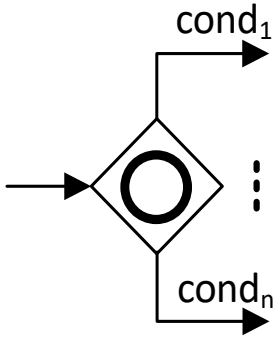

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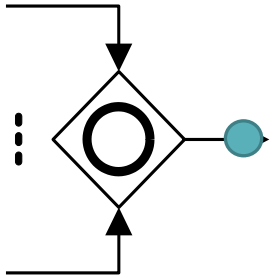

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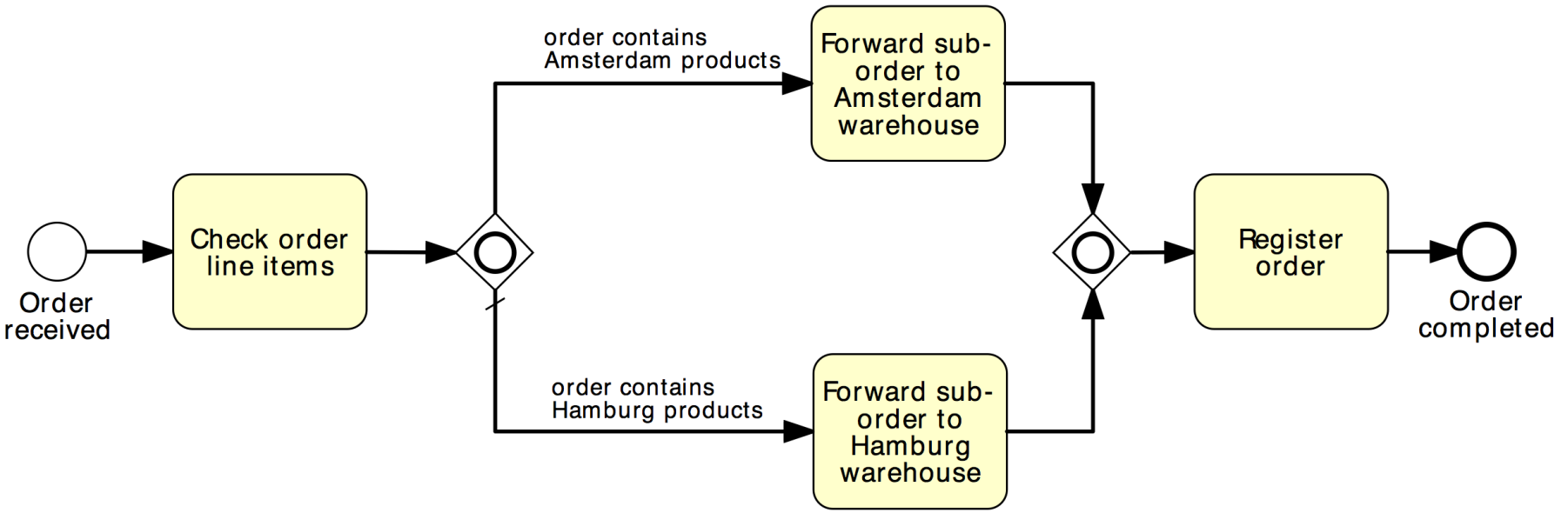
Solution using OR Gateway

Order distribution process



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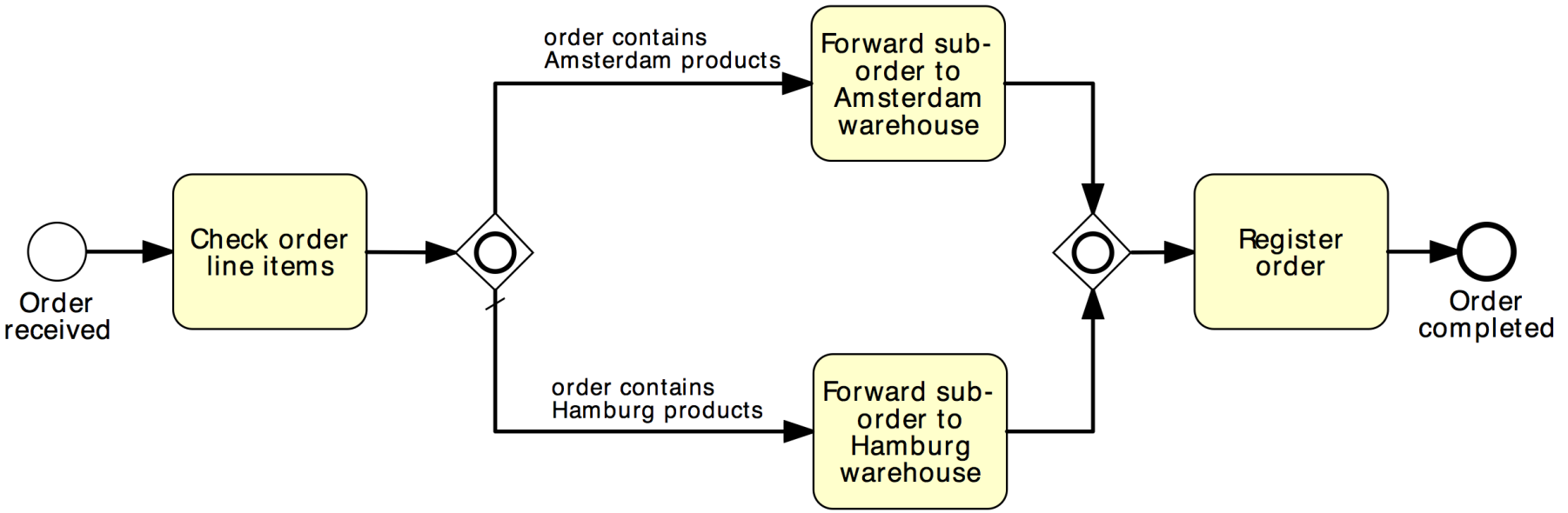

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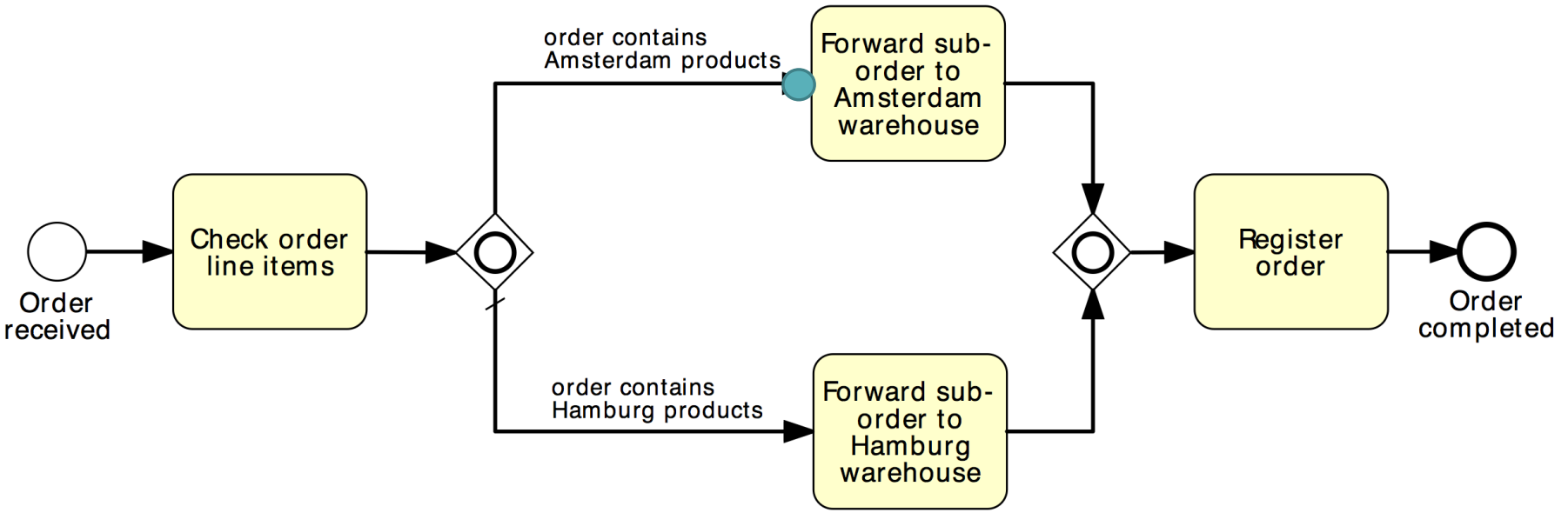

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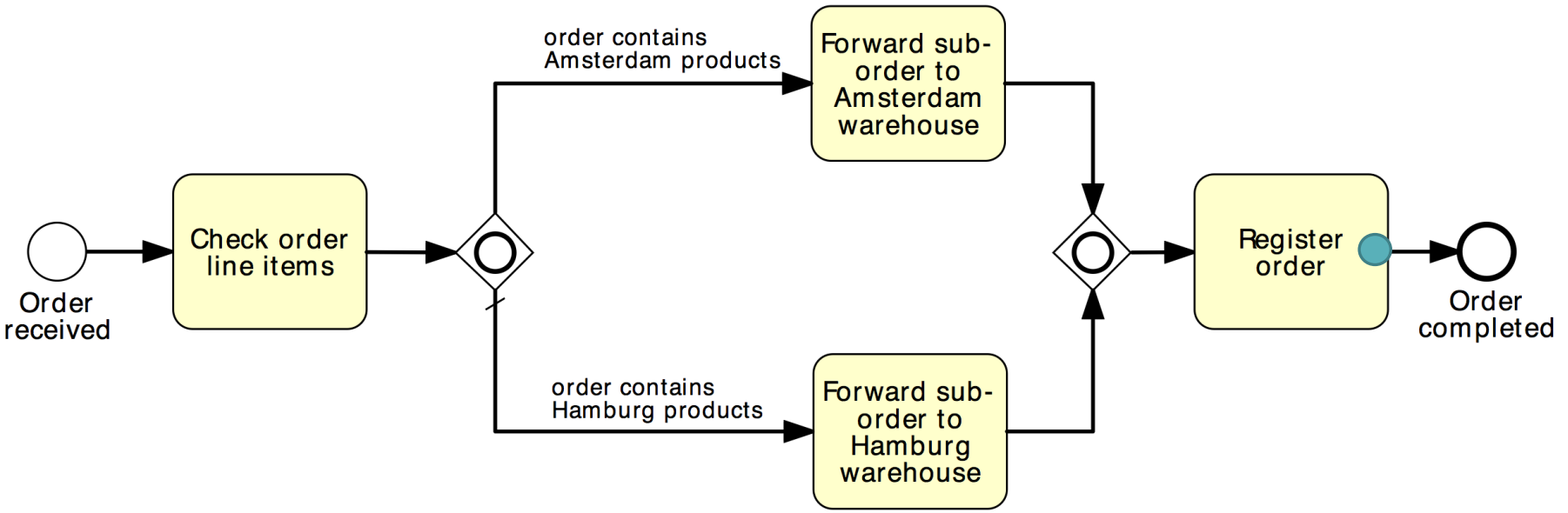
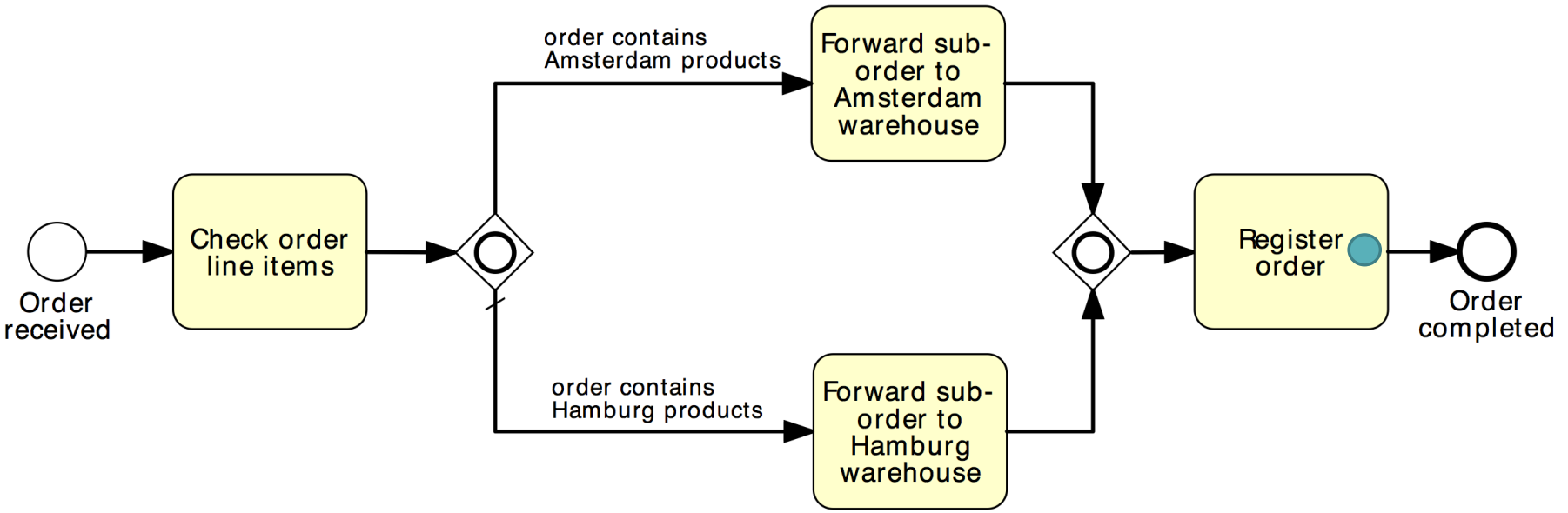


Solution using OR Gateway

Order distribution process



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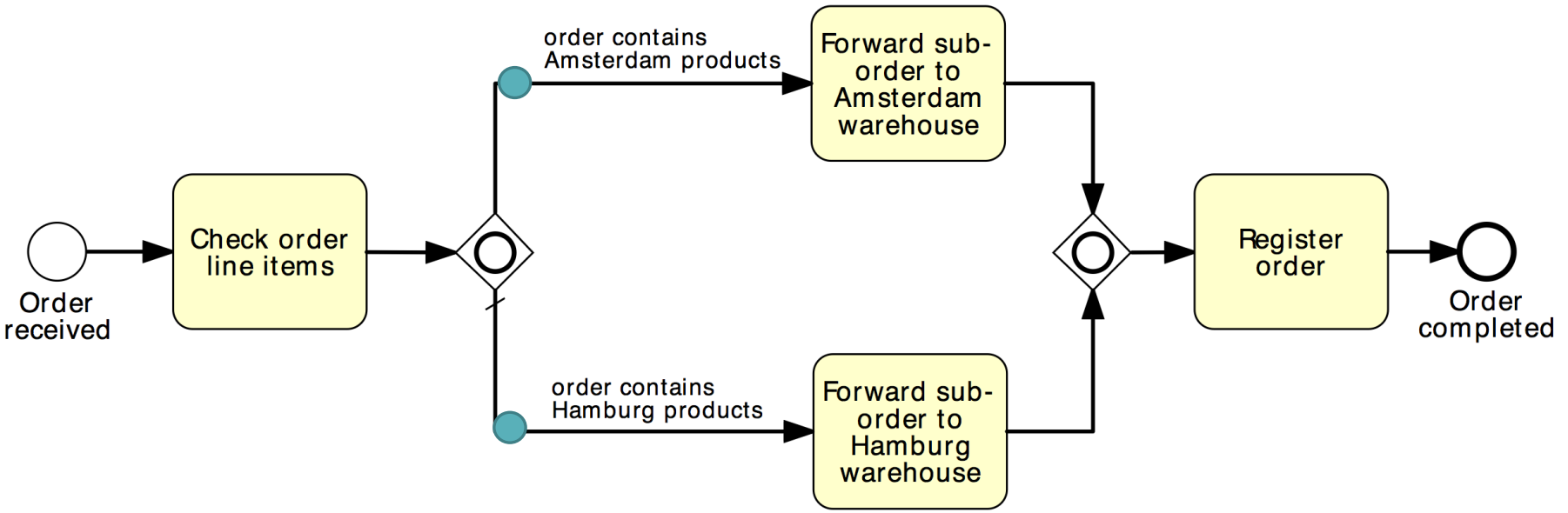

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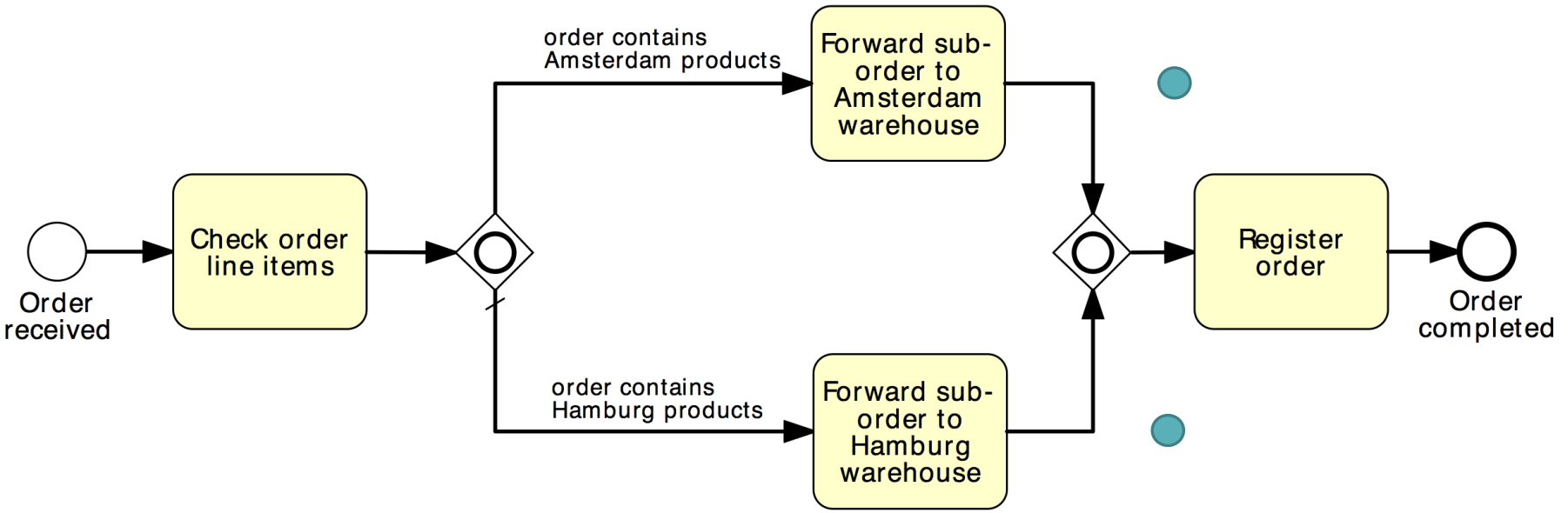

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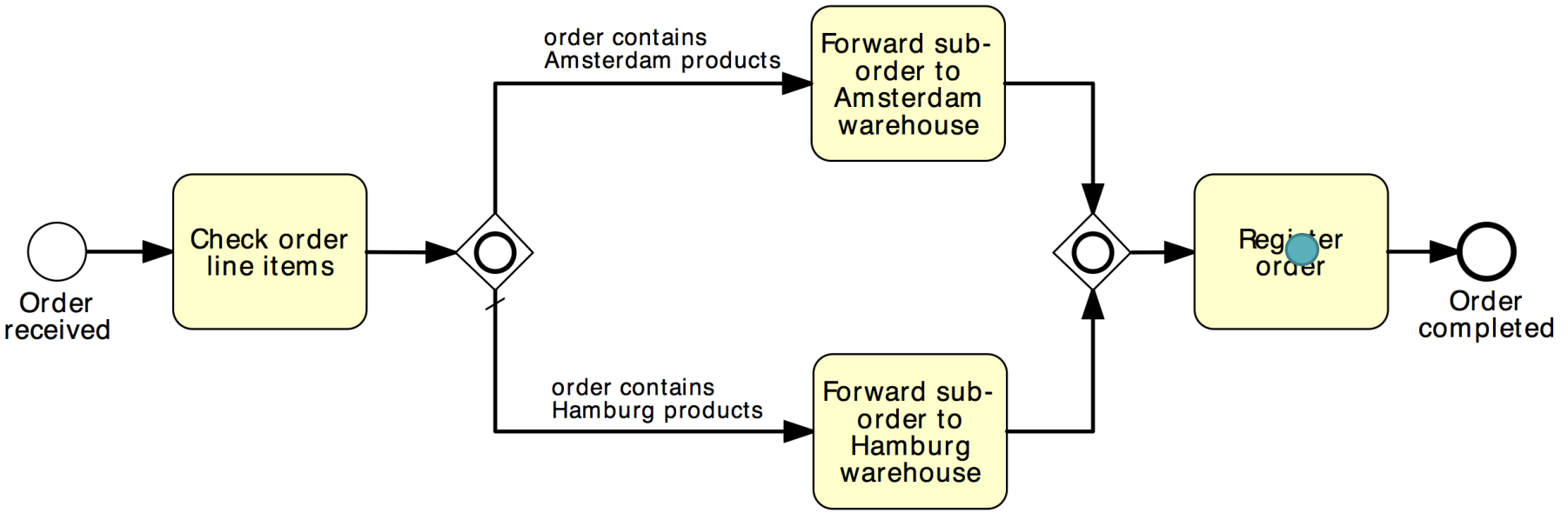

