Business Process Management

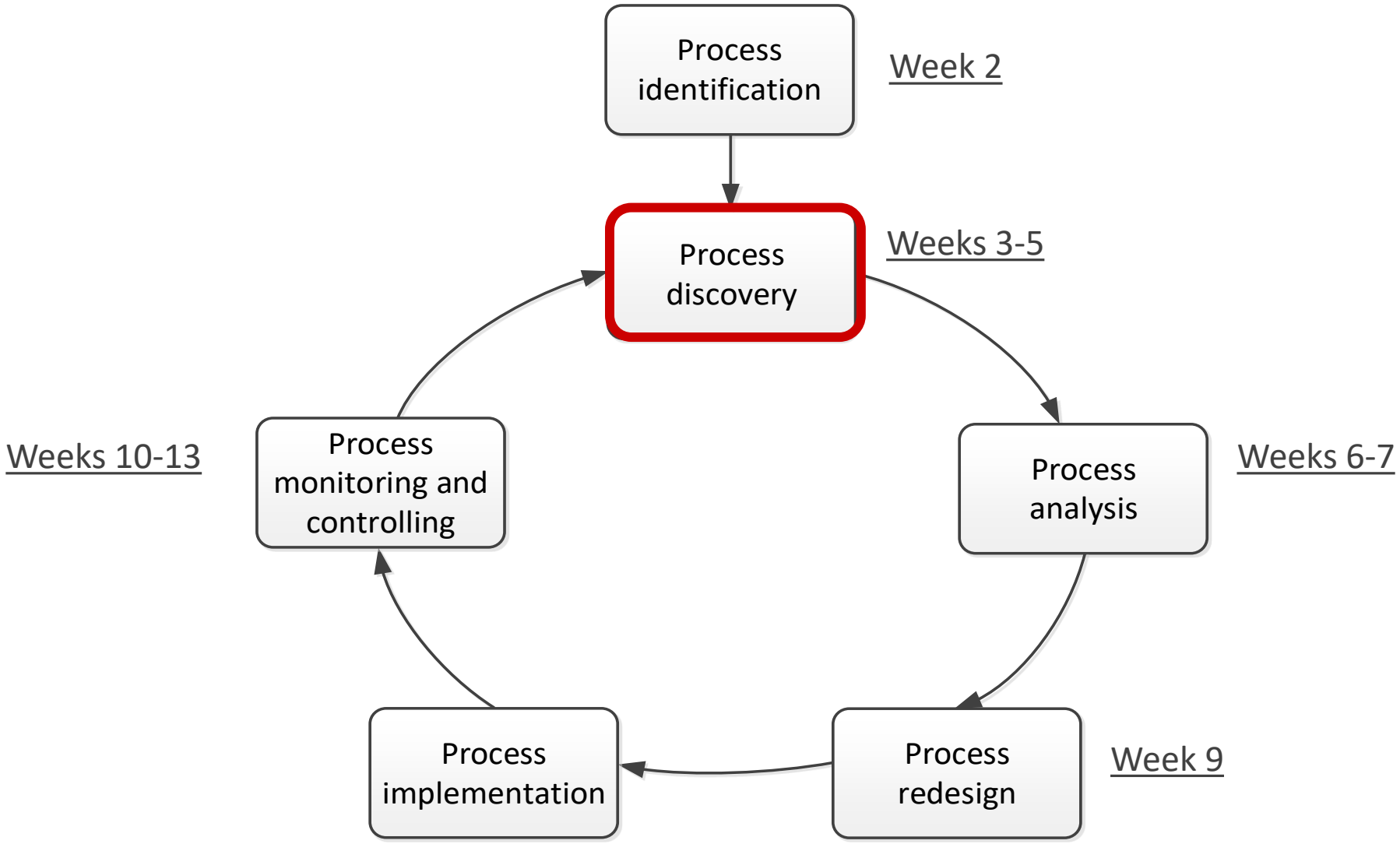
Lecture 4
Essential Process Modeling II

Prof. Josué Obregón

Department of Industrial Engineering - ITM

Seoul National University of Science and Technology

Course structure



BPMN Recap

Activities

Tasks
are activities that represent individual steps within a process.

Subprocesses
represent collapsed details for one task within multiple steps.

Events

Start events
initiate a process instance.

Intermediate events
represent conditions/ milestones in the process.

End events
complete the respective process instances.

BPMN Recap

Gateways

Exclusive Gateways (XOR) are used when several conditions are mutually exclusive and only one selection is possible e.g. “yes” or “no”.

Inclusive Gateways (OR) are used if one or more conditions are possible. Depending on the number of conditions, the merging gateway waits for all possible incoming branches.

Parallel Gateways (AND) activate all outgoing branches simultaneously. They wait for all incoming branches to be completed before continuing the sequence flow.

Connecting Objects

Associations combine data objects and artifacts with other elements.

Sequence flows connect events, gateways, tasks, and subtasks.

Message flows represent communication and interactions between pools.

Guidelines: Naming Conventions

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

Recap with an Exercise

Let us consider the order-to-cash process with possibility of manufacturing products not in stock

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 requested item(s) are available.

If the product requested is not in stock, it needs to be manufactured before the order handling can continue. To manufacture a product, the required raw materials have to be ordered. Two preferred suppliers provide different types of raw materials. Depending on the product to be manufactured, raw materials may be ordered from either Supplier 1 or Supplier 2, or from both. Once the raw materials are available, the product can be manufactured, and the order can be confirmed.

On the other hand, if the product is in stock, it is retrieved from the warehouse before confirming the order.

After order confirmation, the shipment address is received, and the requested product is shipped while the invoice is emitted and the payment is received.

Afterwards, the order is archived, and the process completes.

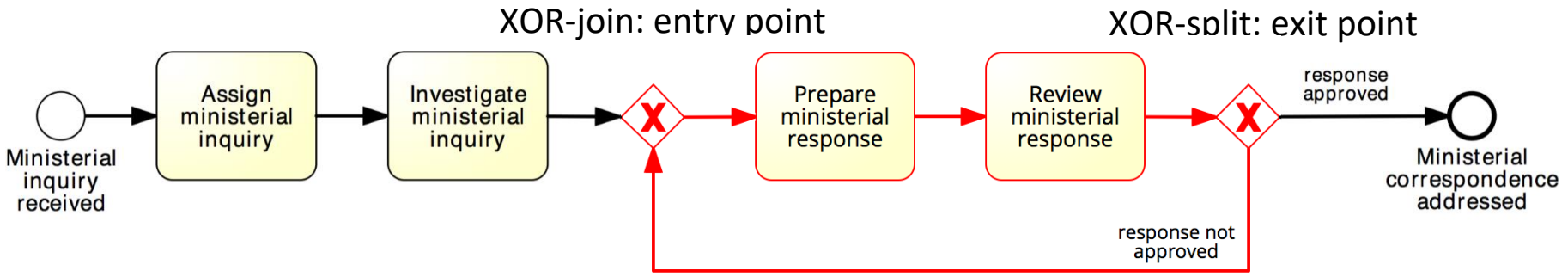
Contents

- Essential Business Process Modeling with BPMN (Continuation)
  - Rework and Repetition
  - Resource/Organizational Perspective
  - Data/Object Perspective
  - Process Decomposition and Reuse

Rework and repetition

Example 3.7. Let us consider this process for addressing ministerial correspondence.

In the treasury minister's office, once a ministerial inquiry has been received, it is first 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.

