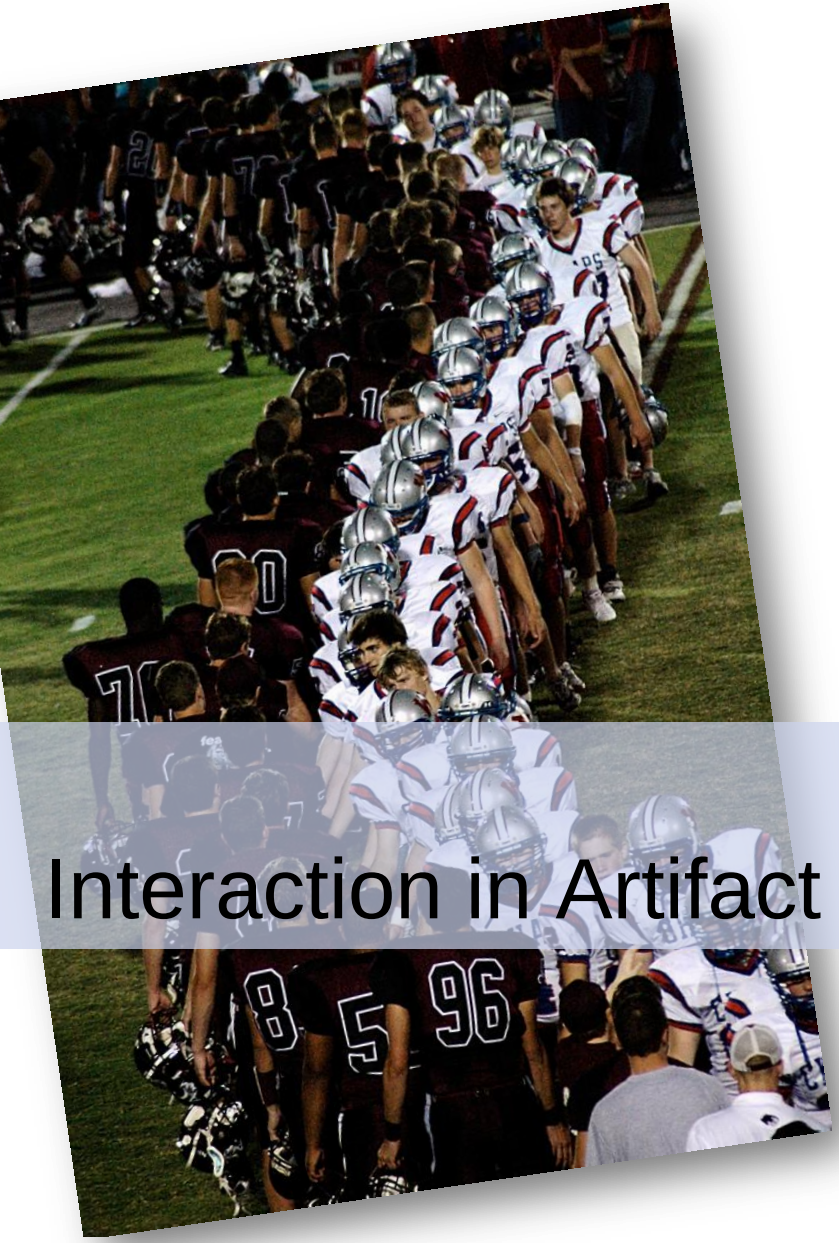

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Many-to-Many: Interaction in Artifact Choreographies