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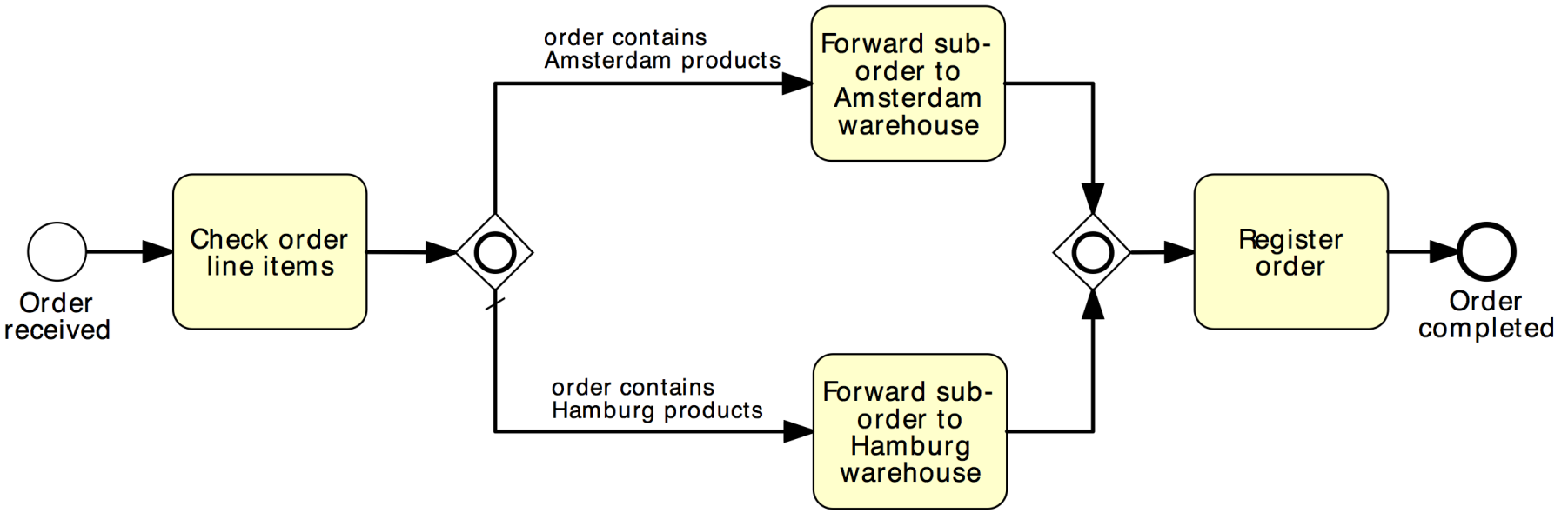

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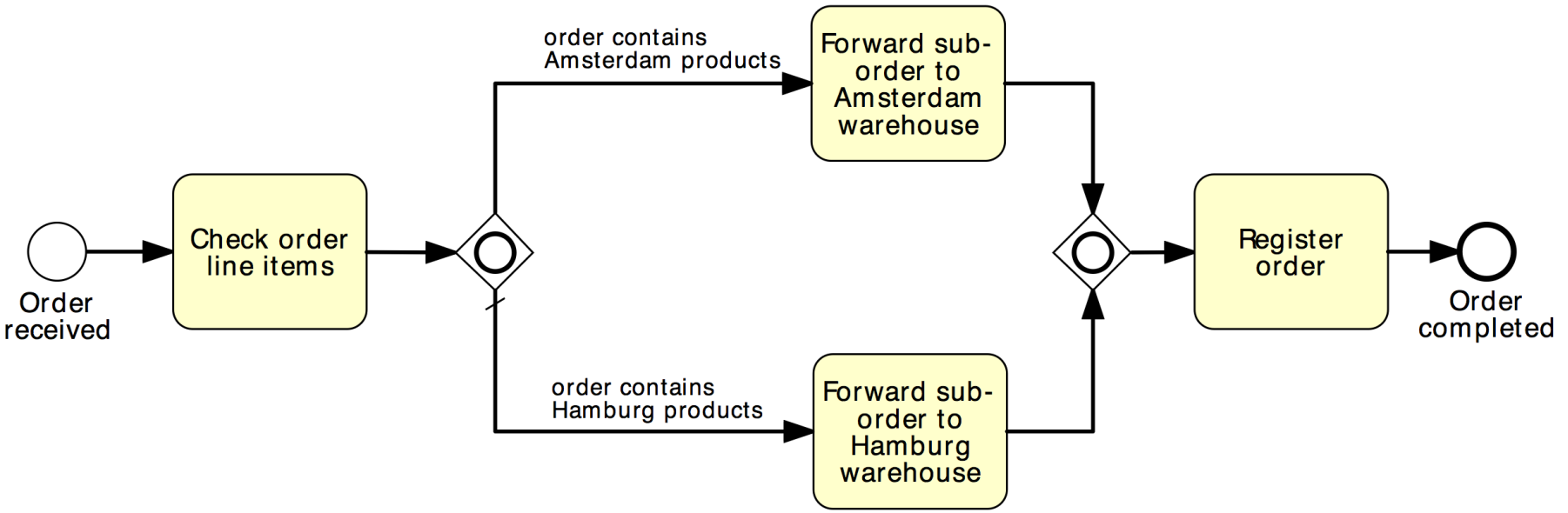
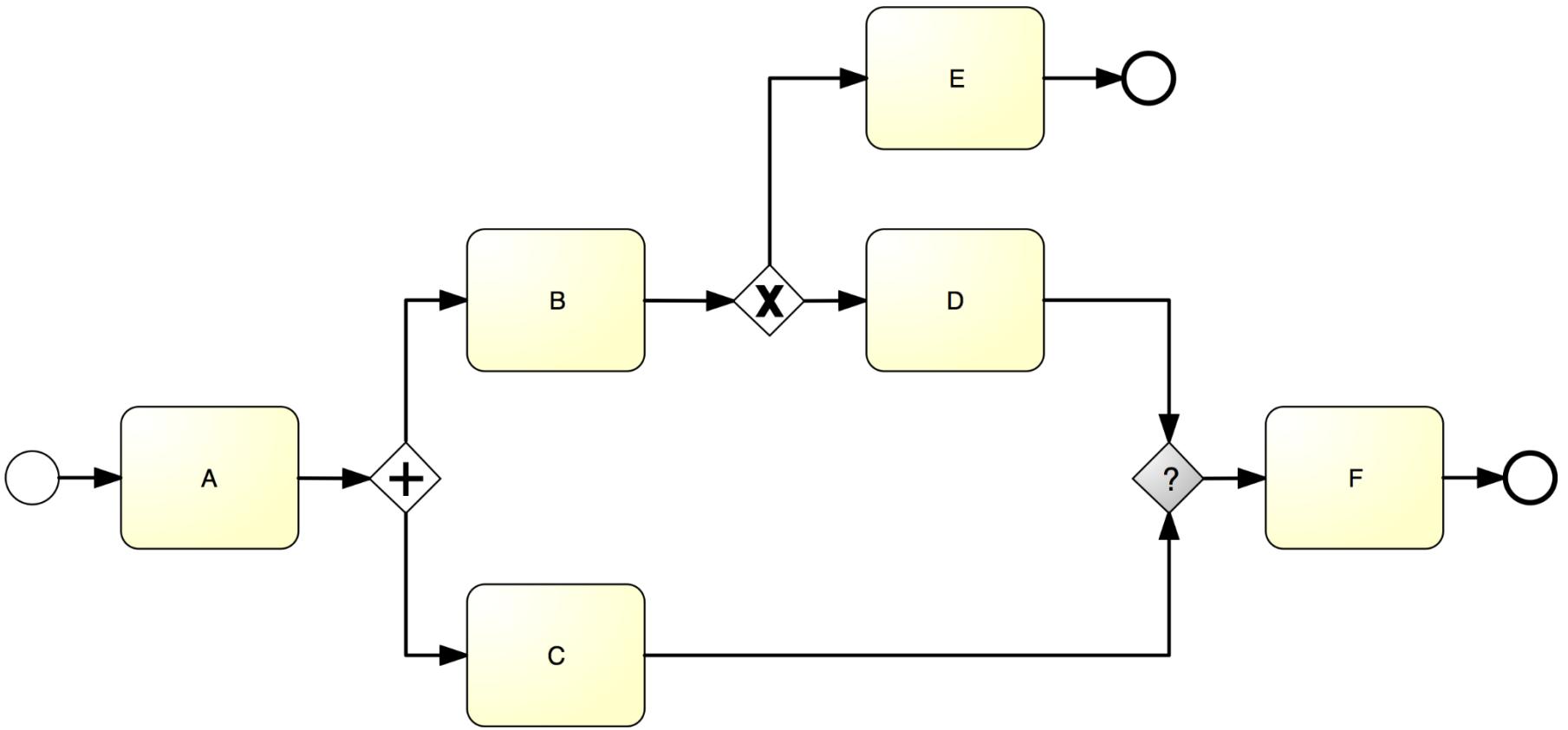


What join type do we need here?



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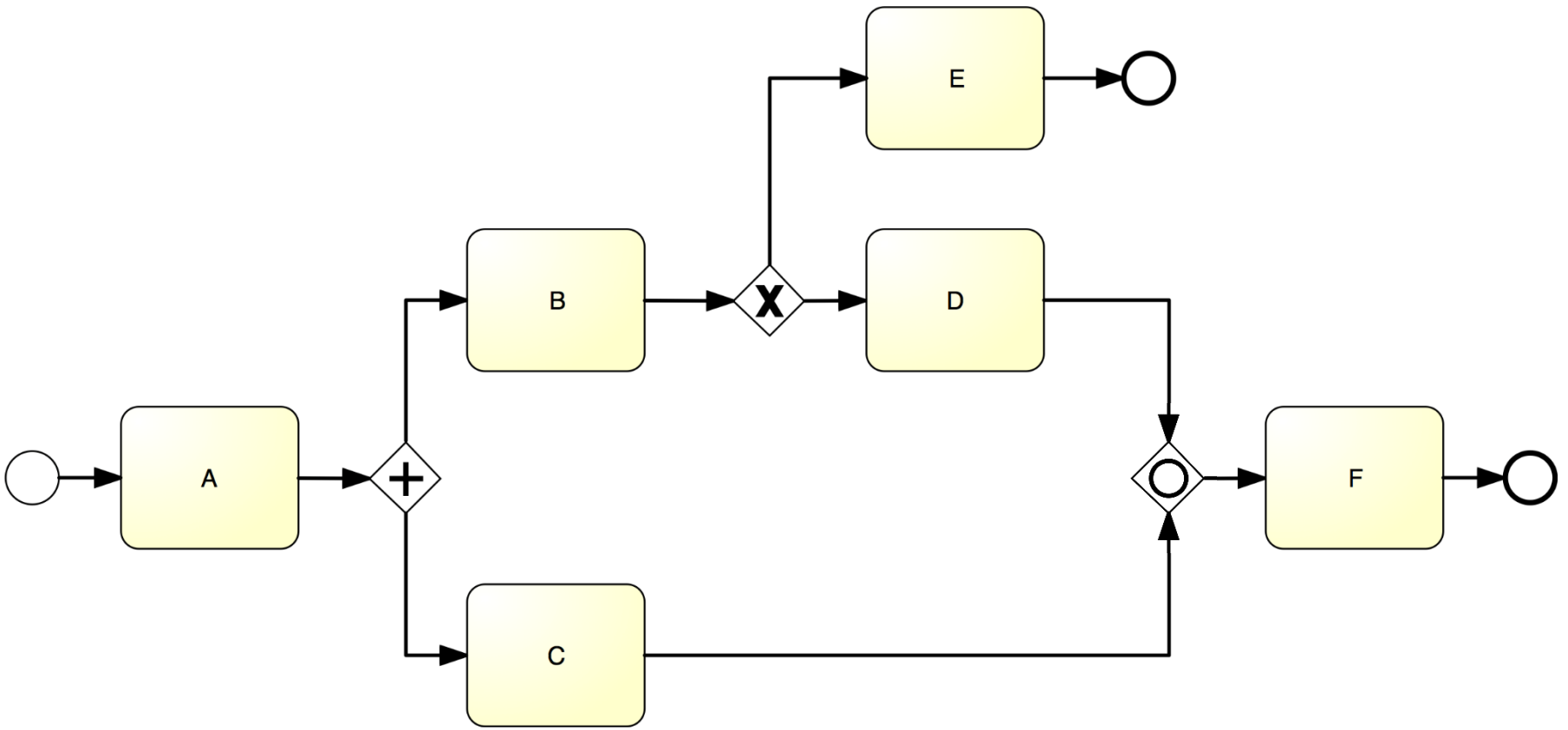
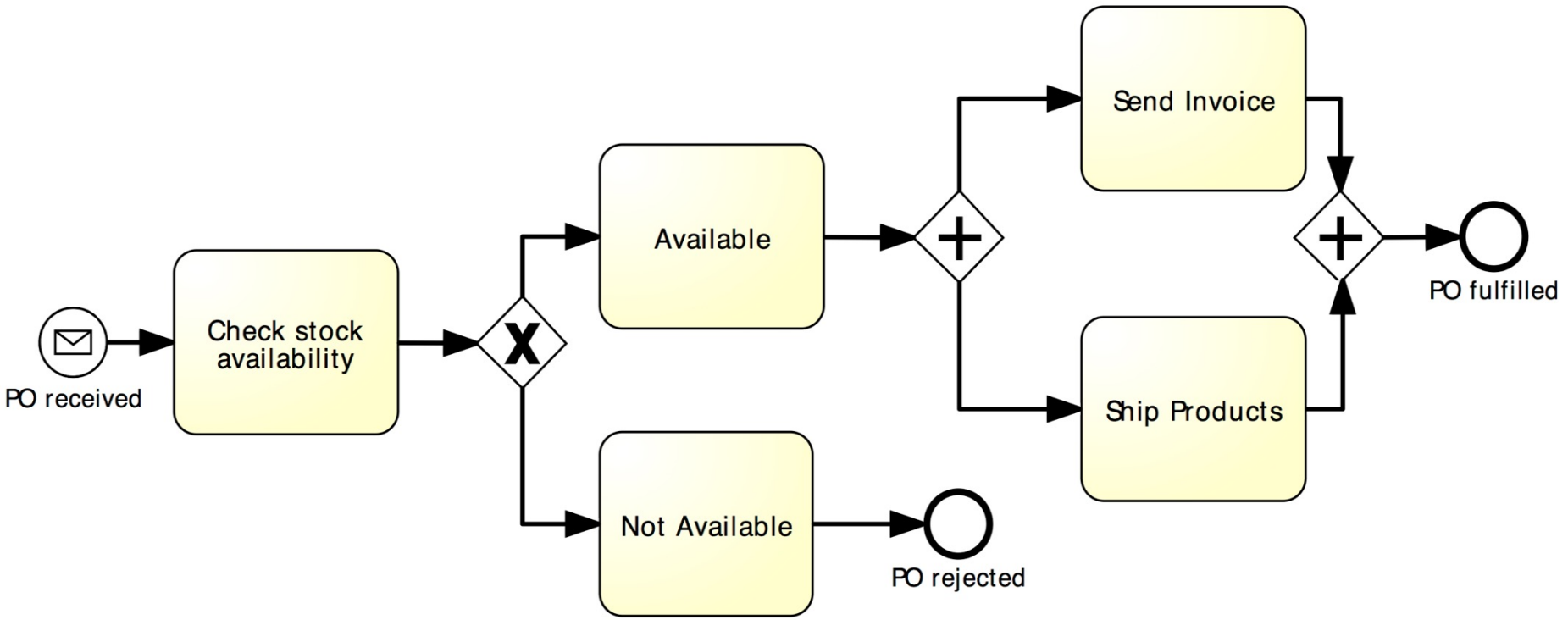


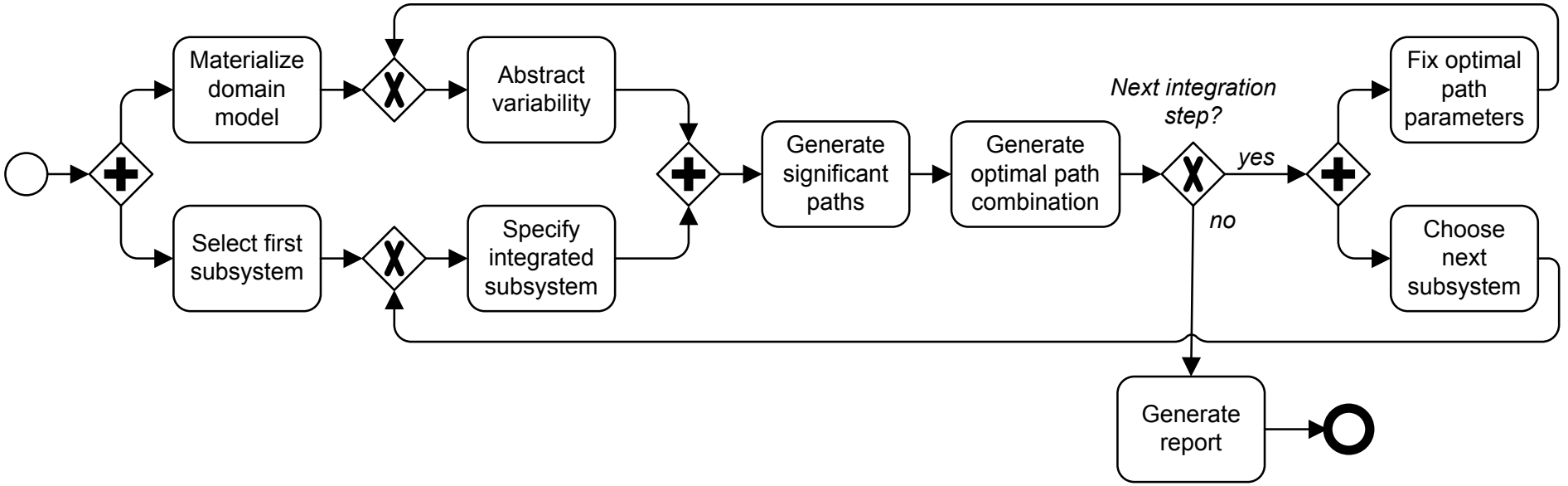
Beware: Beginner's Mistake…

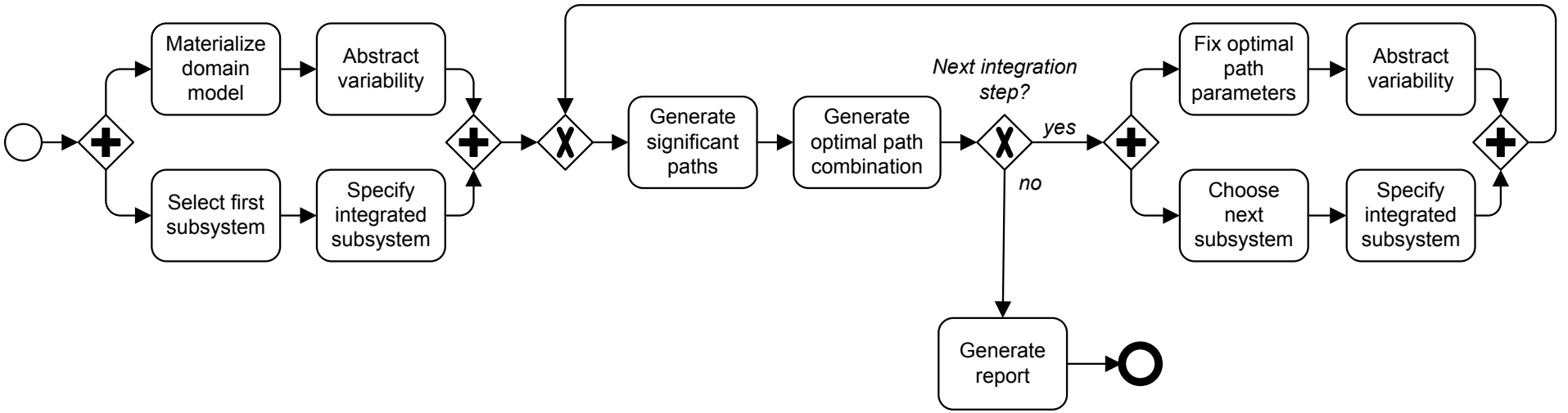


Guidelines: Naming Conventions

1. Give a name to every event and task
2. For tasks: verb followed by business object name and possibly complement
   - Issue Driver Licence, Renew Licence via Agency
3. For message events: object + past participle
   - Invoice received, Claim settled
4. Avoid generic verbs such as Handle, Record…
5. Label each XOR-split with a condition
   - Policy is invalid, Claim is inadmissible

Poll: Which model do you prefer?





