



SUPER

semantics utilised for
process management
within and between
enterprises

European Integrated Project

SUPER
towards changing the
relationship between business
and IT via semantic Web
services

John Domingue



SUPER

semantics utilised for
process management
within and between
enterprises

European Integrated Project

A SUPER Introduction



- Frank Leymann (University of Stuttgart)
- Christian Brelage (SAP)
- Martin Hepp (DERI Innsbruck)
- Sebastian Stein (IDS Scheer)

- Business layer for IT resources
 - ▶ IT no longer a cost separate from business concerns
 - ▶ IT managed directly by business managers using their own terms
- Business layer is a semantic enhancement of existing business tools
- Relates to an IT layer composed of a semantically enhanced service oriented architecture
- Building blocks
 - ▶ Ontologies
 - ▶ Web service standards stack
 - ▶ Business modelling systems
 - ▶ Semantically Enhanced Software Architectures



Project Overview & Key Figures

- SUPER: **S**emantics **U**tilised for **P**rocess management within and between **E**nte**R**prises
- EU Integrated Project (IP)
- Program: Information and Society Technologies
- Duration: 36 months
- Start: April 2006
- Funding: ~16,4 Million € (funded ~11 Million €)
- 19 Partners, ~60 Researchers
- Project Lead: SAP
- Scientific Director: John Domingue

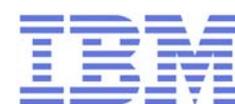
Management & Exploitation & Dissemination



Core Research & Framework



The Open University



Universität Stuttgart
Germany



Concepts & Tools & Architecture



iSOCO



National University of Ireland, Galway
Ollscoil na hÉireann, Gaillimh



Use Cases



NEXCOM



Management & Exploitation & Dissemination



Core Research & Framework



Concepts & Tools & Architecture



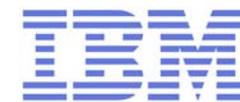
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Management & Exploitation & Dissemination



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Use Cases





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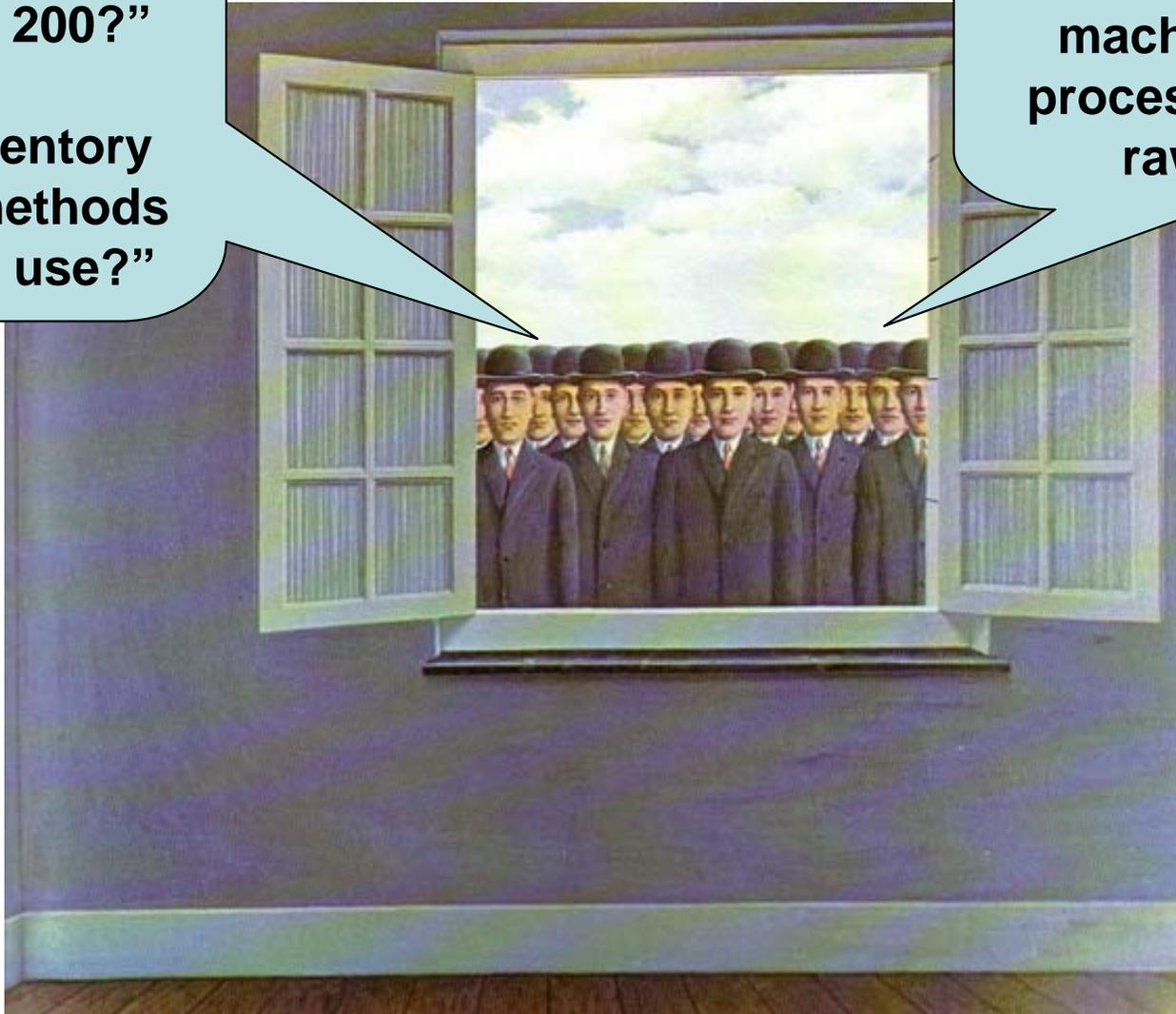
European Integrated Project

The SUPER Problem

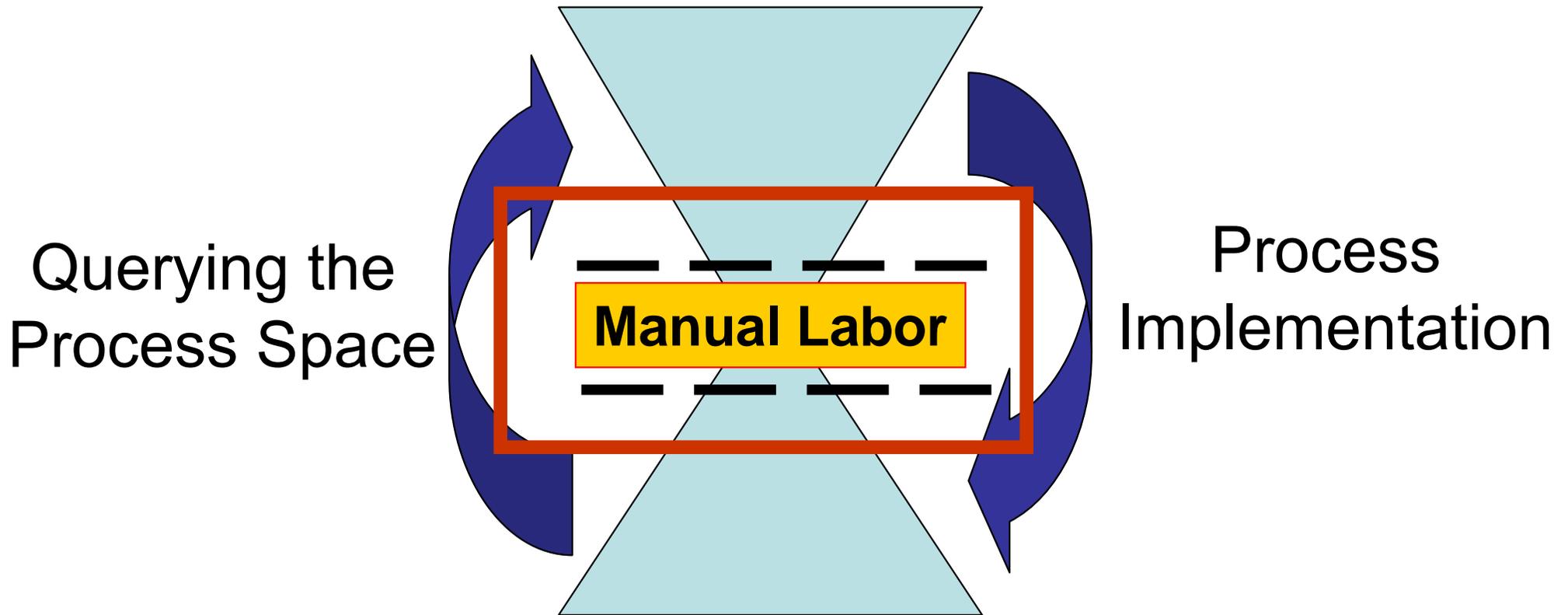
“Do we have a cost approval process for items below \$ 200?”

“How many inventory management methods are currently in use?”

“In which of our food manufacturing machines are we processing meat or raw eggs?”

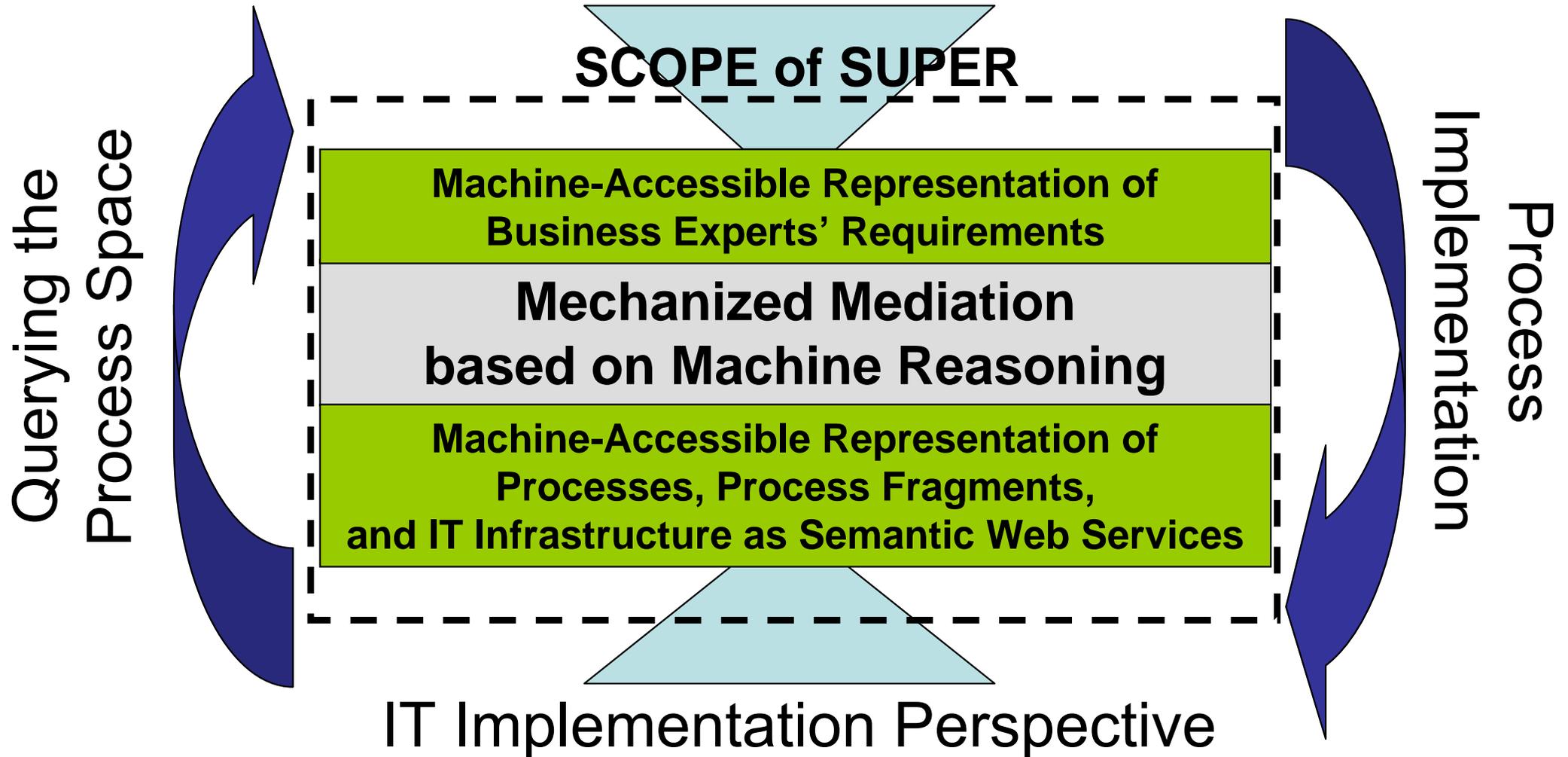


Business Experts' Perspective: Processes



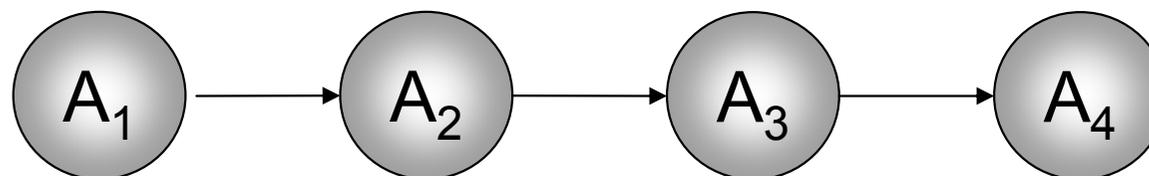
IT Implementation Perspective

Business Experts' Perspective: Processes





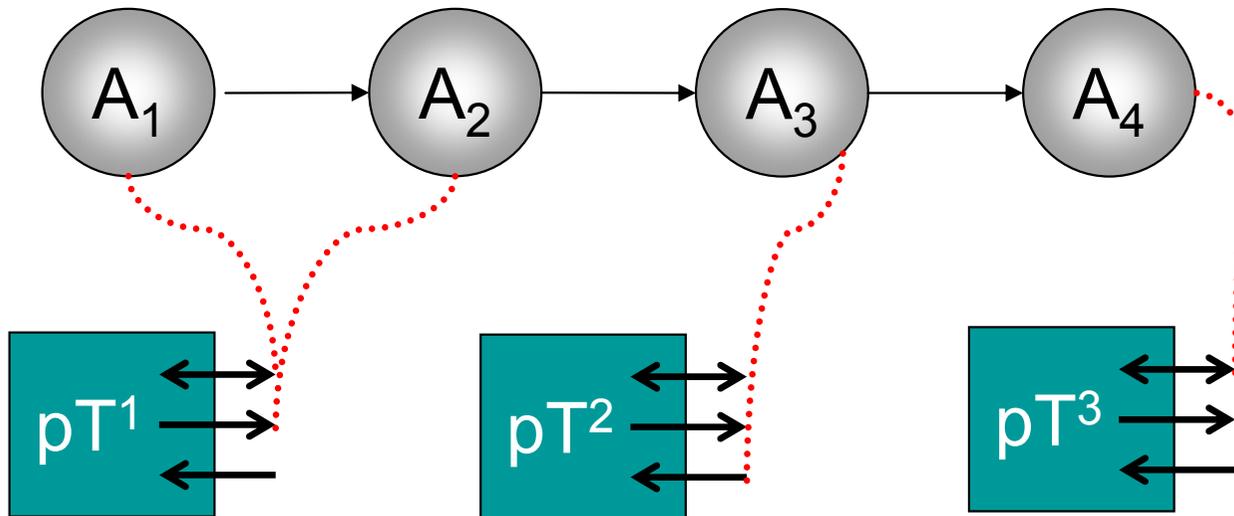
Here is my business process!
I think this solves my business
problem nicely...



Nice try, but it won't run...
You need to specify the services that
perform each step!



I don't understand about these technical details! This is my view on the process...



o.k. no problem, I will help you...