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Where innovation starts

ZEUS 2011, February, Karlsruhe

A process that needs multiple instances

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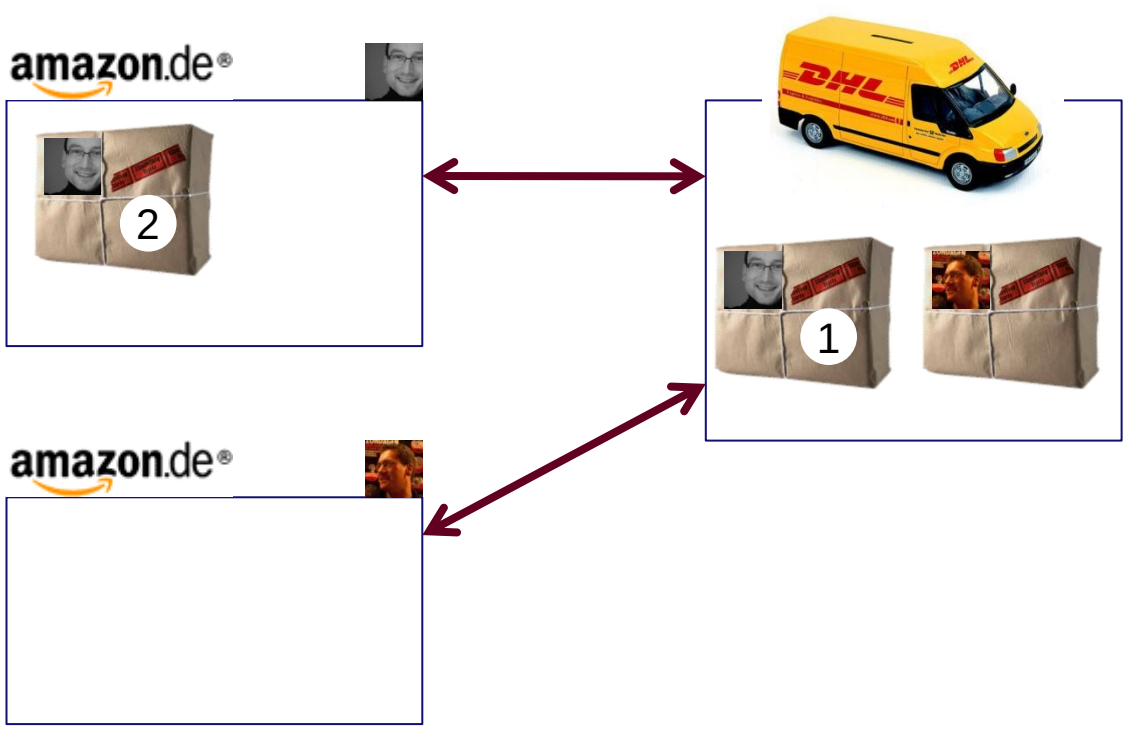
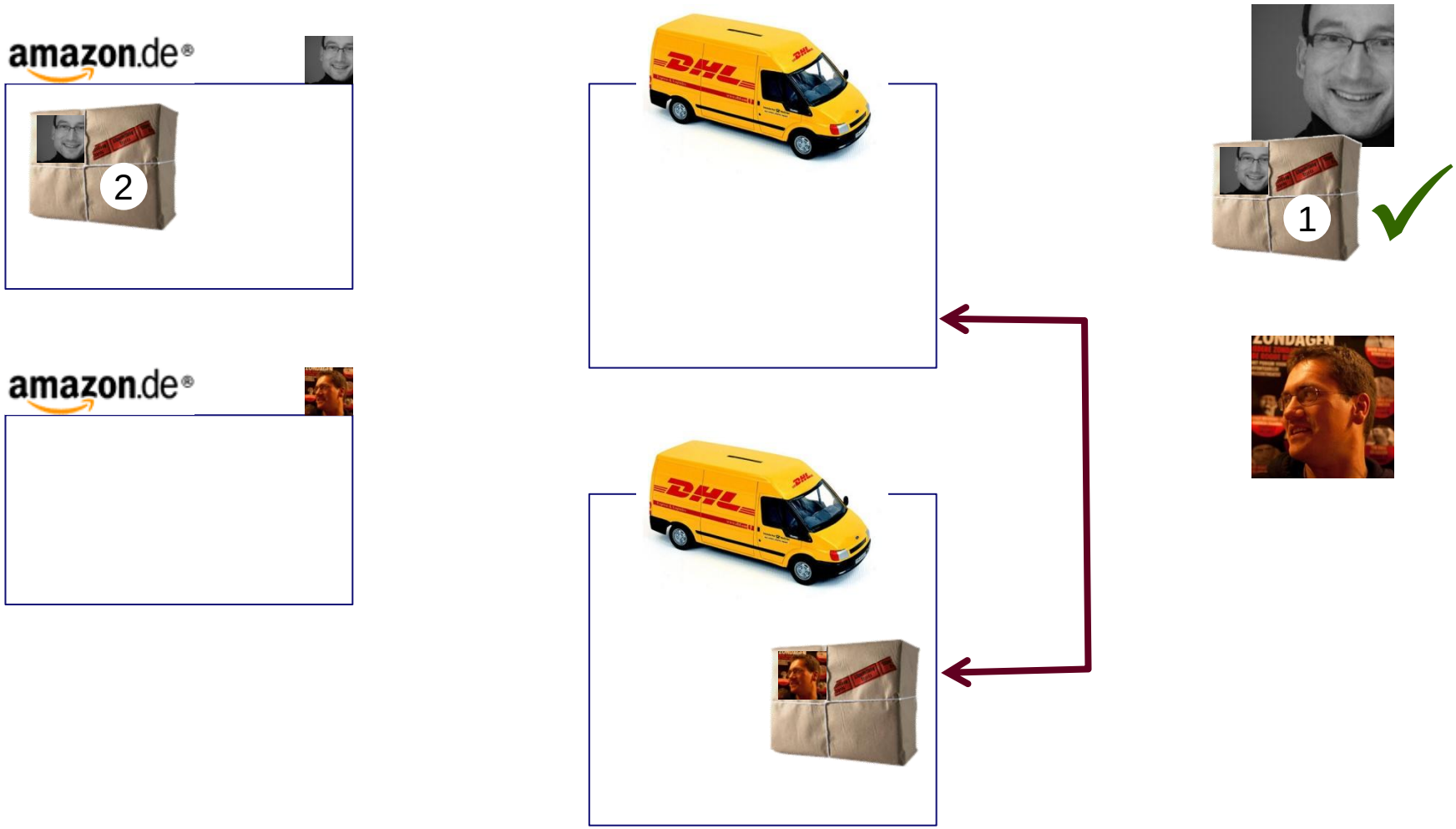
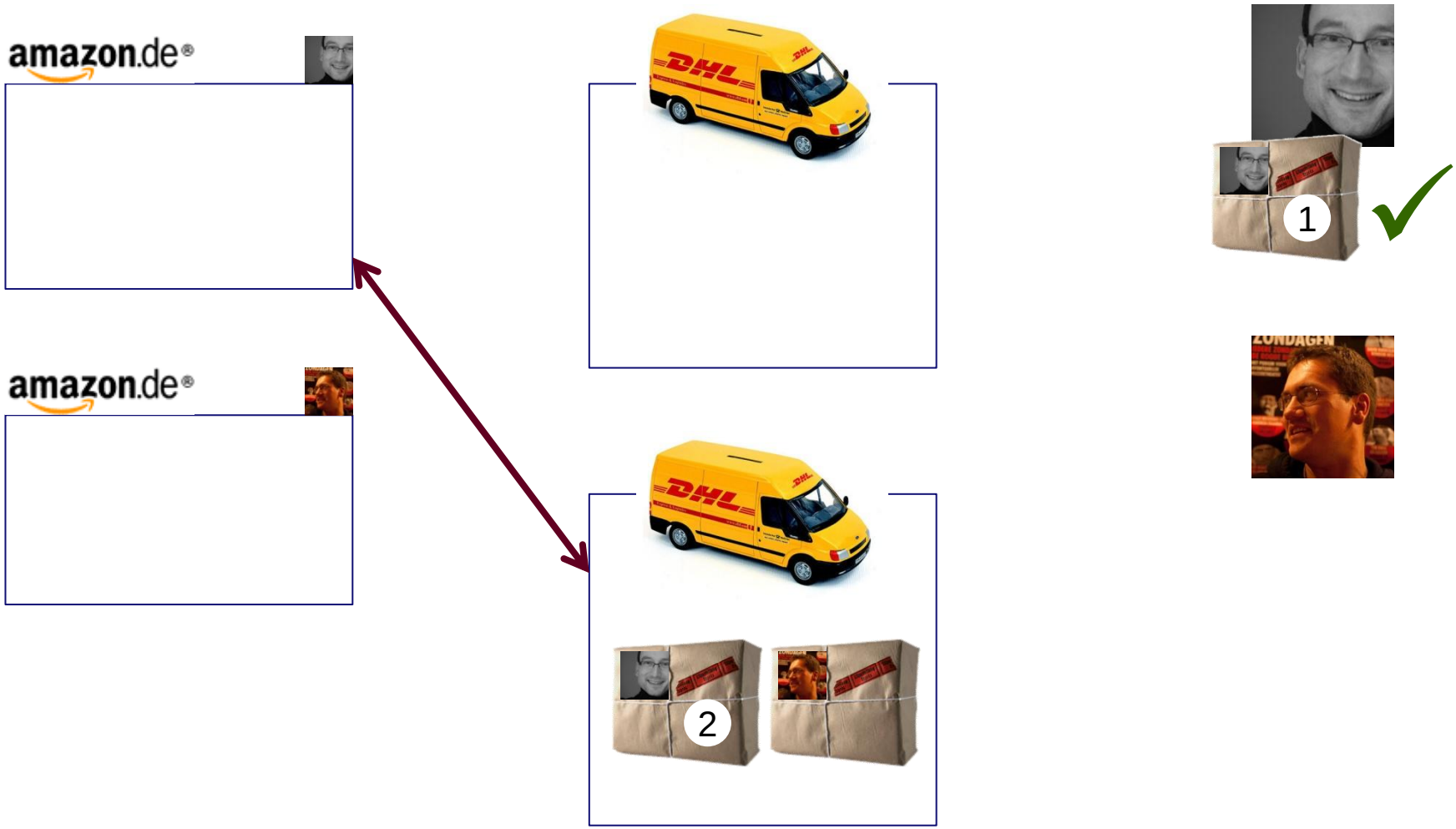