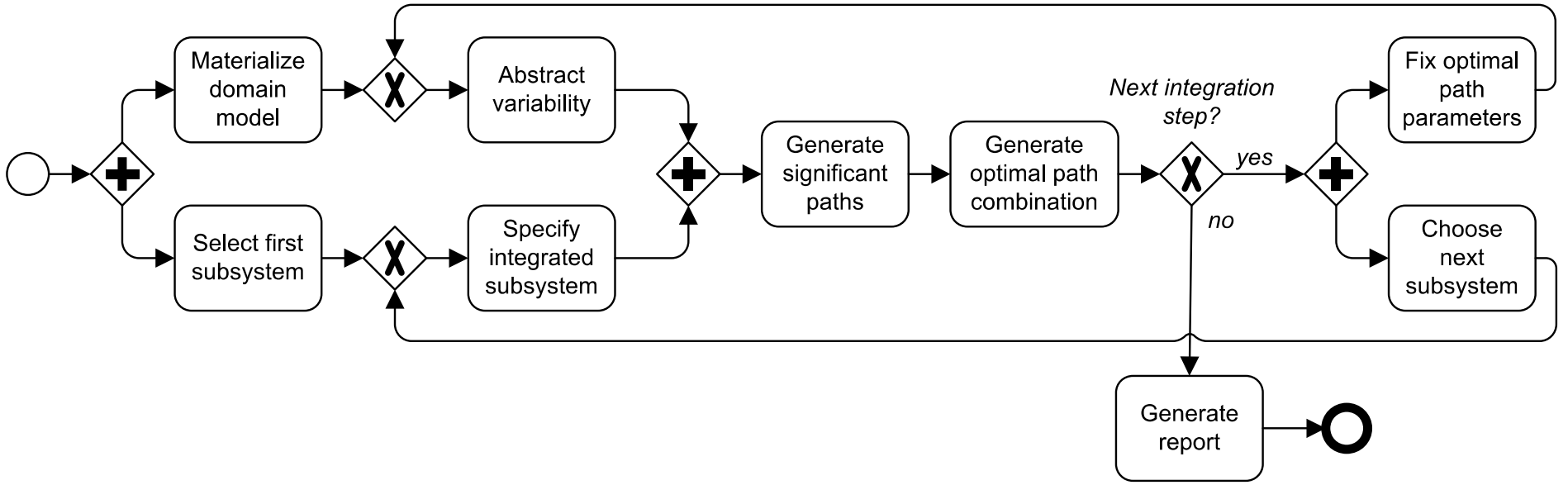


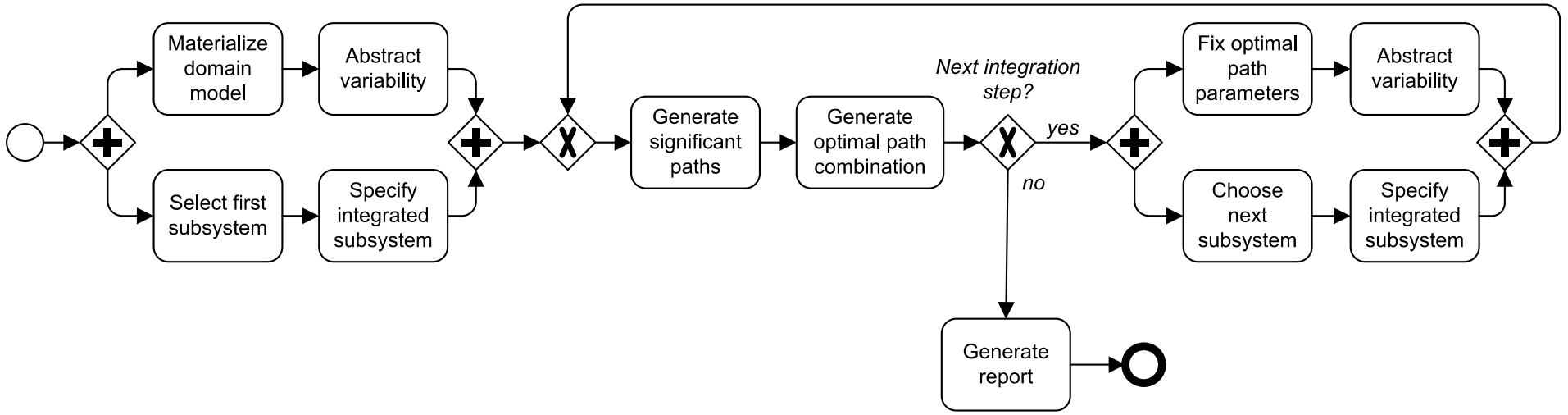
Exercise 3.4

Model the following fragment of a business process for assessing loan applications.

Once a loan application is received by the loan provider, and before proceeding with its assessment, the application itself needs to be checked for completeness. If the application is incomplete, it is returned to the applicant, so that they can fill out the missing information and send it back to the loan provider.This process is repeated until the application is found complete.

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-to-cash example)

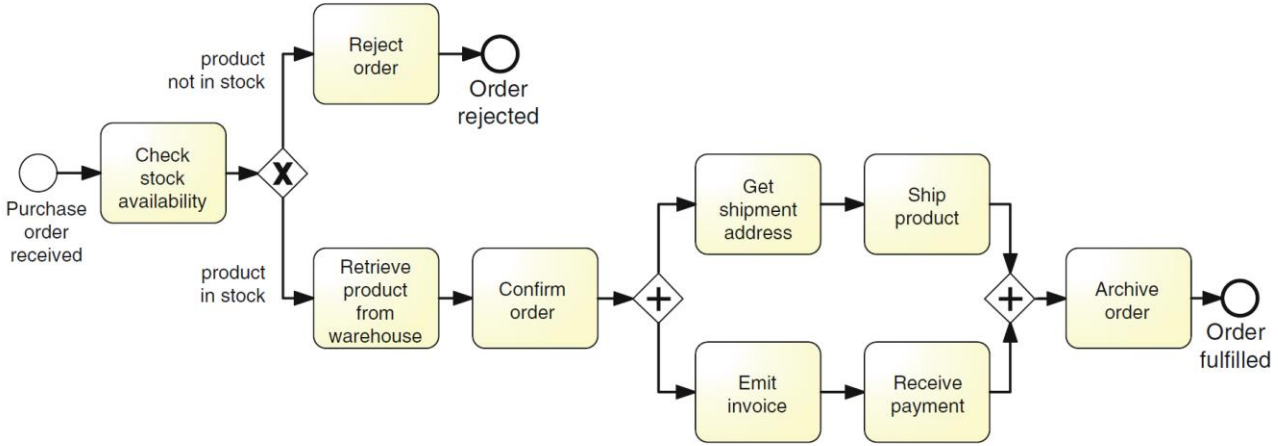
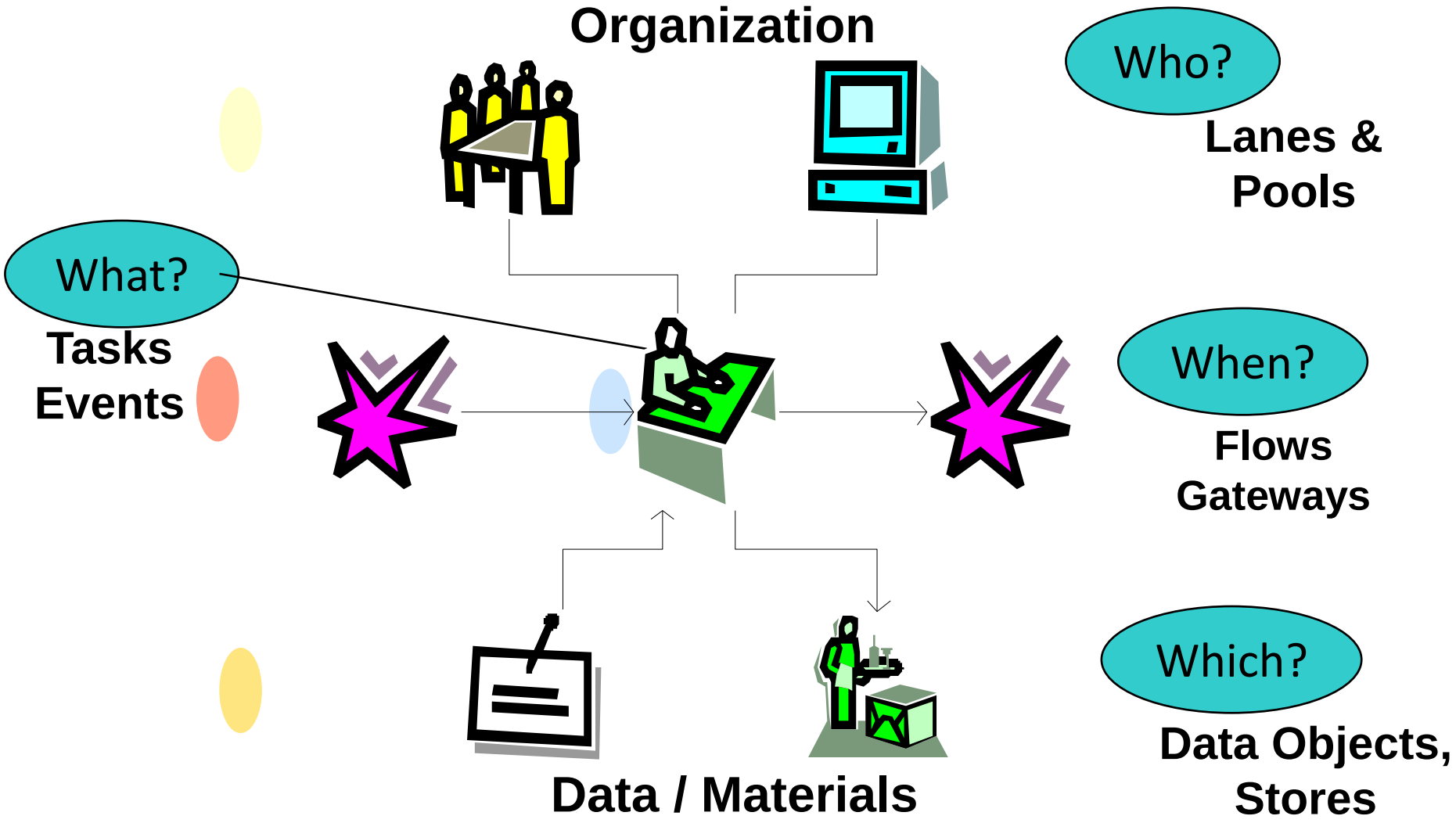


Fig. 3.6 A more elaborated version of the order-to-cash process diagram

Process Modelling Viewpoints



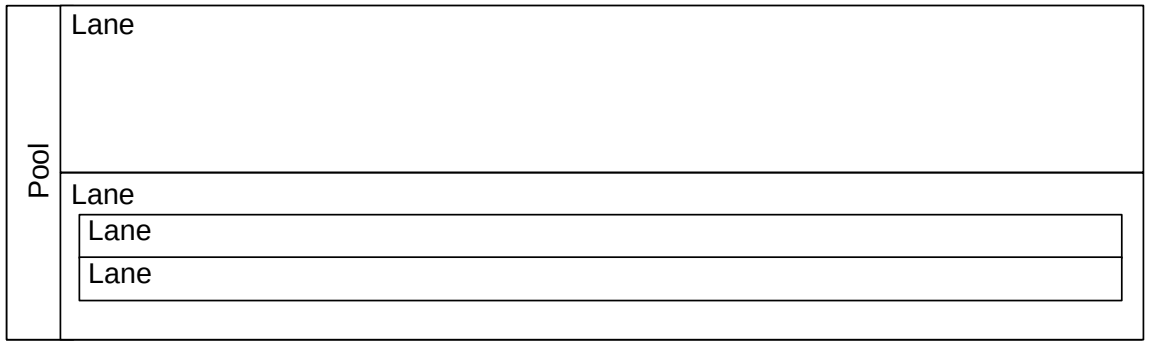
Organizational Elements in BPMN – Pools & Lanes