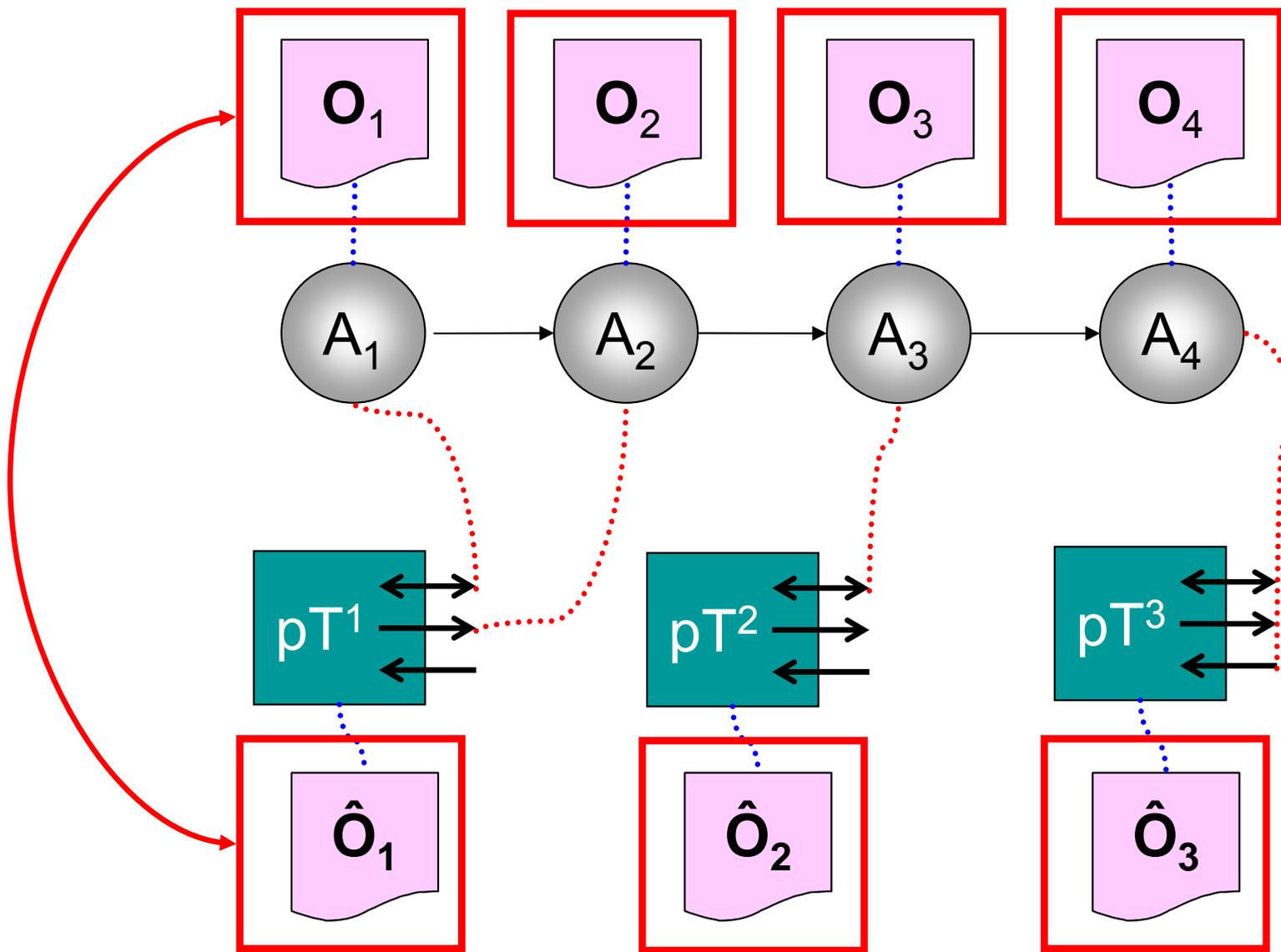


This is cumbersome!
Why do I always need IT staff to solve my
business problems?

It takes too long to get these folks, they use
different terminology than I do...

I am happy to describe what the activities do in
my terms.

Can the system be smart enough and find the
right services itself???



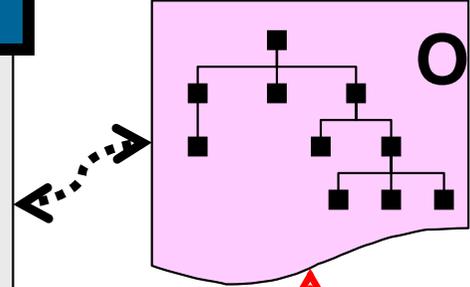
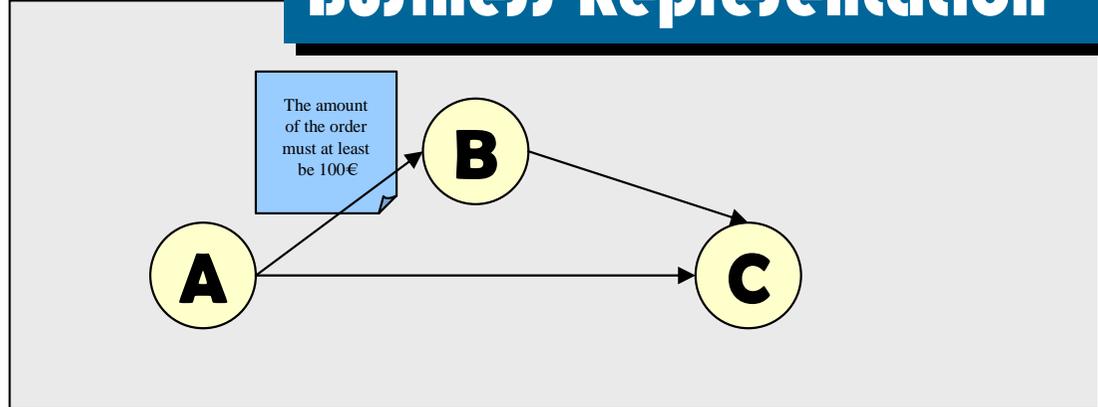
Semantic Web Services



Why do I have to draw everything?
Why do I have to use “expressions” and that technical
stuff at all?
Why isn't my description sufficient?

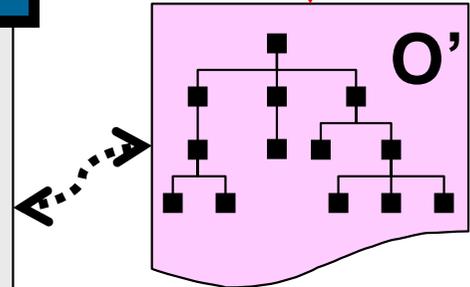
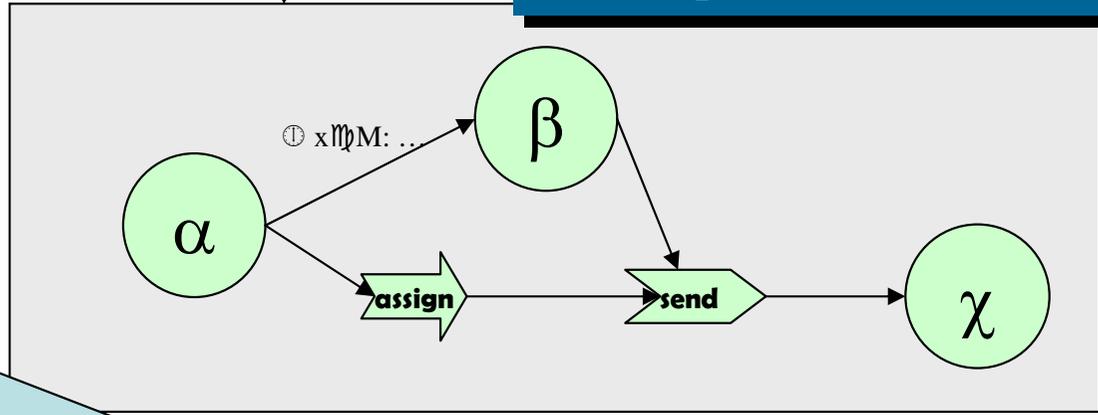
Here is my business process!

Business Representation



M

IT Representation



↕



Wow! This is perfect – nothing left to do for me!



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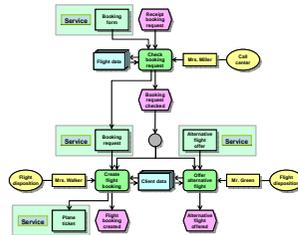
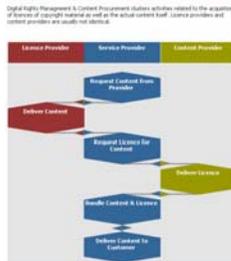
The SUPER Approach



- Making sense of a domain\problem
- Communication tool
- What is it all about?

- Solution maps
- Mind maps
- Ad-hoc modelling techniques
- ...

Digital Rights Management & Content Procurement



- Visualizing\specifying business process
- Focus: Business Problem
- Who does what, when, how and why?
- Usually multiple layers

- Business Scenario Maps
- Event-driven process chains
- Flowchart techniques
- BPMN
- ...

Digital Rights Management & Content Procurement

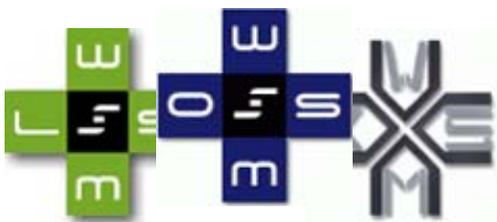
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- Process execution specification
- Formal, clearly specified grammar
- Focus: Implementation
- Which component is called when, how, by whom with which data?

- BPEL
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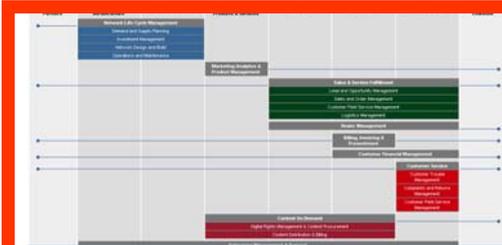
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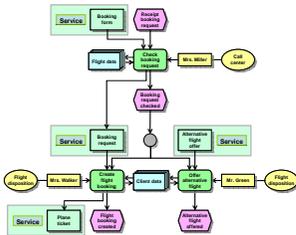
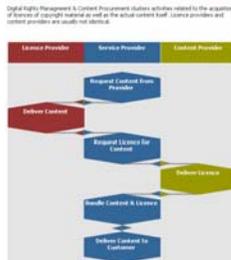
- Programming languages
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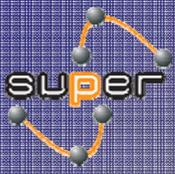
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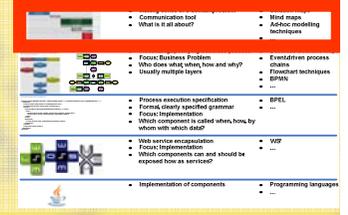


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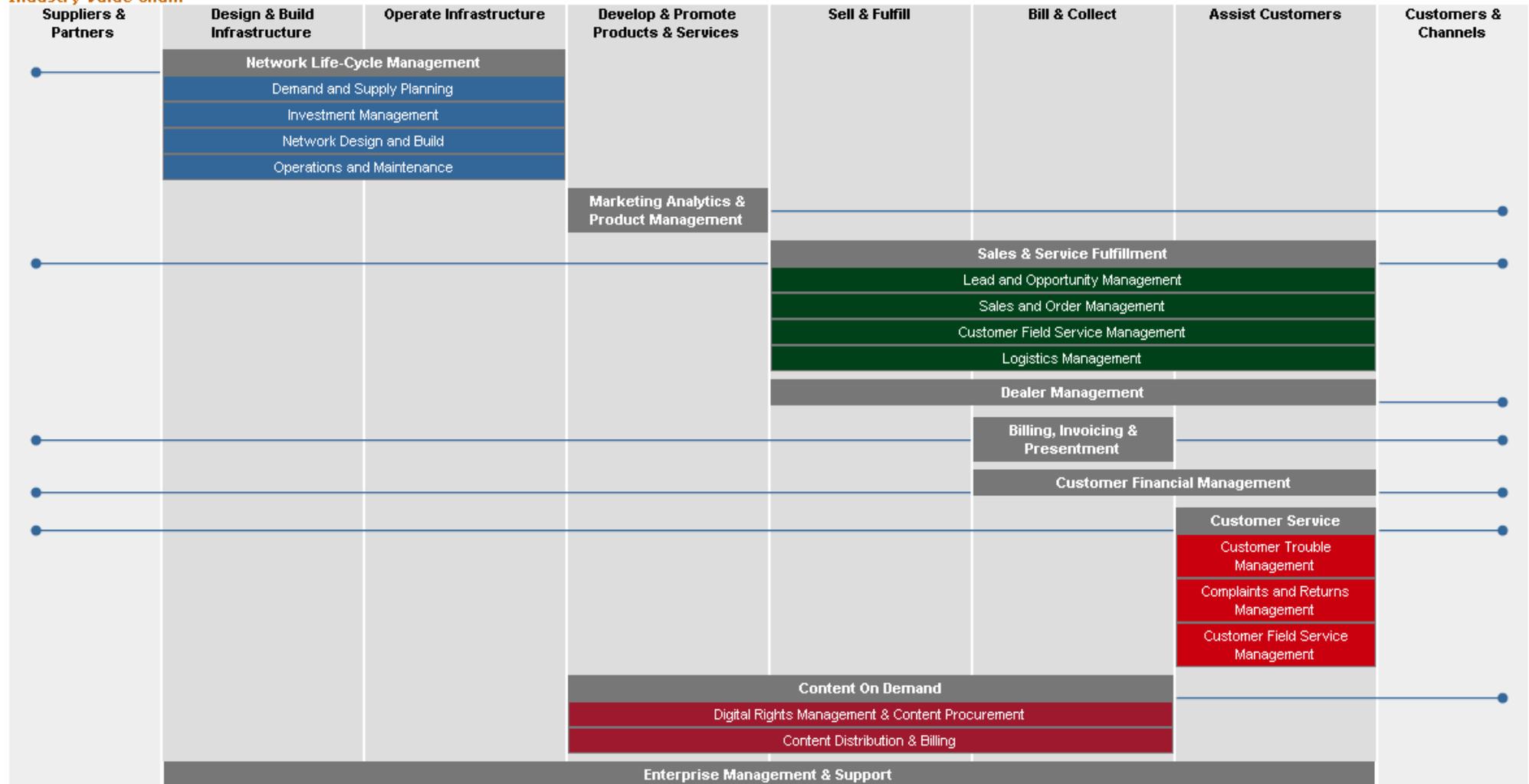
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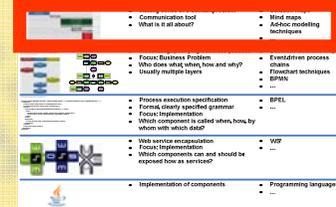