complex relations between service **instances**

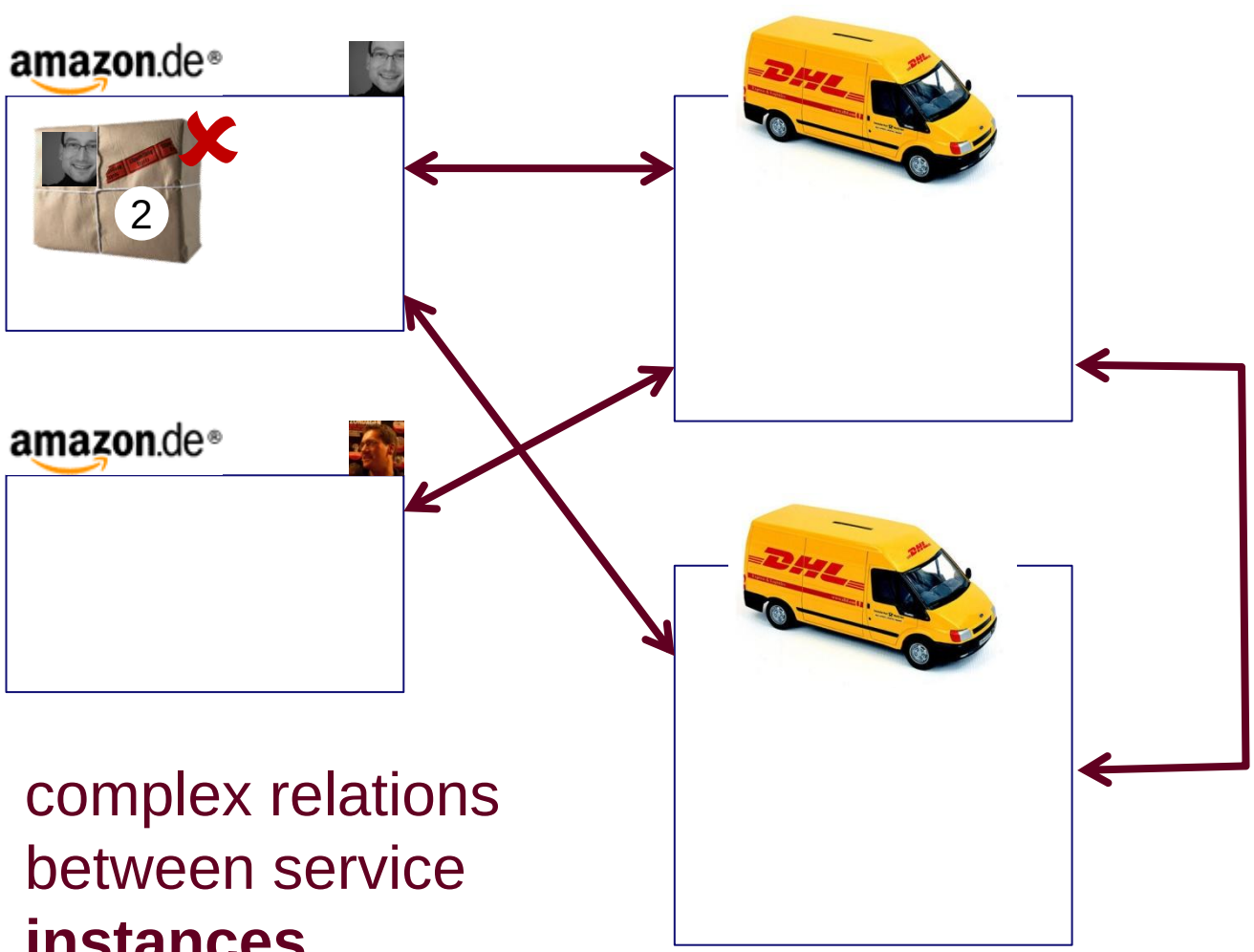
A process that needs multiple instances



A process that needs multiple instances



A process that needs multiple instances

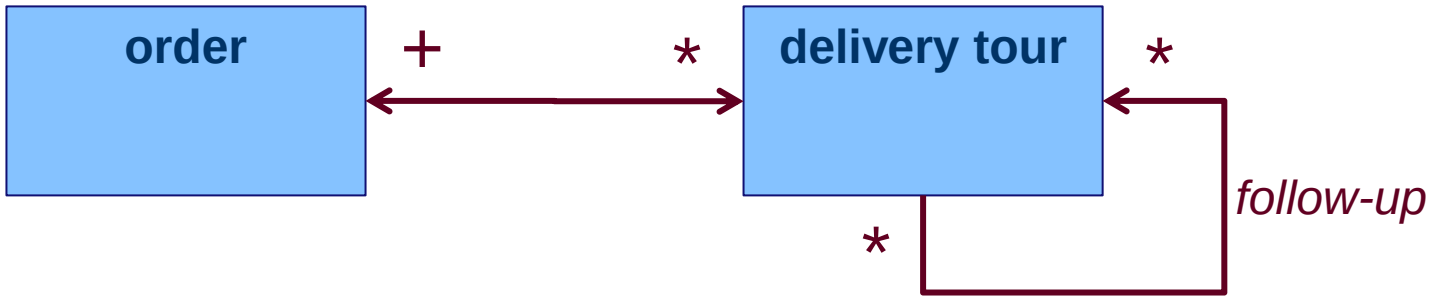


complex relations between service **instances**

The reason of complex relations

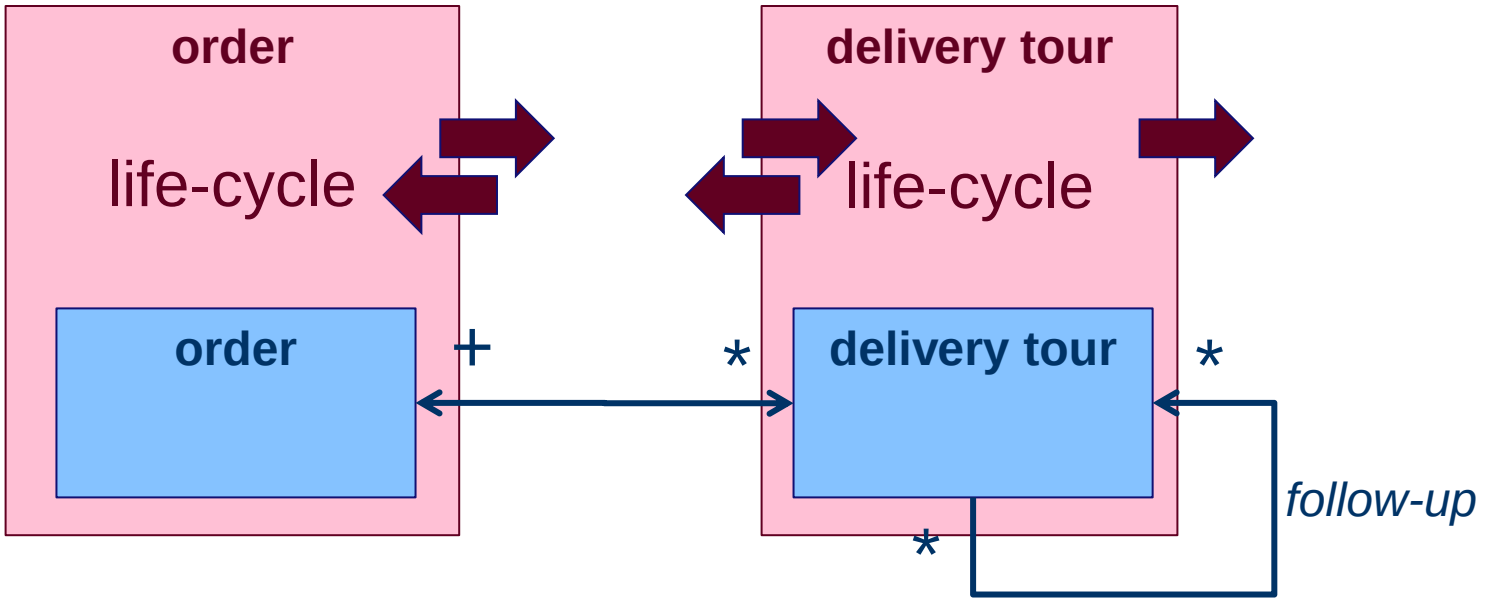
- **Data**

- each process is founded in its data objects
  - an order
  - a delivery tour
- the data-objects can be in complex relations