One more guideline…

- Model in blocks
  - Pair up each AND-split with an AND-join and each XOR-split with a XOR-join, whenever possible
  - Exception: sometimes a XOR-split leads to two end events – different outcomes (cf. order management example)

Rework and repetition

Address ministerial correspondence

In the minister’s office, when a ministerial inquiry has been received, it is registered into the system. Then the inquiry is investigated so that a ministerial response can be prepared.

The finalization of a response includes the preparation of the response itself by the cabinet officer and the review of the response by the principal registrar. If the registrar does not approve the response, the latter needs to be prepared again by the cabinet officer for review. The process finishes only once the response has been approved.

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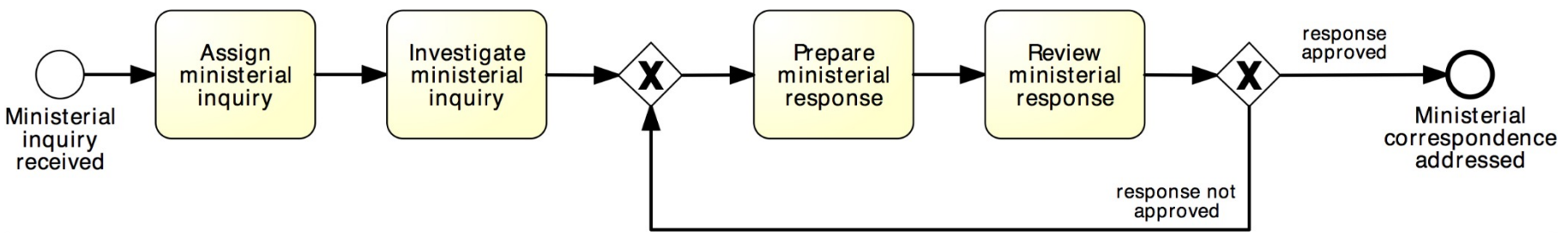

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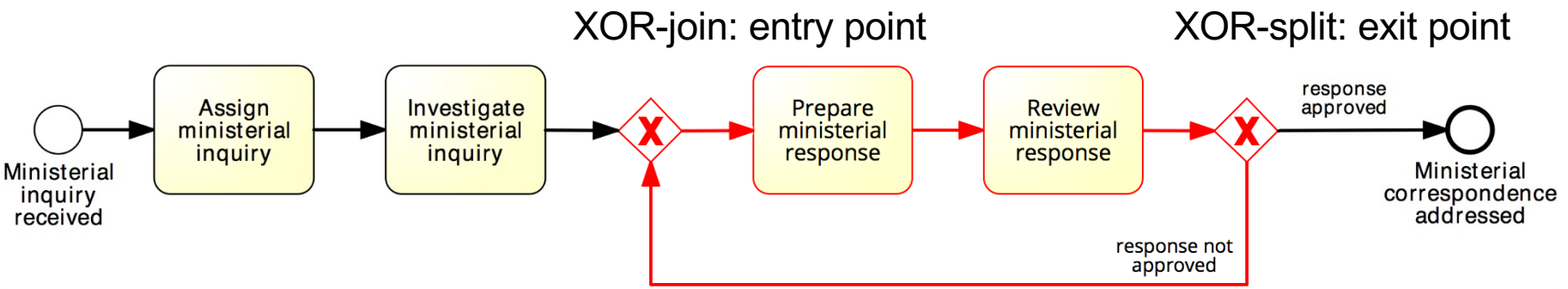
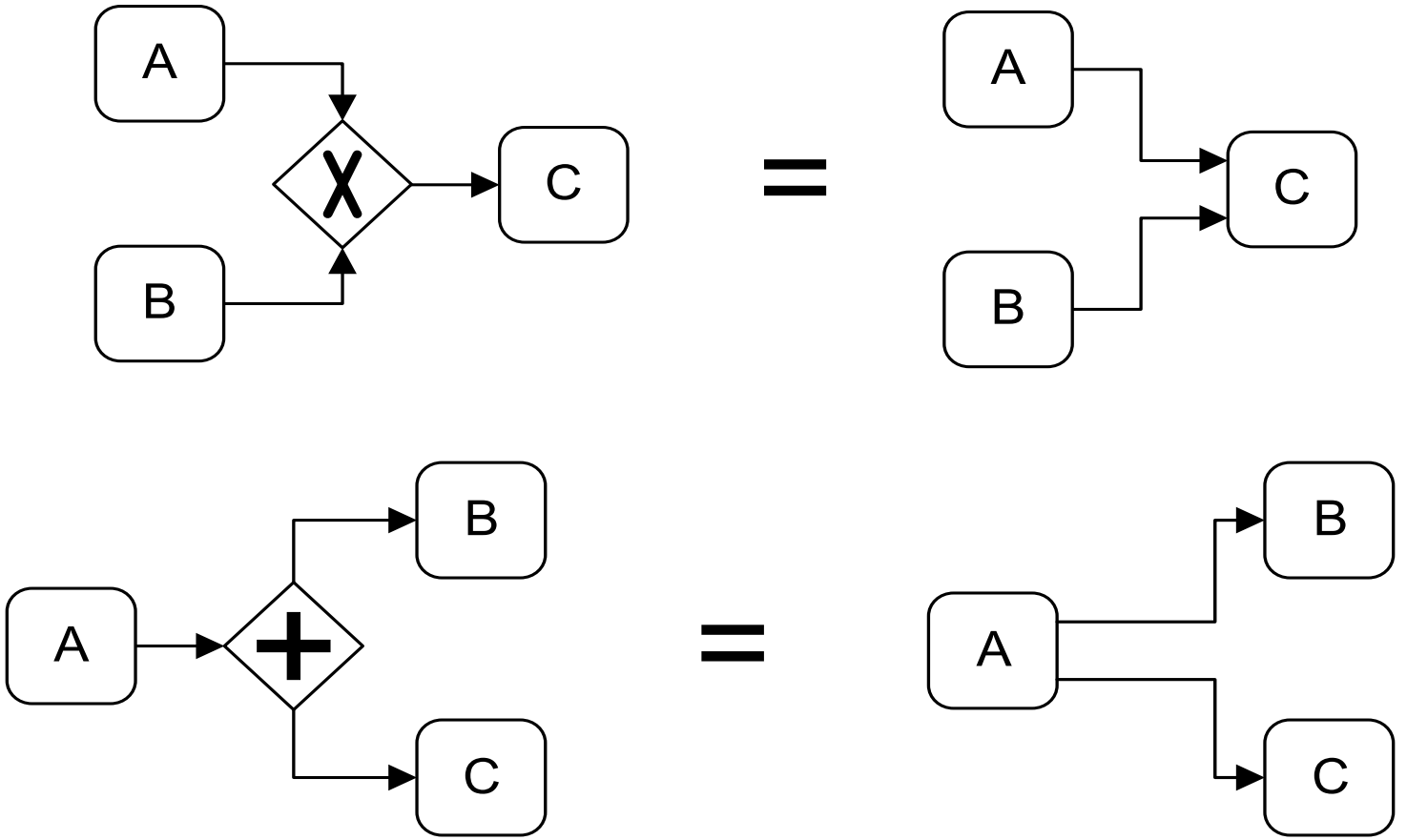
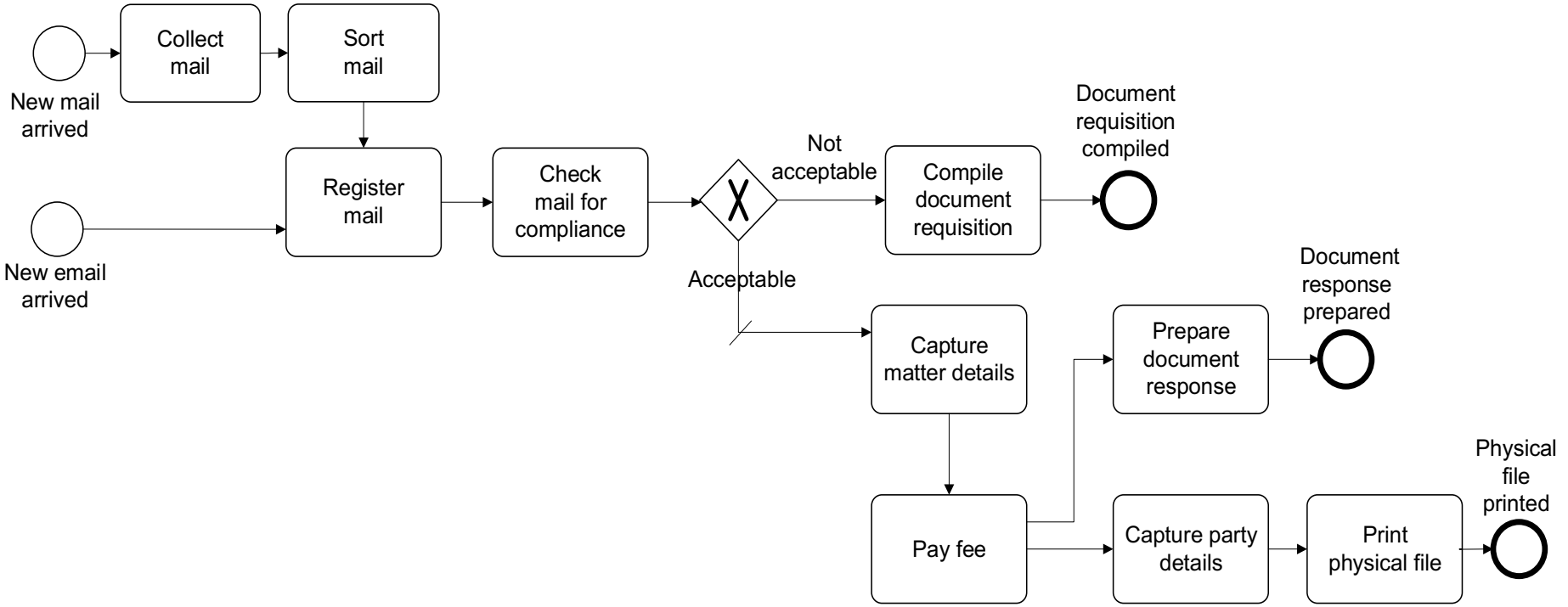


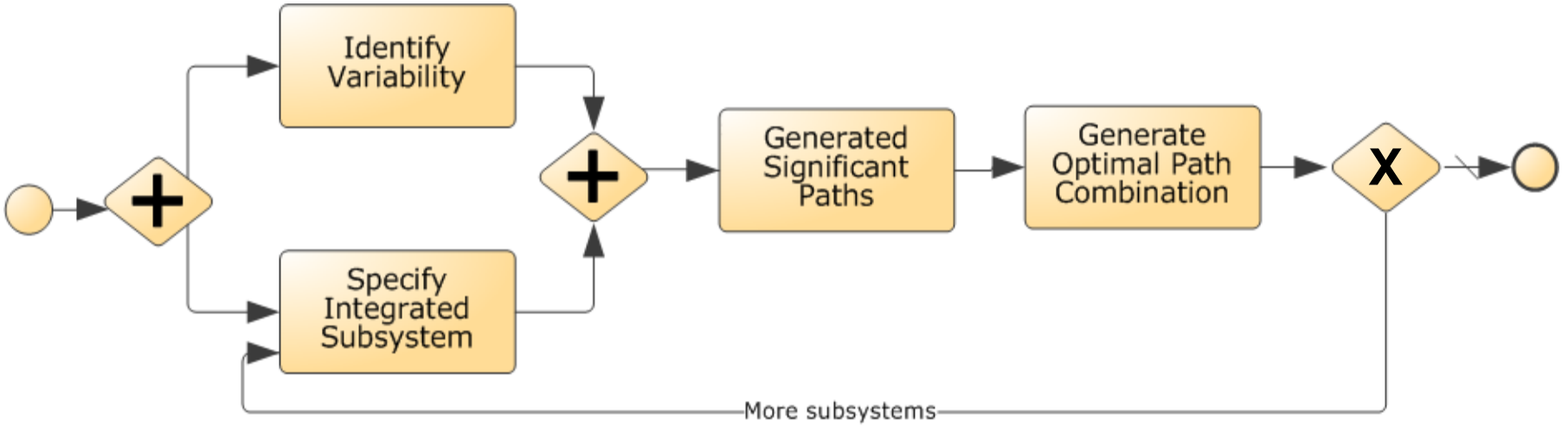
Quick Note: Implicit vs. explicit gateways



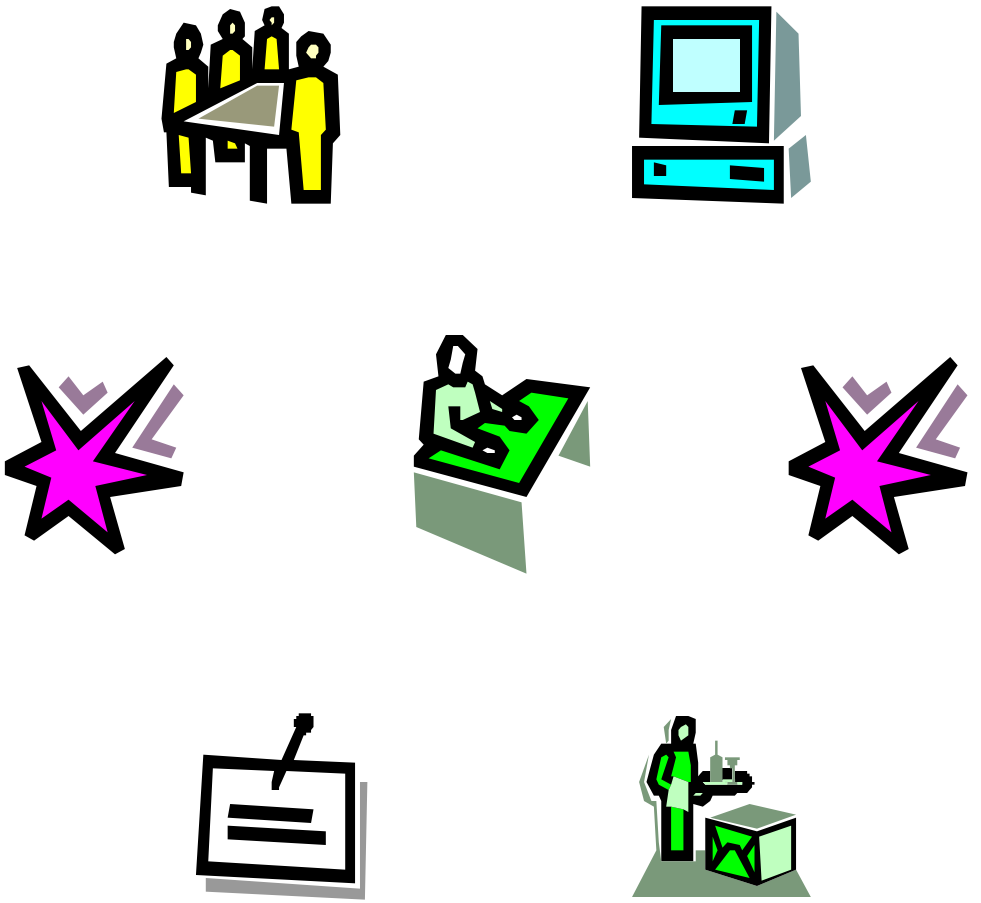
How this process starts? How it ends?



What's wrong with this model? How to fix it?



Process Modelling Viewpoints



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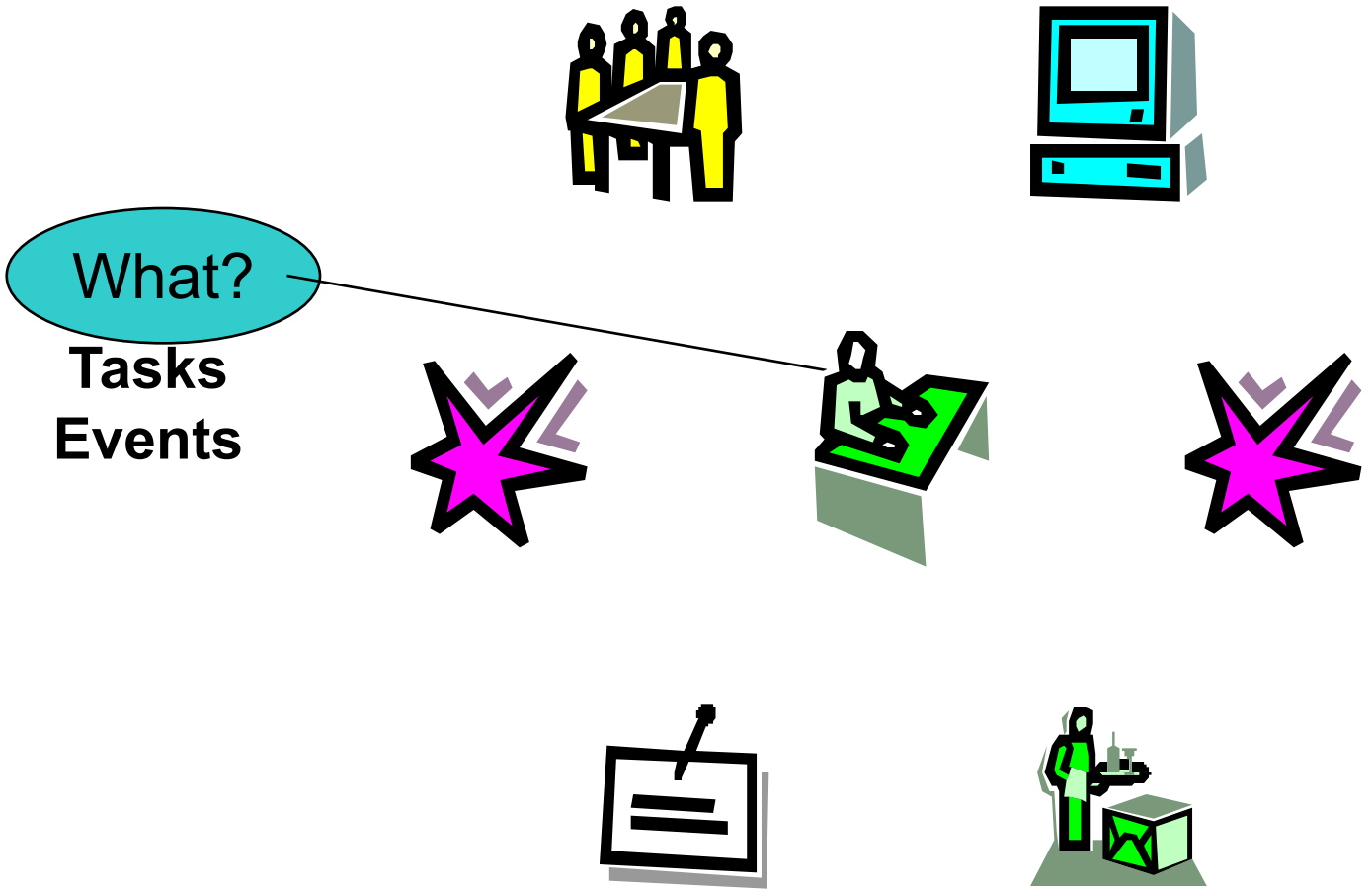