Telecommunications Solution Map

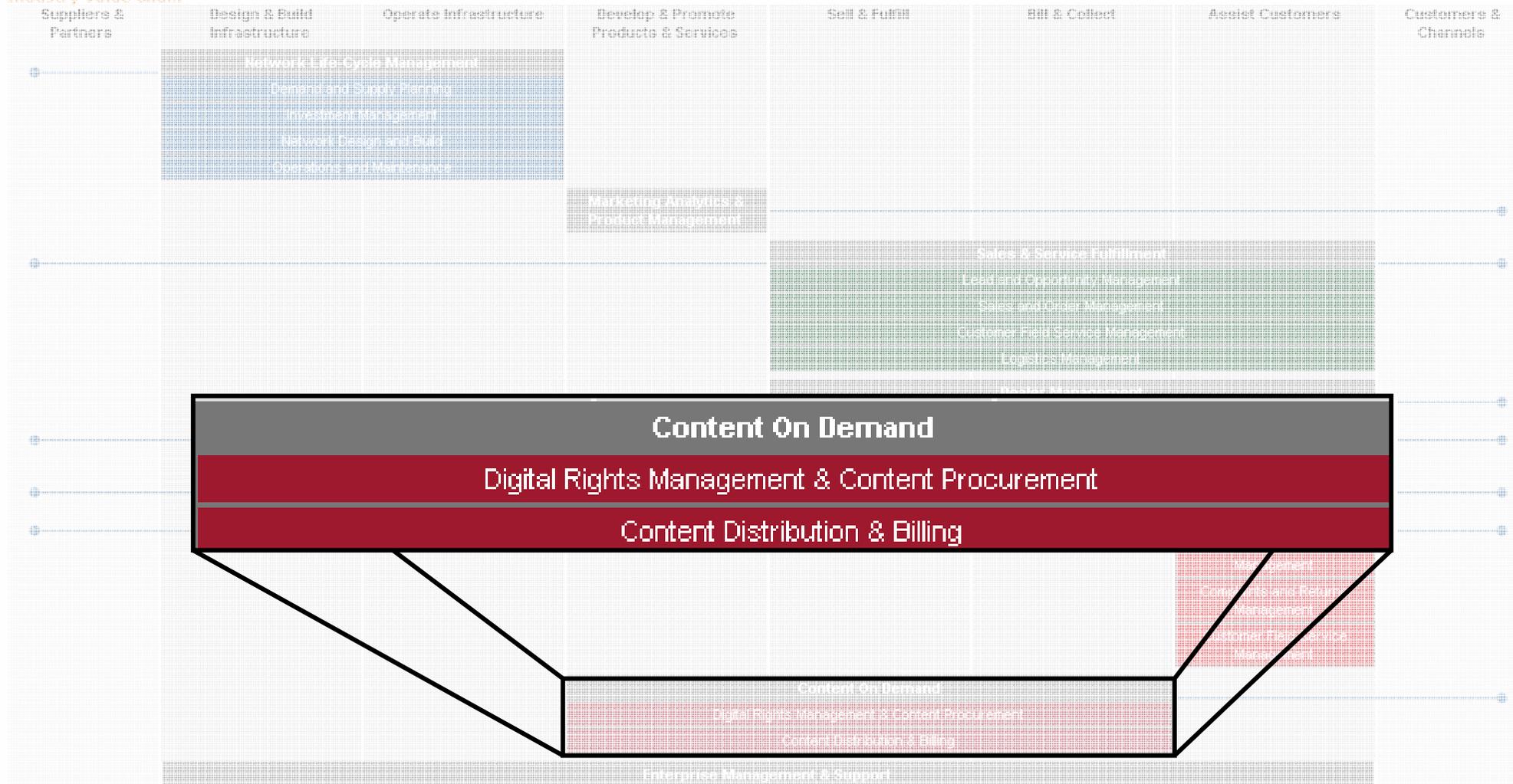


Industry Value Chain



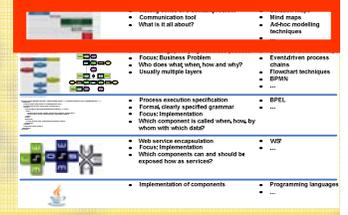


Industry Value Chain





Digital Rights Management & Content Procurement



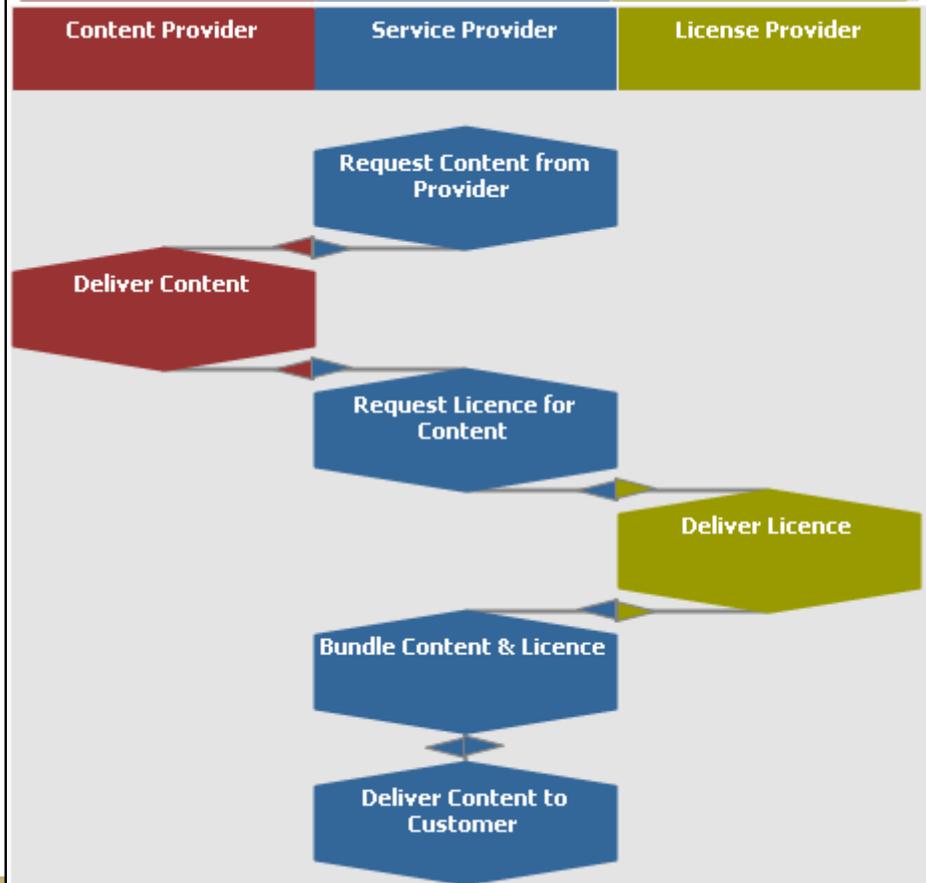
Content On Demand

Digital Rights Management & Content Procurement

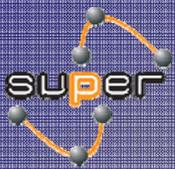
Content Distribution & Billing

Digital Rights Management & Content Procurement

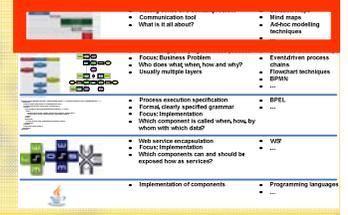
Digital Rights Management & Content Procurement clusters activities related to the acquisition of licences of copyright material as well as the actual content itself. Licence providers and content providers are usually not identical.



Digital Rights Management & Content Procurement



Digital Rights Management & Content Procurement



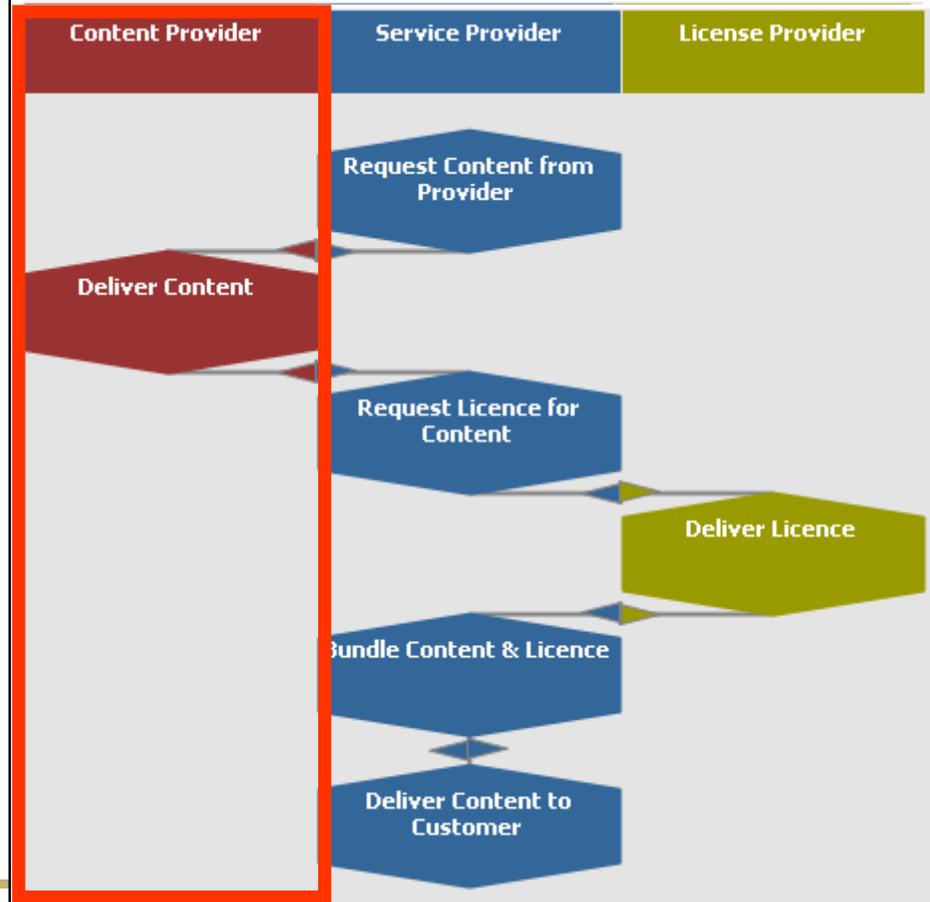
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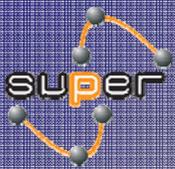
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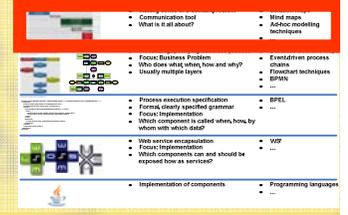
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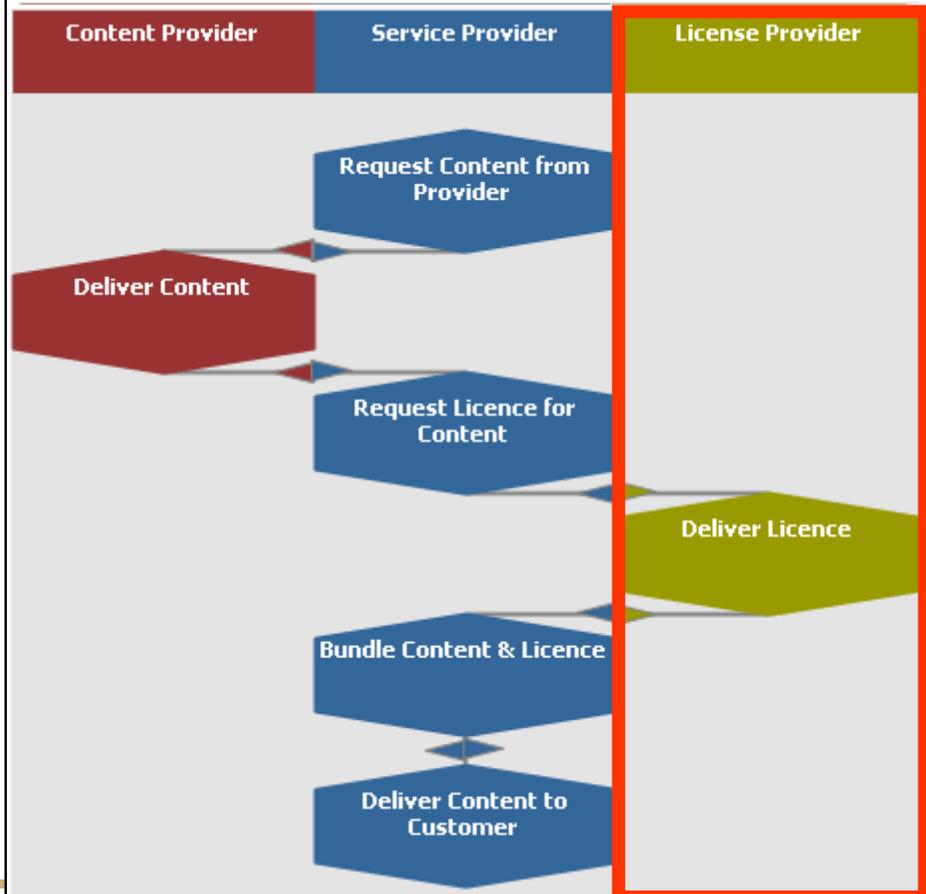
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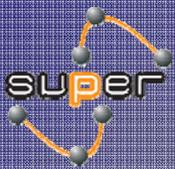
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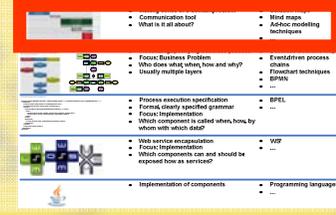
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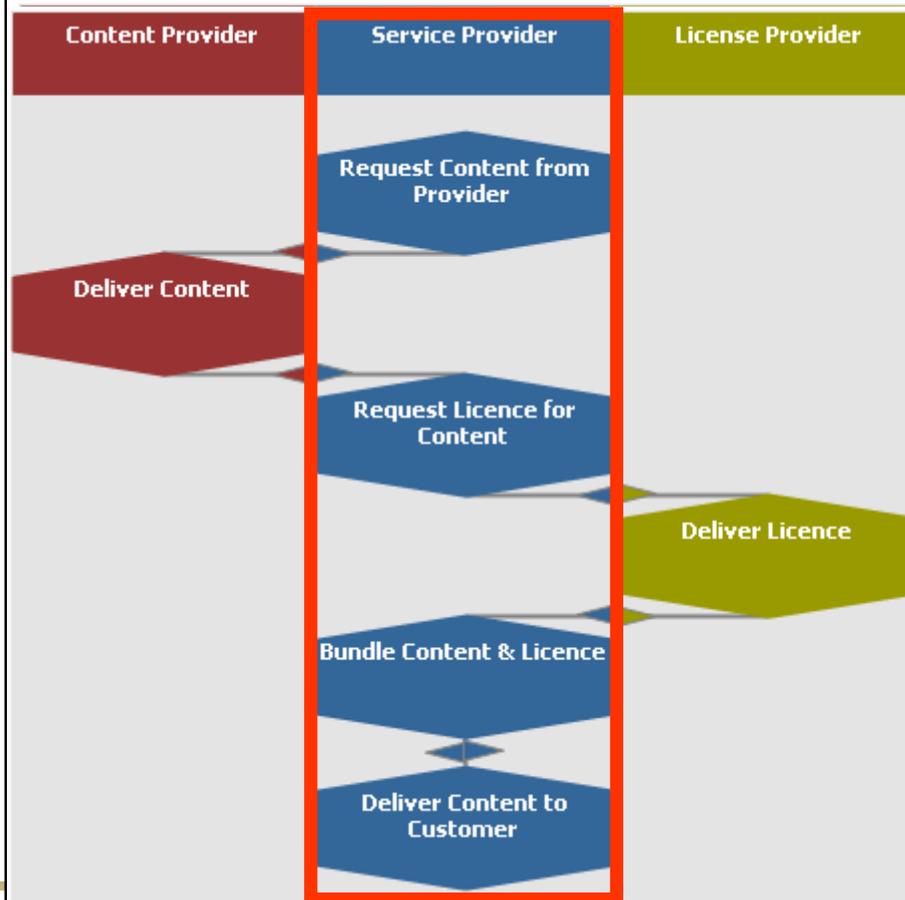
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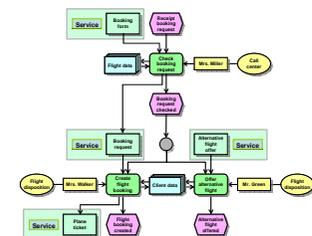
Digital Rights Management & Content Procurement



- Making sense of a domain\problem
- Communication tool
- What is it all about?

- Solution maps
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Digital Rights Management & Content Procurement



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Digital Rights Management & Content Procurement

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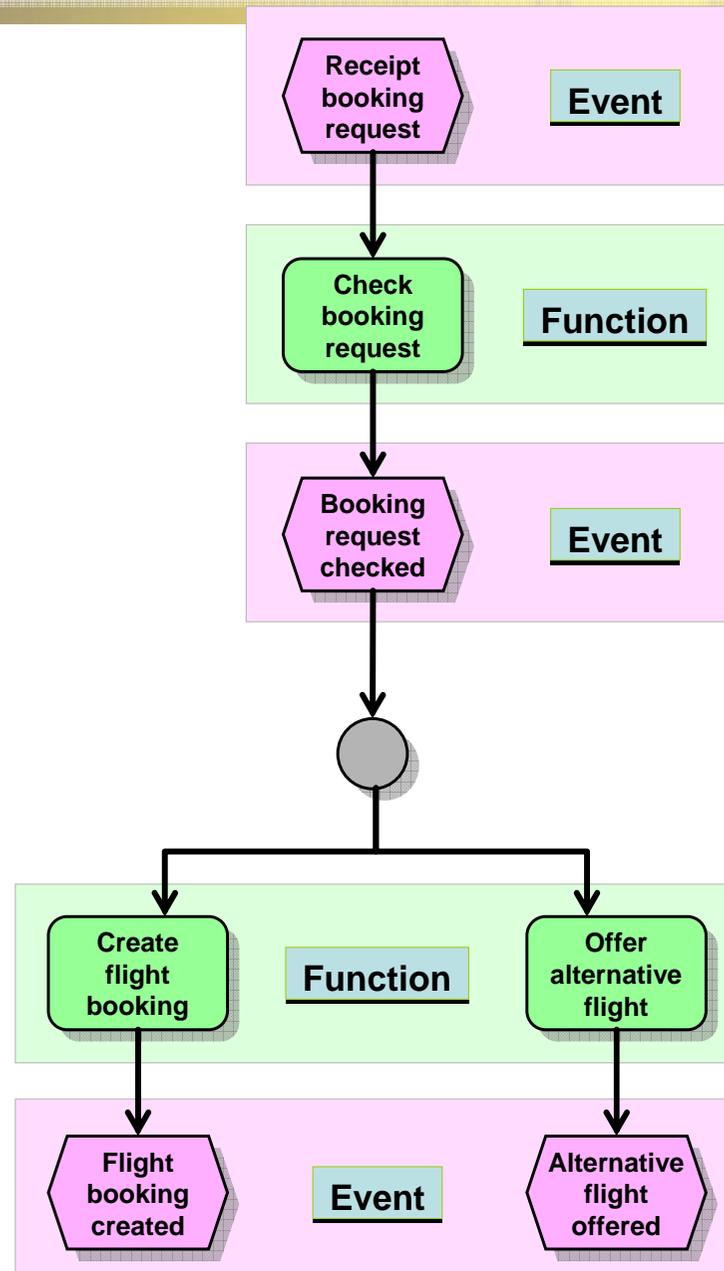


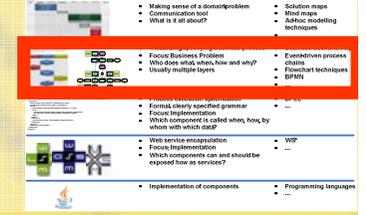
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Events trigger functions