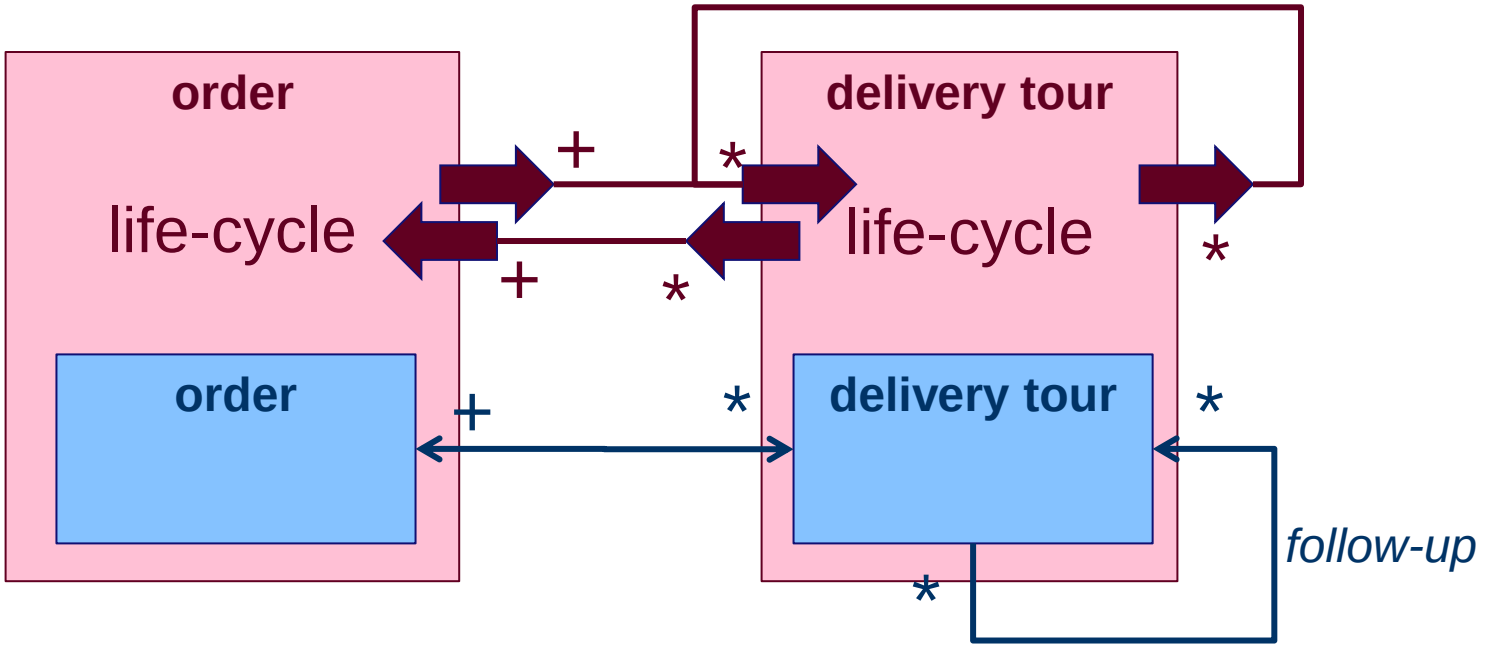
Artifacts

- encapsulate each class of data objects in a service
- service behavior = data object life-cycle
- service interface = retrieve data, update data, …

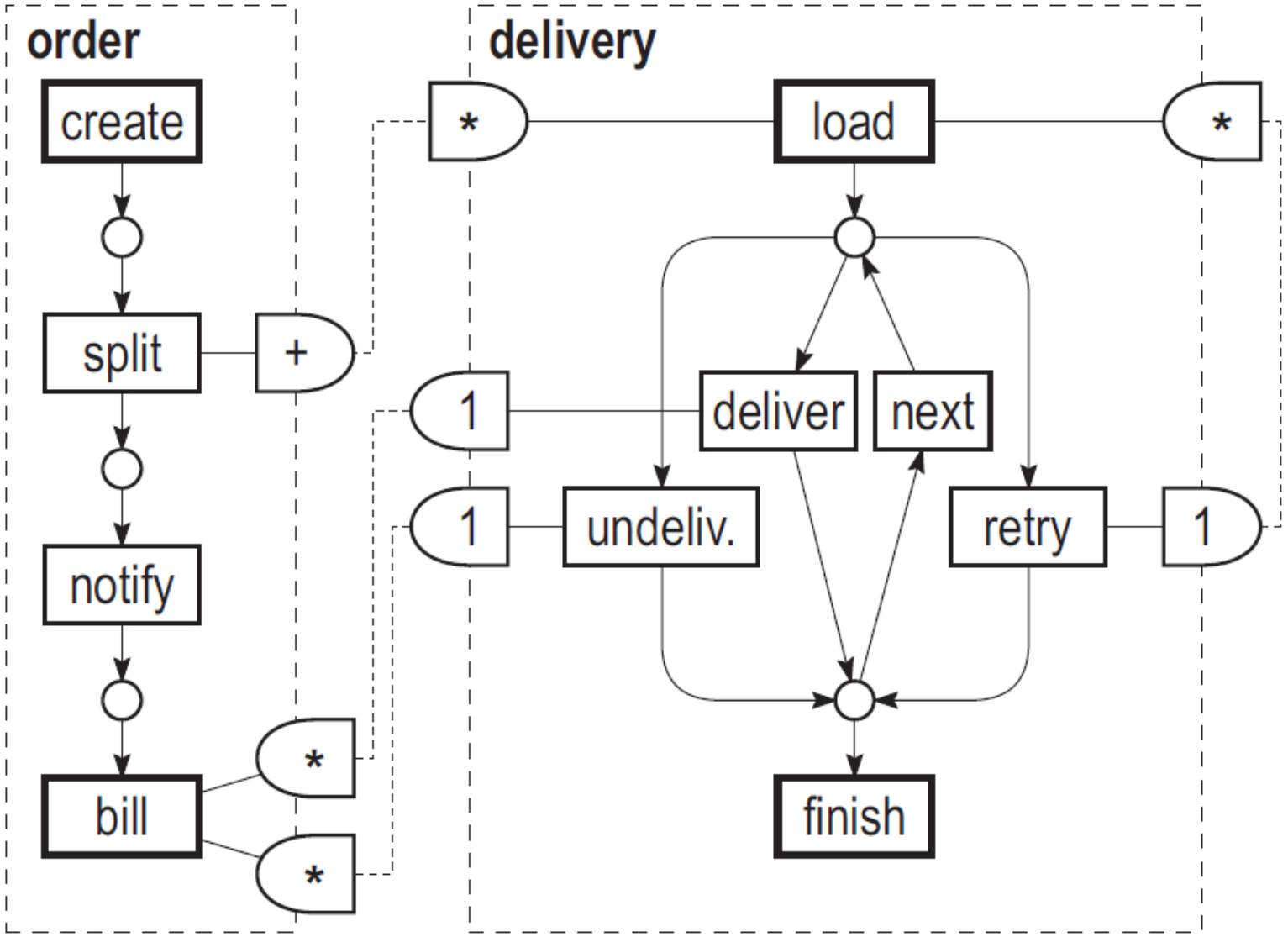


Choreography inherits relations

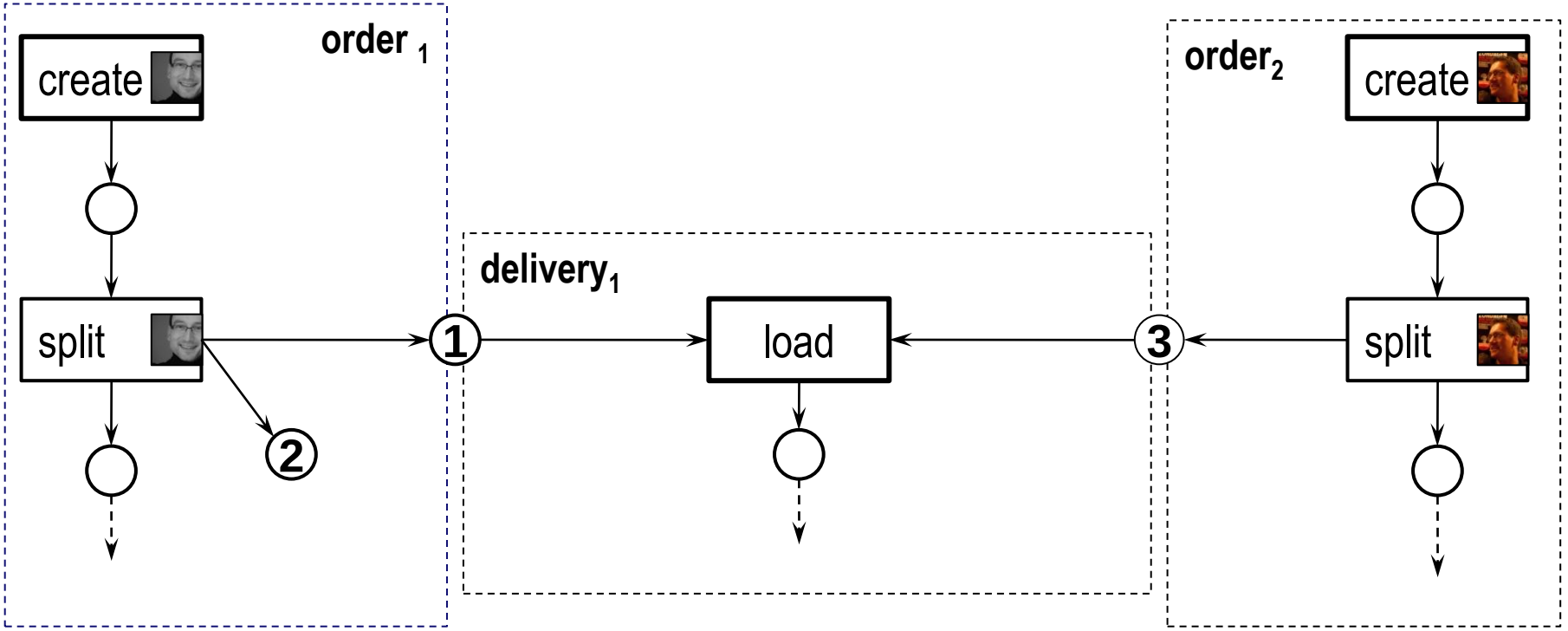
- wiring:
  relations between service instances (= objects)
- **cardinality constraints** express
  how many instances interact with each other