Pool

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

Lane

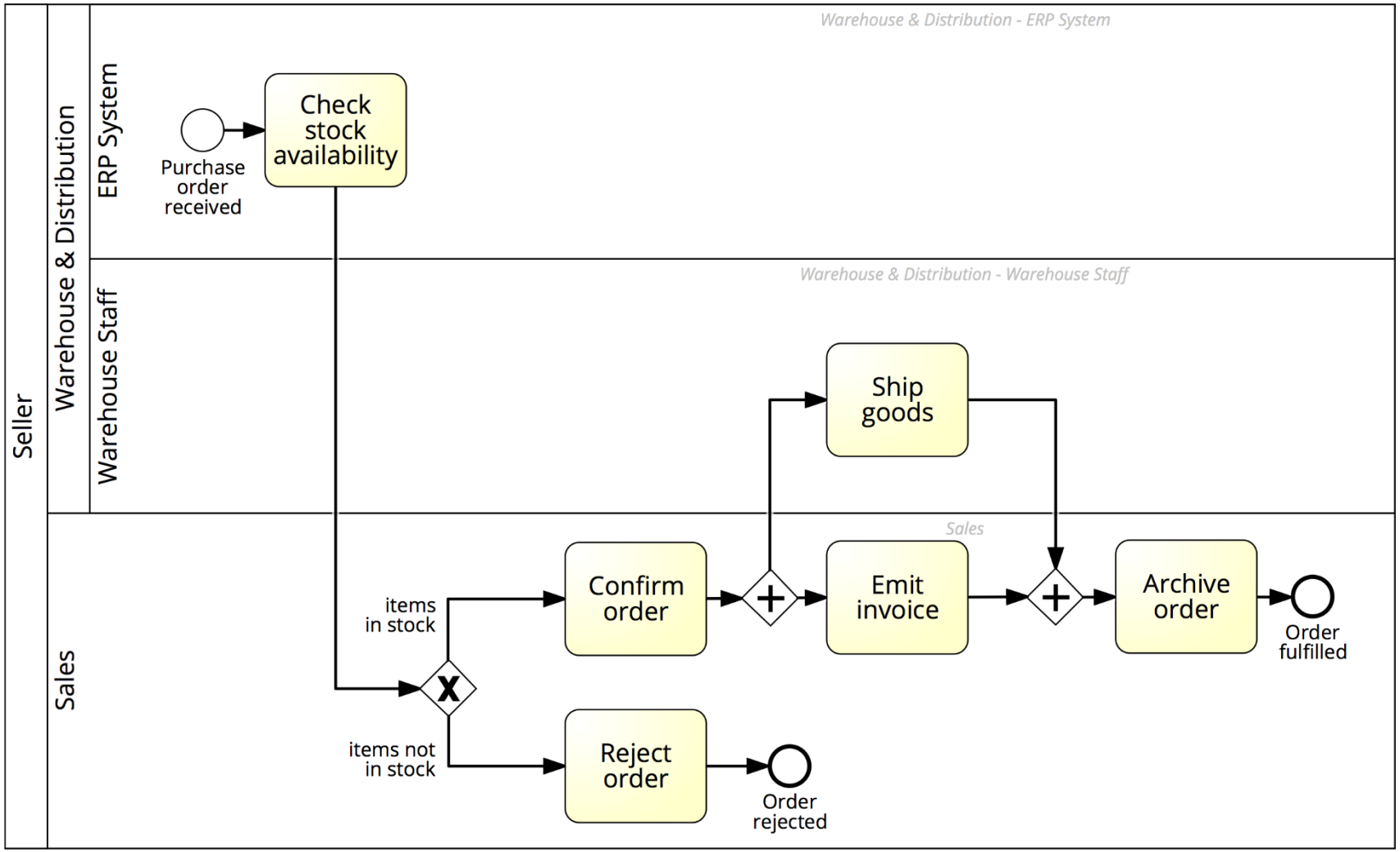
A *resource sub-class* within a pool. Generally used to model departments (e.g. shipping, finance), internal roles (e.g. Manager, Associate), software systems (e.g. ERP, CRM)



Resources in the order-to-cash example

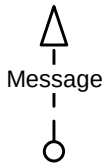
- The order-to-cash process is carried out by a seller's organization which includes two departments: the Sales department and the Warehouse & Distribution department.
- The purchase order received by the Seller has to be checked against the stock. This is done via an ERP module within the Warehouse & Distribution department.
- If the purchase order is confirmed, the Warehouse & Distribution department ships the goods. Meantime, the Sales department emits the invoice. The process concludes with the order being archived by the Sales department.

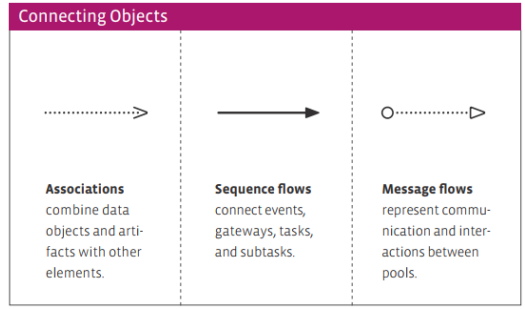
Order-to-cash process with lanes



Message Flow

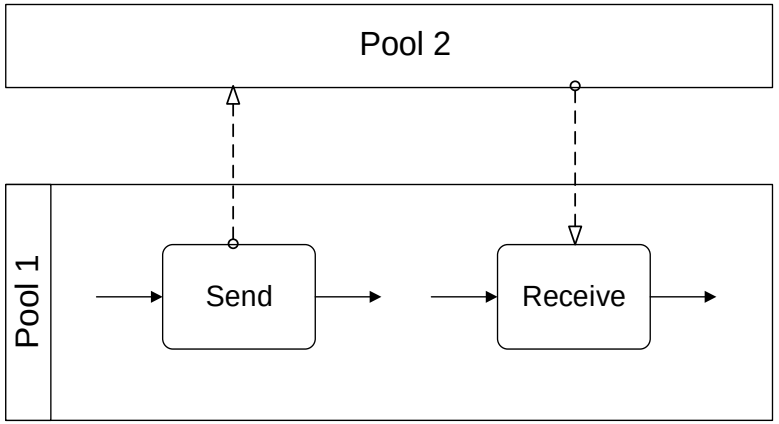
A *Message Flow* represents a flow of information between two process parties (Pools)

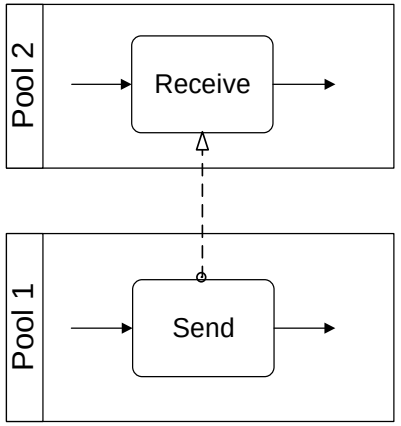




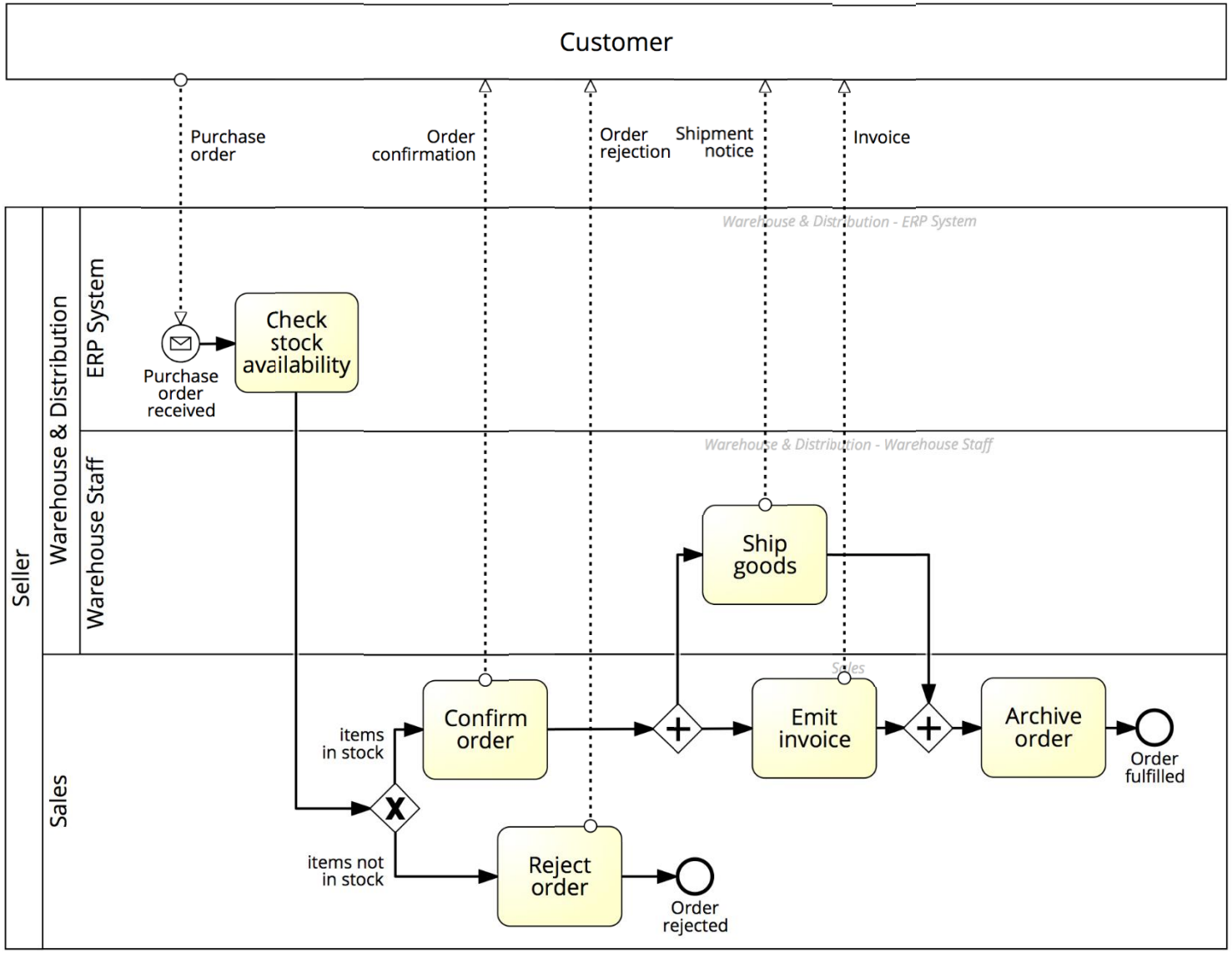
A Message Flow can connect:

- directly to the boundary of a Pool ➔ captures an *informative* message to/from that party
- to a specific activity or event within that Pool ➔ captures a message that triggers a specific activity/event within that party



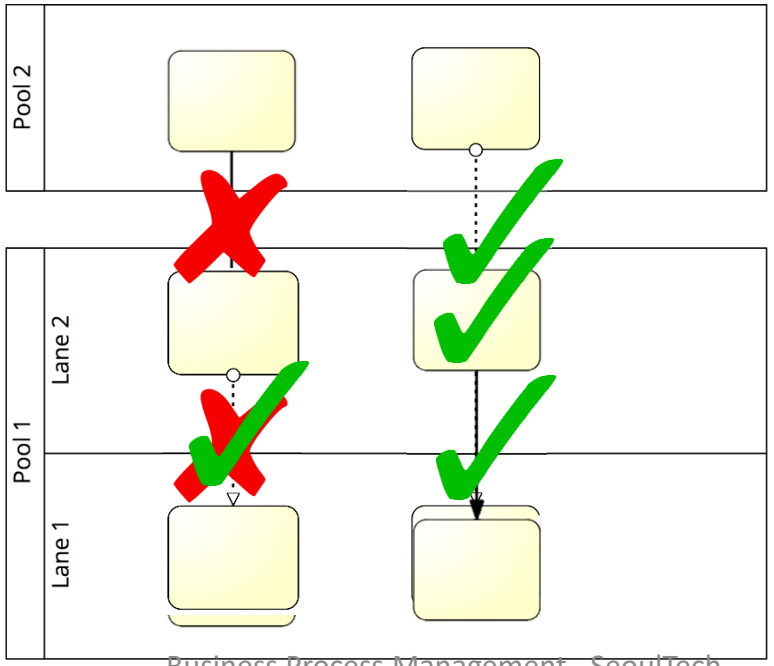


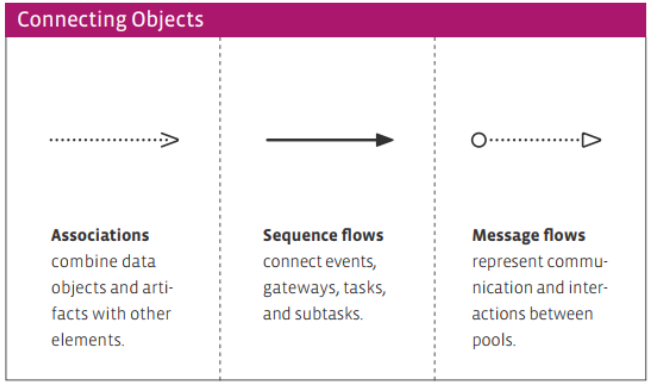
Order-to-cash process with a black-box customer pool



Pools, Lanes and Flows: syntactic rules

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

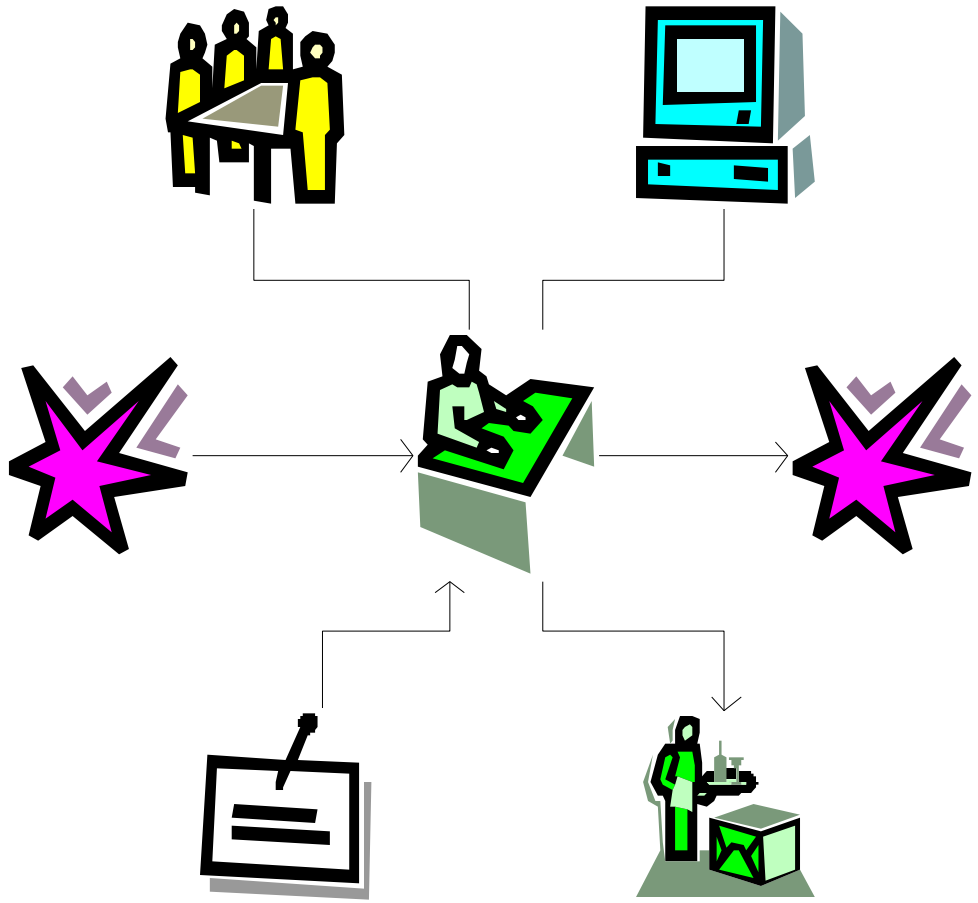
- Start modeling with one single "white-box" pool
  - Initially, put the events and tasks in only one pool – the pool of the party who is running the process
  - Leave all other pools "black-boxed"
  - Once you have modeled this way, and once the process diagram inside the white-box pool is complete, 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

Suggested exercise (optional)

1. Put together the four fragments of the loan assessment process that you created in Exercises 3.1 to 3.4.
   - Hint: Look at the labels of the start and end events to understand the order dependencies among the various fragments.

2. Then, extend the business process for assessing loan applications by considering the following resource aspects.
   - The process for assessing loan applications is executed by four roles within the loan provider: a financial officer takes care of checking the applicant's credit history; a property appraiser is responsible for appraising the property; an insurance sales representative sends the home insurance quote to the applicant if this is required. All other activities are performed by the loan officer who is the main point of contact with the applicant.
     - Note. You do not need to add a pool for the applicant, only consider the Loan Provider pool.

Process Modelling Viewpoints

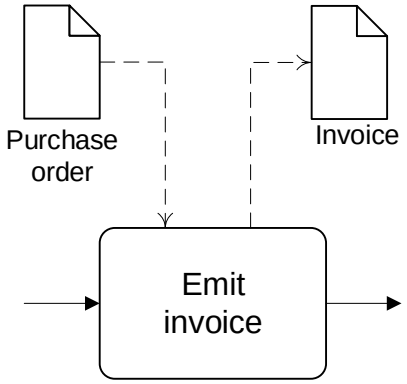


Data / Materials

Which?

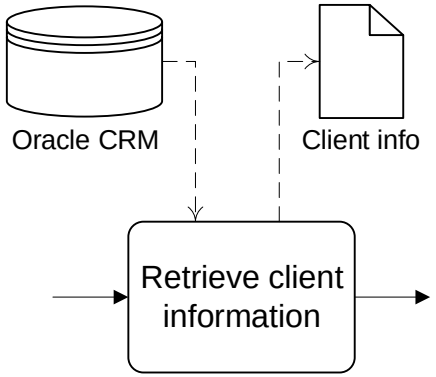
Data Objects, Stores

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.