Functions generate events



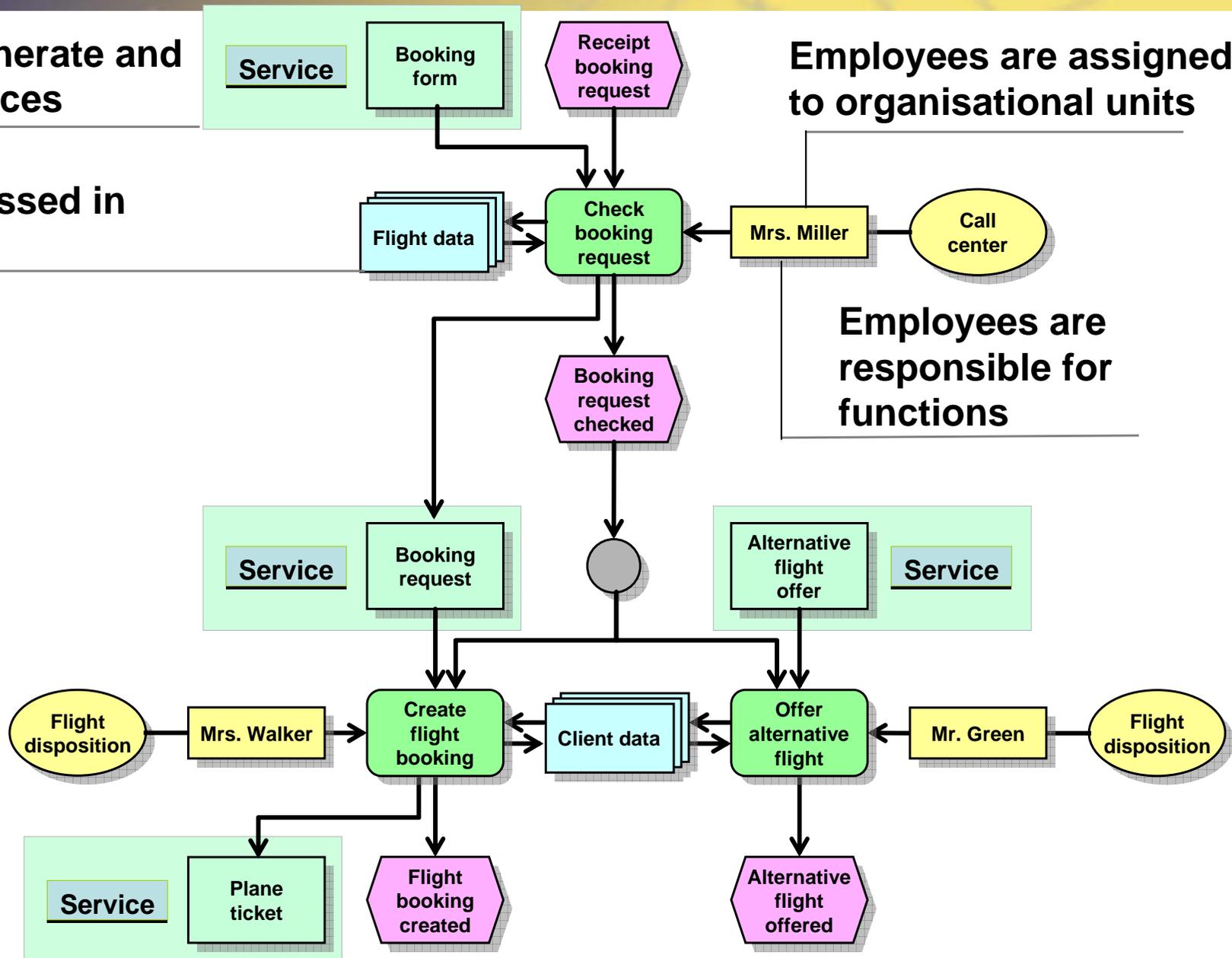


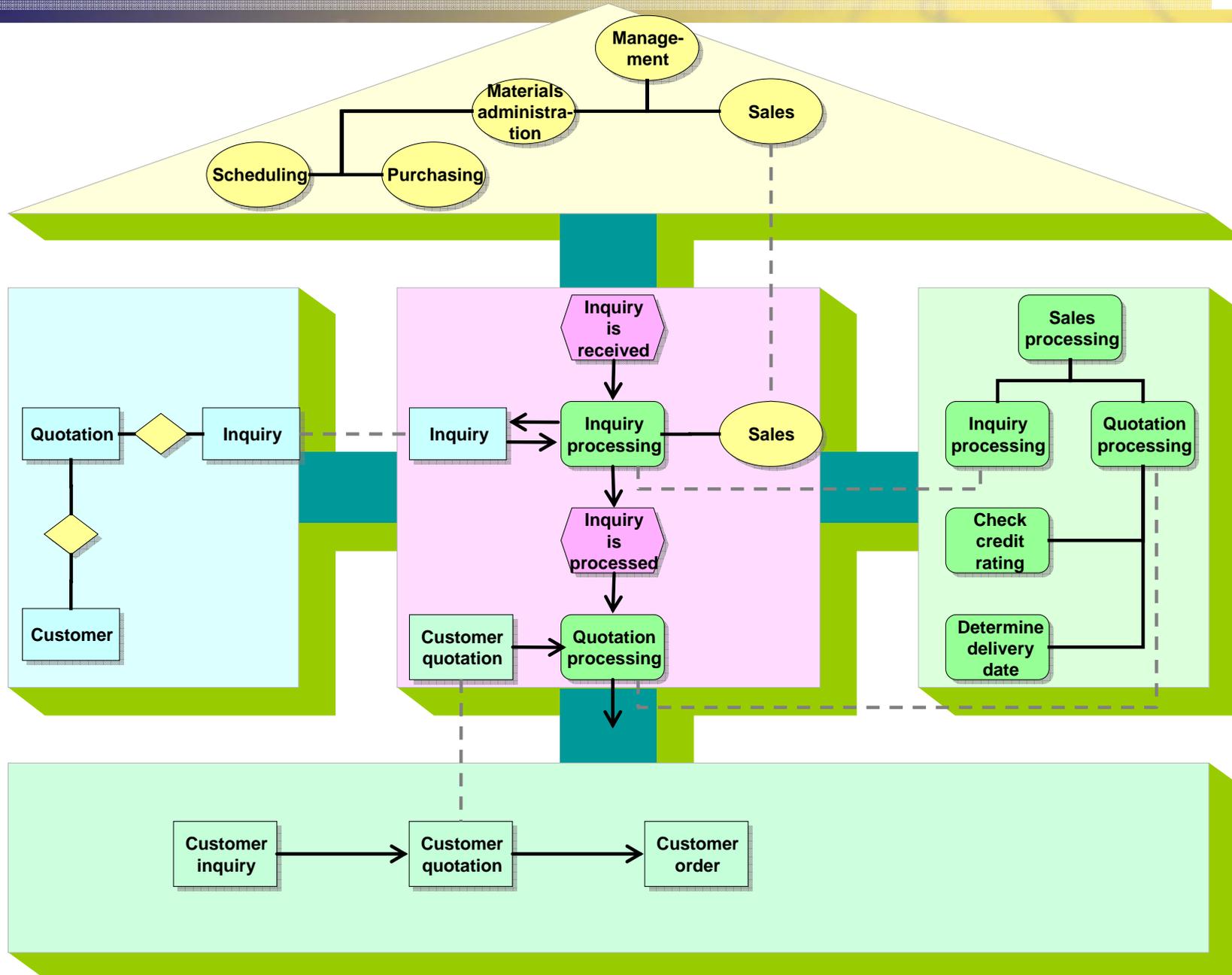
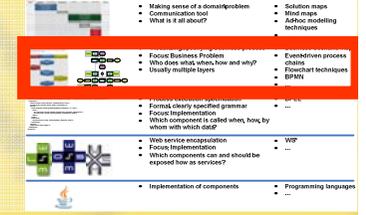
Functions generate and process services

Data is processed in functions

Employees are assigned to organisational units

Employees are responsible for functions



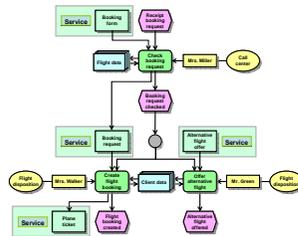




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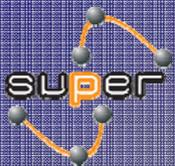
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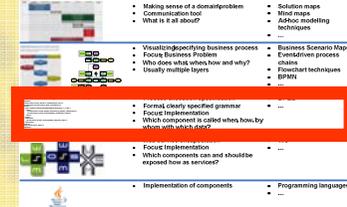


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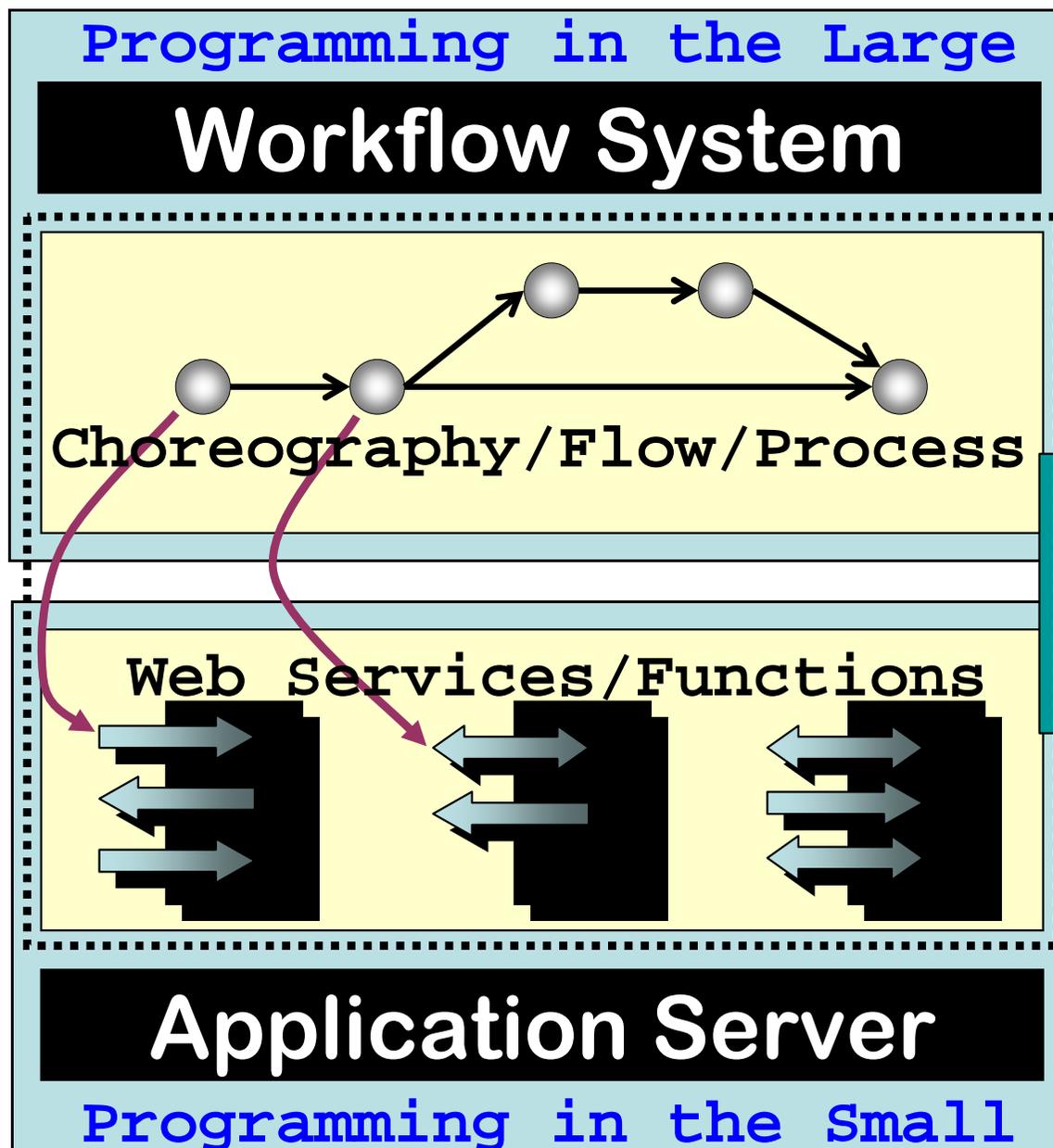
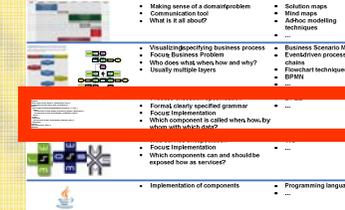