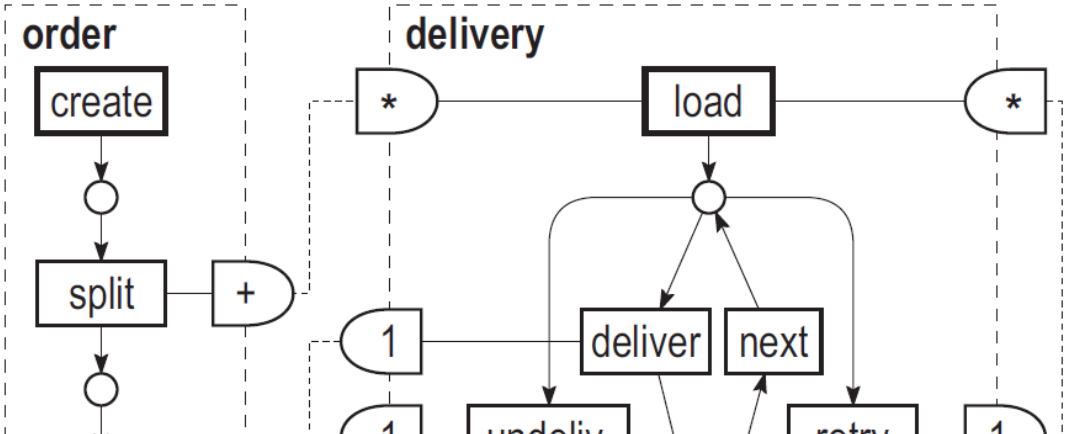


Formal notation: Proclets

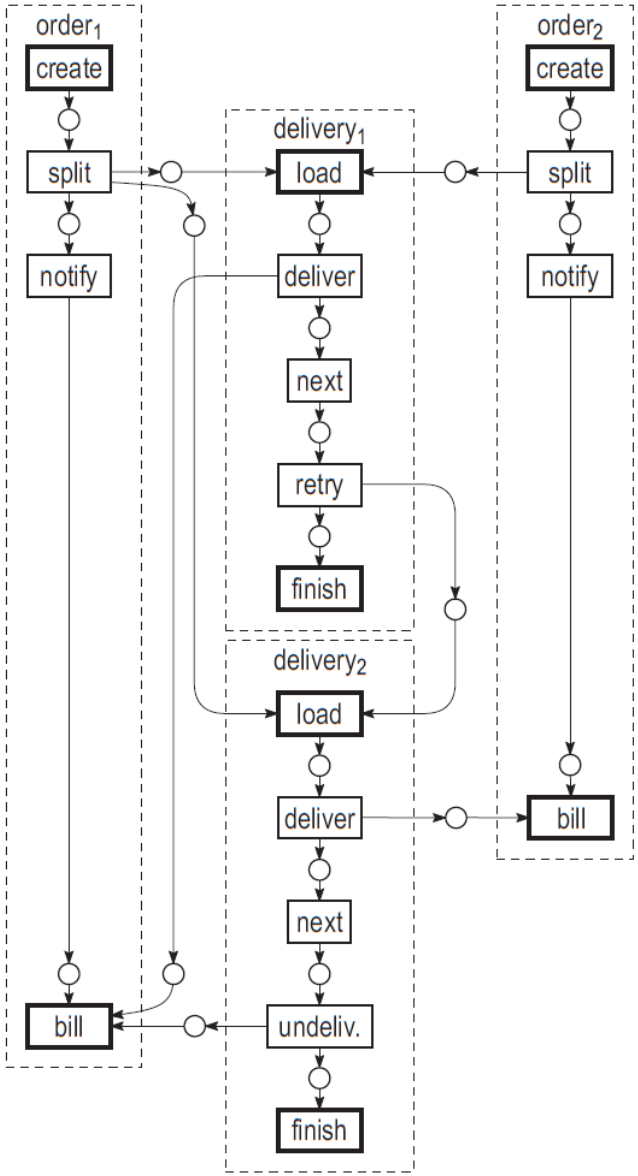


Example execution





Many instances talking to each other



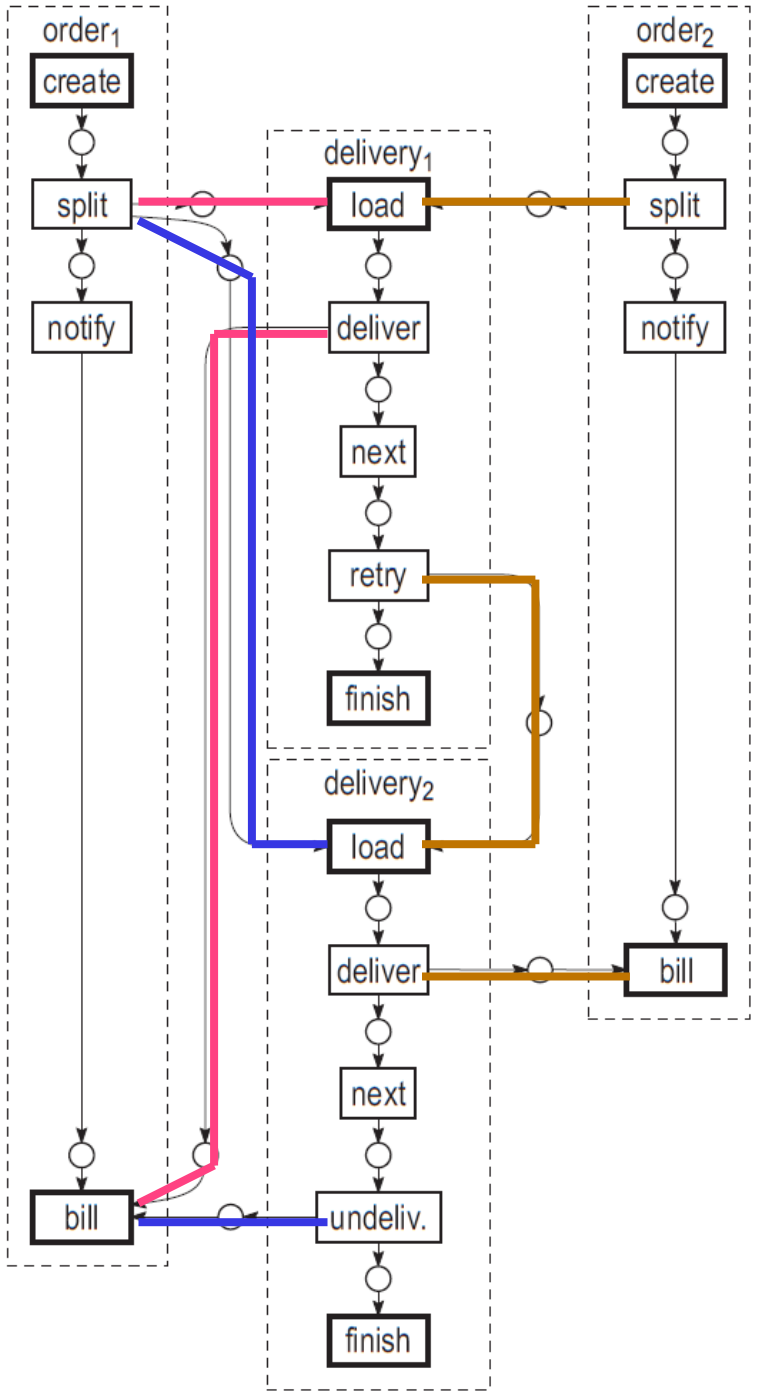
New Paradigm → New Problems

- Artifacts
  - a service instance encapsulates a data object
  - relations between data objects
  - complex communications between service instances