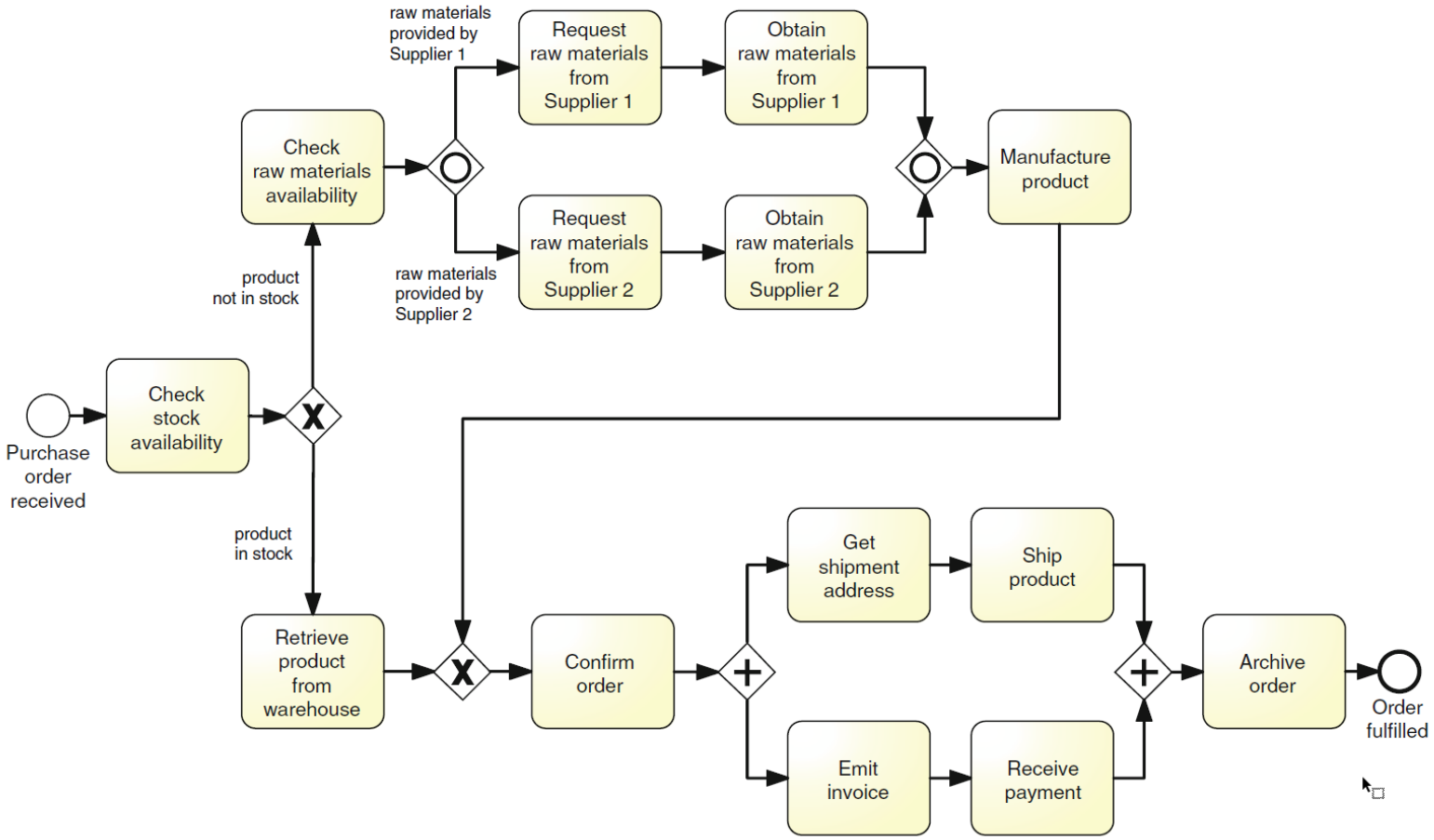
Order-to-cash process, again

The **purchase order** document serves as an input to the stock availability check.

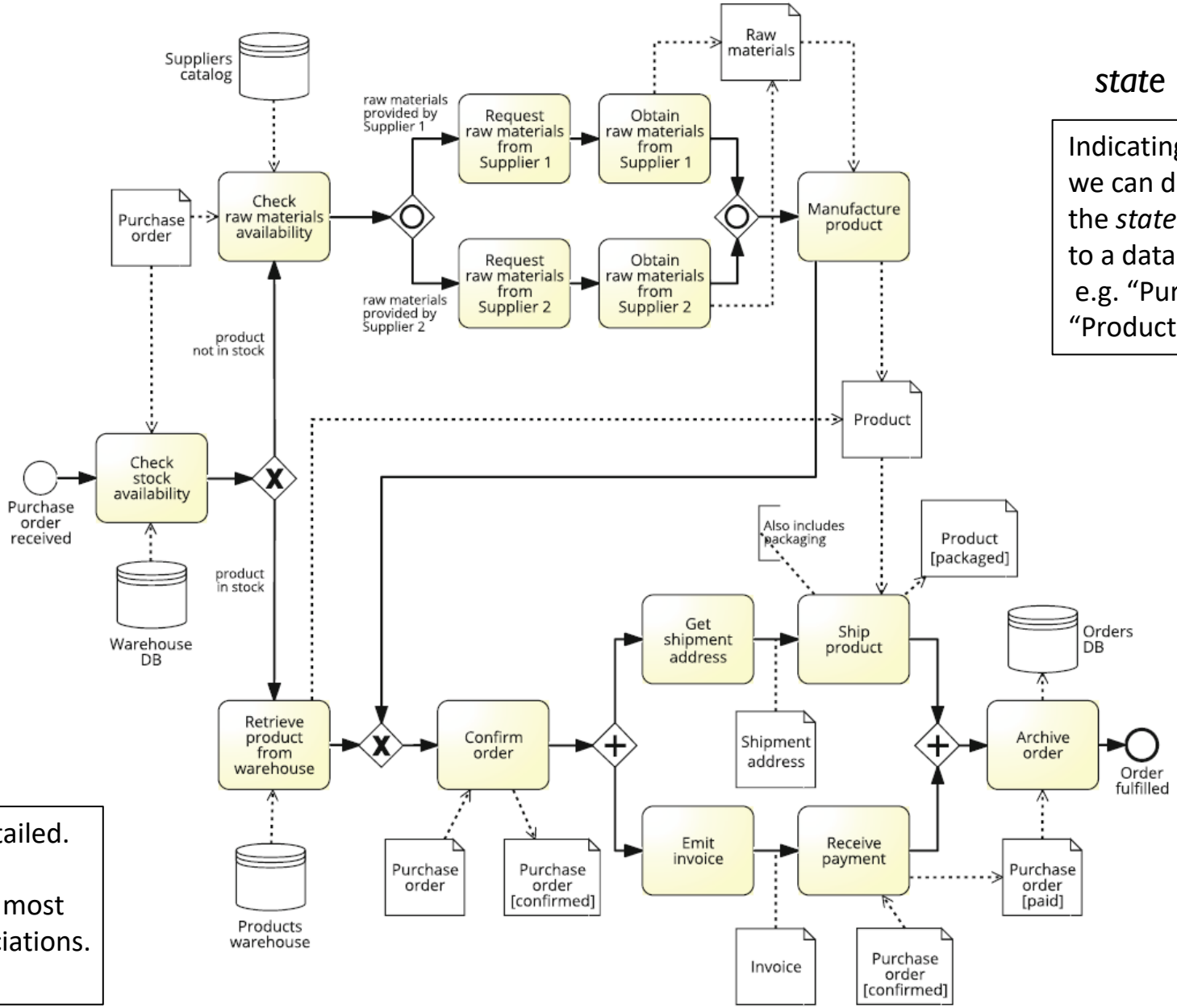
After the product is either manufactured or retrieved from warehouse, the status of the document is updated, to “confirmed”.

After that an invoice is produced.

Then, a purchase order will be updated to "paid"



Order-to-cash process, with data objects and data stores



state of data objects

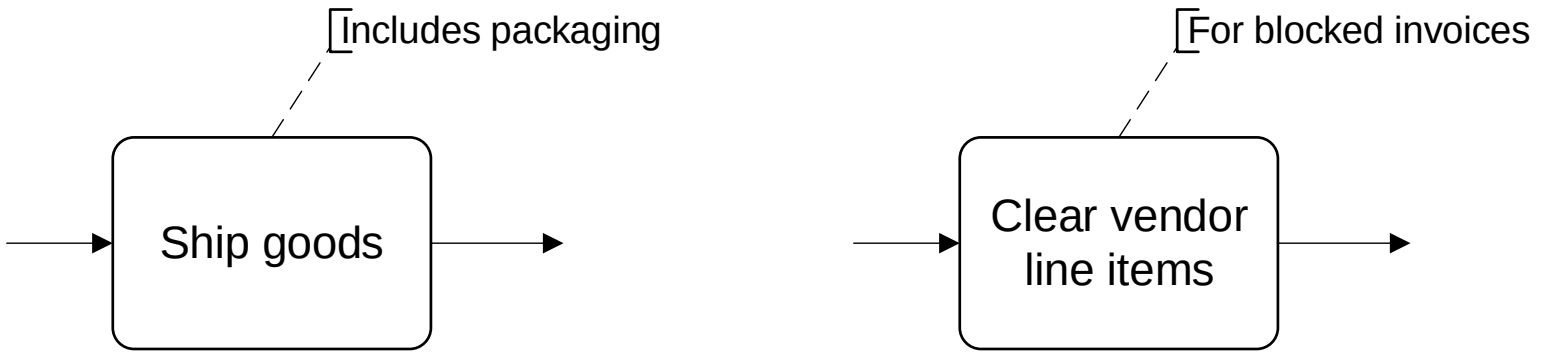
Indicating data objects' states is optional: we can do so by appending the name of the *state* between square brackets to a data object's label, e.g. "Purchase Order [confirmed]", "Product [packaged]".

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 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



Anything wrong with this model?