BPEL Developers

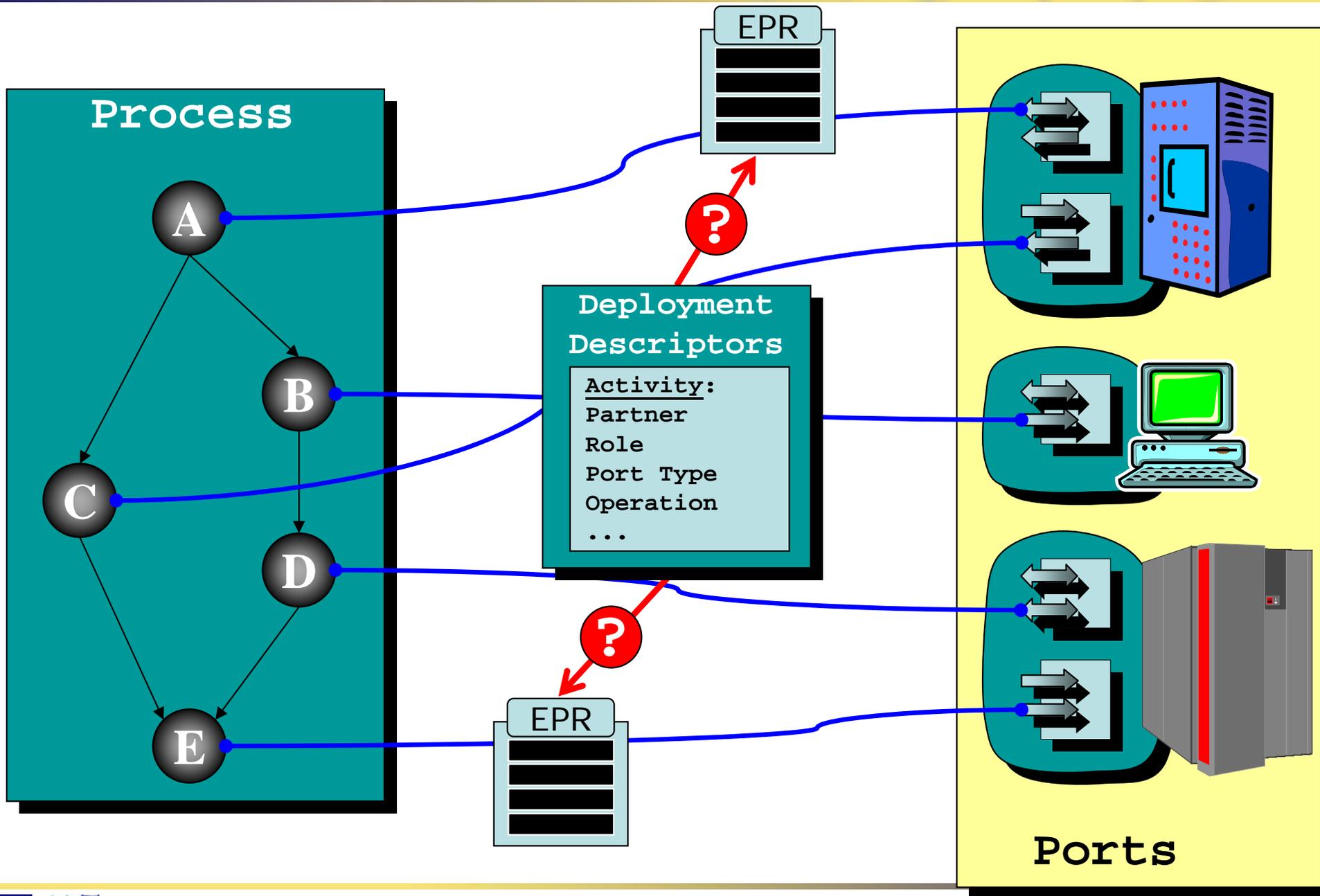


Advancing E-Business Standards Since 1993

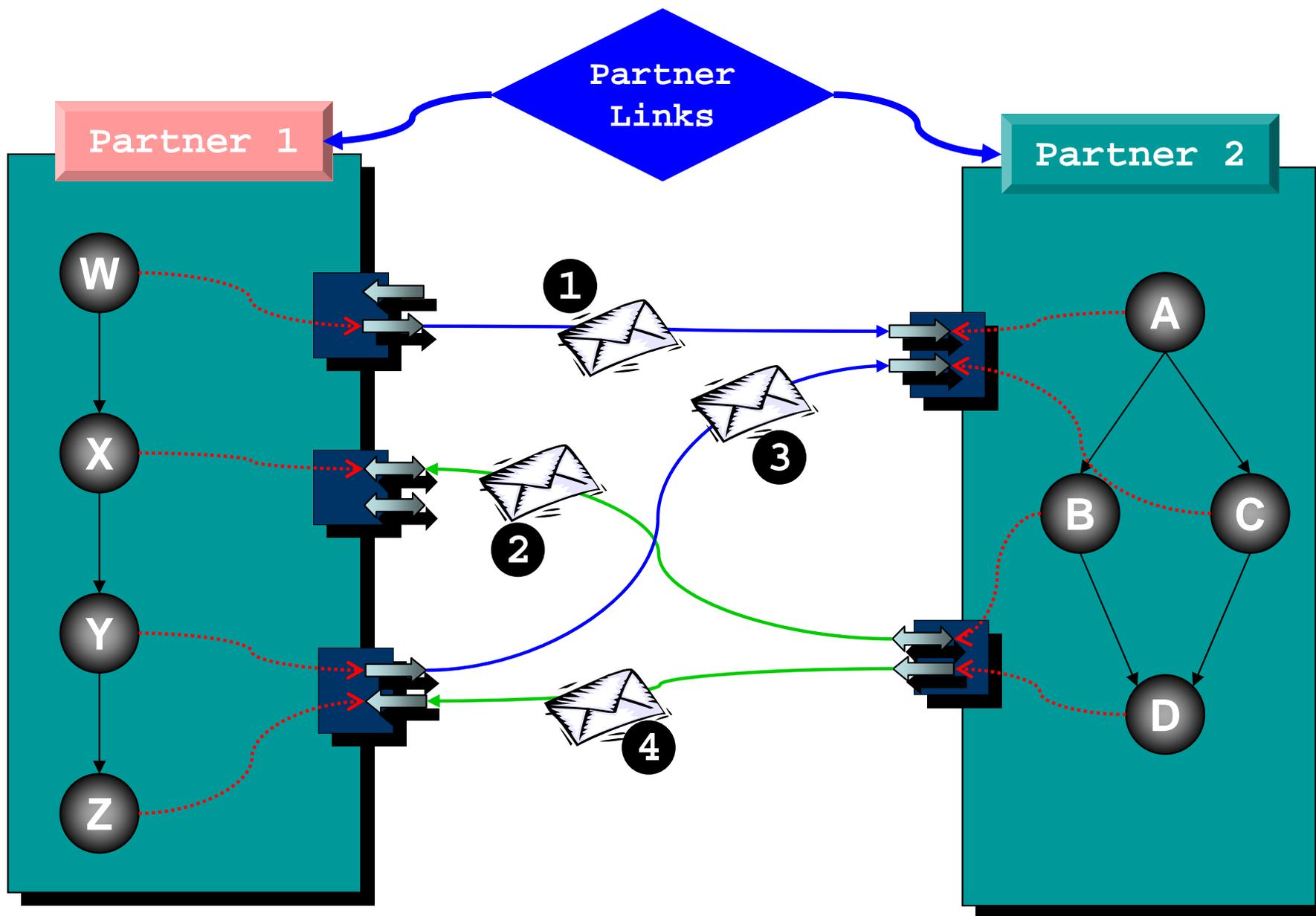


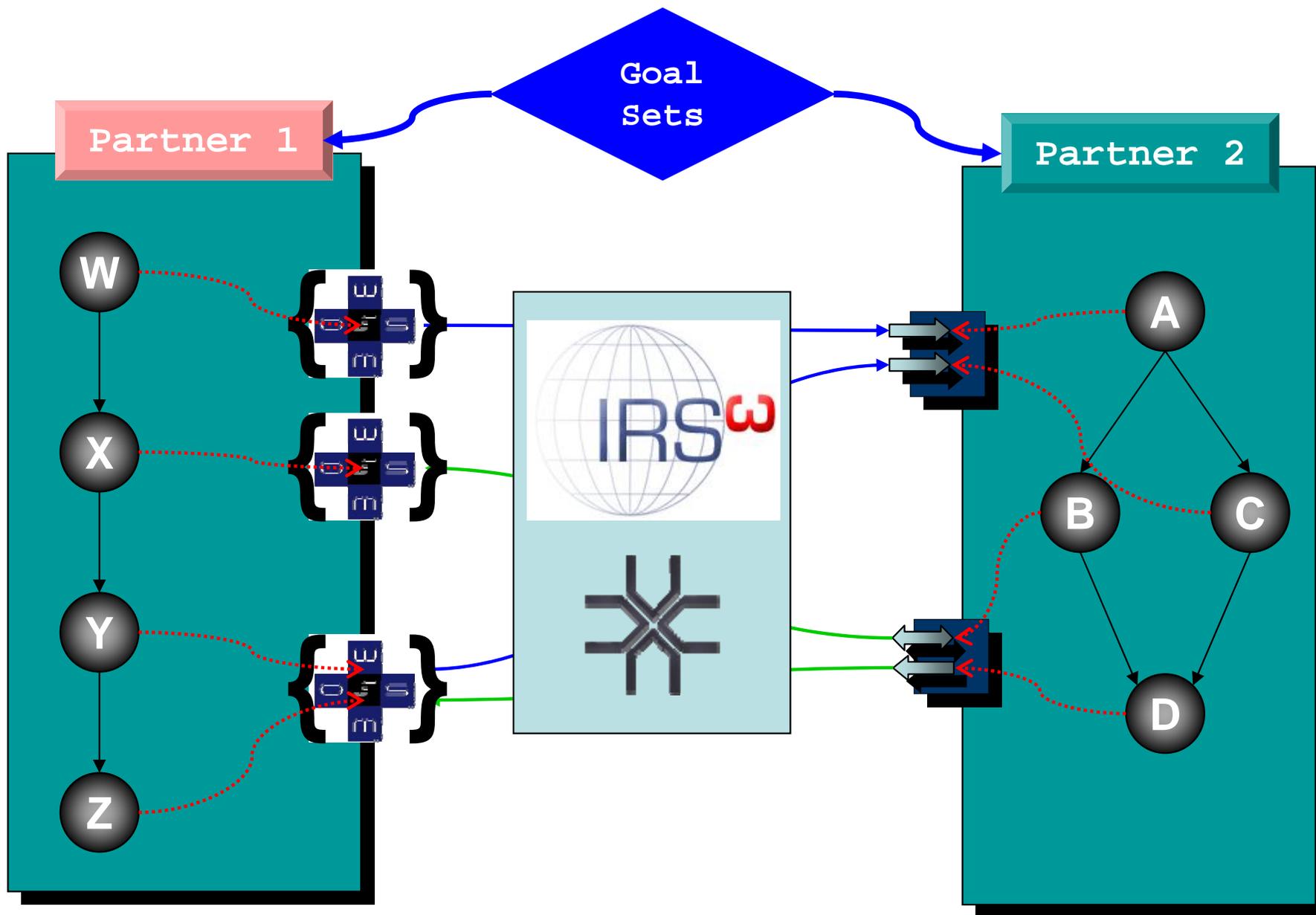


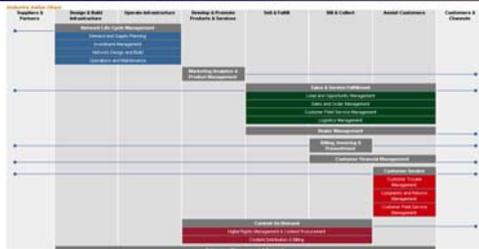
Application



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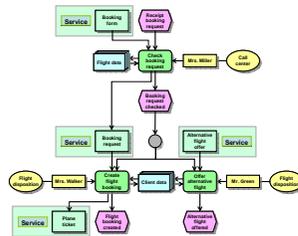
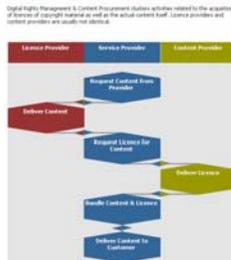