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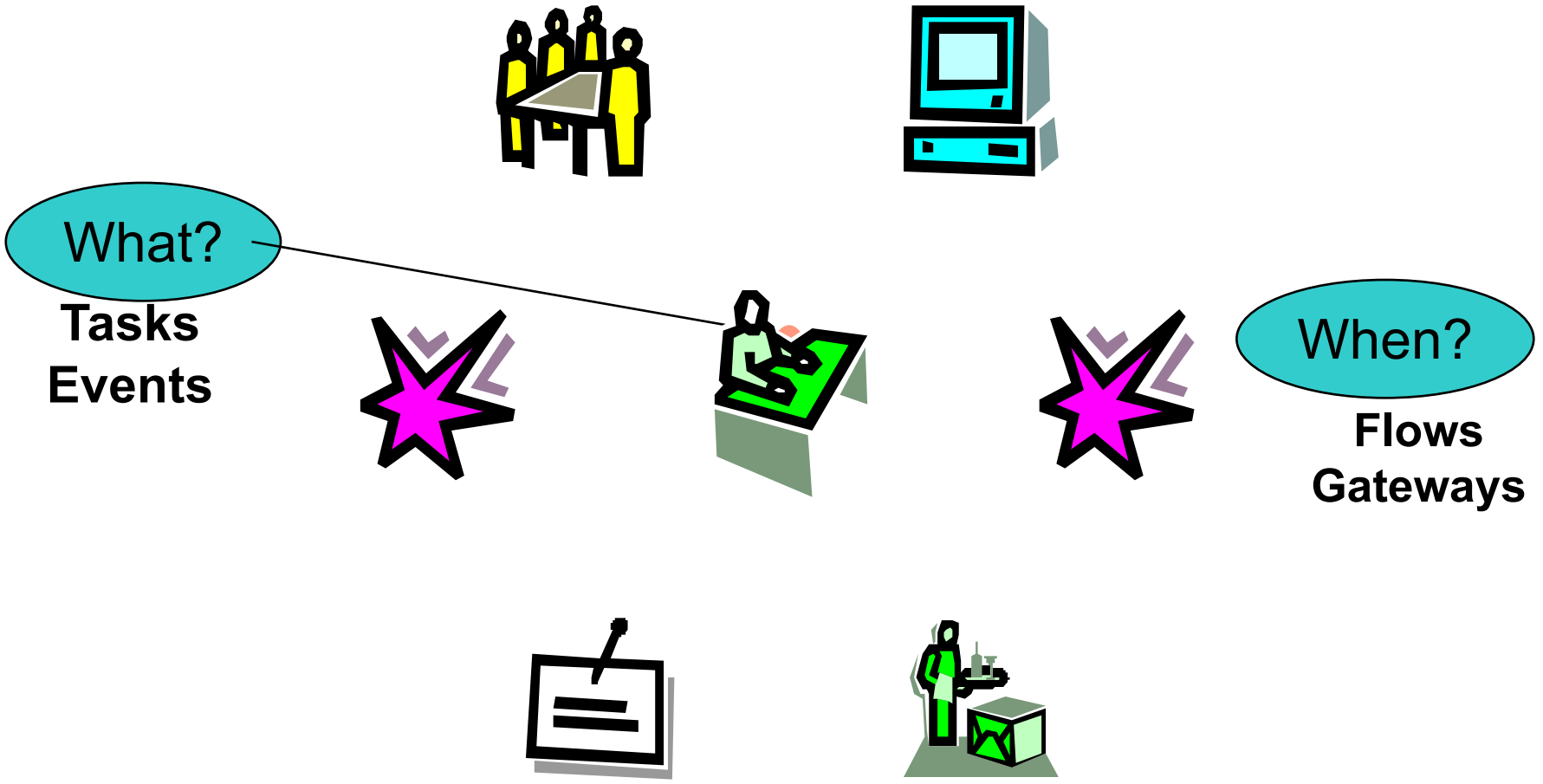

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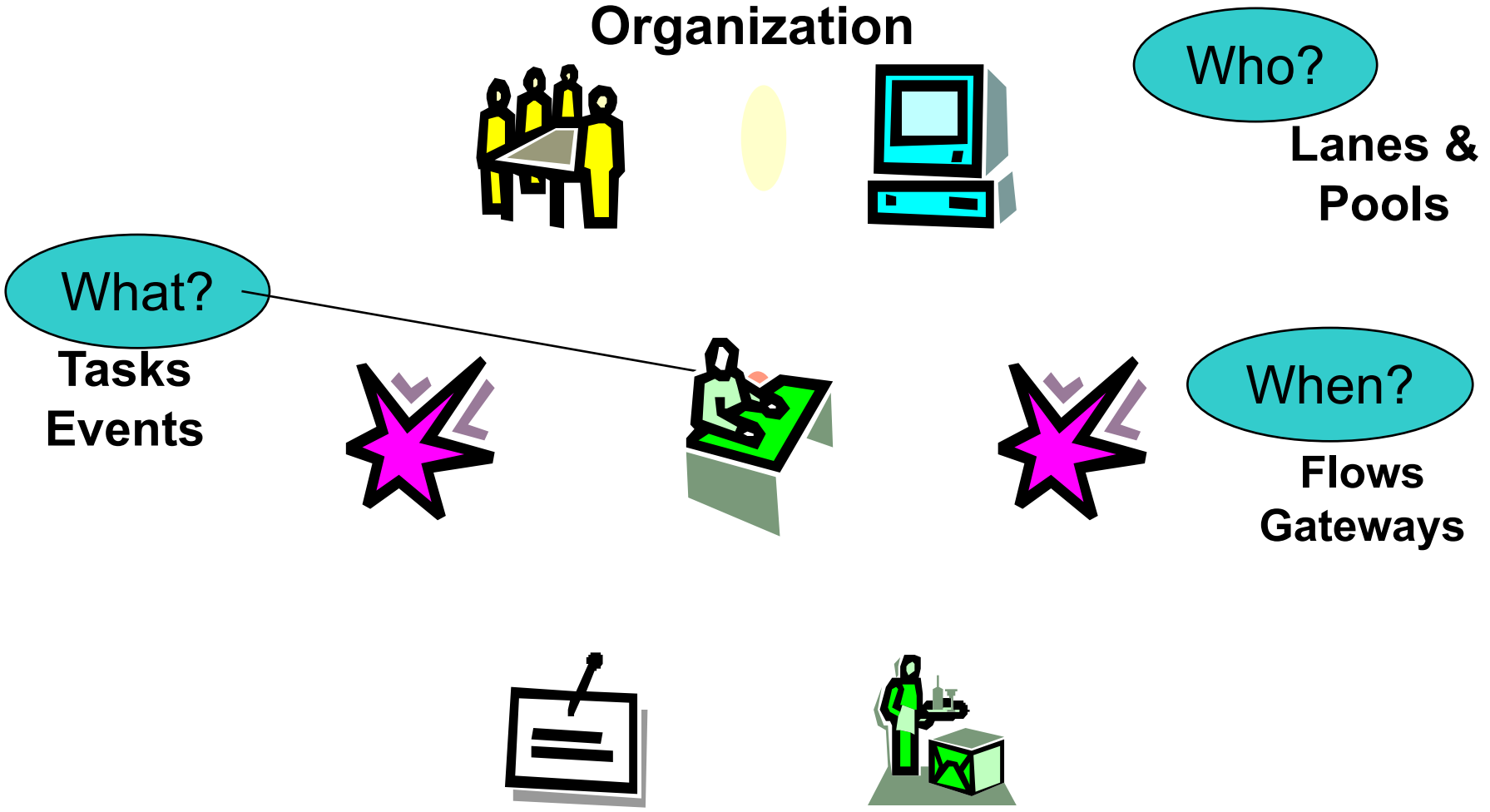

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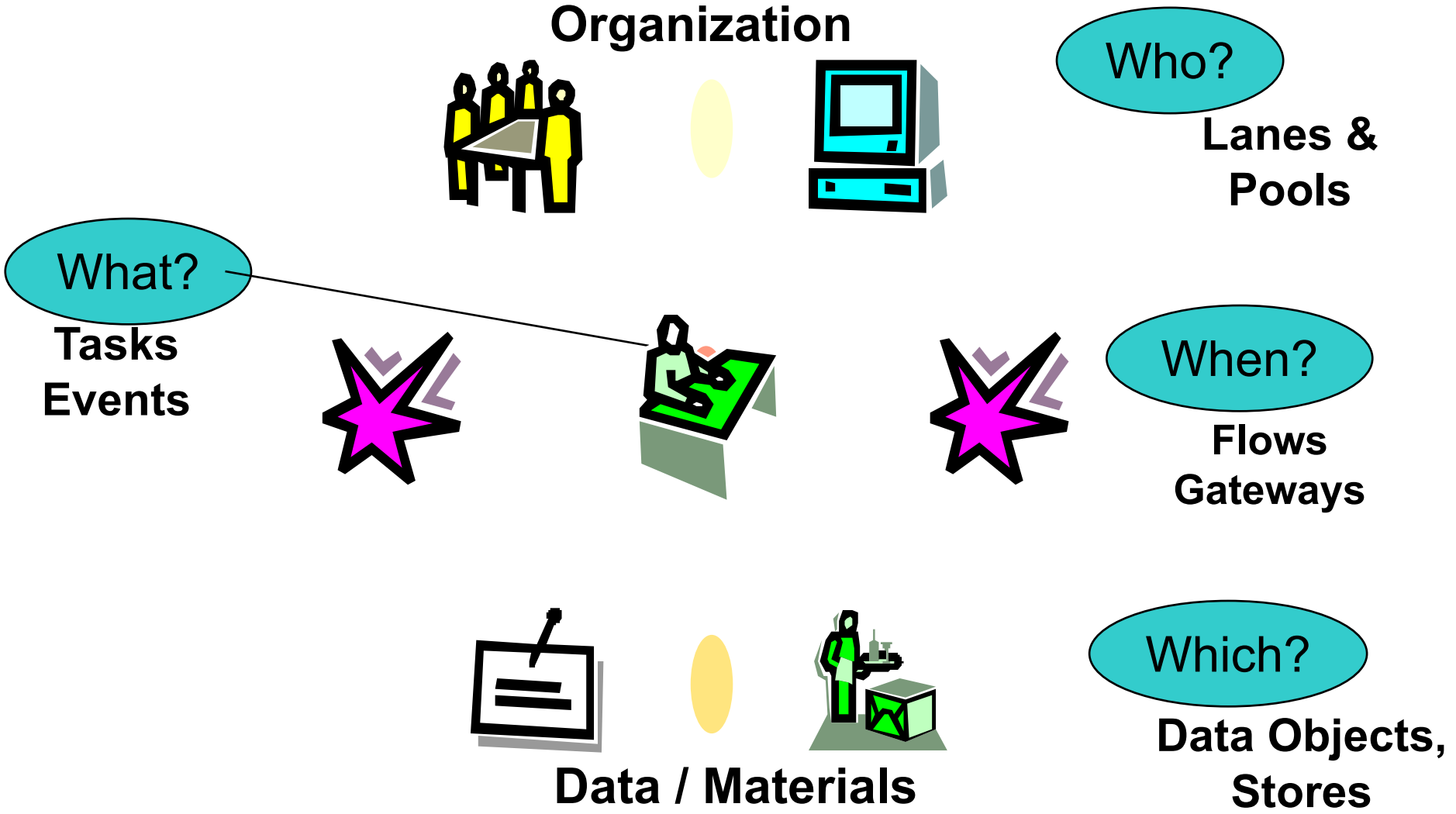

Organizational Elements in BPMN – Pools & Lanes

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Pool

Captures a resource class. Generally used to model a business party (e.g. a whole company)

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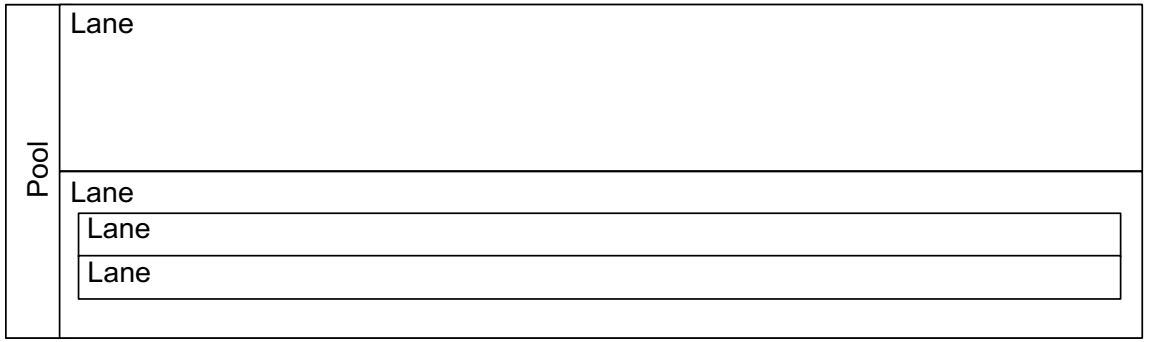
Lane

A *resource sub-class* within a pool. Generally used to model departments (e.g. shipping, finance), internal roles (e.g. Manager, Associate), software systems (e.g. ERP, CRM)



Order-to-cash process with lanes

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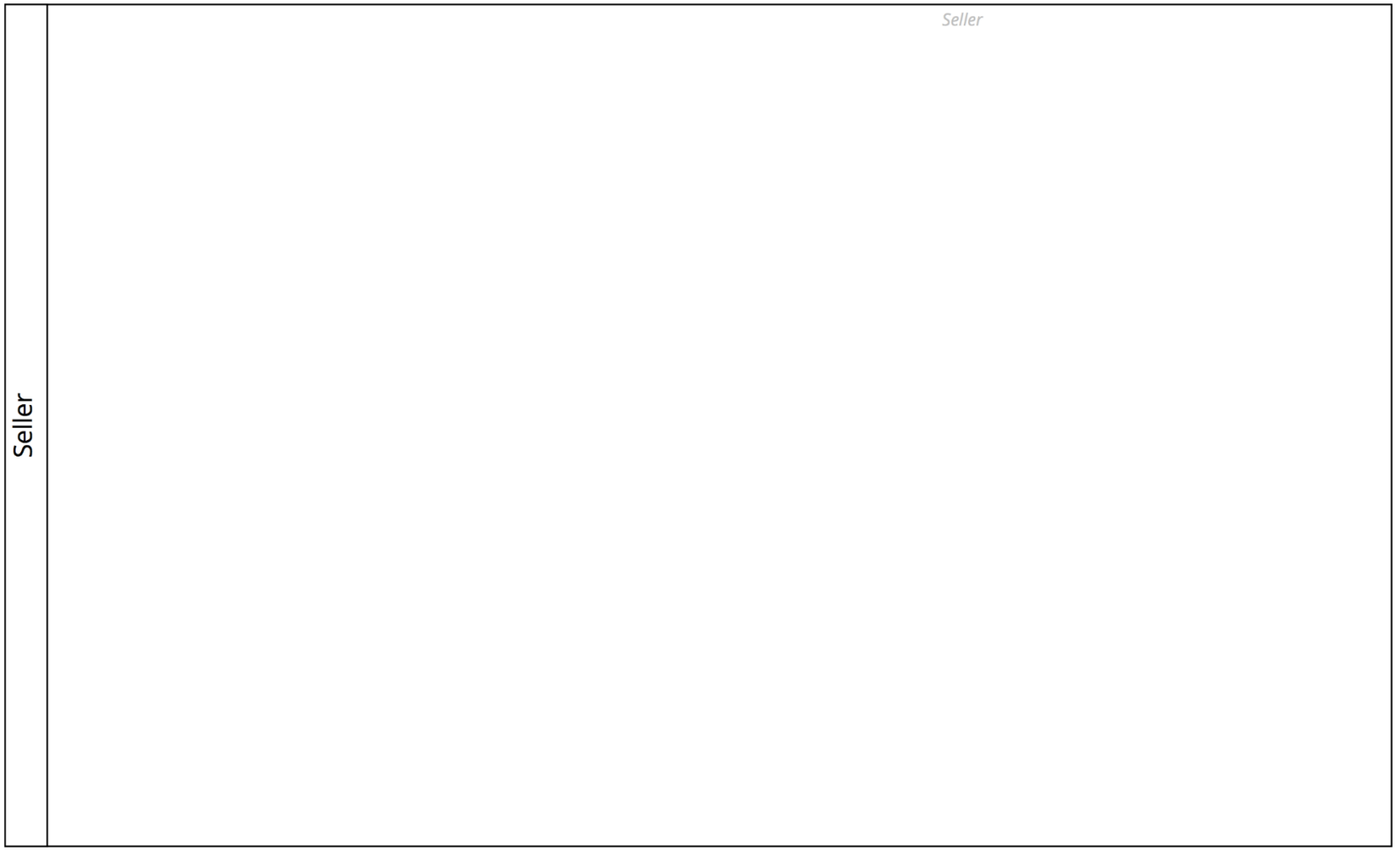

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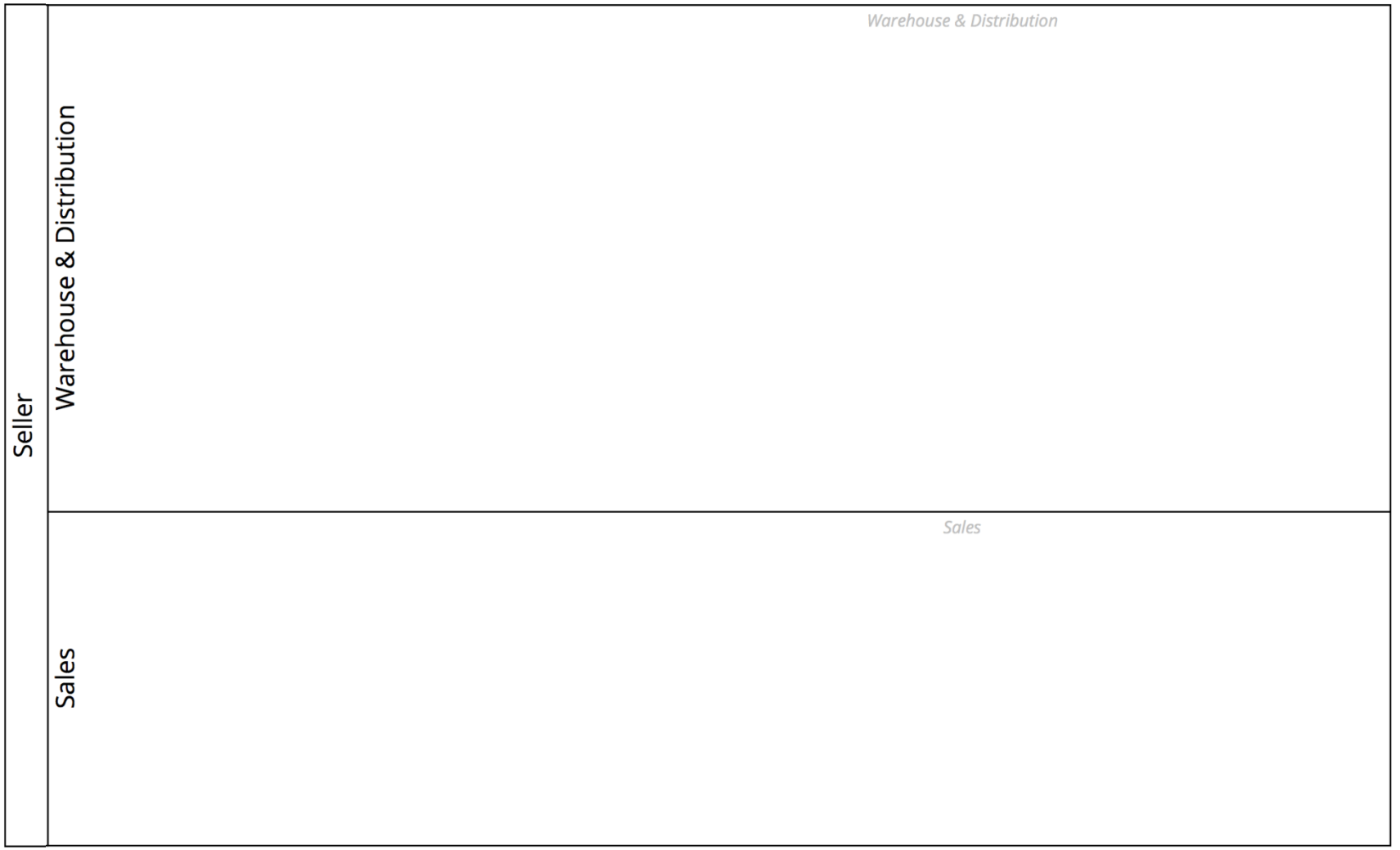