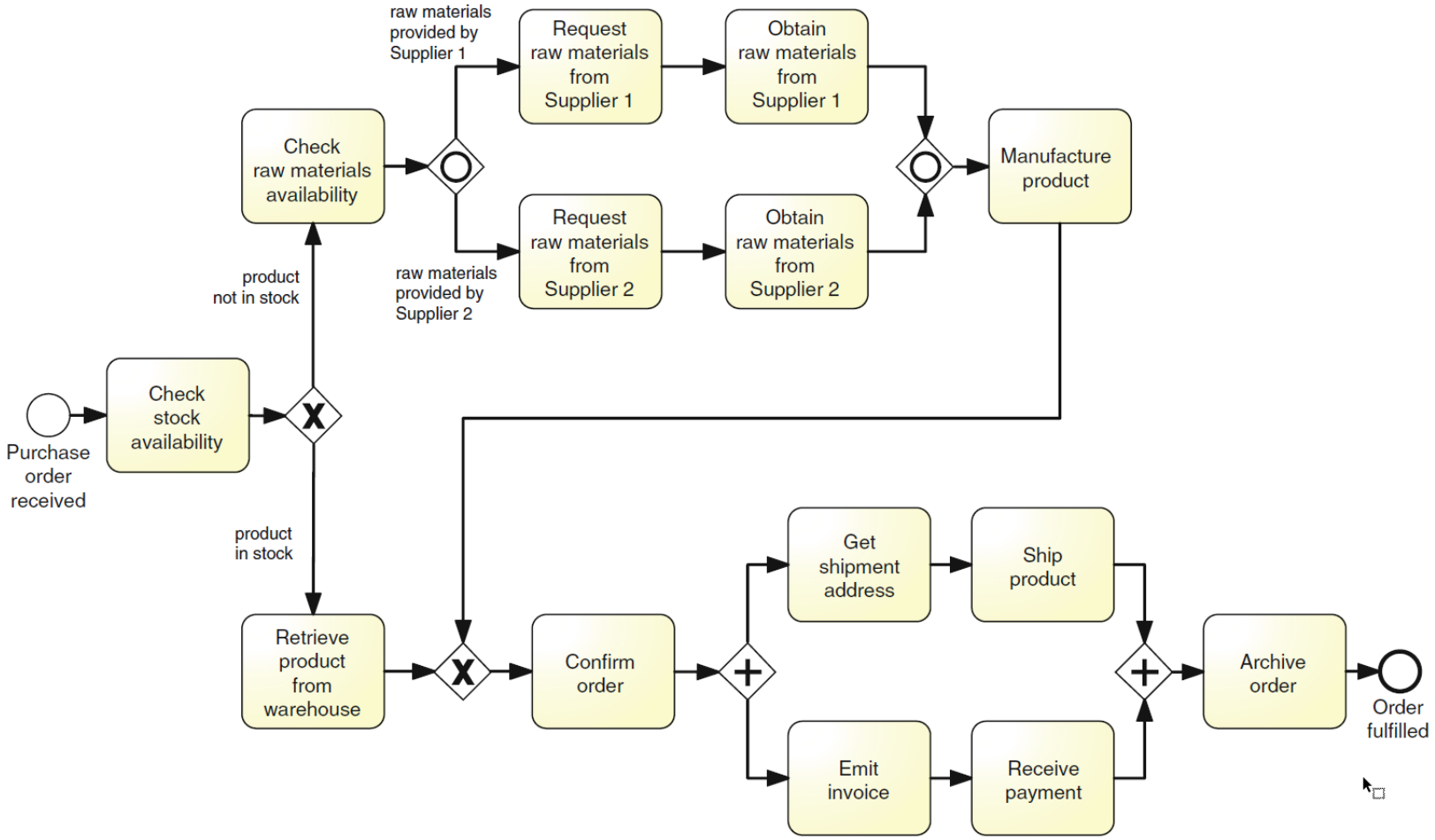
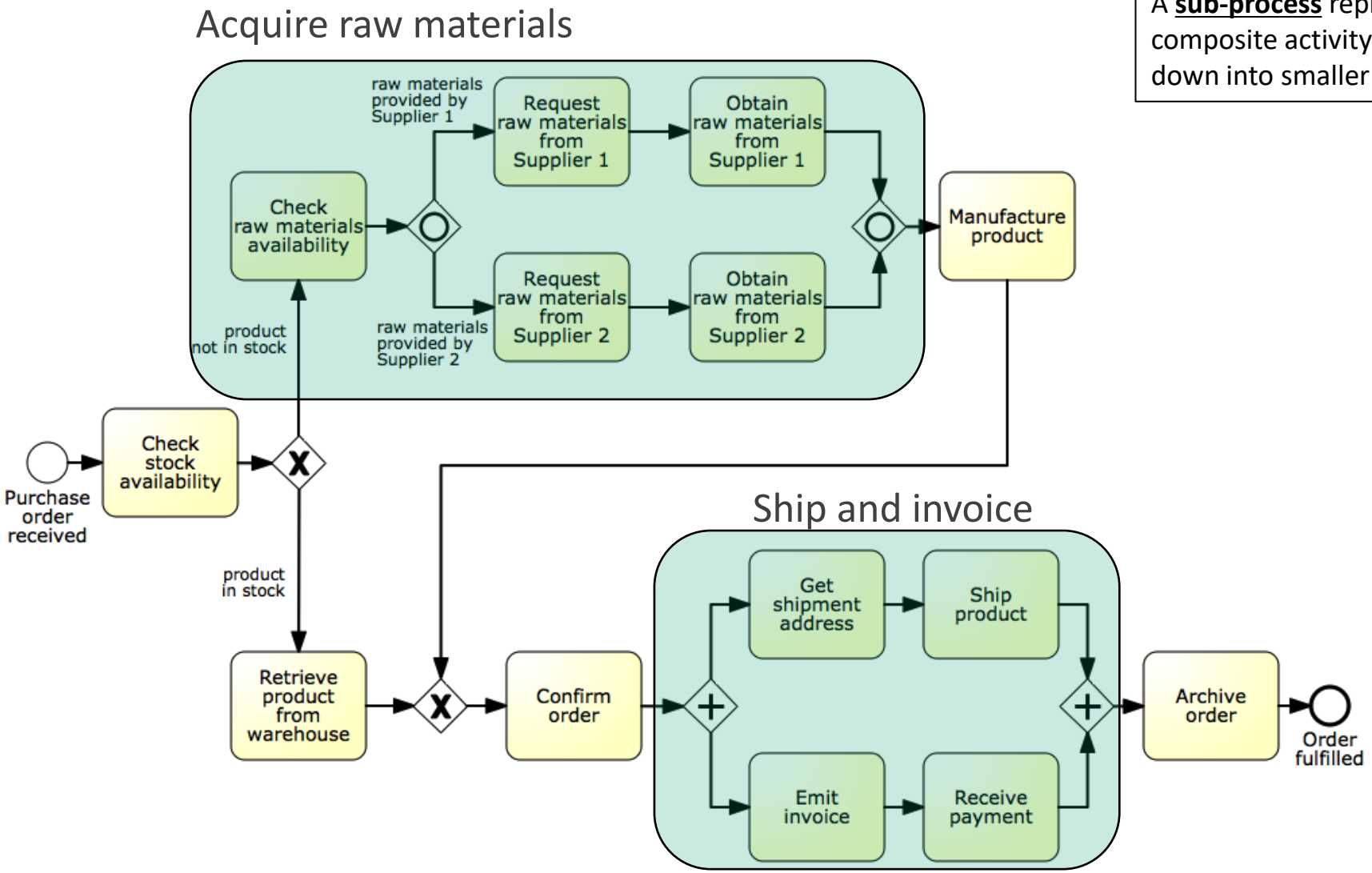


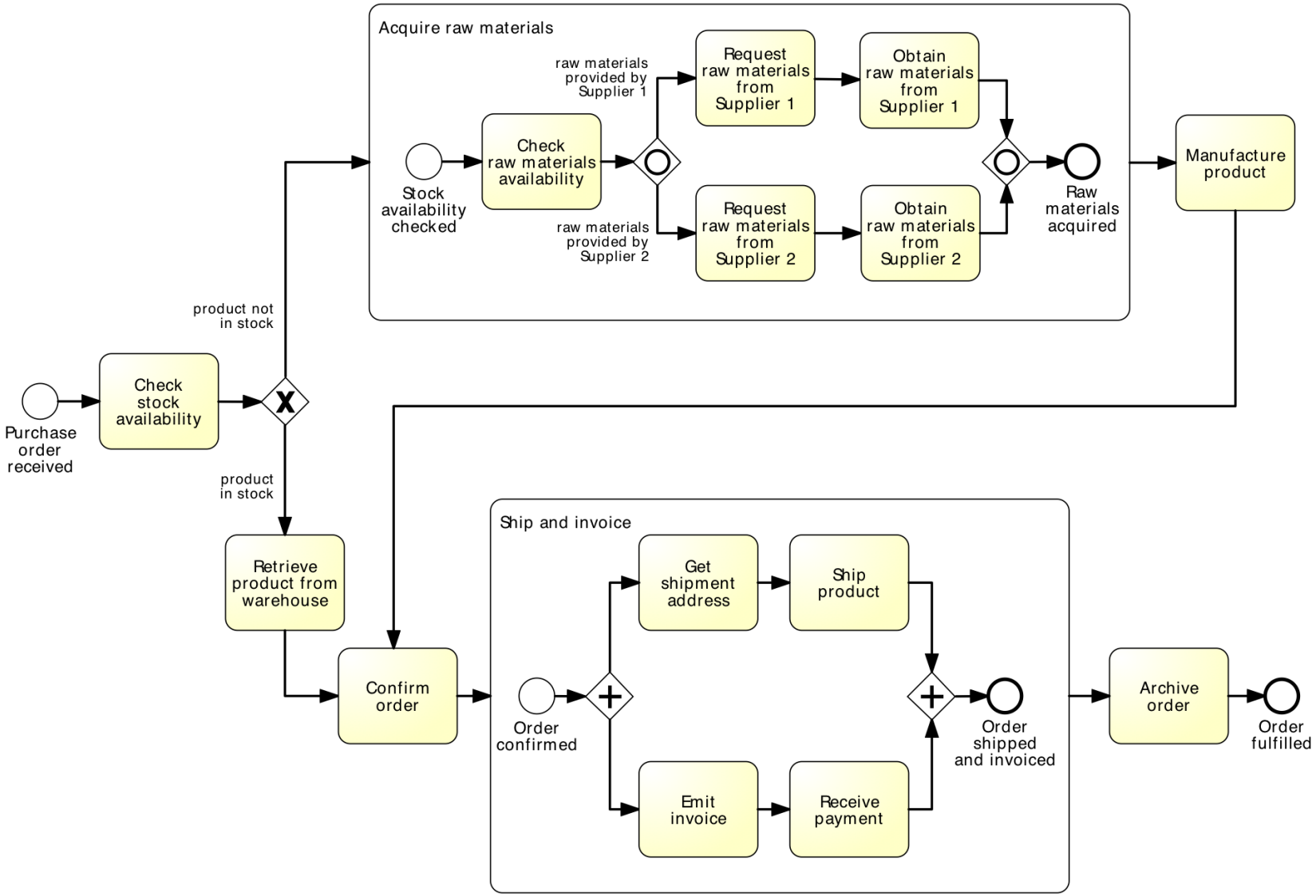
Fig. 3.12 The order-to-cash process model with product manufacturing