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      </case>
      <otherwise>
        <invoke name="Invoke_CustomerReply_Rejection_Note"/>
      </otherwise>
    </switch>
    <reply name="Final_Reply"/>
  </sequence>
</process>

```

- Process execution specification
- Formal, clearly specified grammar
- Focus: Implementation
- Which component is called when, how, by whom with which data?

- BPEL
- ...



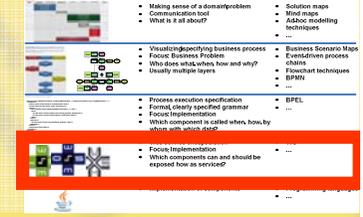
- Web service encapsulation
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- Which components can and should be exposed how as services?

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- ...



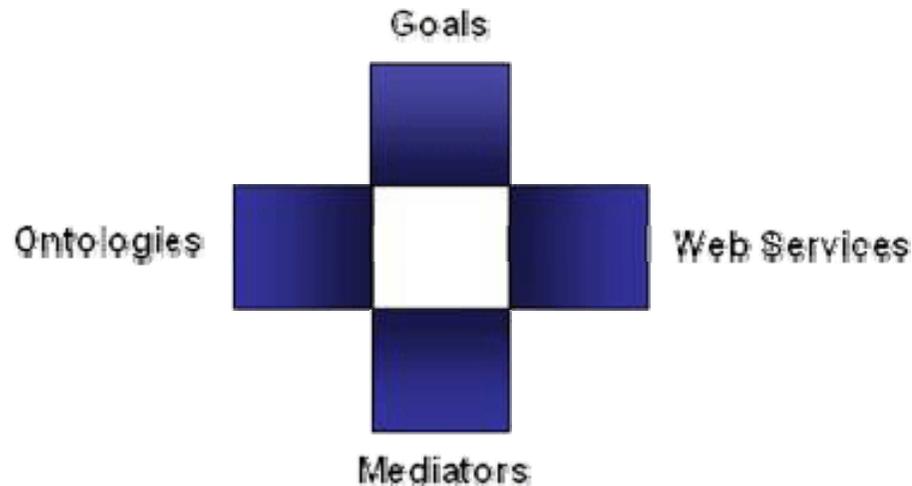
- Implementation of components

- Programming languages
- ...



Objectives that a client wants to achieve by using Web Services

Provide the formally specified terminology of the information used by all other components



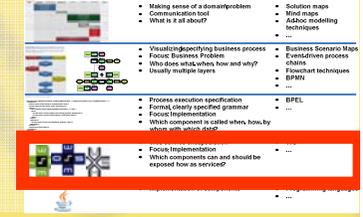
Semantic description of Web Services:
 - Capability (*functional*)
 - Interfaces (*usage*)



Data, Information and Process Integration with Semantic Web Services

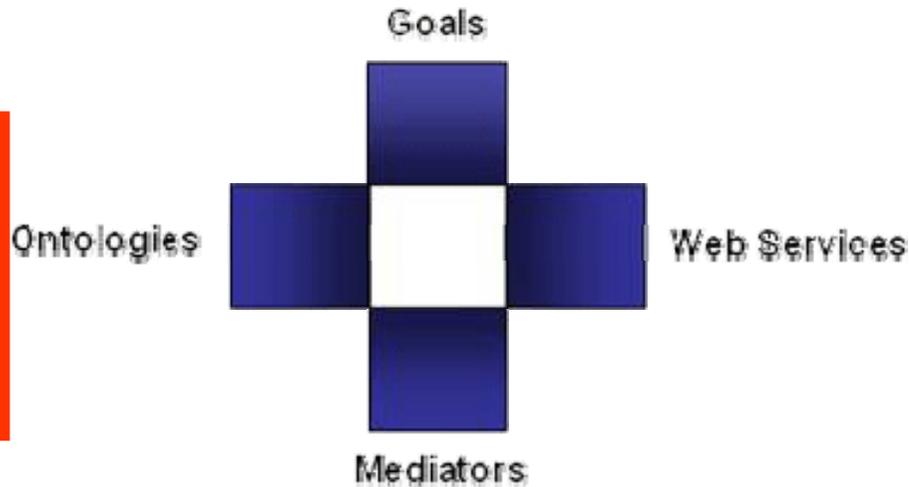
Connectors between components with mediation facilities for handling heterogeneities