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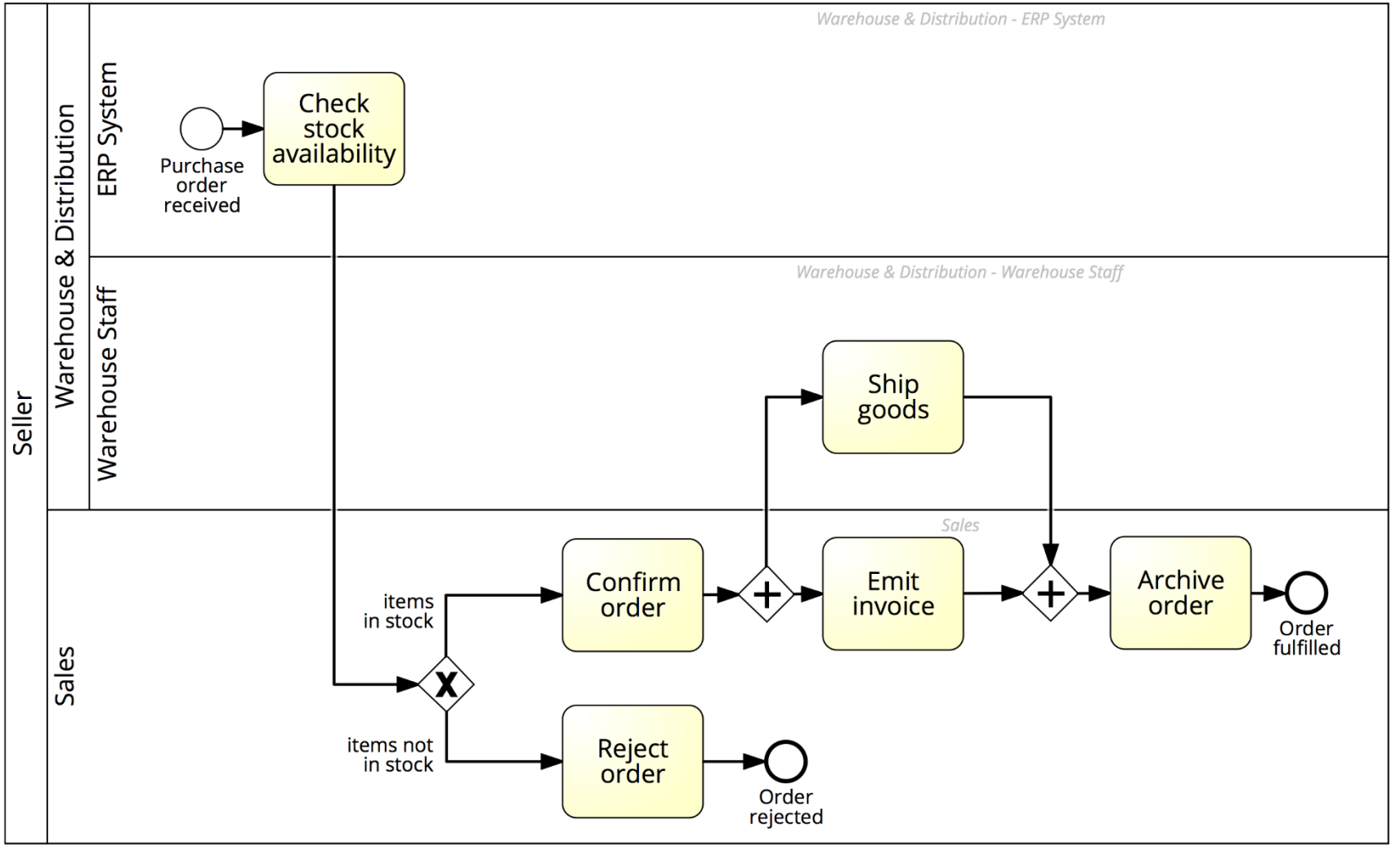
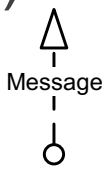


Message Flow

A *Message Flow* represents a flow of information between two process parties (Pools)



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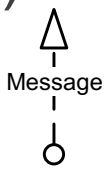
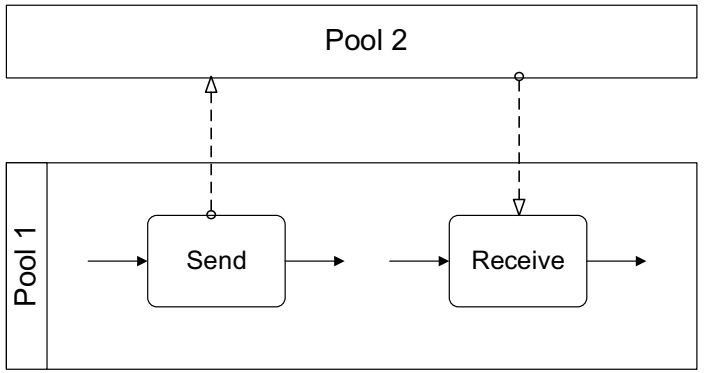


A Message Flow can connect:

- directly to the boundary of a Pool ➔ captures an *informative* message to/from that party



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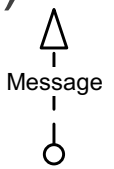

A Message Flow can connect:

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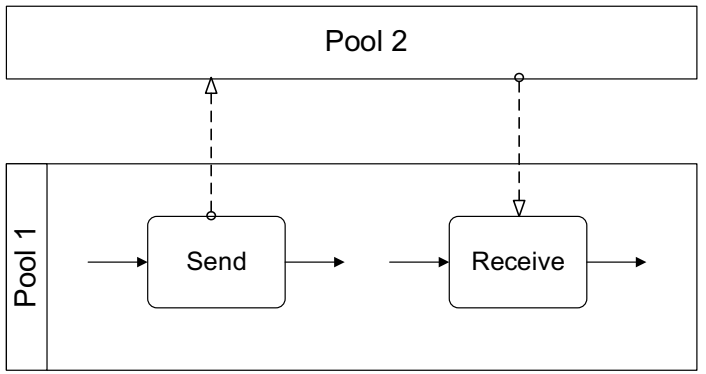
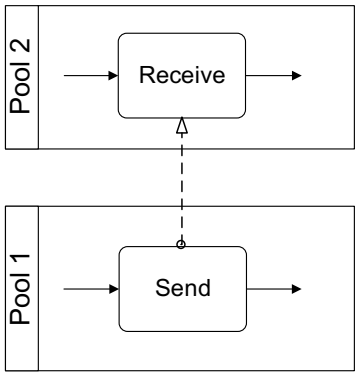
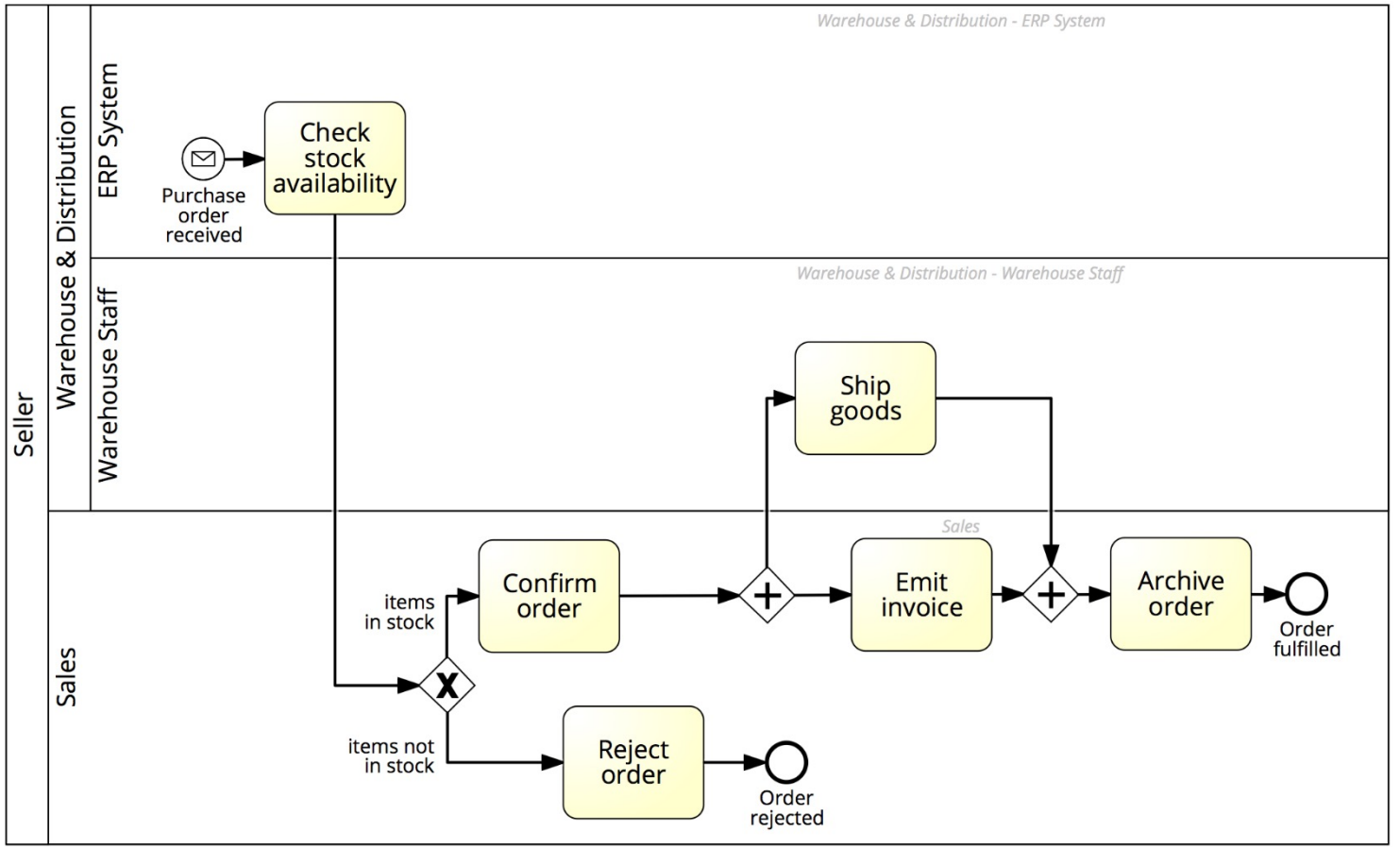
- to a specific activity or event within that Pool ➔ captures a message that triggers a specific activity/event within that party





Order-to-cash process with a black-box customer pool



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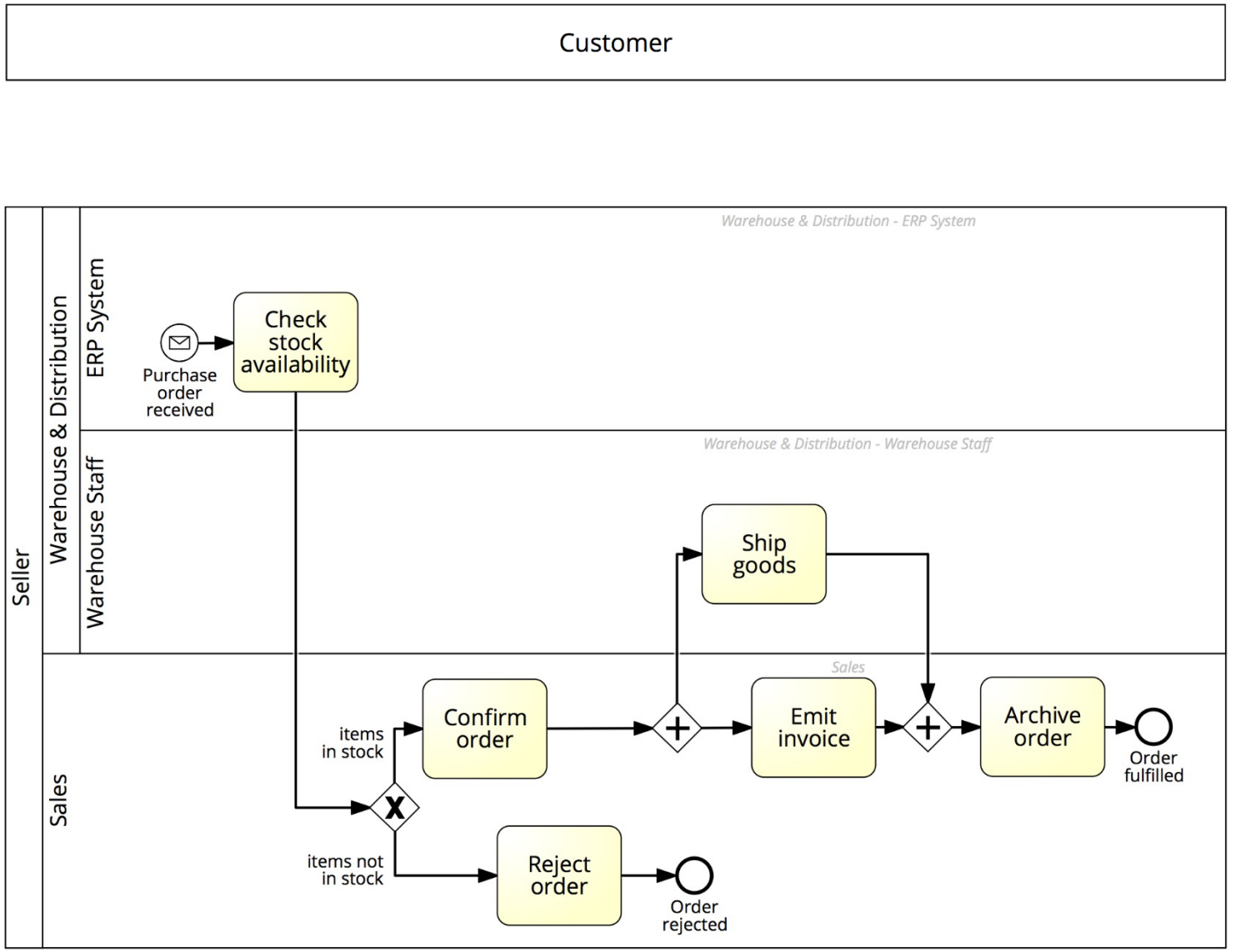

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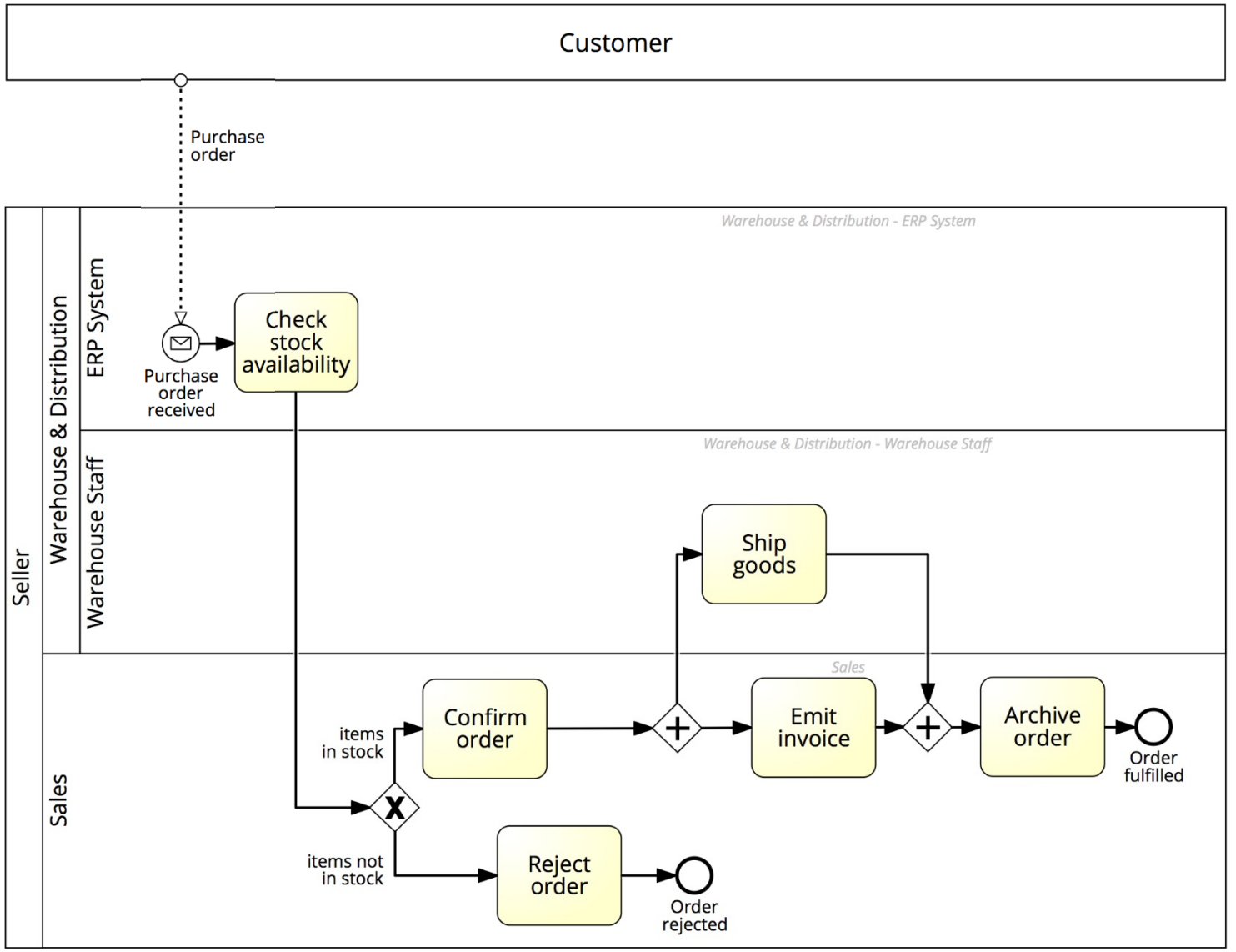

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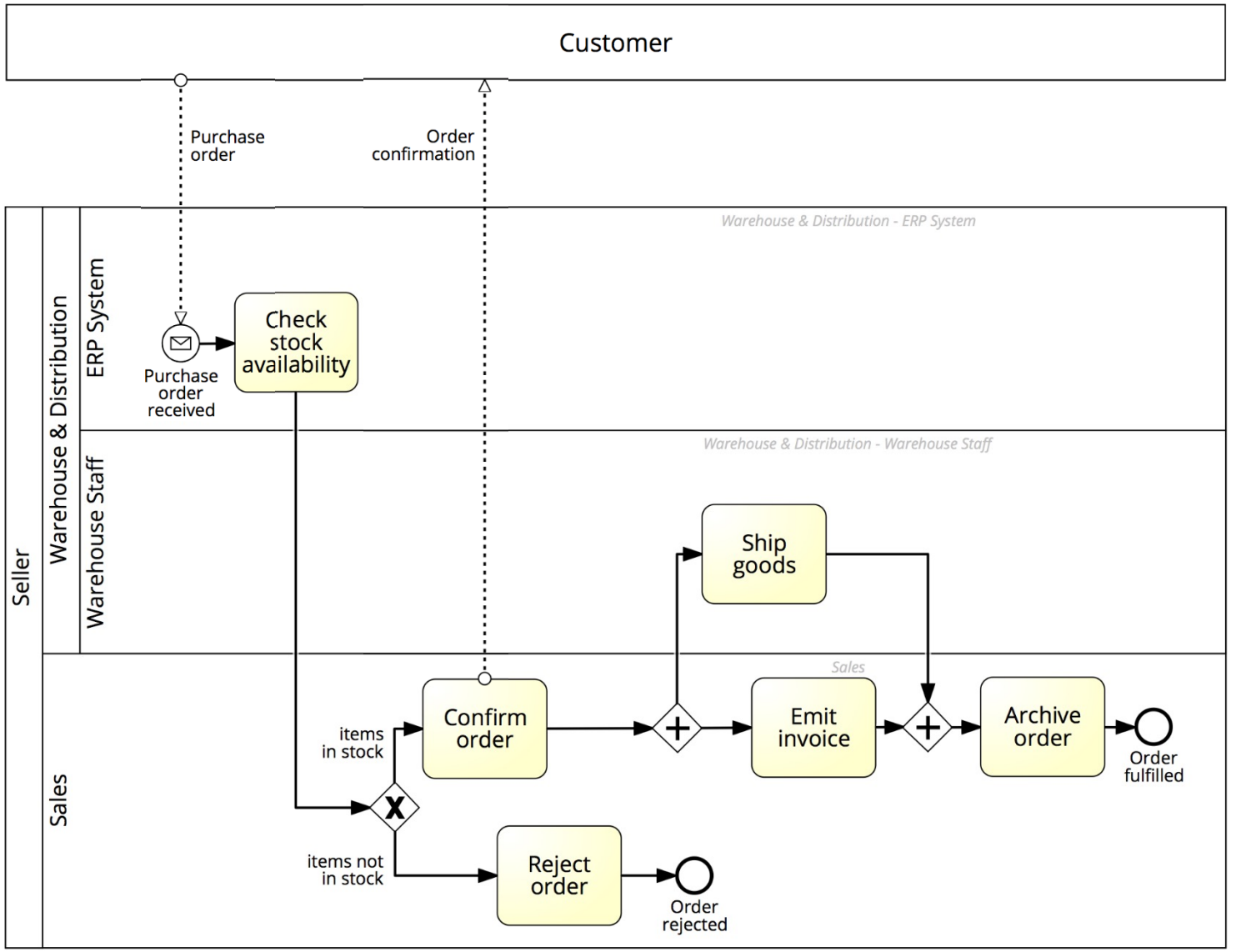