Identifying sub-processes

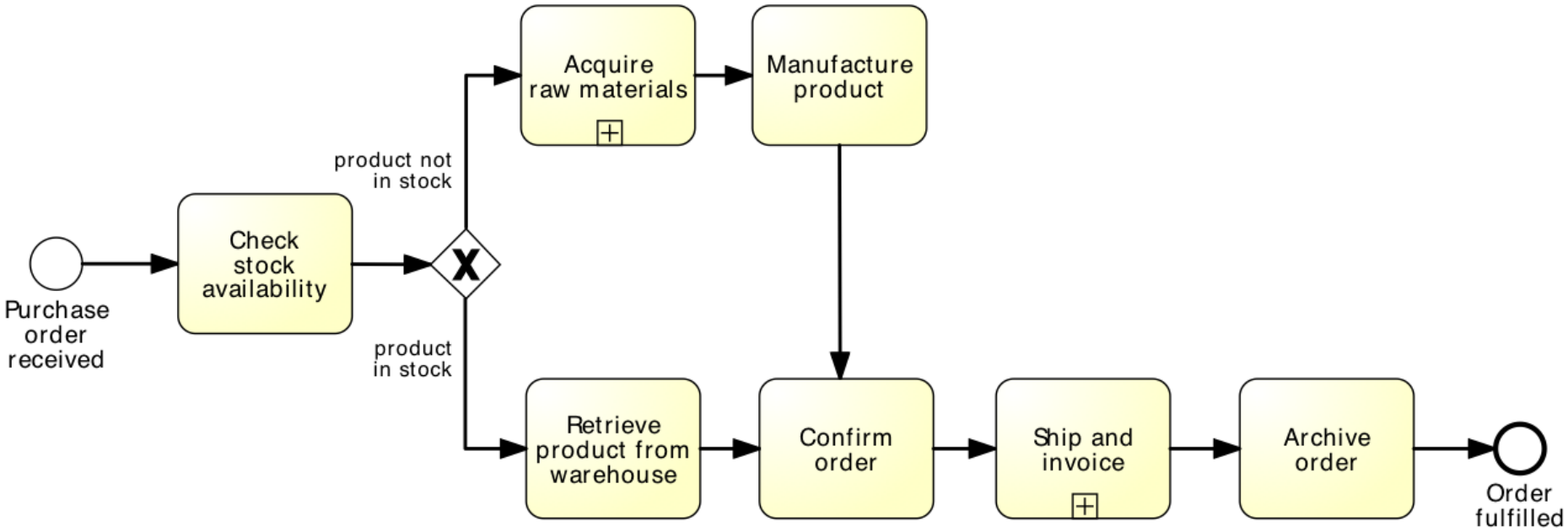
A **sub-process** represents a self-contained, composite activity that can be broken down into smaller units of work



Expanded Sub-Process Notation



Collapsed Sub-Process Notation



Sub-processes

- An activity in a process can invoke a separate sub-process
- Use this feature to:
    1. Decompose large models into smaller ones, making them easier to understand and maintain

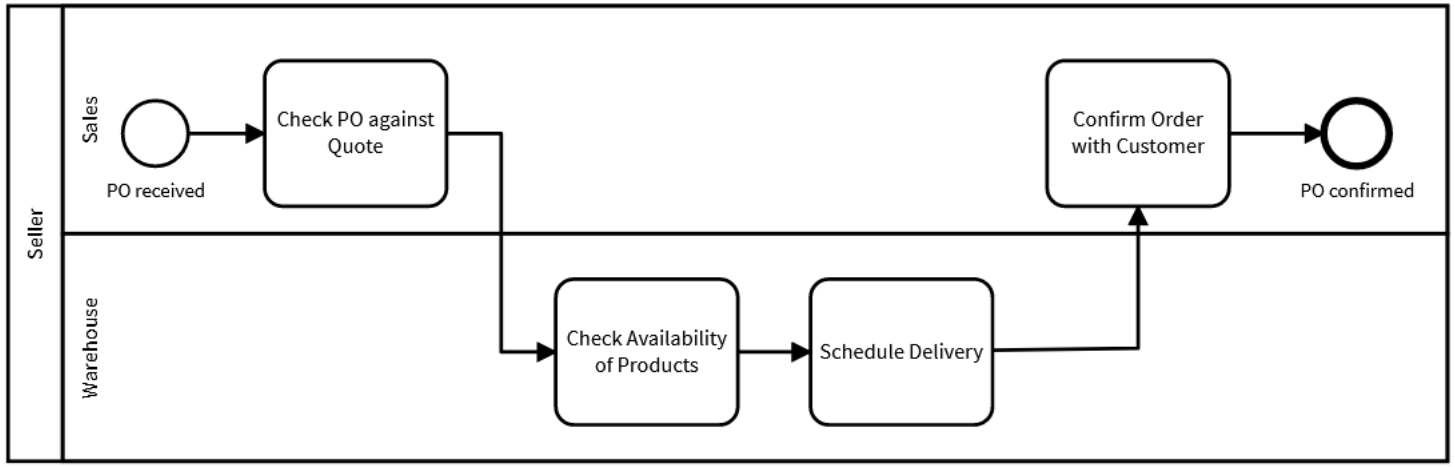
Guideline: Multi-level modeling

- Level 1: **value chain**
  - Simple linear description of the phases of the process
  - No gateways
  - Each activity chain is a sub-process
- Level 2+: expand each activity in the value chain, add incrementally the following:
  - Decisions, handoffs (lanes, pools)
  - Parallel gateways, different types of events
  - Data objects & data stores
  - And as much detail as you need, and no more

Multi-Level Modeling: Example

Level 1:
Value Chain

Level 2:
Detailed
Processes



...

...

Guideline: Multi-level modeling (cont.)

- At each level, decompose according to:
  - Logical milestones towards achieving the outcome of the process
  - Major objects used in the process
- Decompose until processes are of "reasonable" size
  - Using approximately 30 flow objects (i.e. activities, events, gateways) leads to an increased probability of making mistakes in a process model (e.g. introducing behavioral issues)
  - As a rule of thumb use up to 20 flow objects per model
    - If you need more, decompose!

Exercise

Model the following process for paying-out (disbursement) home loans from receipt to loan disbursement. Use up to three hierarchical levels.

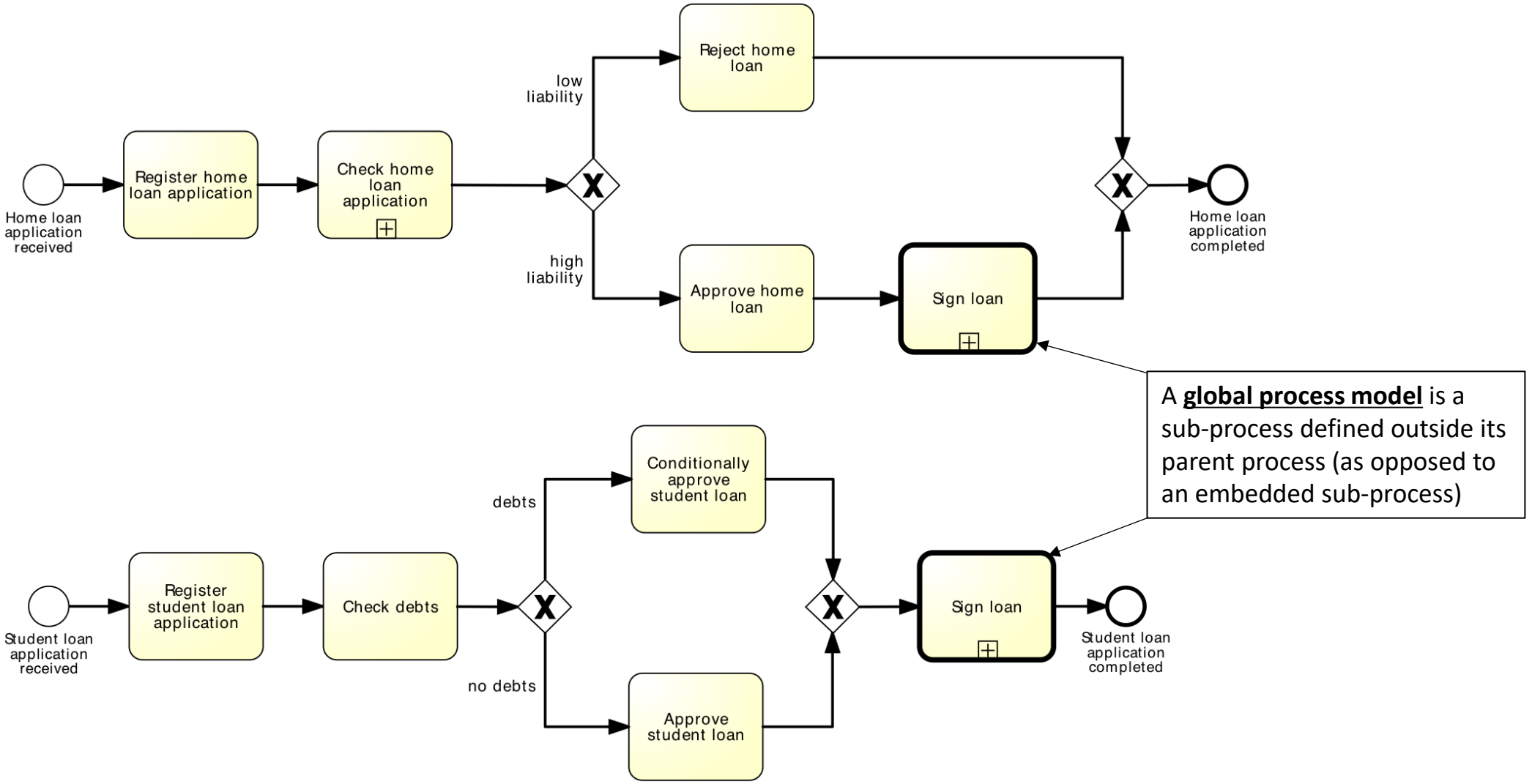
When a home loan application is received, the application is registered followed by a liability check. Based on the result (high liability vs. low liability), the loan is either rejected or approved. If approved, the process continues with the applicant signing the loan contract, and finally, the loan application is completed.

When checking the applicant liability, the credit history and the character are checked in parallel. The process of signing the loan includes three main activities: the singing of the contract is scheduled, then the contract is signed and finally the loan disbursement is scheduled. Additionally, when the loan disbursement is scheduled, three activities are executed sequentially, the start date and interest are calculated, the loan disbursement is actually scheduled and finally the applicant is notified.