- Two research problems
  1. addressing instances: correlation
  2. completing artifact choreographies

Conversation

- a set of corresponding communication events
- between a fixed set of instances
  - C1: order1, delivery1
  - C2: order2, delivery1, delivery2
  - C3: order1, delivery2
- conversations can overlap



Correlation

- conversation = a set of related interaction events

- **correlation**: mechanism to define whether an event is part of a specific conversation
- key-based correlation: data-fields of the event
- same value → same conversation
  (e.g. orderID, deliveryID)

- available in BPEL and BPMN 2.0

Correlation Handling in WS-BPEL

```
<receive partnerLink="Buyer" portType="SP:PurchasingPT“
         operation="PurchaseRequest" variable="PO">
  <correlations>
     <correlation set="PurchaseOrder" initiate="yes" />
  </correlations>
</receive>
...

<invoke partnerLink="Buyer" portType="SP:BuyerPT„
        operation="PurchaseResponse" inputVariable="POResponse">
  <correlations>
     <correlation set="PurchaseOrder" initiate="no" />
     <correlation set="Invoice" initiate="yes" />
  </correlations>
</invoke>
```

incoming message: service instance now participates in the conversation ***C*** defined by **`PurchaseOrder`**

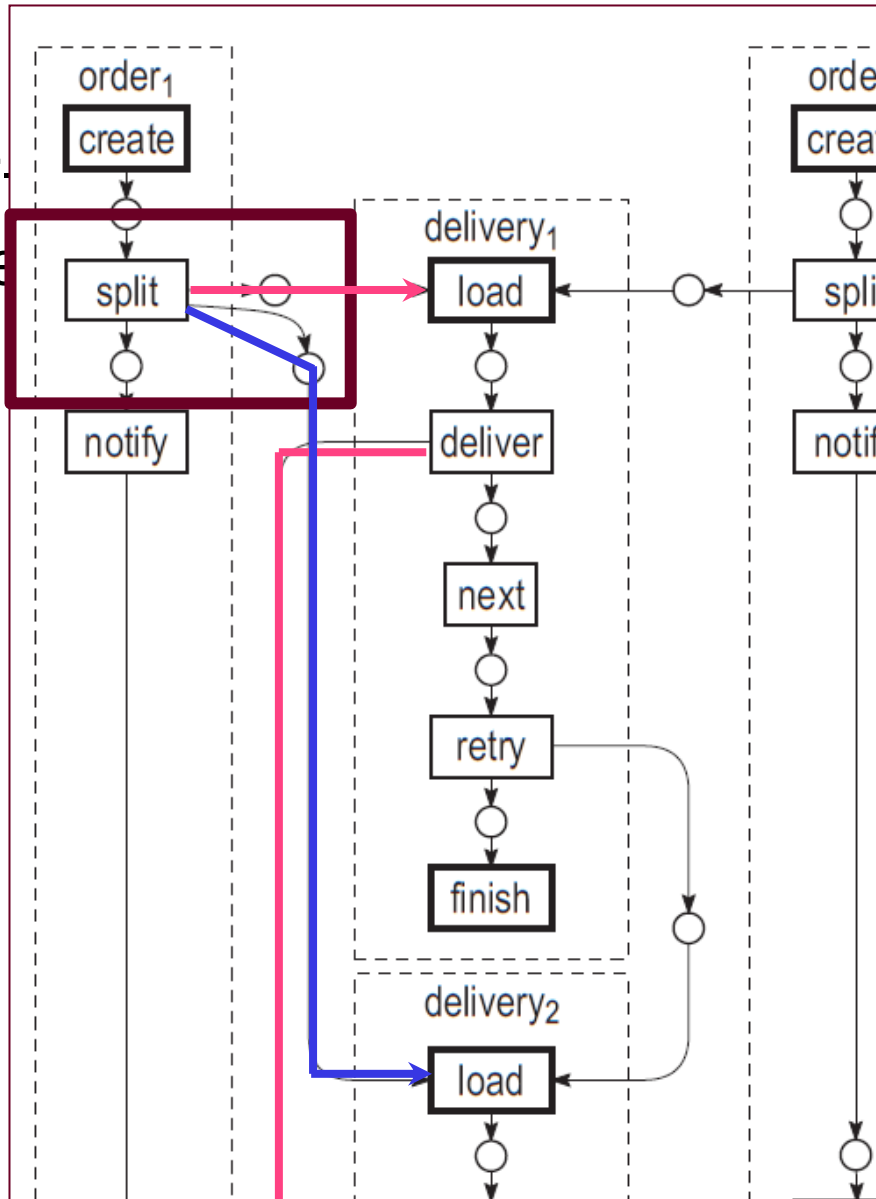
outgoing message part of conversation ***C***

and initiates a new conversation ***C2***

[wsbpel-v2.0-OS, page 81]