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Semantic description of Web Services:

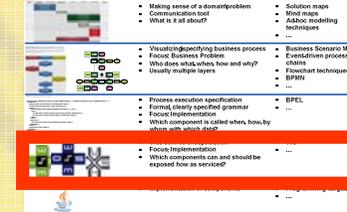
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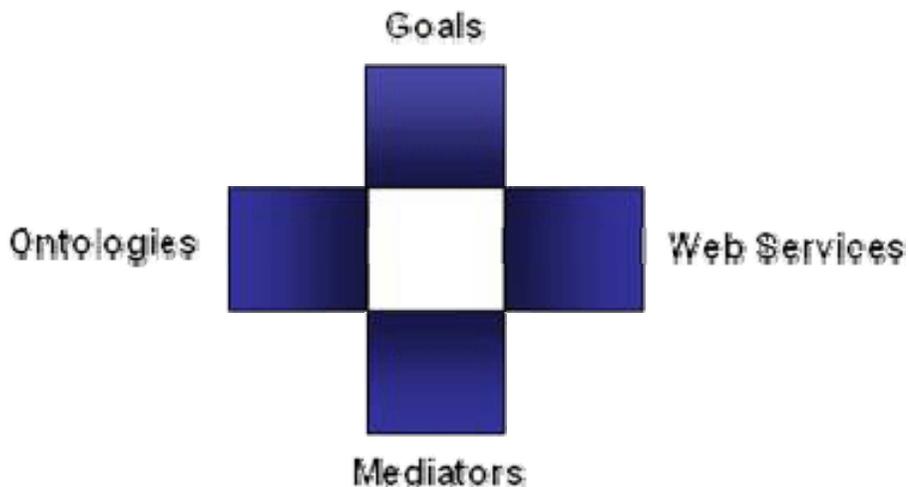
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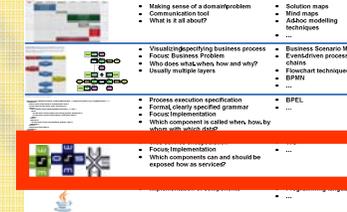
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Data, Information and Process Integration with Semantic Web Services

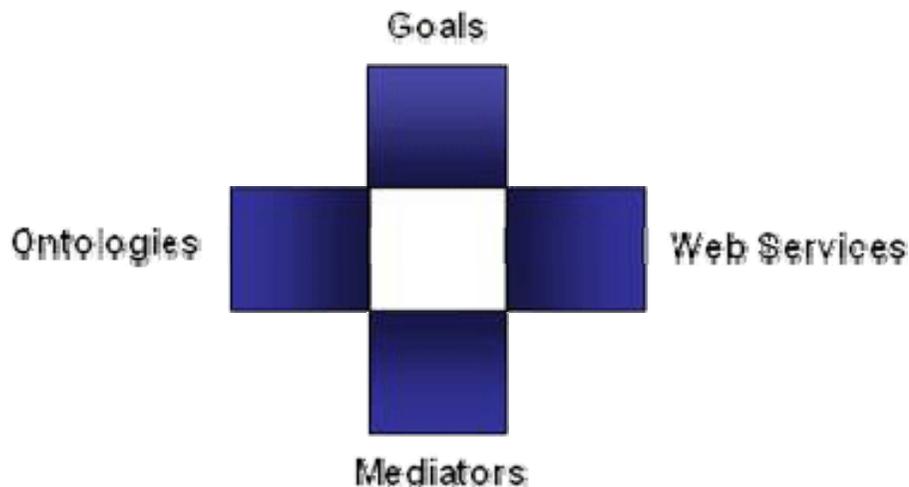
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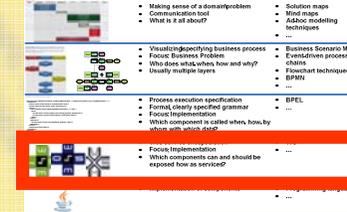
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Data, Information and Process Integration with Semantic Web Services

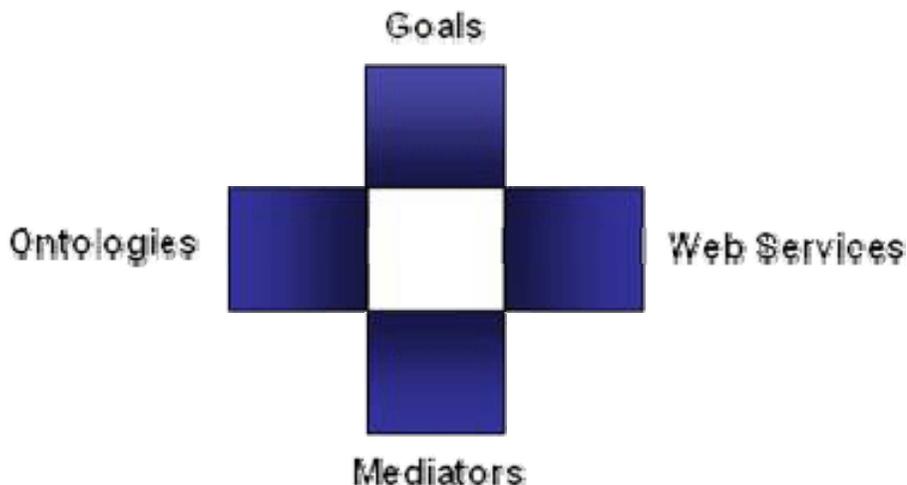
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Data, Information and Process Integration with Semantic Web Services

Connectors between components with mediation facilities for handling heterogeneities



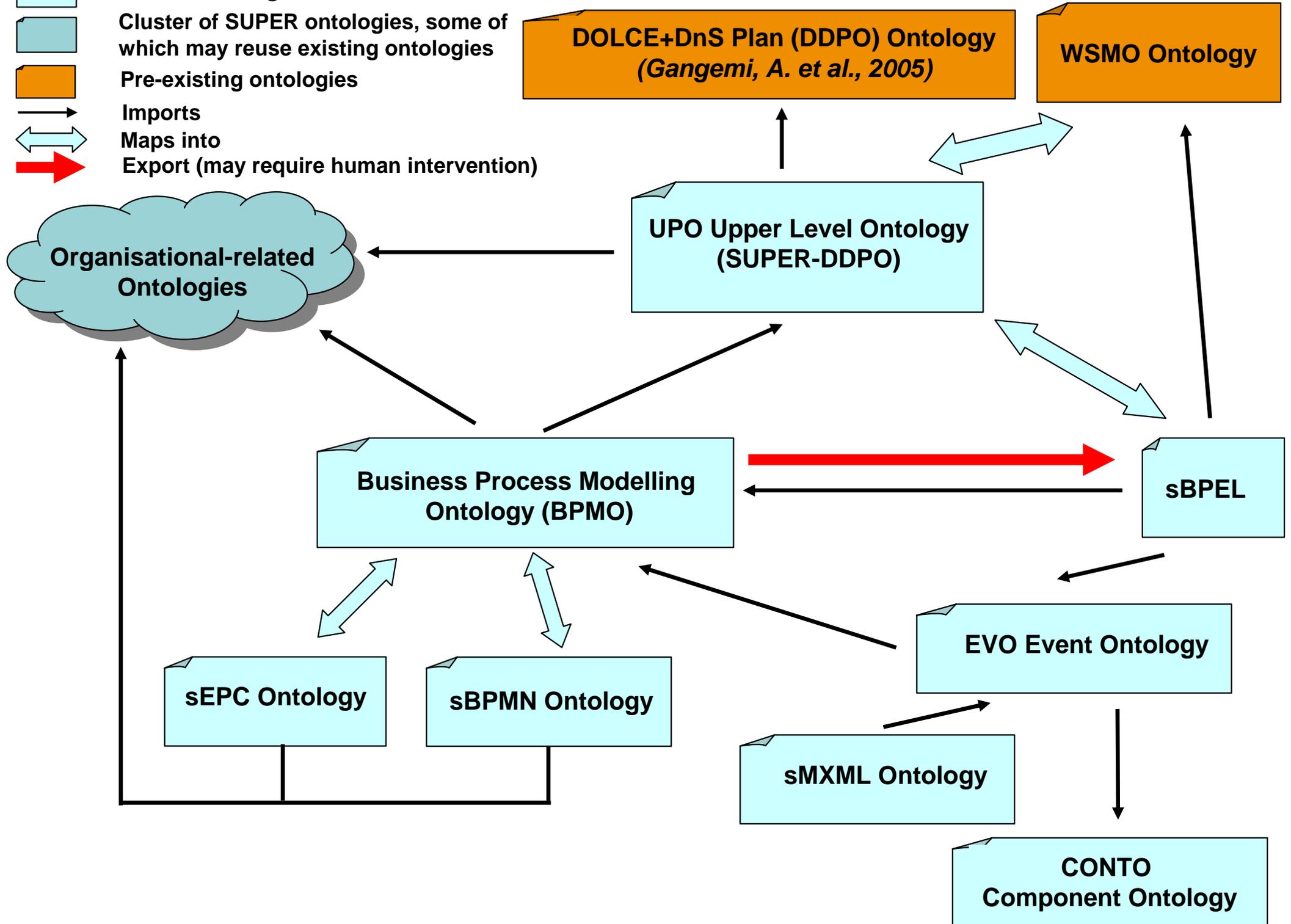
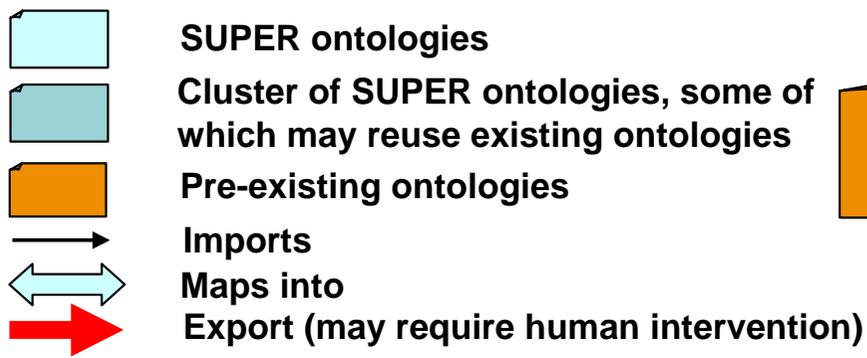


SUPER

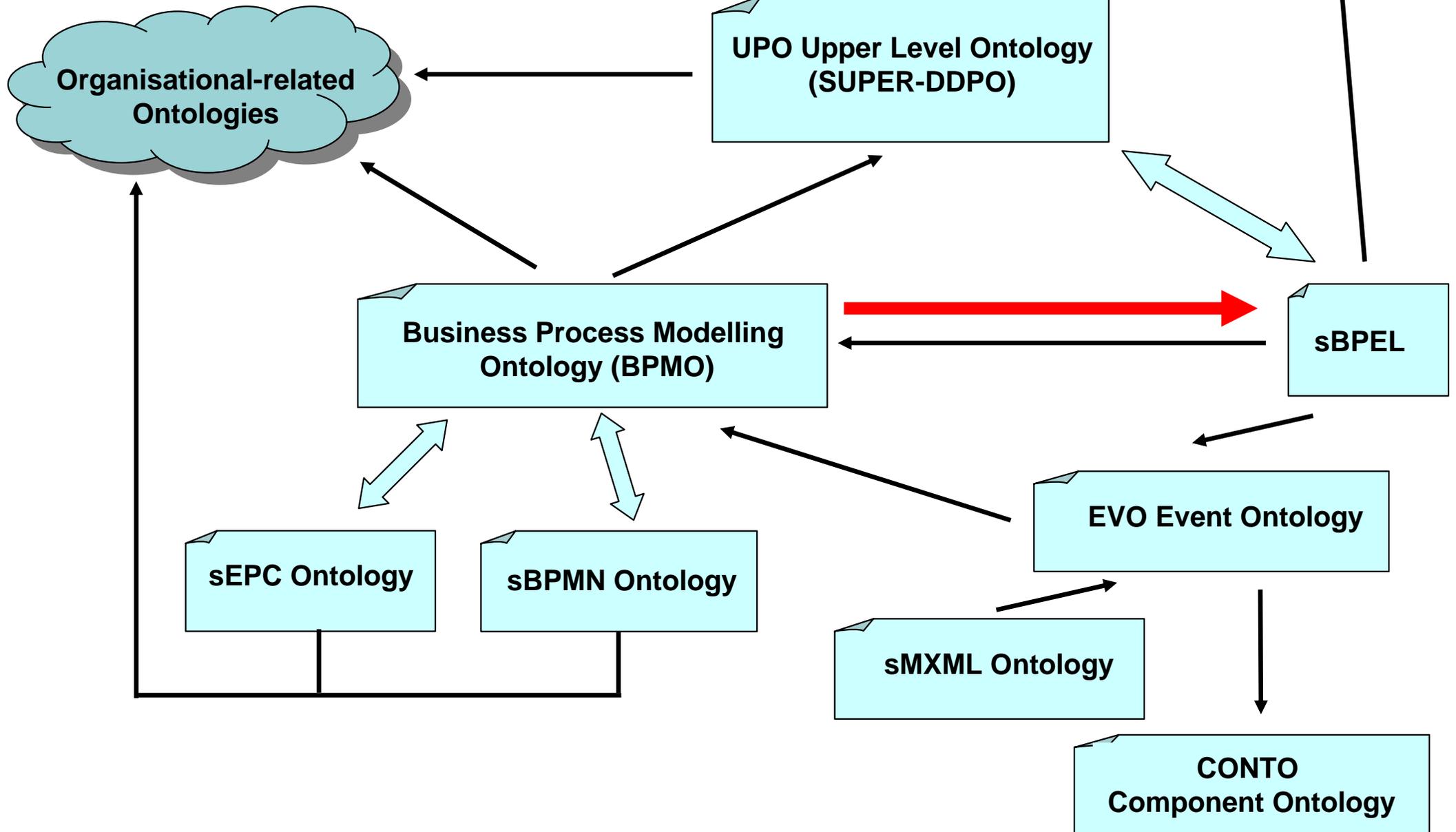
semantics utilised for
process management
within and between
enterprises

European Integrated Project

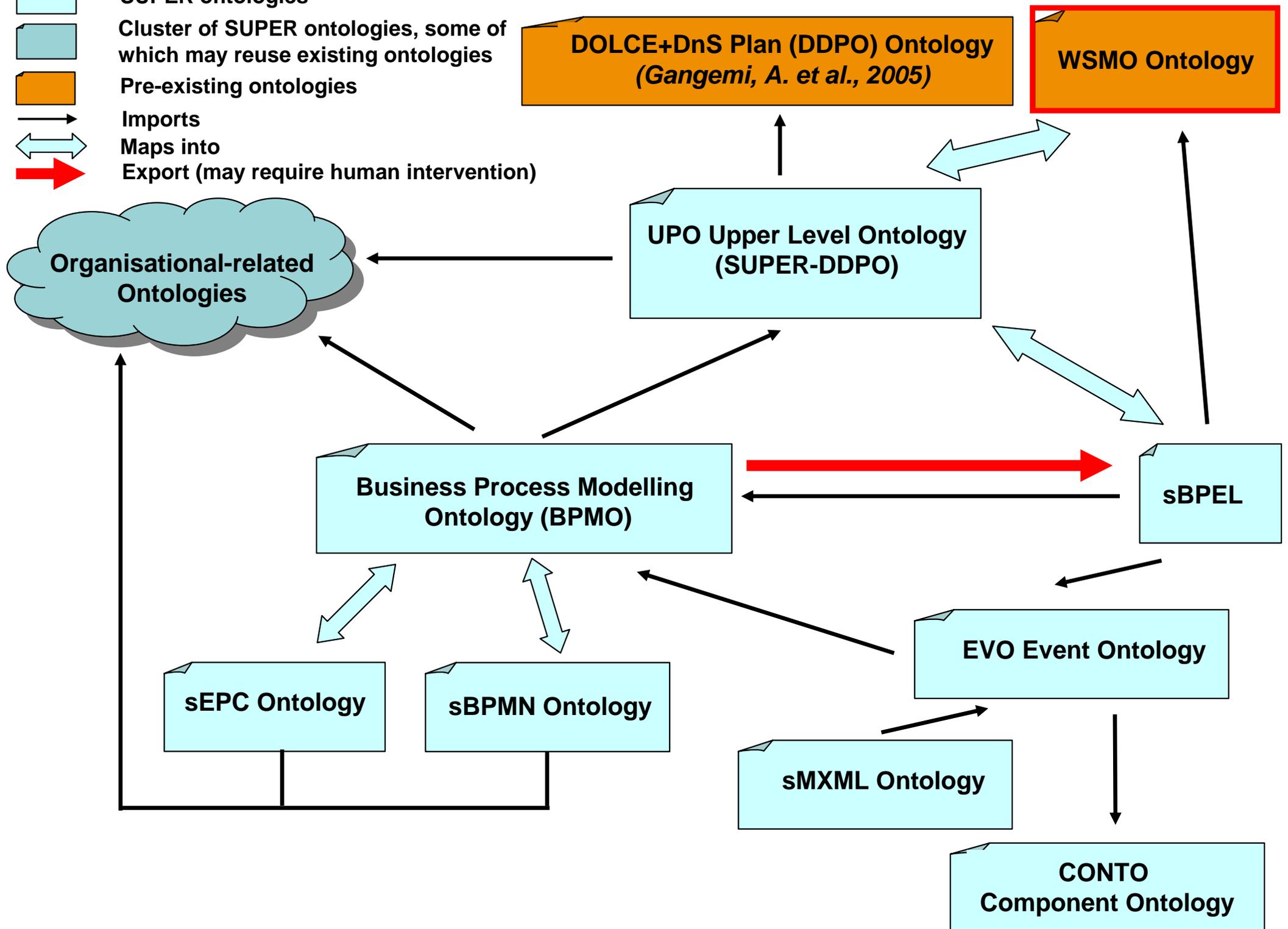