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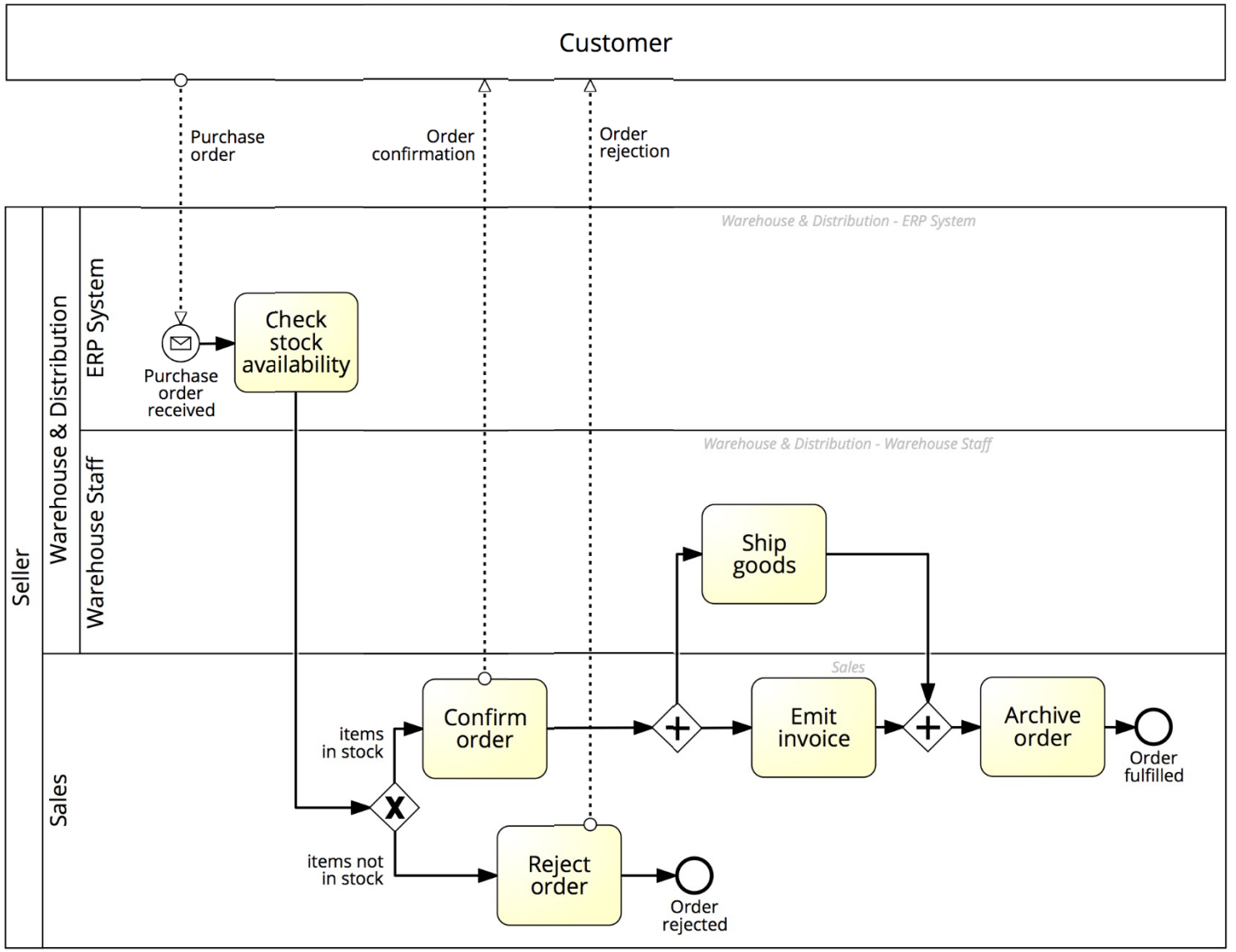

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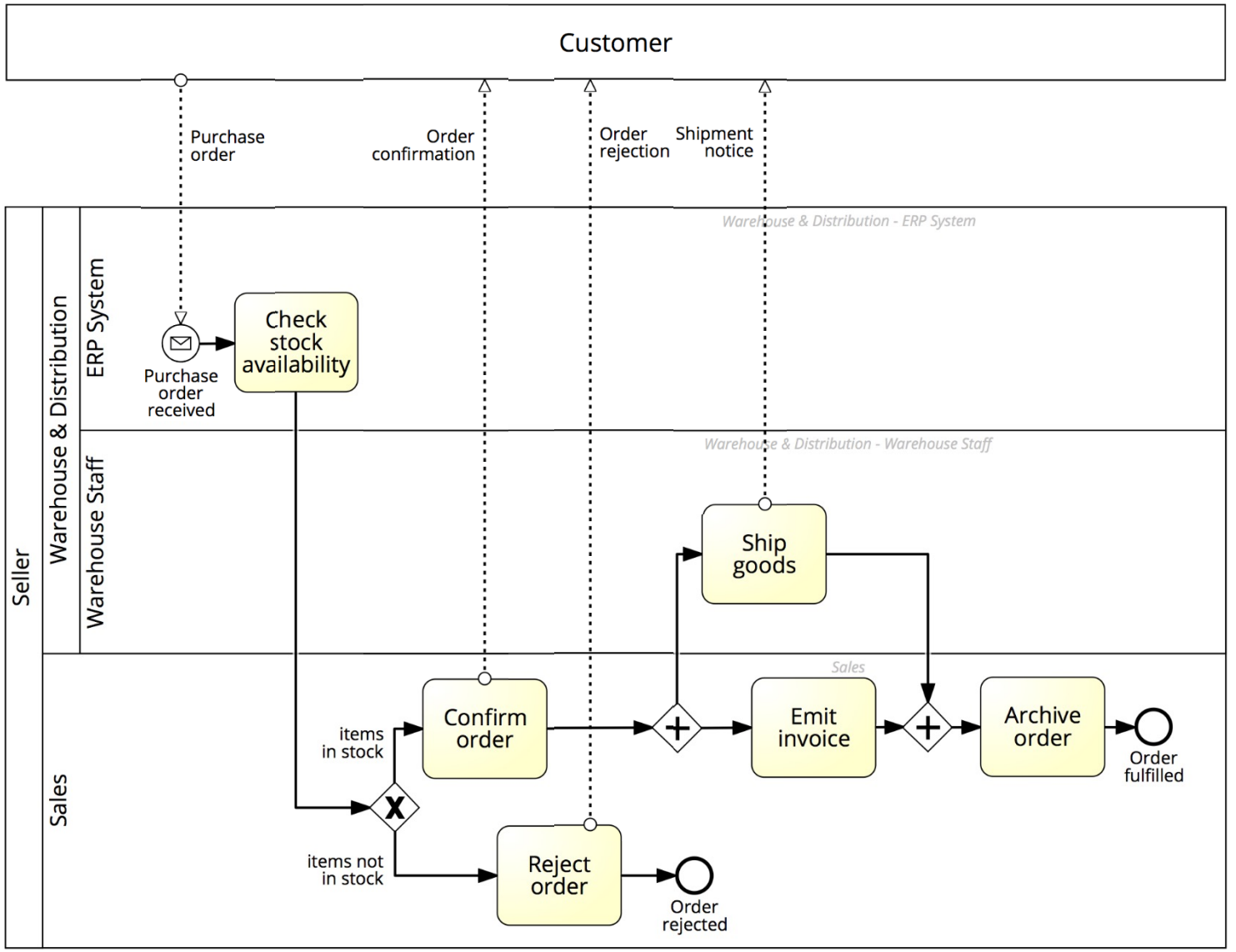

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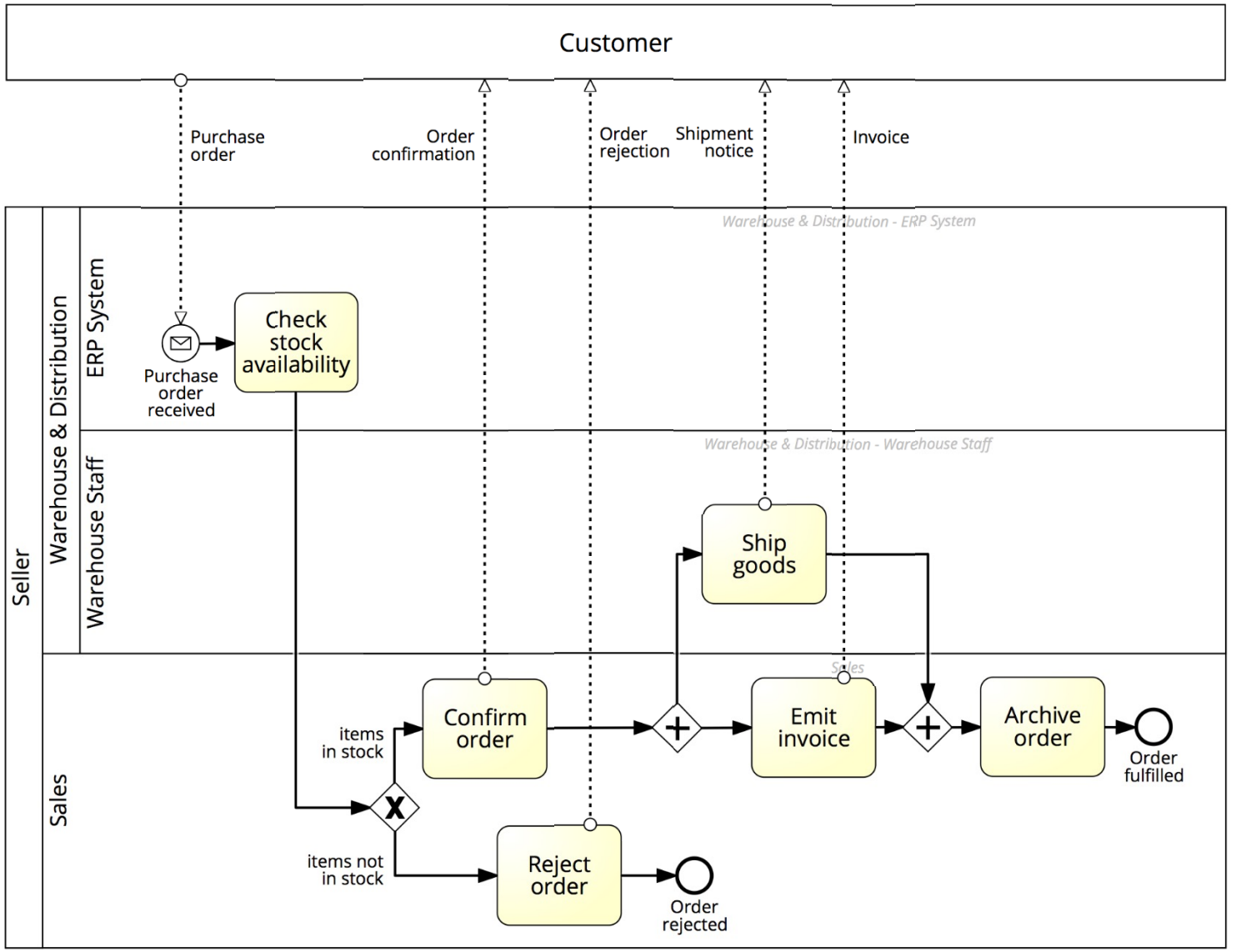
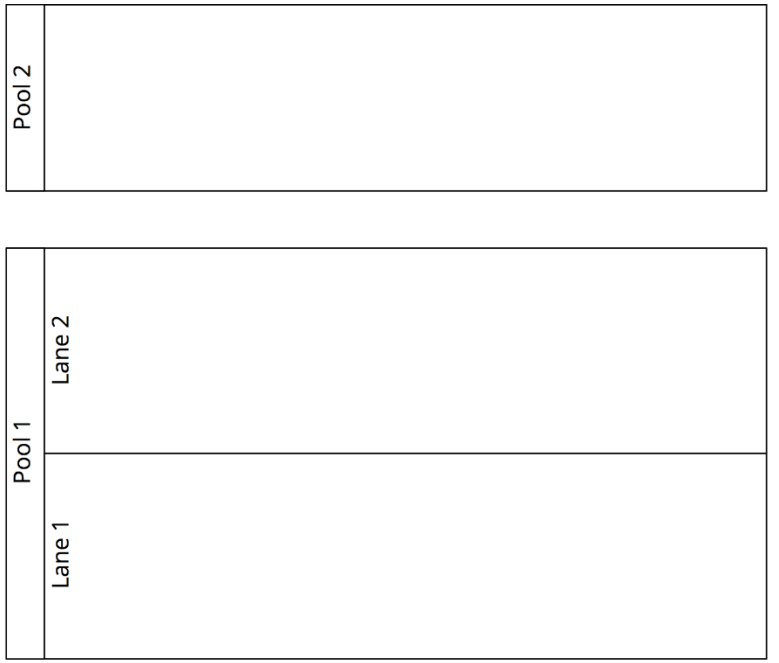
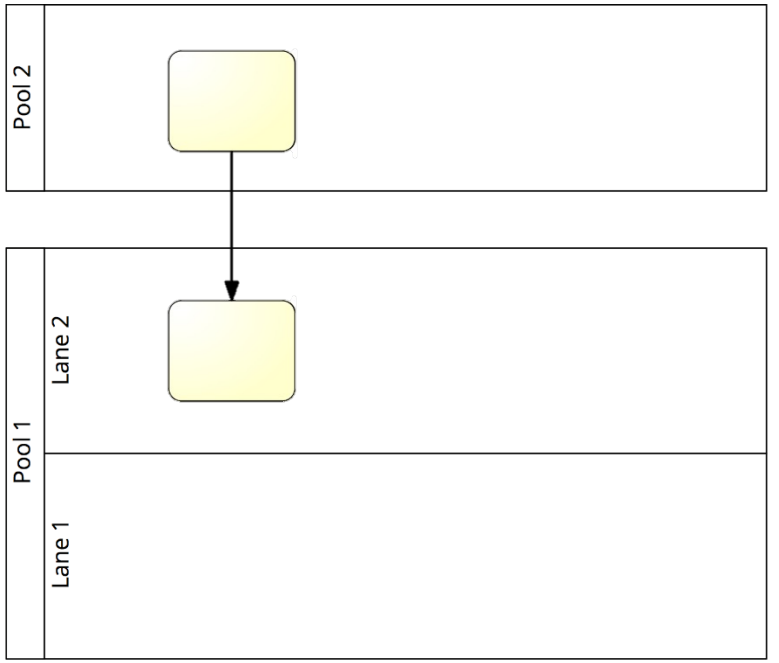


Pools, Lanes and Flows: syntactic rules



Pools, Lanes and Flows: syntactic rules

1. A Sequence Flow **cannot** cross the boundaries of a Pool (message flows can)



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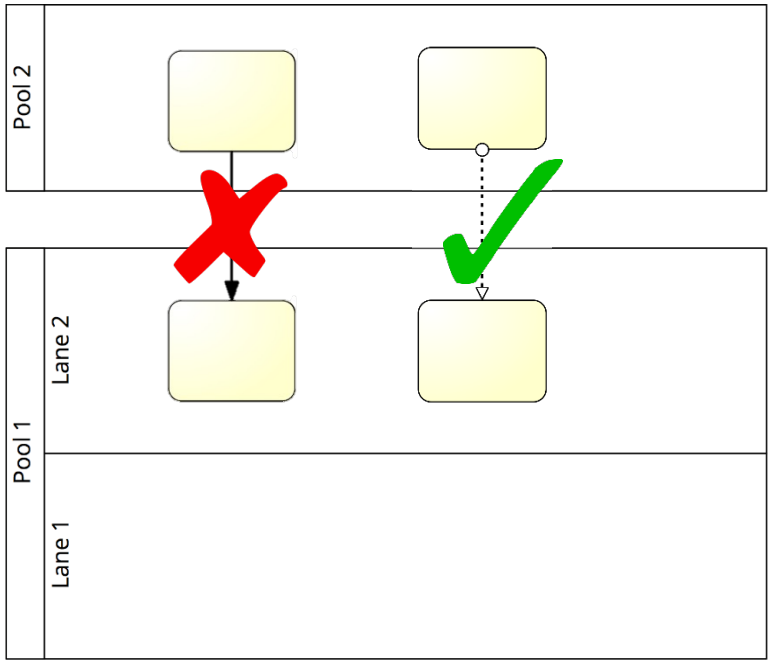

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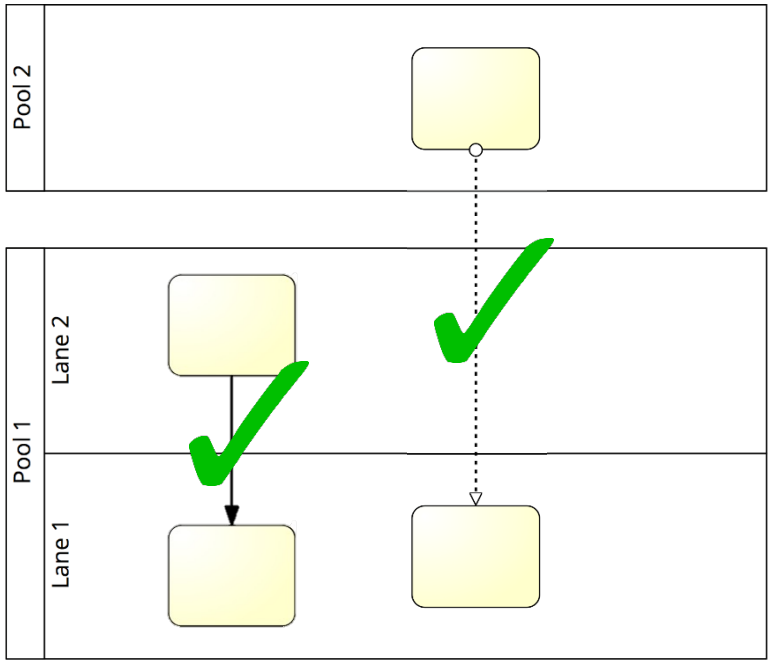

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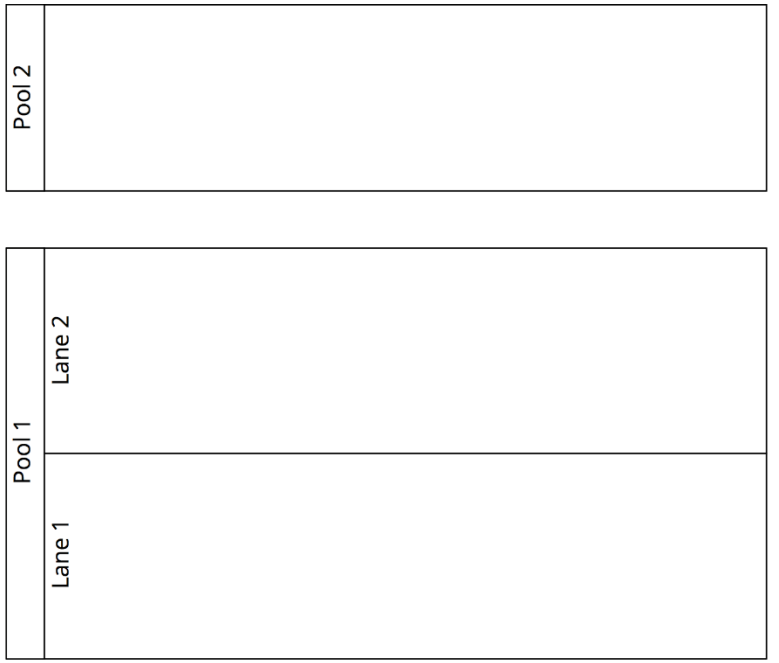