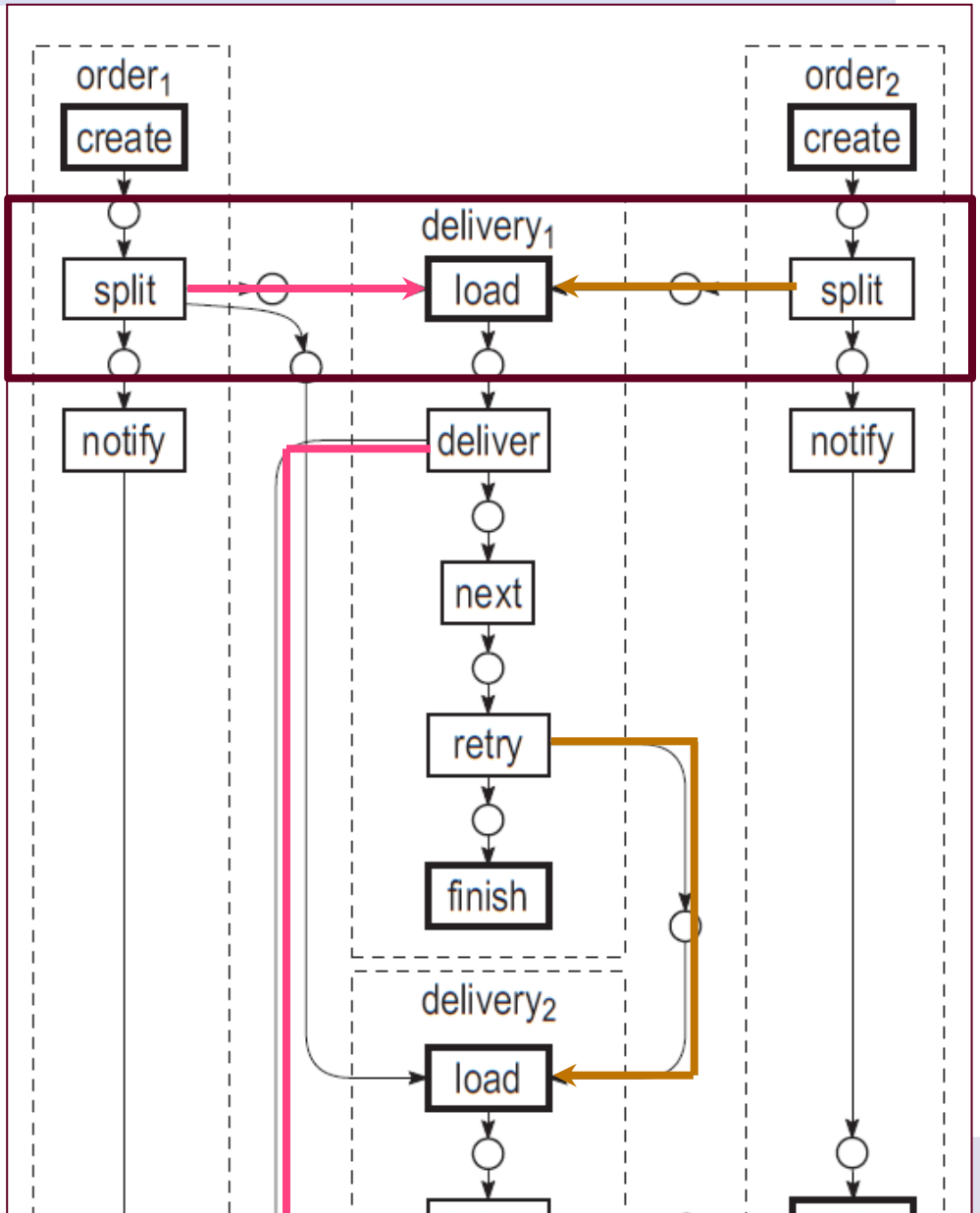
Artifacts Require Stronger Correlation

- BPEL
  - expresses correlation on a per-
  - two correlation patterns require
- **multiple consumption**: one send event → several receive events in different instances
- **dynamic list of correlation values**



Artifacts Require Stronger Correlation

- **atomic consumption**: several send events in different instances
  → one receive event
- dynamic list of send events
- **correlation values** not known to receiver
- → OR-join problem

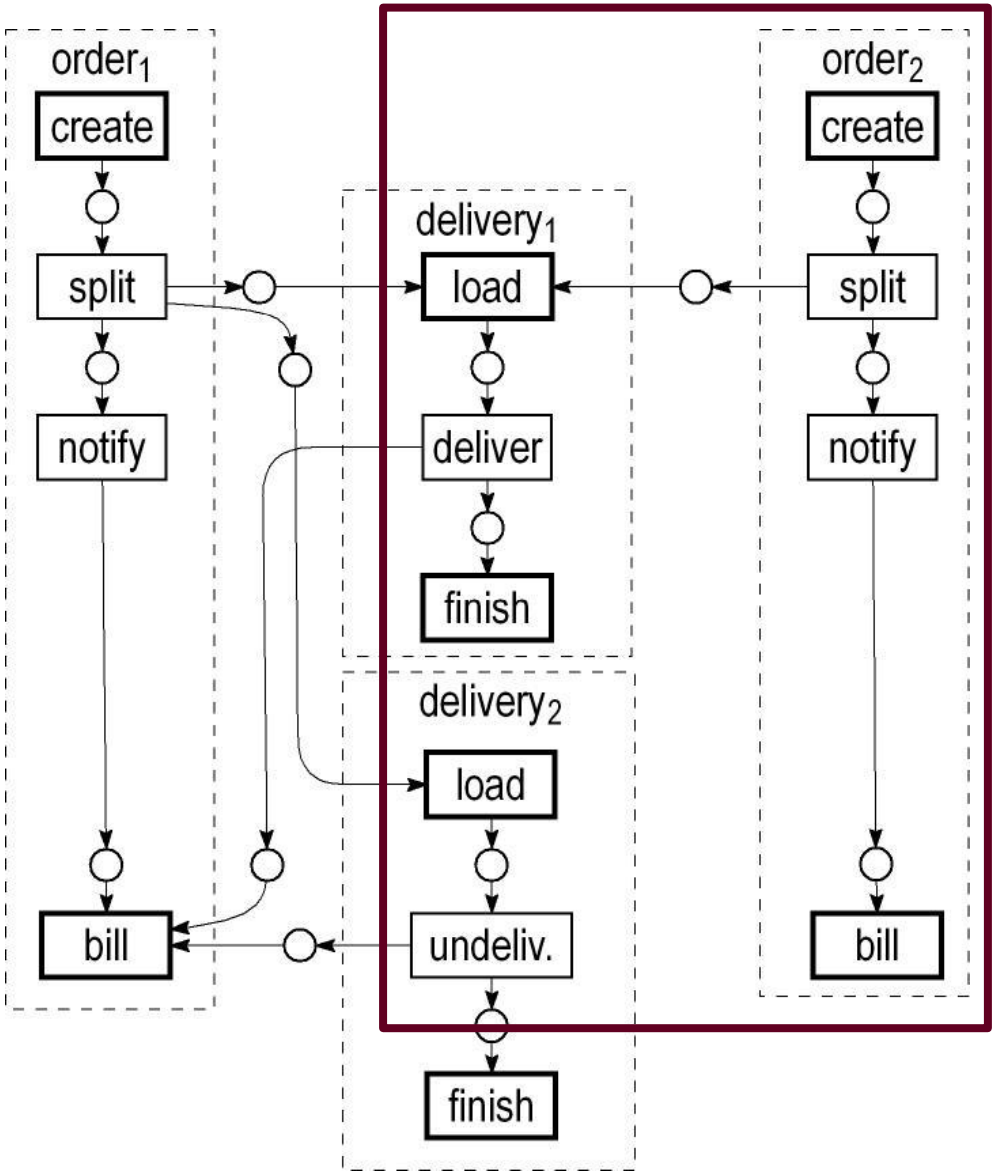


Two Research Problems

- Artifacts
  - a service instance encapsulates a data object
  - relations between data objects:
  - complex communications between service instances

- Two research problems
  1. addressing instances: correlation
  2. completing artifact choreographies