Sub-processes

- An activity in a process can invoke a separate sub-process
- Use this feature to:
    1. Decompose large models into smaller ones, making them easier to understand and maintain
    2. Share common fragments across multiple processes (Process Model Reuse)

Shared sub-process

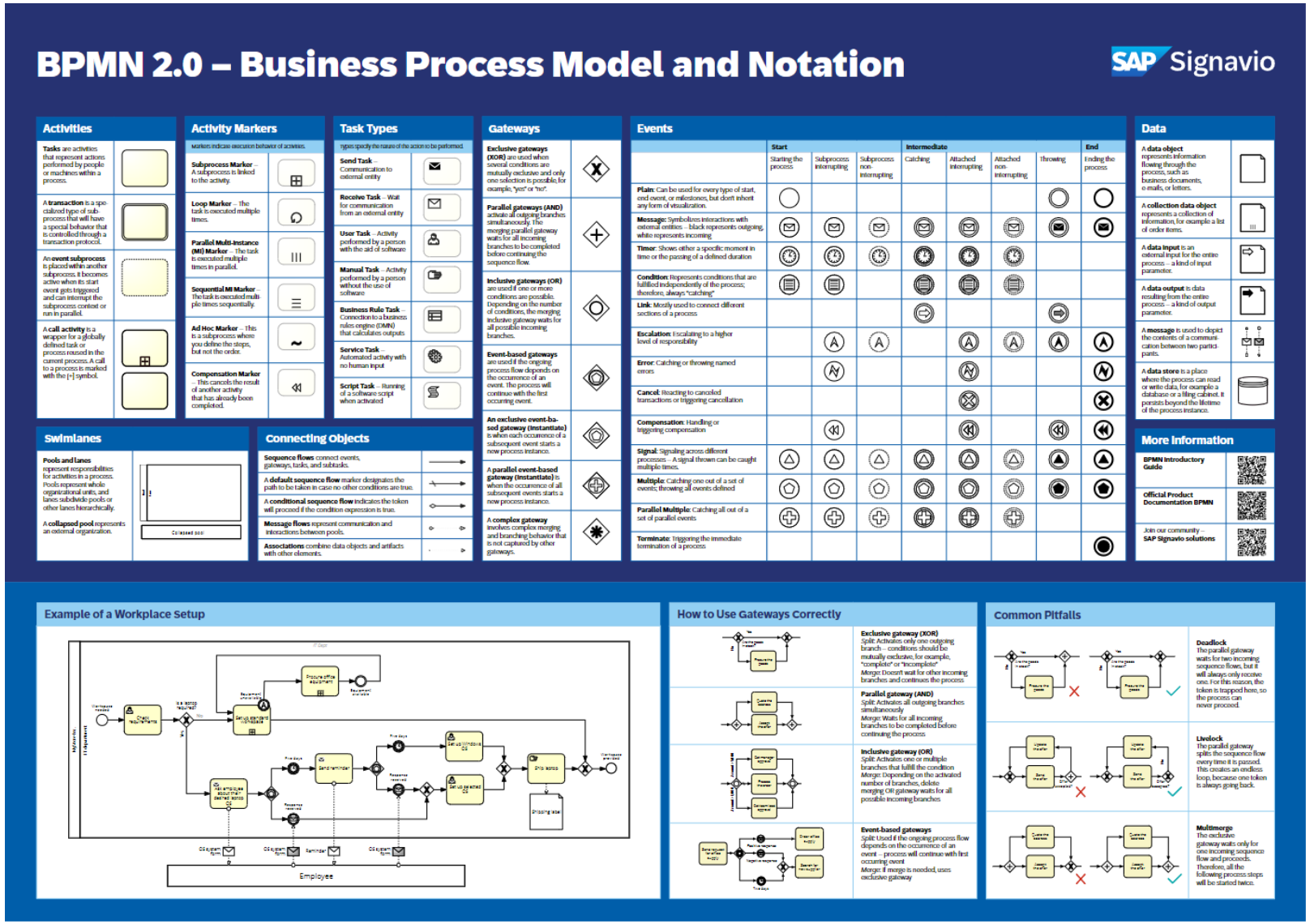


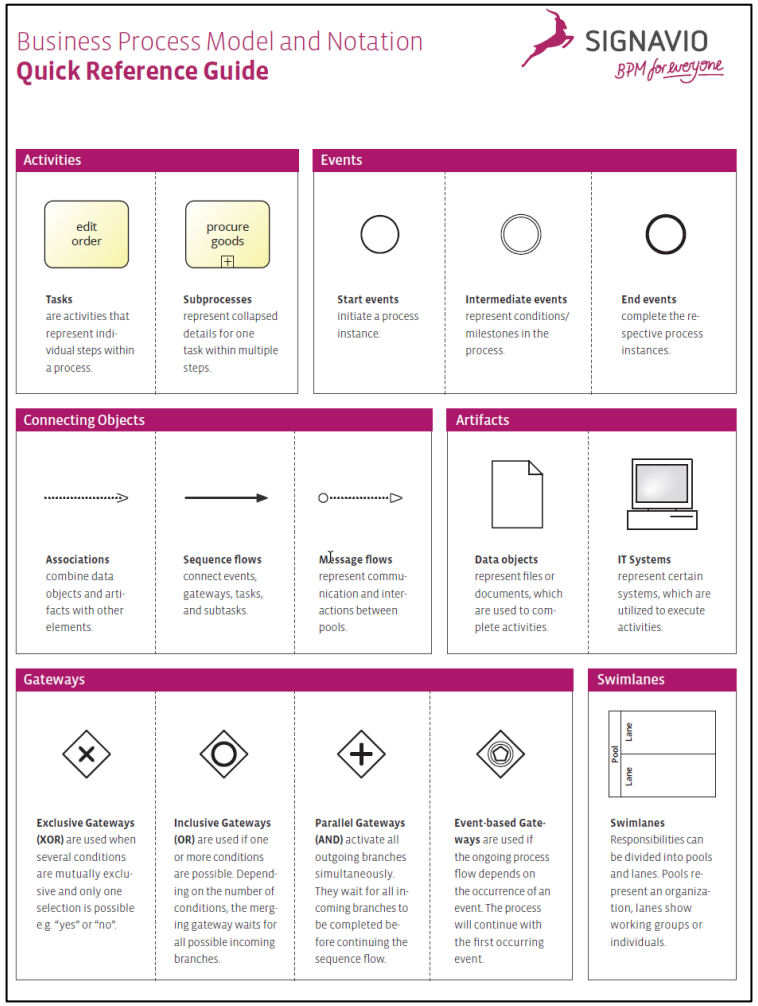
Embedded or global sub-process?

Example 3.9. Let us consider the procurement process of a pharmaceutical company.

A pharmaceutical company has different business units within its manufacturing department, each producing a specific type of medicine. For example, there is a business unit looking after inhaled medications, and another one producing vaccines. The various business units make use of a direct procurement process for ordering chemicals, and of an indirect procurement process for ordering spare parts for their equipment..

BPMN Poster and Quick Reference Guide (available in the "Materials" page)



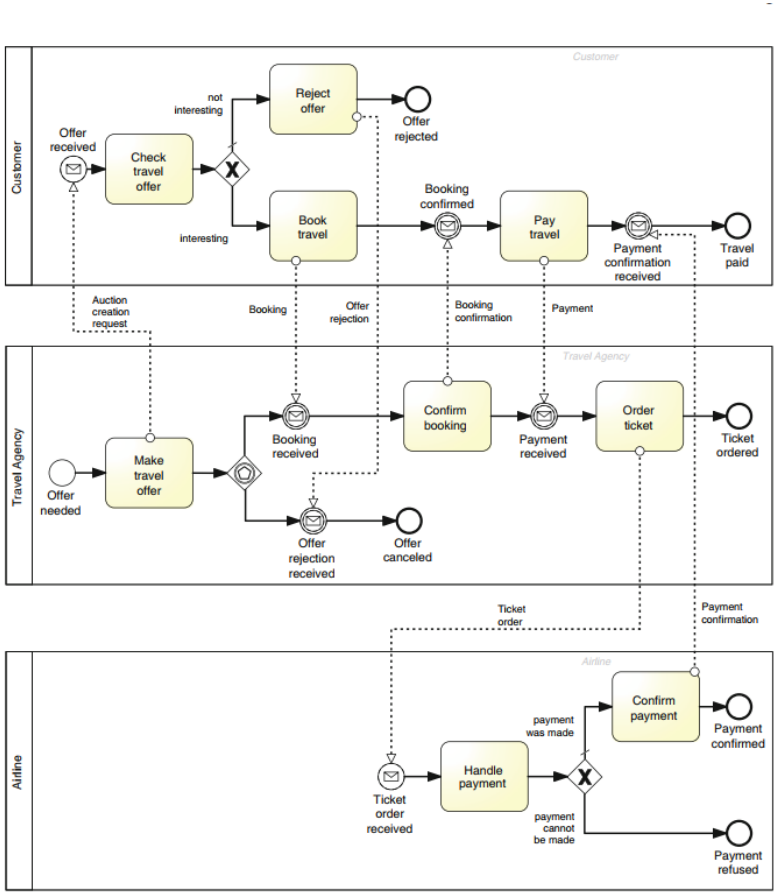


Recap of Essential Process Modeling

1. BPMN activities capture units of work in a process
2. Events define the start and end of a process, and signal something that happens during the execution of it
3. Gateways model exclusive and inclusive decisions, merges, parallelism and synchronization, and repetition
4. A process model depicts all the possible ways a given business process can be executed, while a process instance captures one specific process execution out of all possible ones
5. Pools generally model resource classes while lanes are used to partition pools
6. Data objects capture a physical or digital business object required to execute an activity or trigger an event, or that results from the execution of an activity or an event occurrence
7. A sub-process represents a self-contained, composite activity that can be broken down into smaller units of work. It can be a global process or an embedded subprocess

Next Week

Advanced Process Modeling and Process Discovery



Acknowledgements

- Most of the content notes for this lecture feature content borrowed with or without modification from the following sources:
  - "Source: M. Dumas, M. La Rosa, J. Mendling and H. Reijers, *Fundamentals of Business Process Management*, 2nd edition, Springer, 2018".