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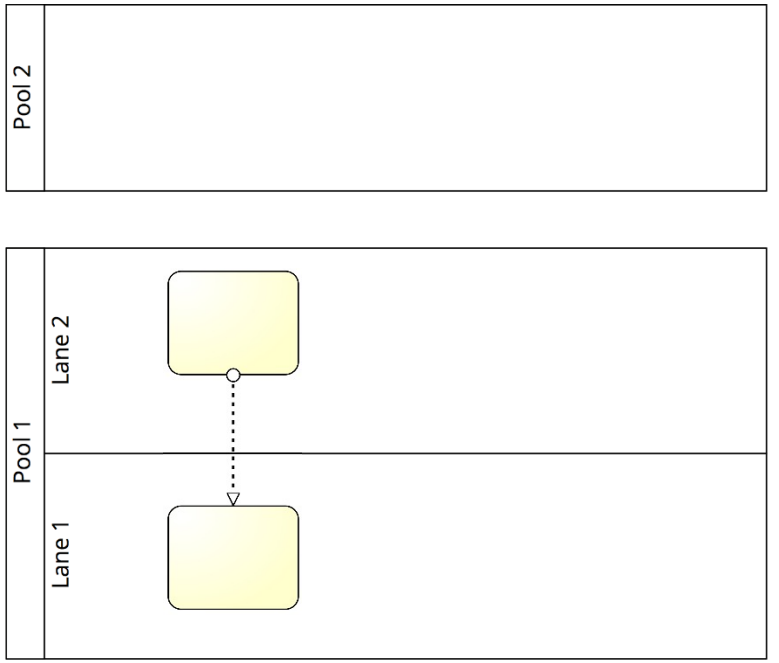

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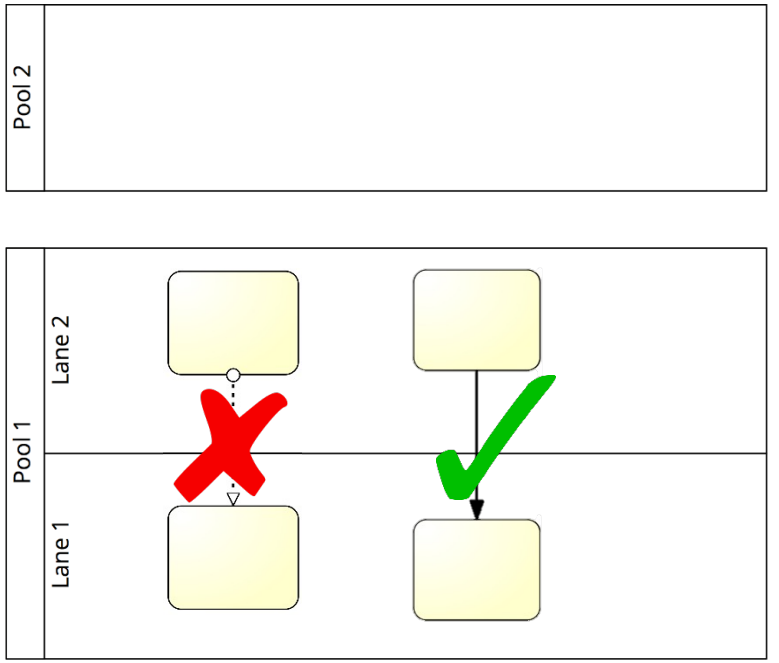
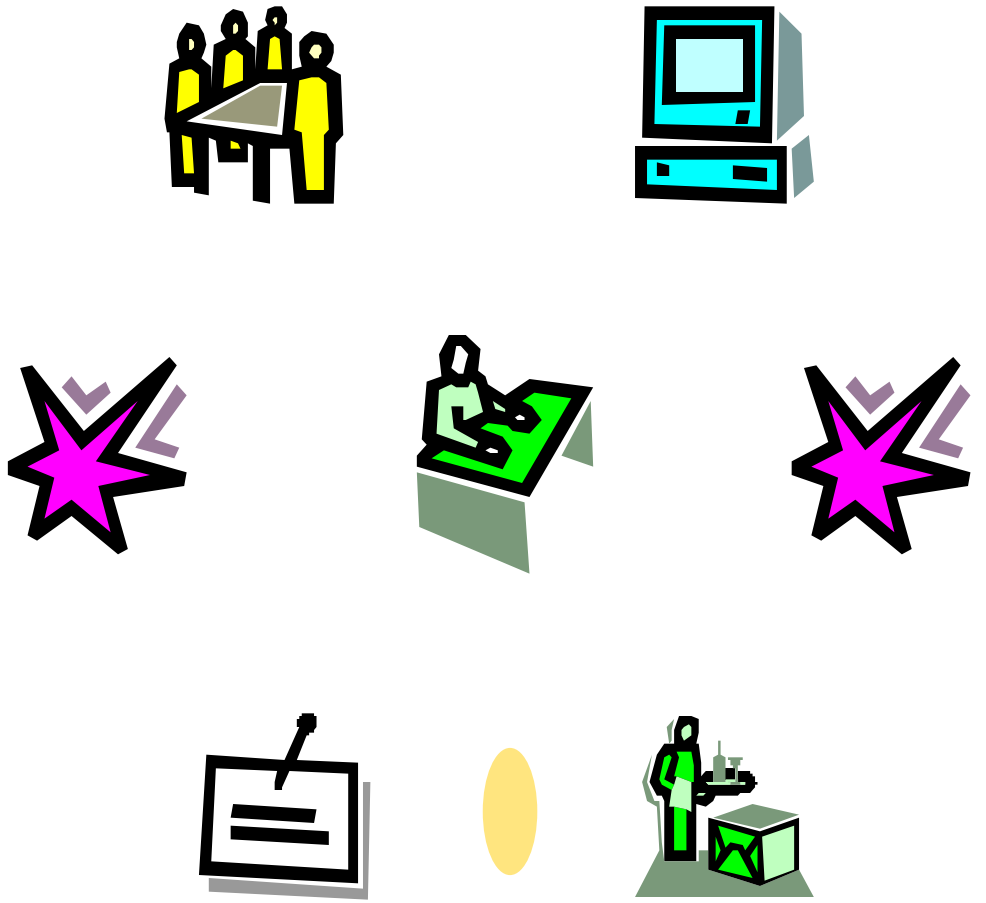
2. Both Sequence Flow and Message Flow **can cross** the boundaries of Lanes
3. A Message Flow **cannot connect** two flow elements within the same pool



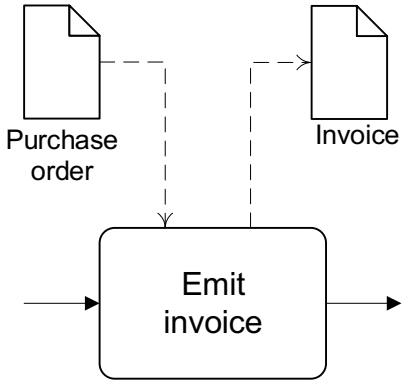
One more guideline…

- Start modeling with one single “white-box” pool
  - Initially, put the events and tasks in only one pool – the pool of the party who is running the process
  - Leave all other pools “black-boxed”
  - Once you have modeled this way, and once the process diagram inside the white-box pool is complete, you can model the details (events and tasks) in the other pools if that is useful.
  - In this course we will only model processes with one single white-box pool – all other pools are black-box

Process Modelling Viewpoints

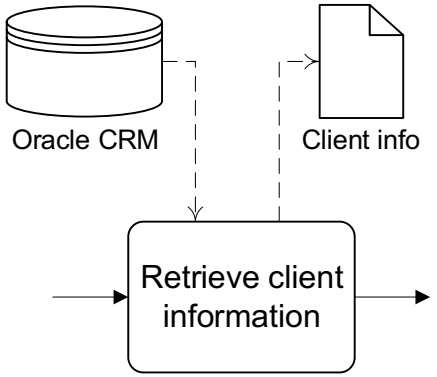


BPMN Information Artifacts



A *Data Object* captures an artifact required (input) or produced (output) by an activity.

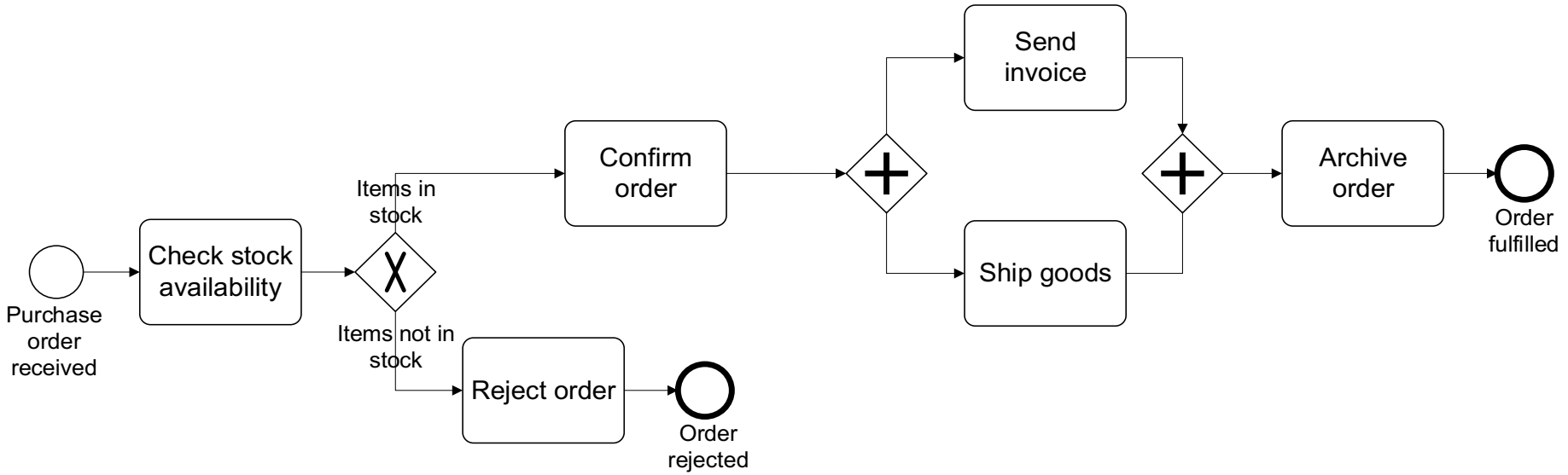
- Can be physical or electronic



A *Data Store* is a place containing data objects that must be persisted beyond the duration of a process instance.

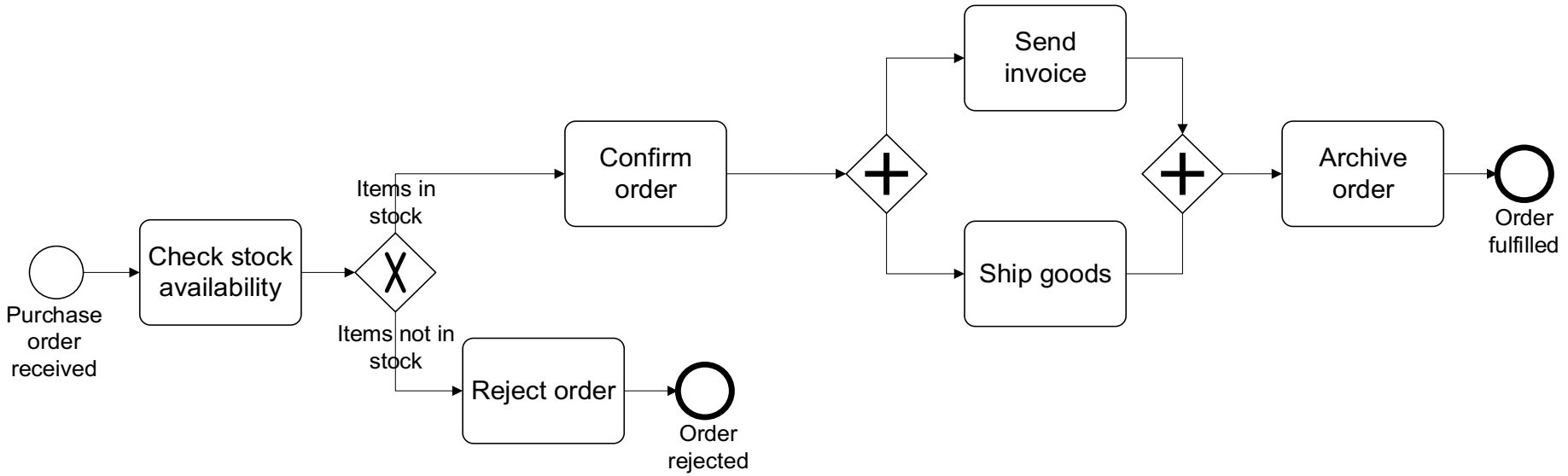
It is used by an activity to store (as output) or retrieve (as input) data objects.

Order-to-cash process, again

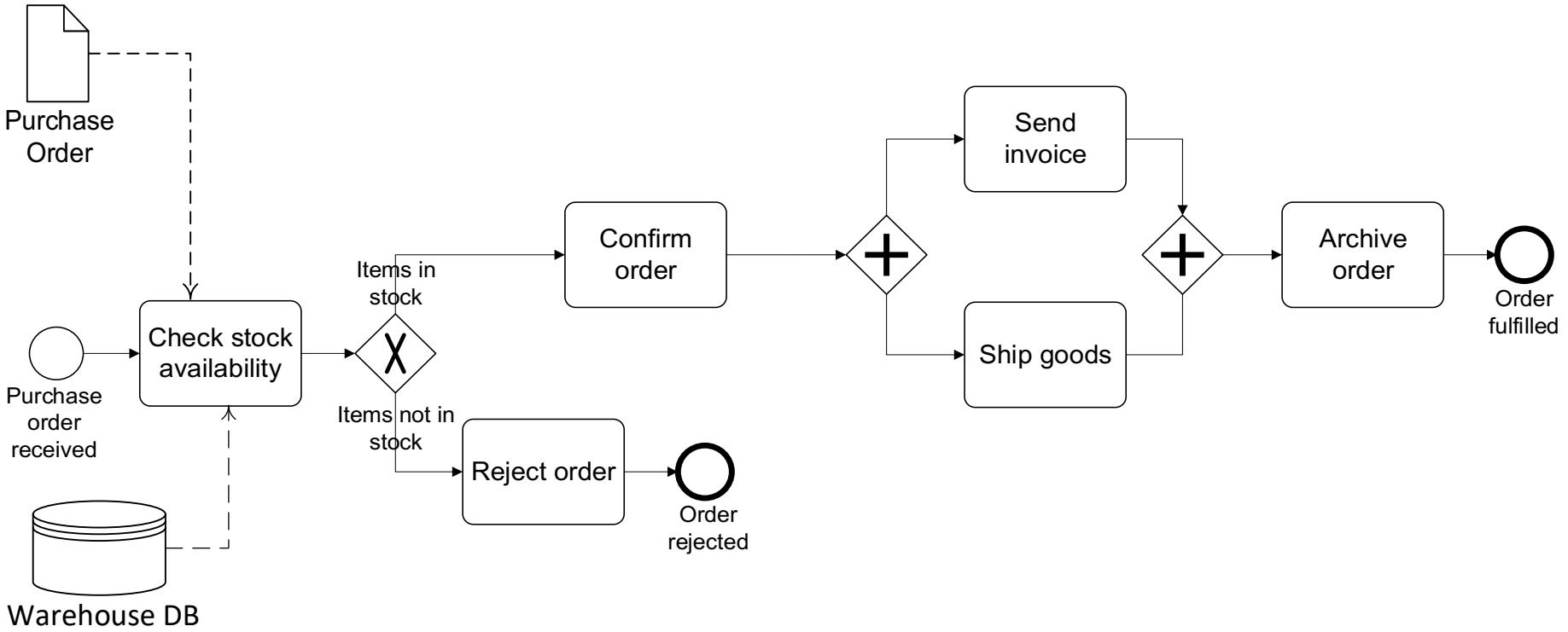


The purchase order document serves as an input to the stock availability check. Based on the outcome of this check, the status of the document is updated, either to “approved” or “rejected”. If the order is approved, an invoice and a shipment notice are produced.