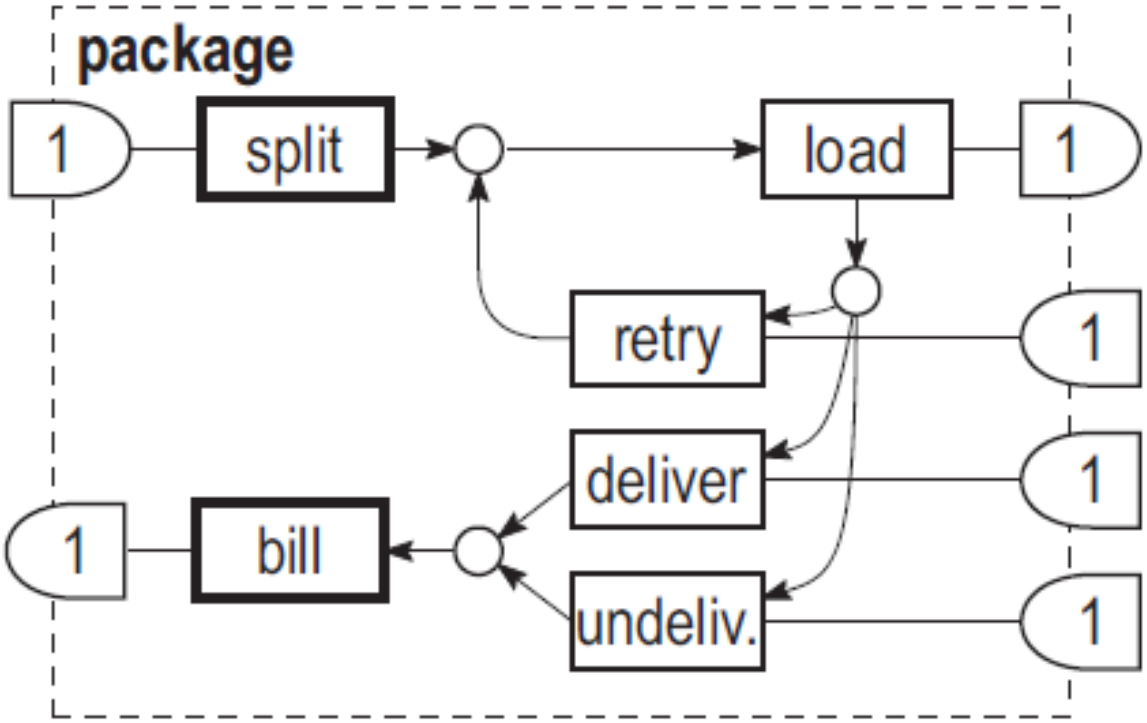
Intuitively not allowed



incomplete conversation

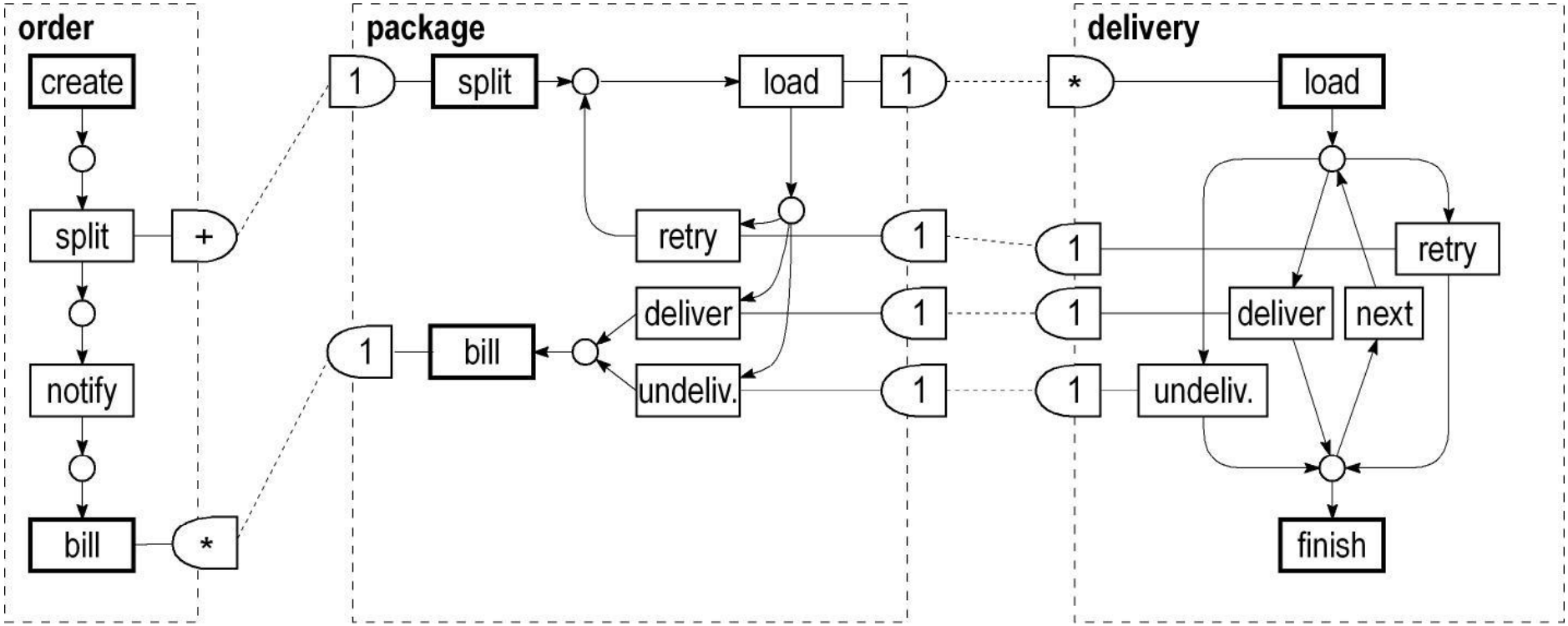
Specify conversations

- describe interaction between service instances
- from start to completion
- proposal: **specify as an artifact again**



Refine choreography

- Replace channels with conversation artifact



- composition: synchronous, dynamic

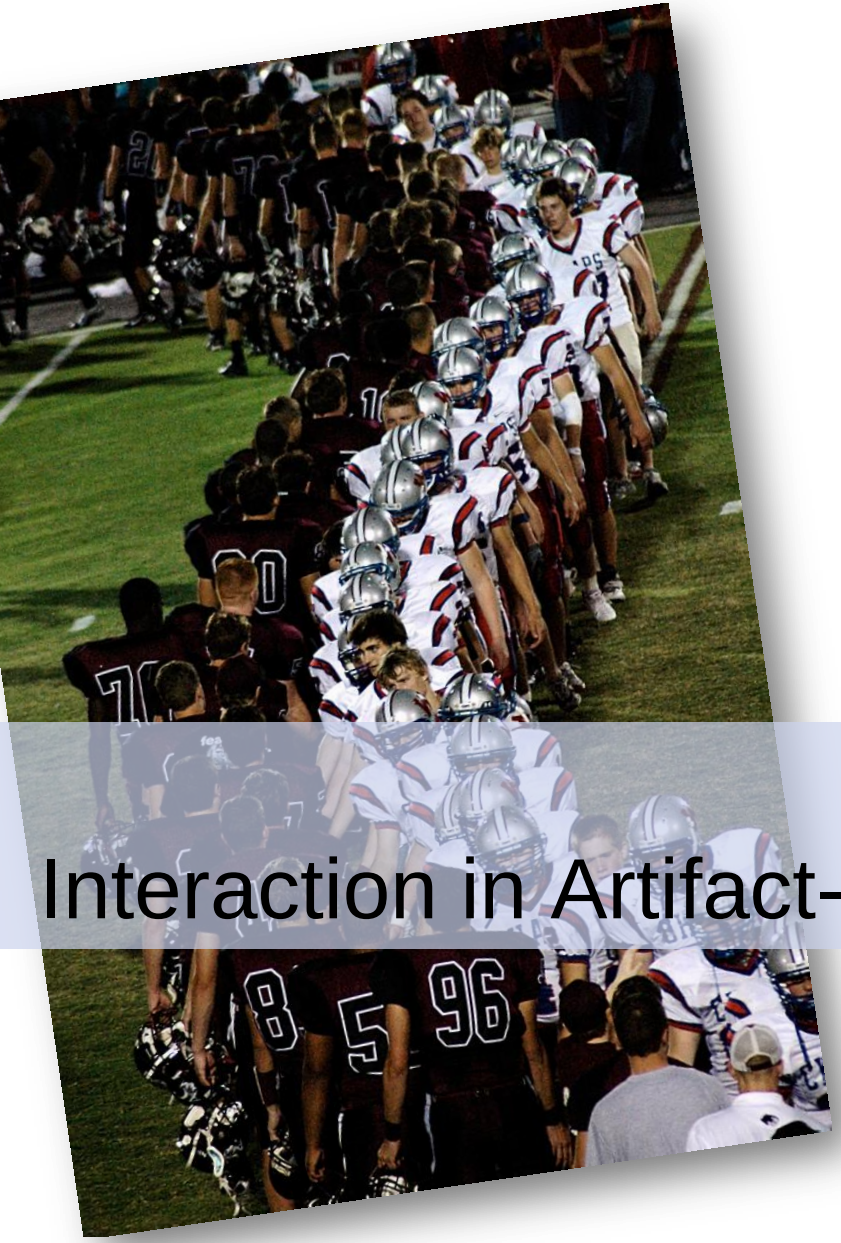
New problem: choreography completion

- Given:
  - artifact choreography with asynchronous channels
  - correlation specification
  - and desired properties, e.g.
    goal states per artifact + “no messages in channels”
- Wanted:
  - conversation artifacts s.t.
  - the composition satisfies the desired properties and
  - artifacts fit correlation specification
    (e.g. each conversation artifact implements associated correlation properties)

Take home points

- Processes in reality are driven by data objects
- Artifacts: each service instance encapsulates a data objects
- Choreography: wiring reflects object relations

- Two new problems
  - More involved correlation: which events belong to one conversation?
  - Choreography completion: find the conversation protocol s.t. the choreography has desired properties



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Many-to-Many:
Interaction in Artifact-Choreographies

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