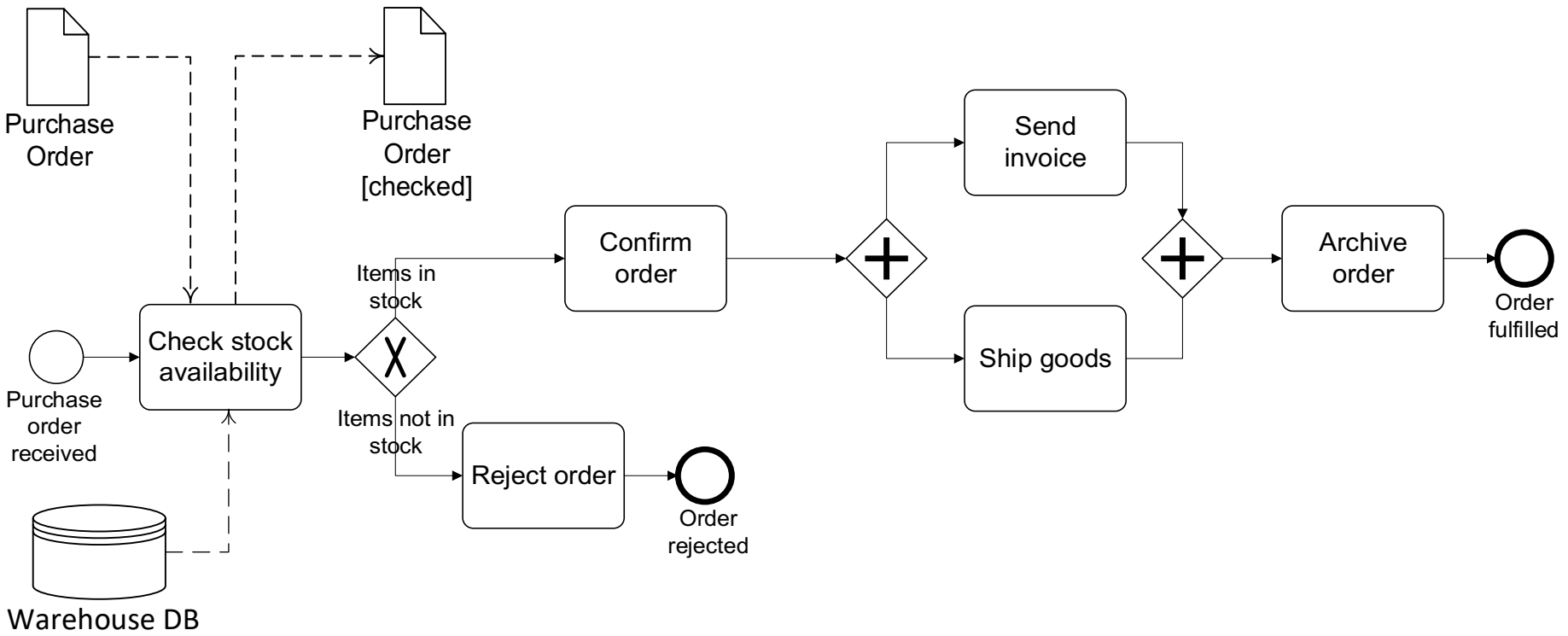
Model with information artifacts



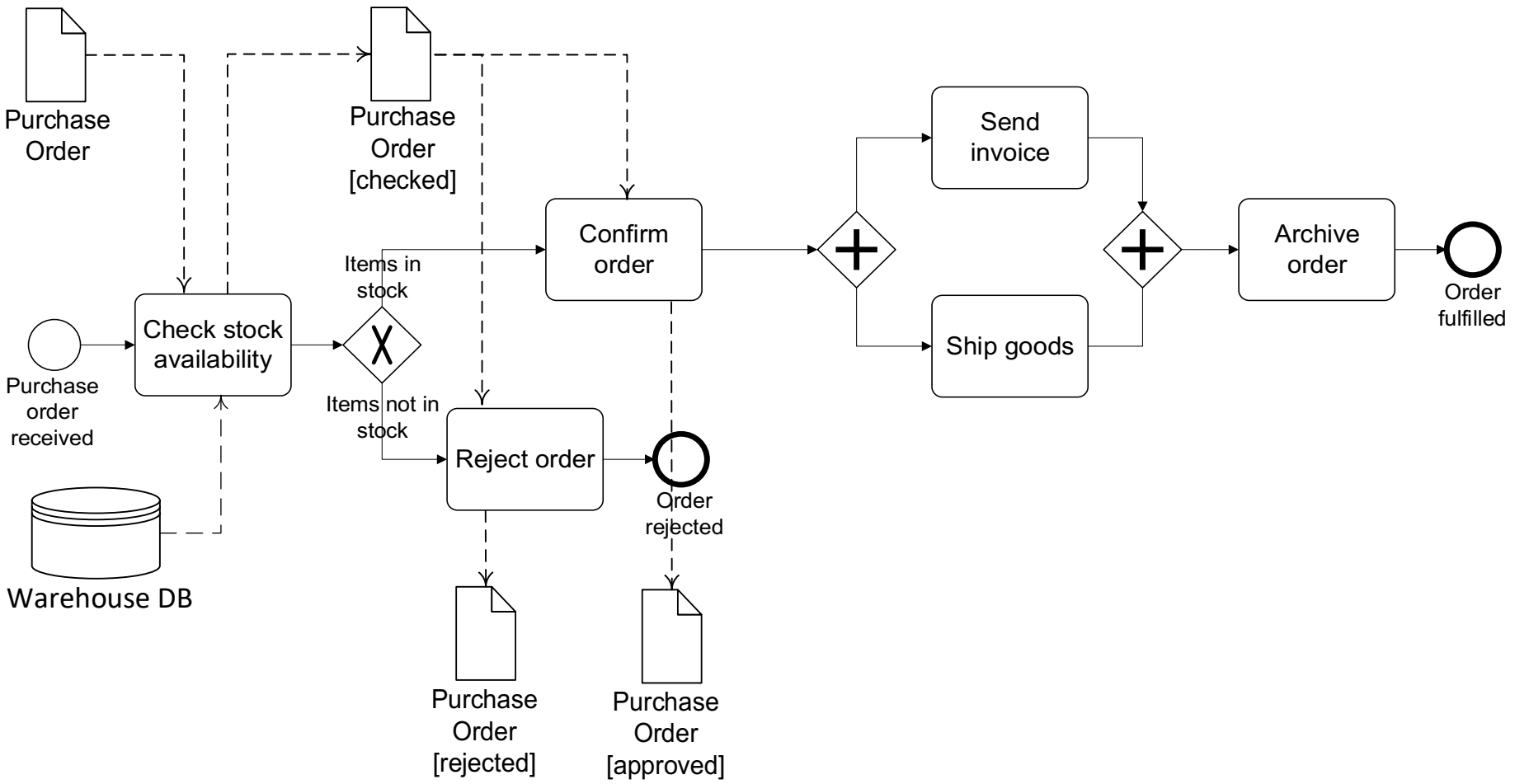
Model with information artifacts



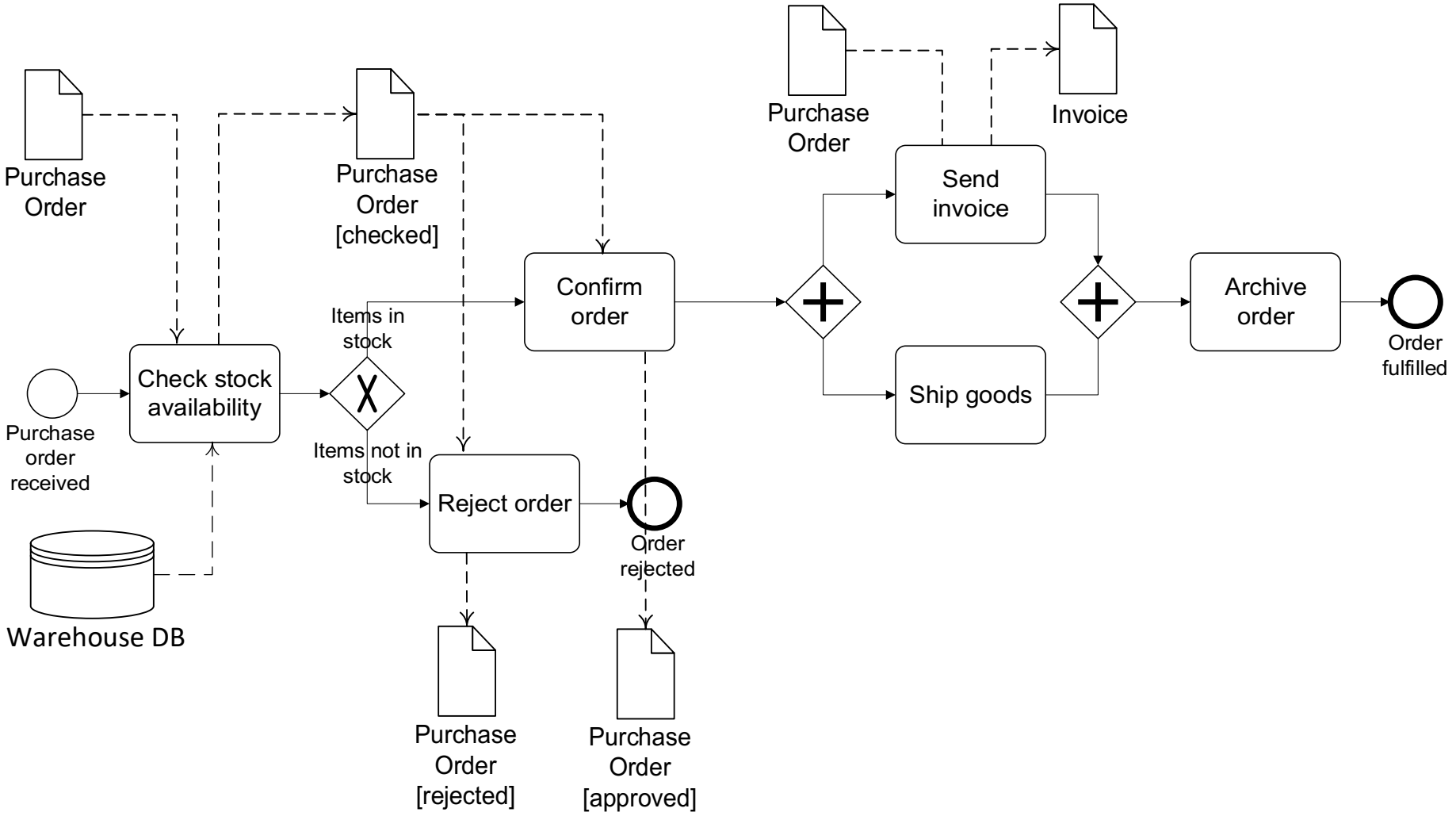
Model with information artifacts



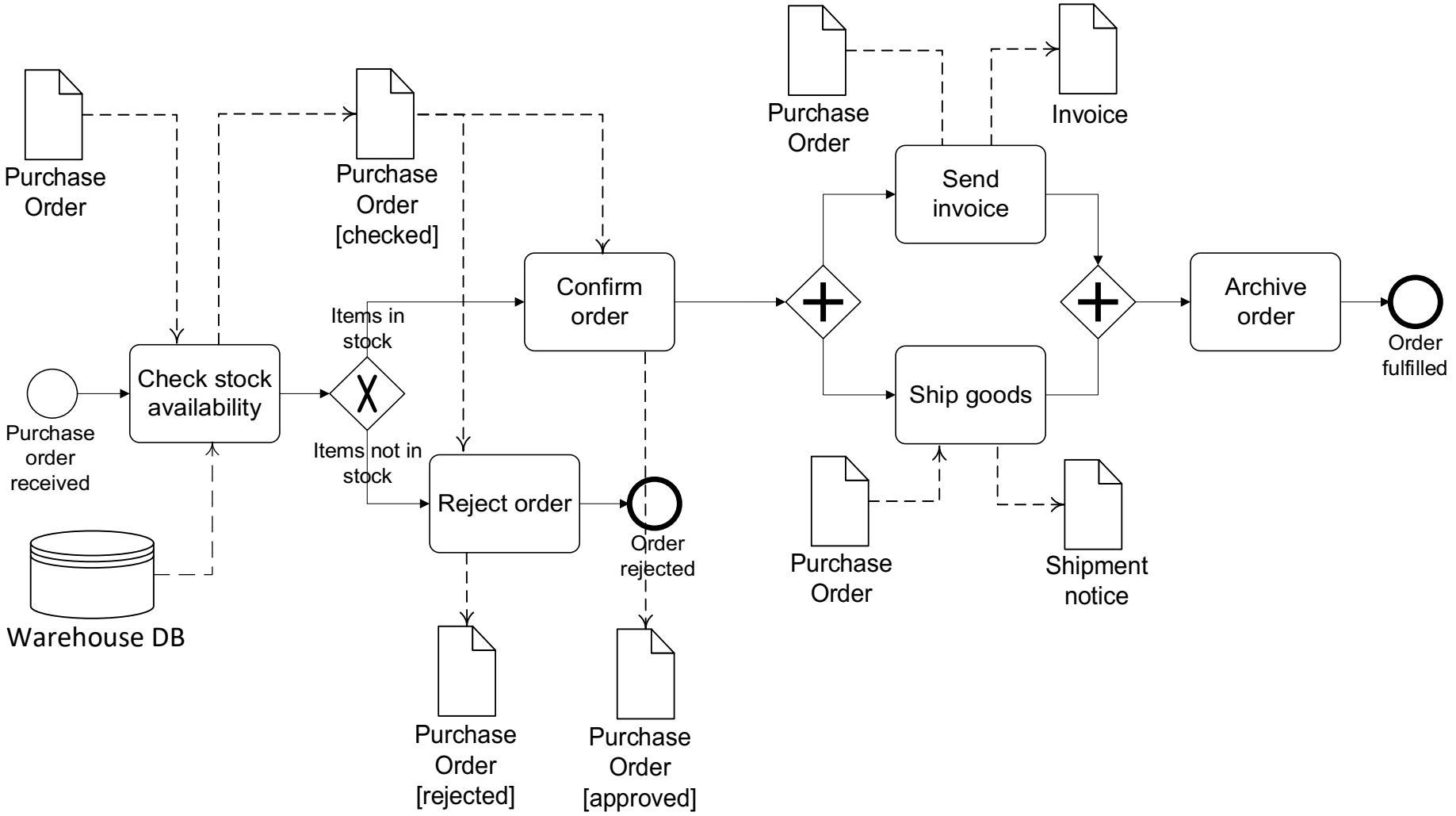
Model with information artifacts



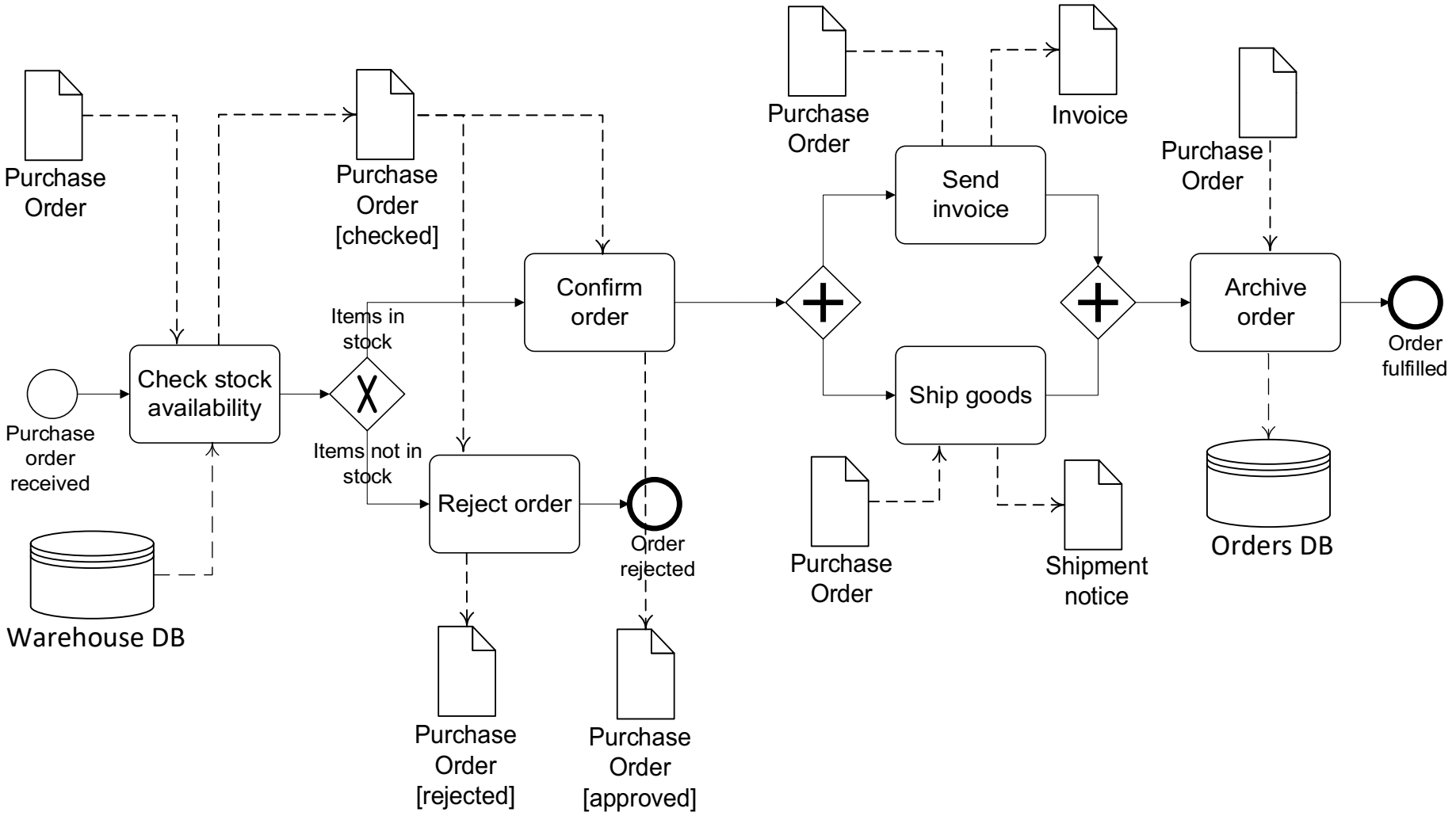
Model with information artifacts



Model with information artifacts



Model with information artifacts

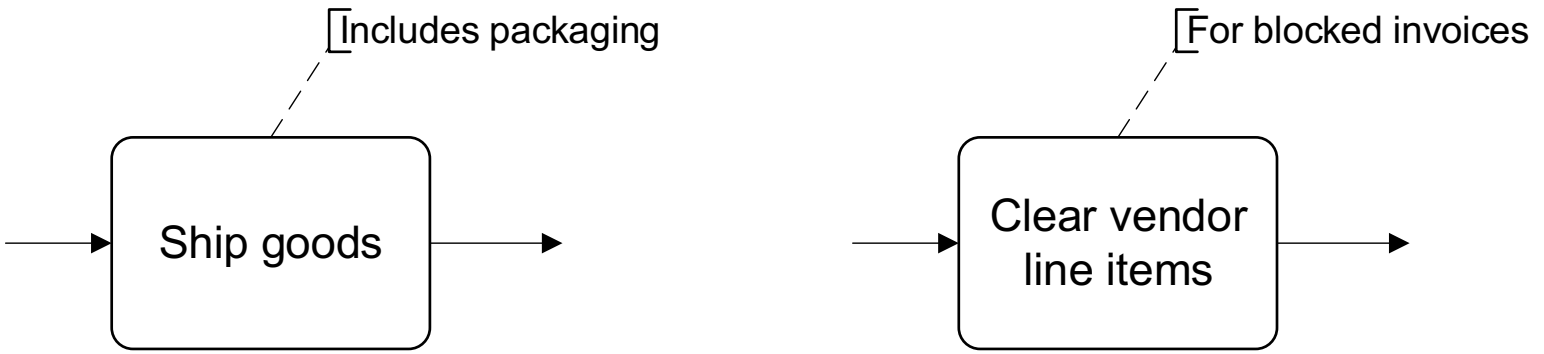


Beware: This diagram is a too detailed. It is for illustration purposes. In practice, try to only model the most important data objects and associations. Keep the model readable.

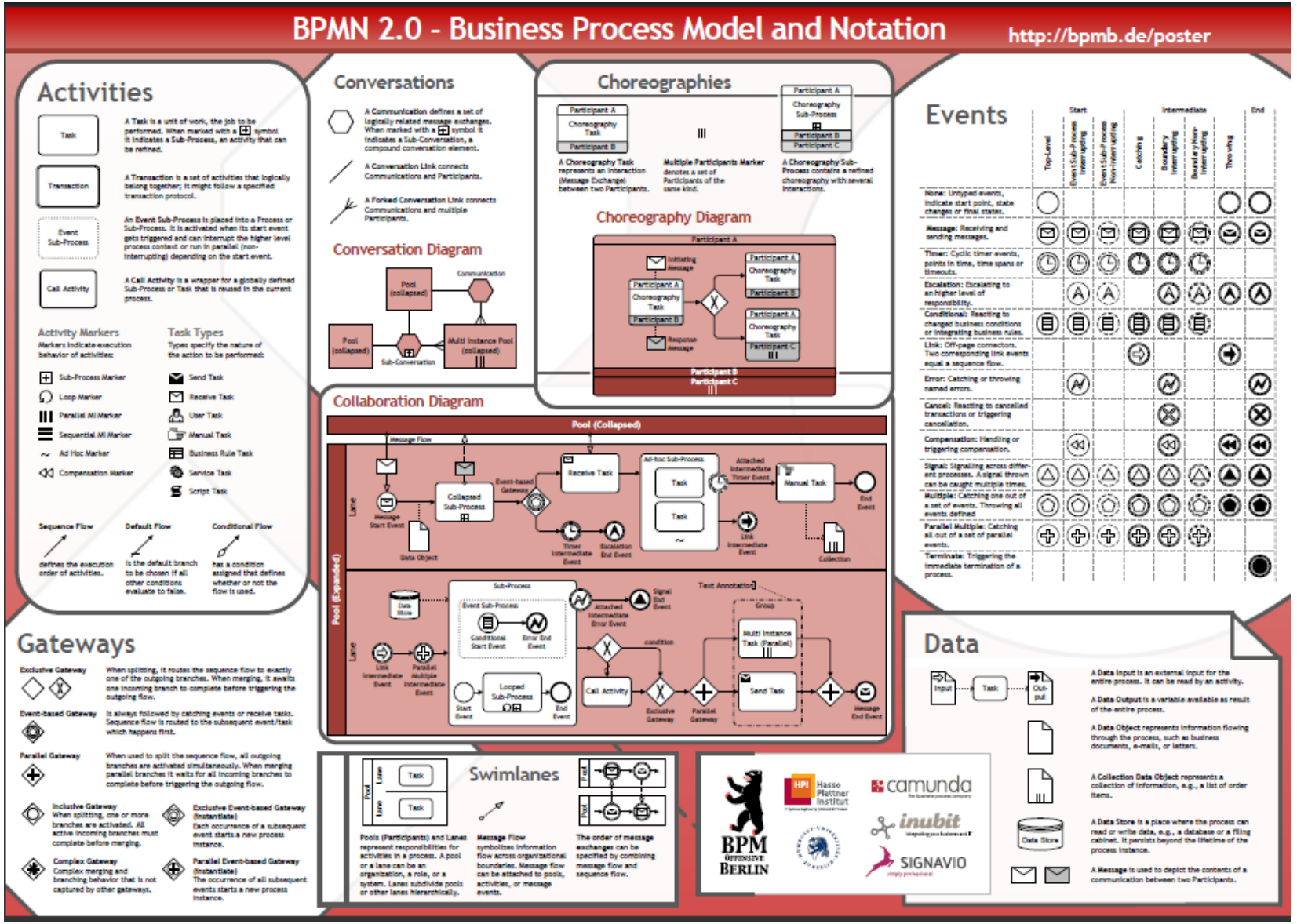
A Final Note: BPMN Text Annotations

A *Text Annotation* is a mechanism to provide additional text information to the model reader

- **Doesn't affect** the flow of tokens through the process



BPMN Poster


BPMN 2.0 - Business Process Model and Notation
http://bpmb.de/poster
Activities
Conversations
Choreographies
Events
Gateways
Data
Swimlanes
Conversation Diagram
Choreography Diagram
Collaboration Diagram
BPMN Berlin
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SIGNAVIO

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