SUPER Ontology Stack



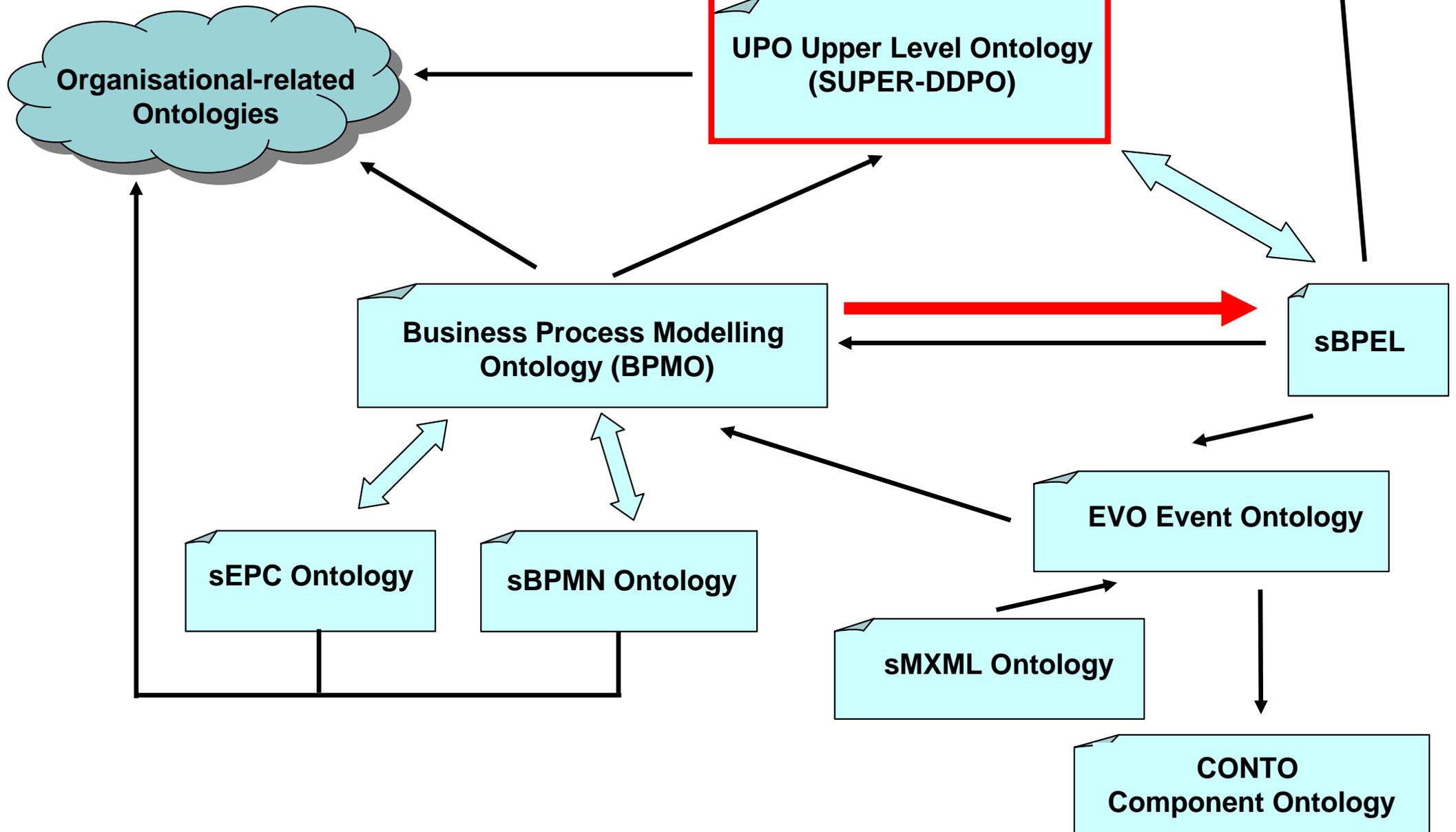
-  SUPER ontologies
-  Cluster of SUPER ontologies, some of which may reuse existing ontologies
-  Pre-existing ontologies
-  Imports
-  Maps into
-  Export (may require human intervention)

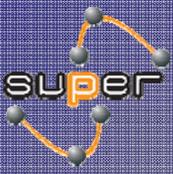


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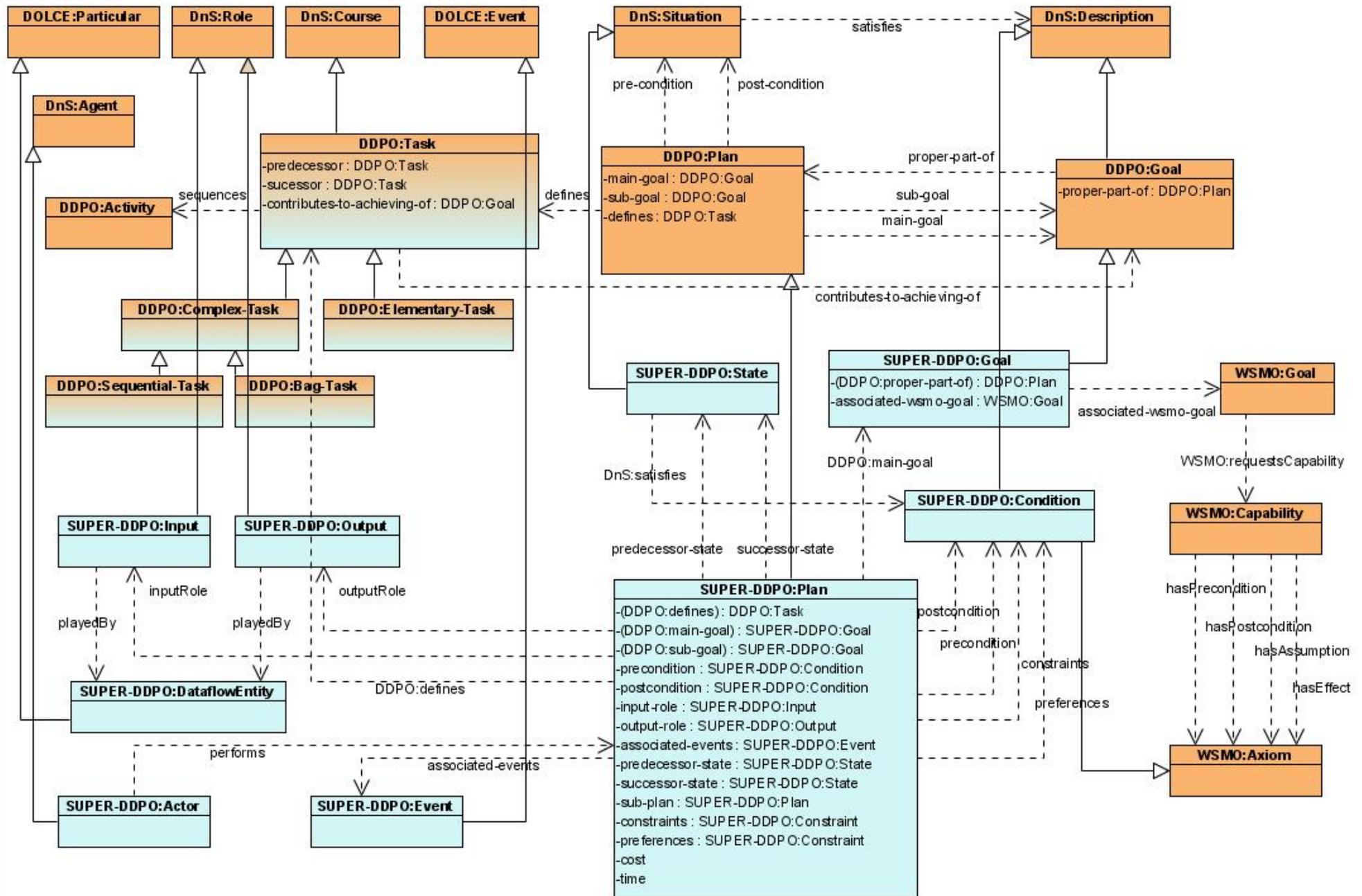
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UPO Class diagram

Visual Paradigm for UML Community Edition [not for commercial use]
Class Diagram

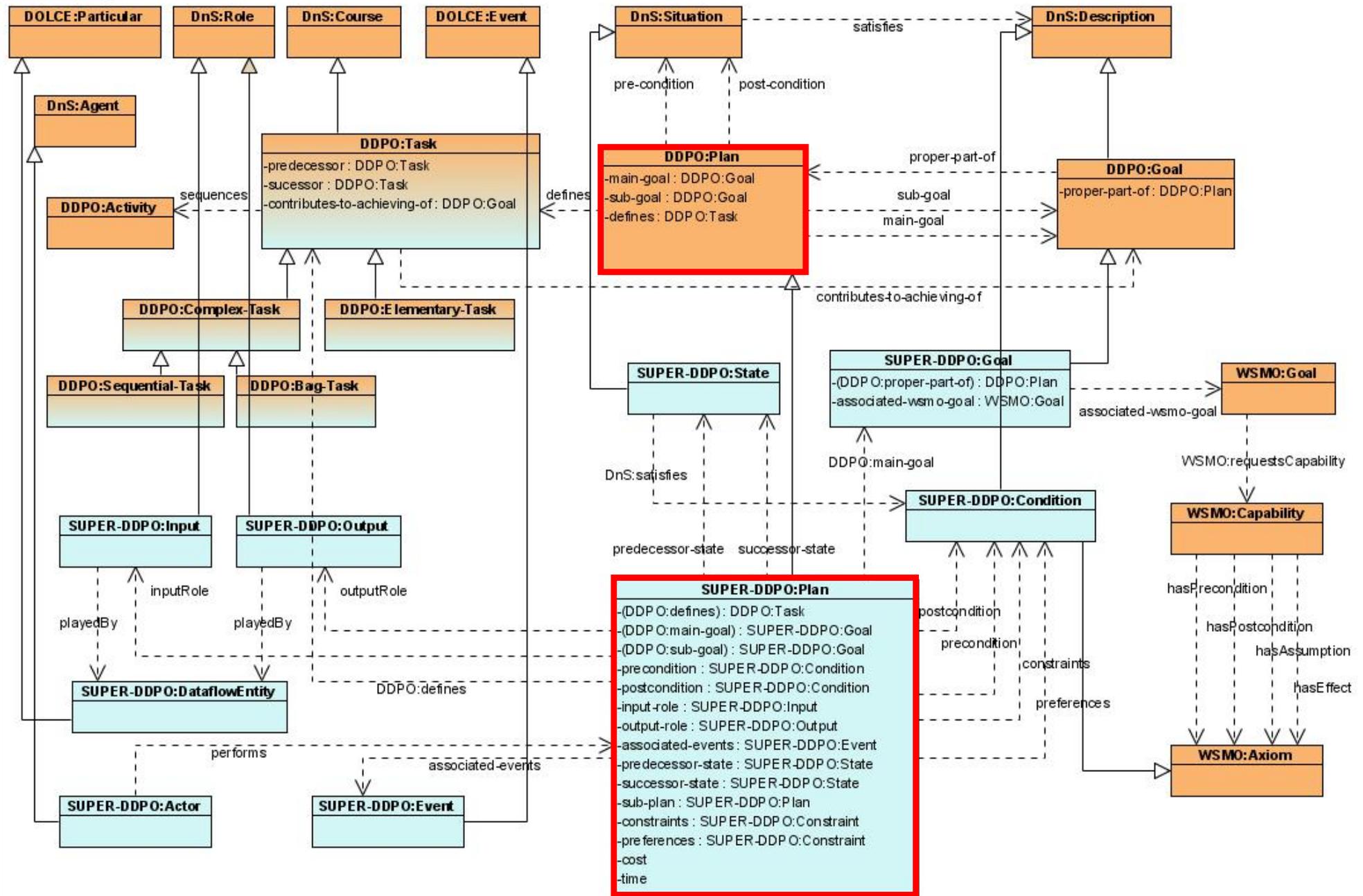




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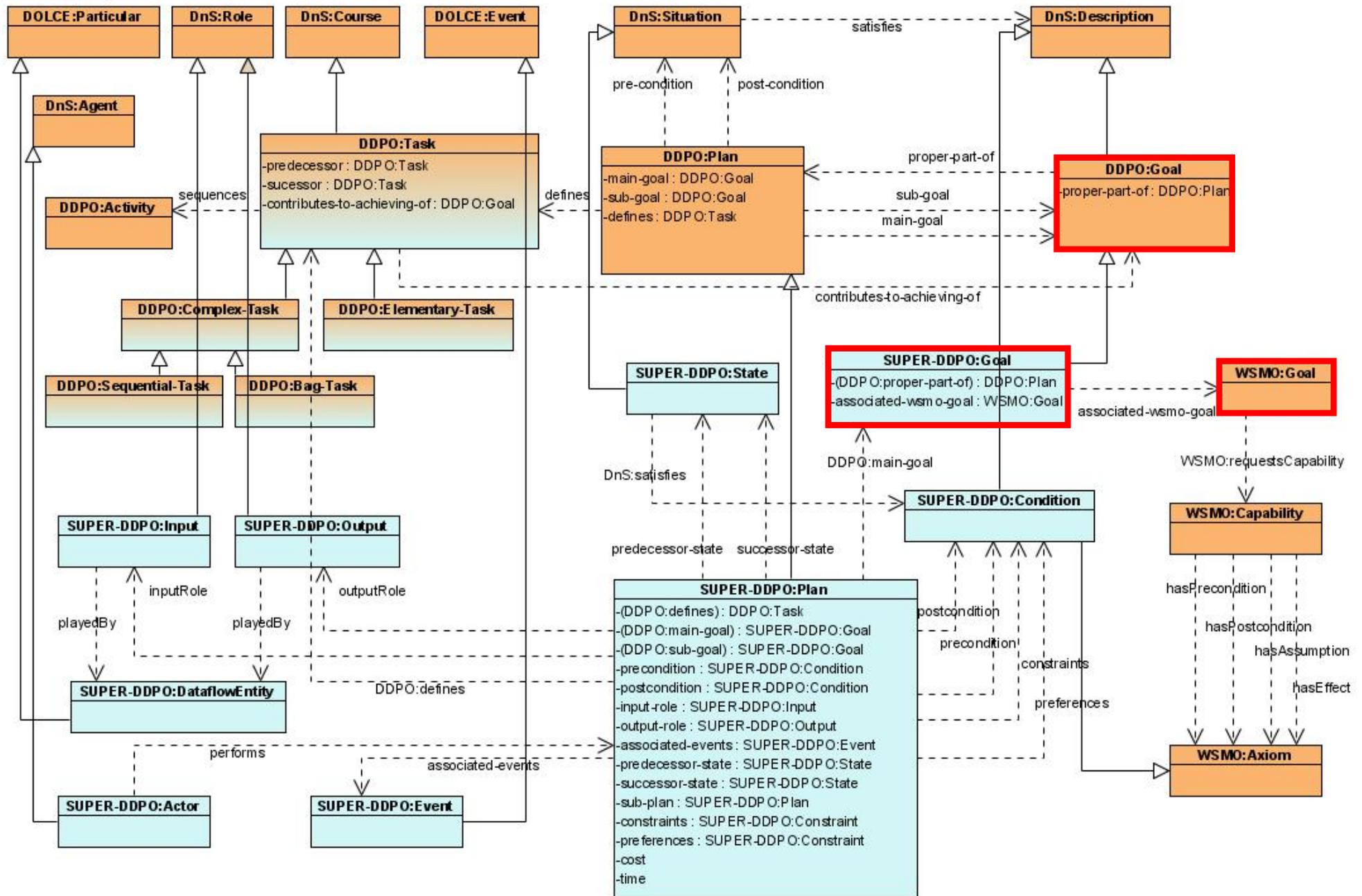
Class Diagram

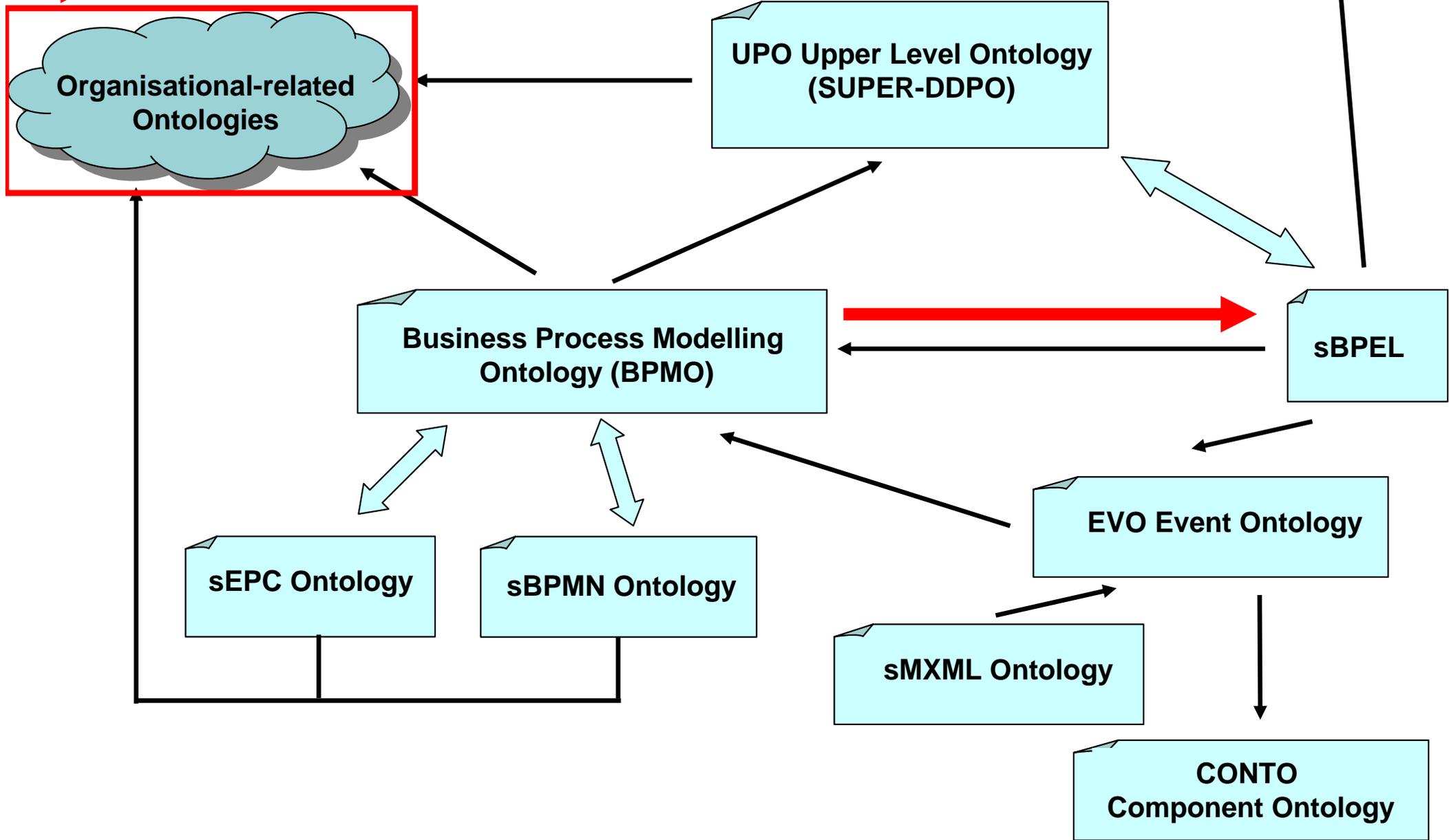
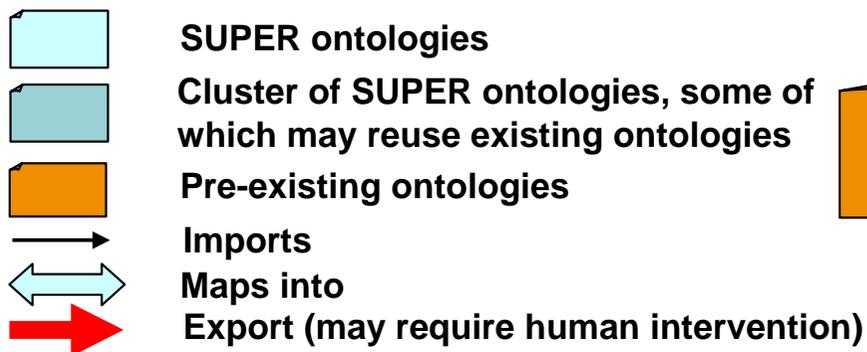


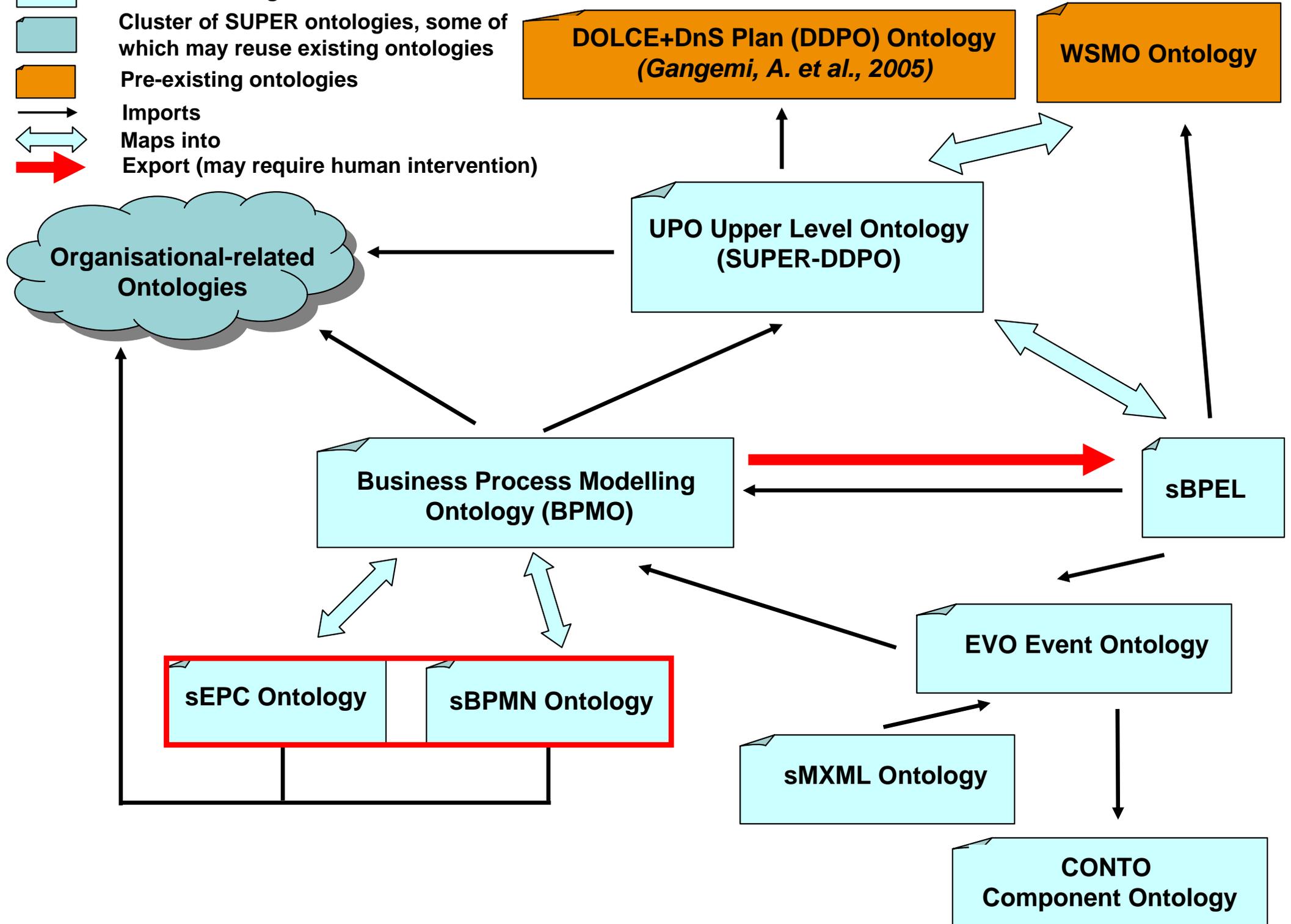
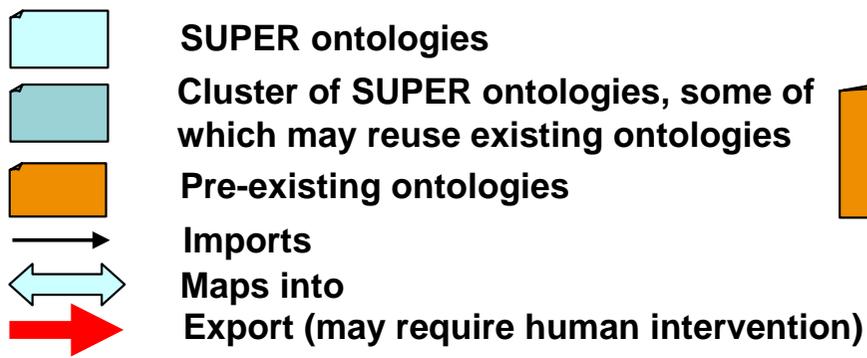


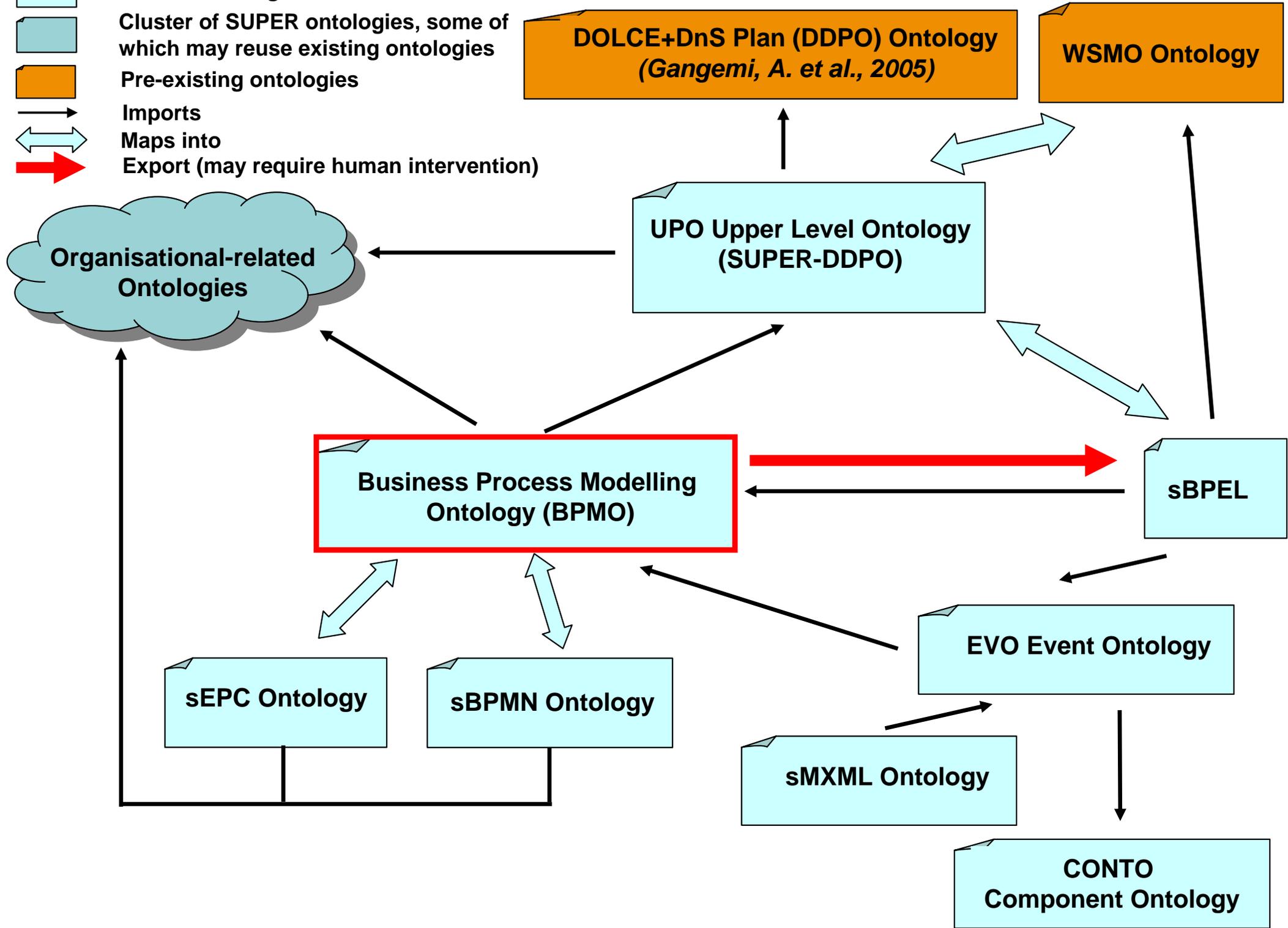
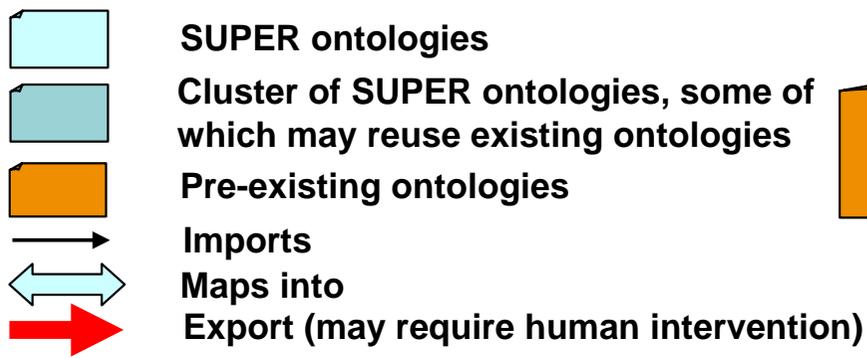
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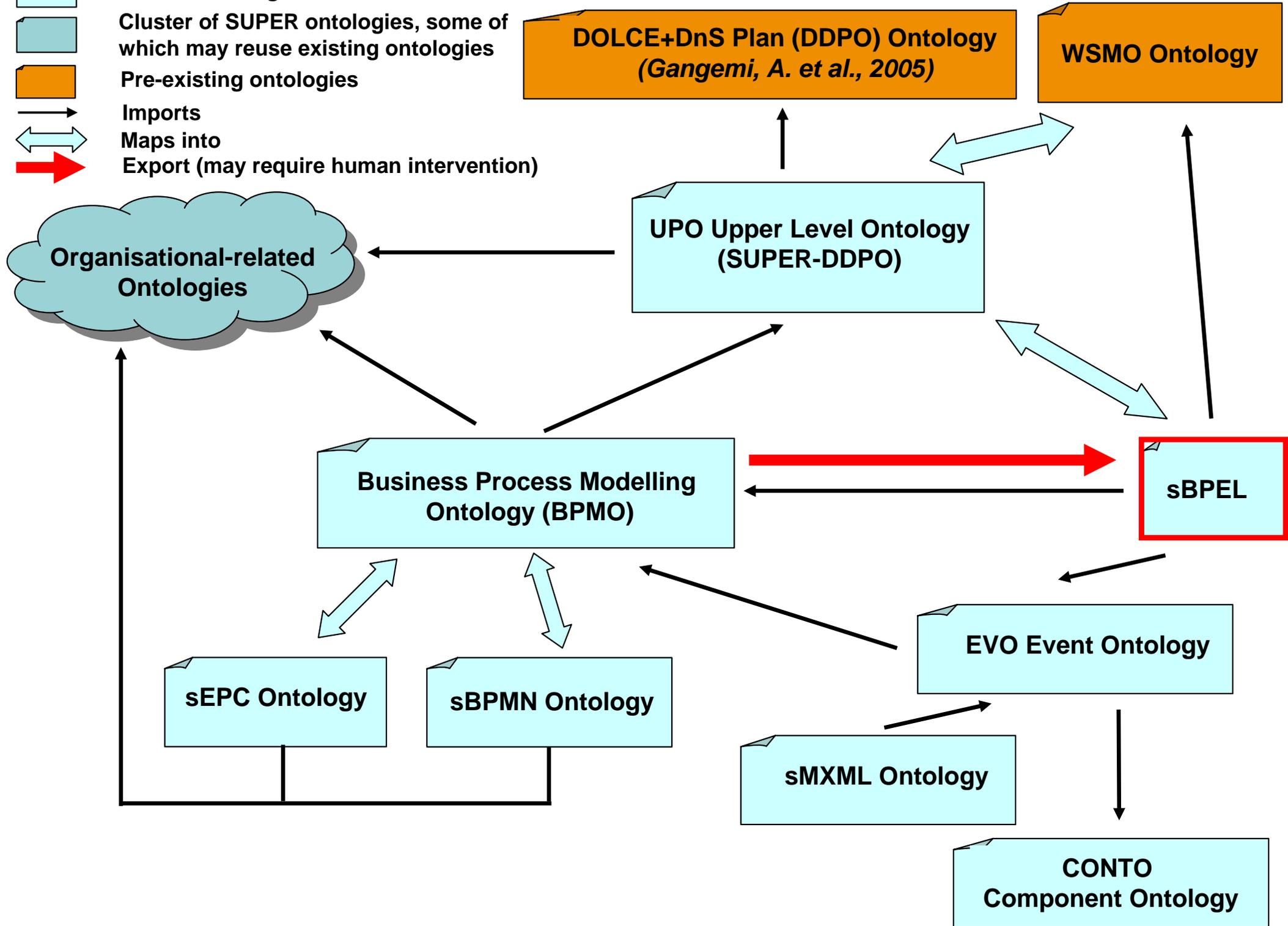


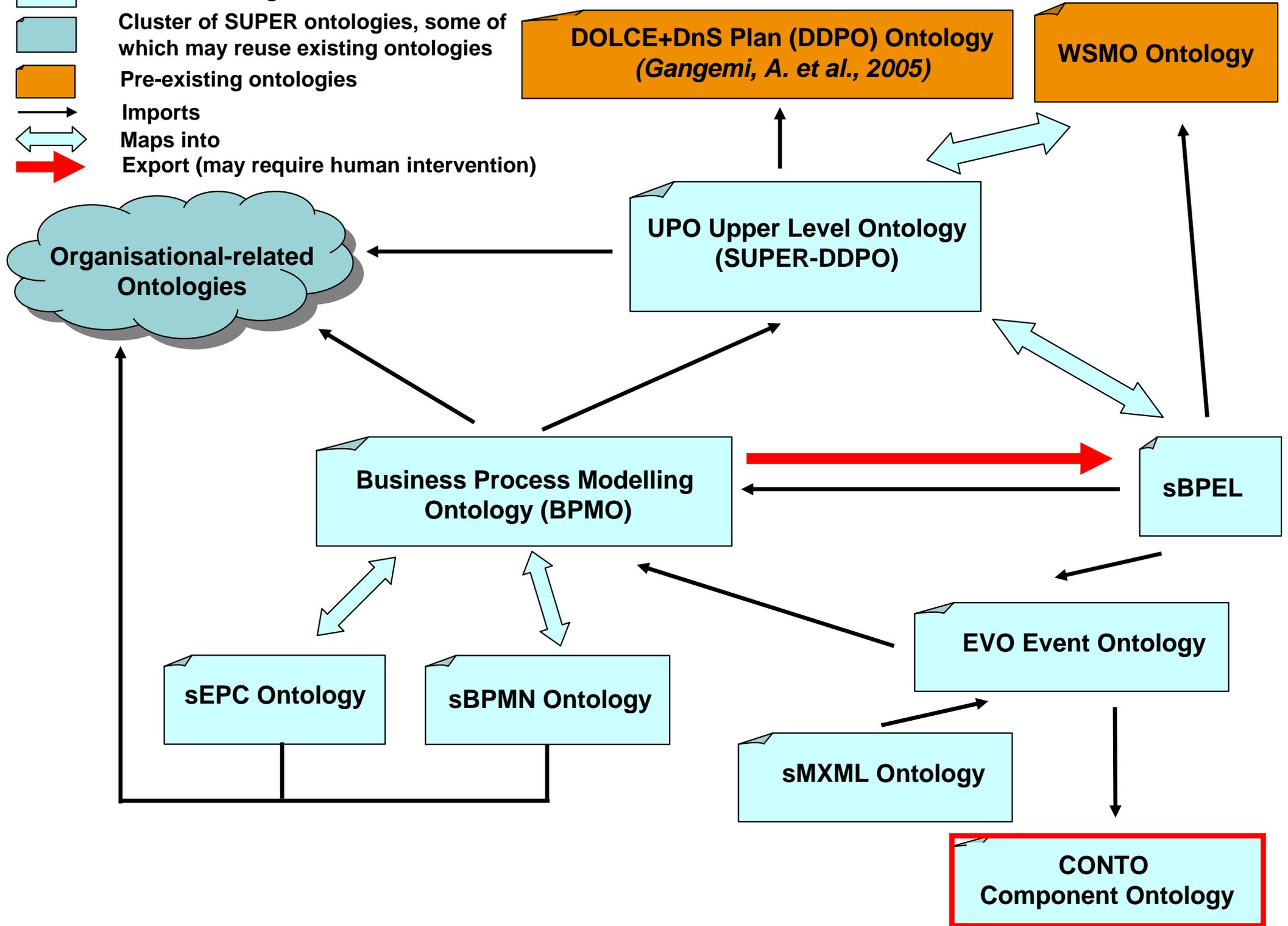
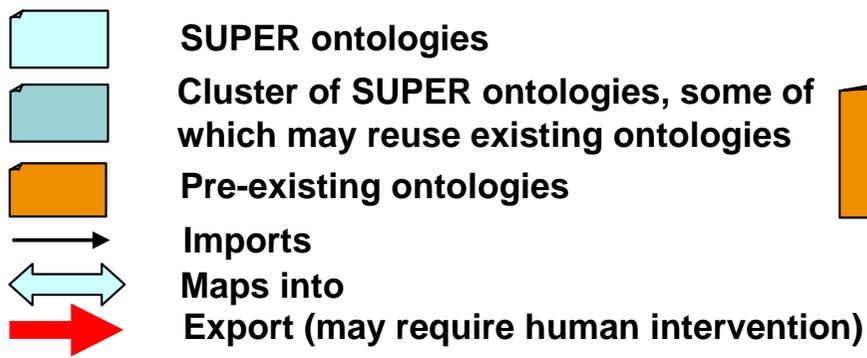




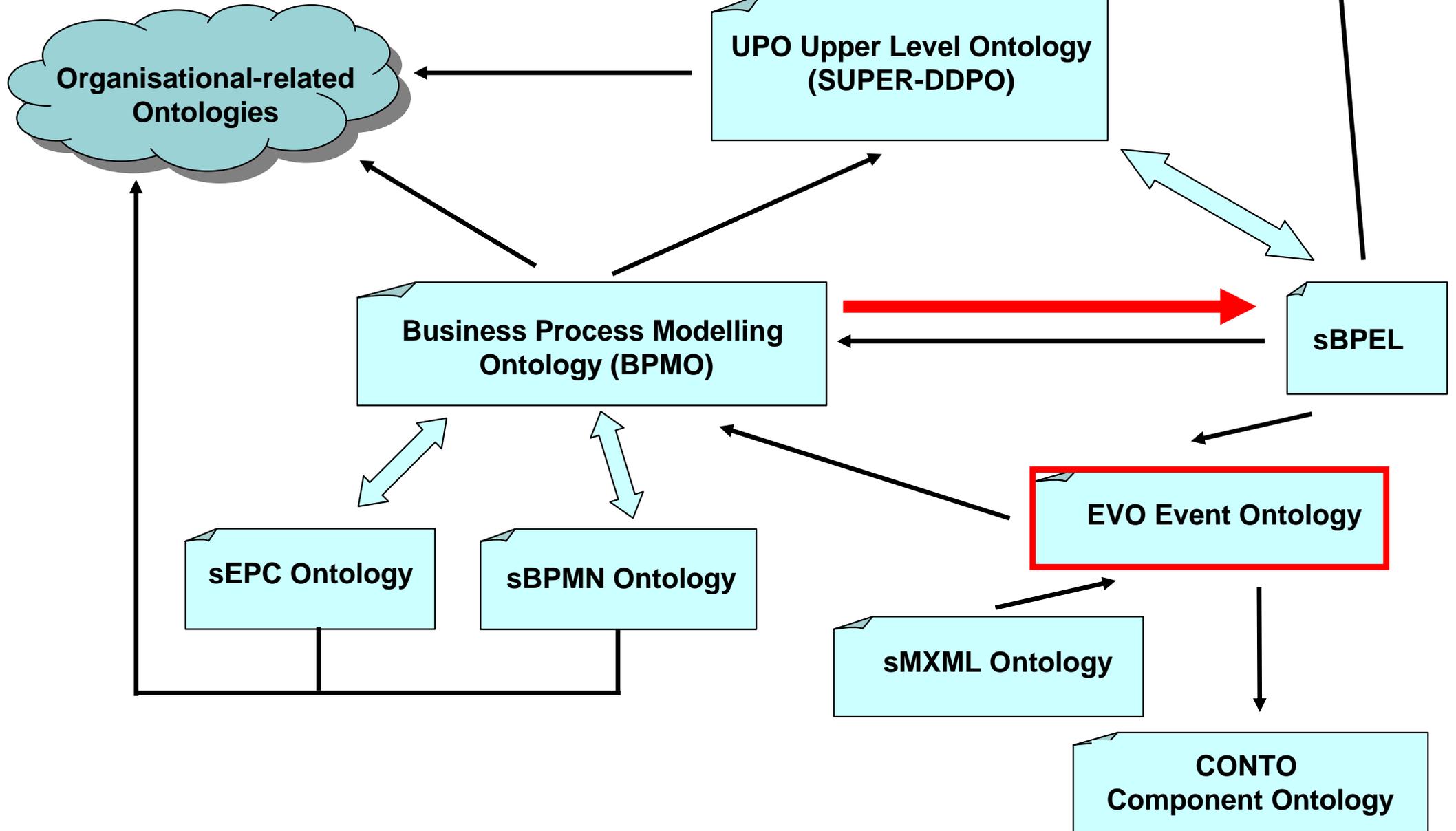


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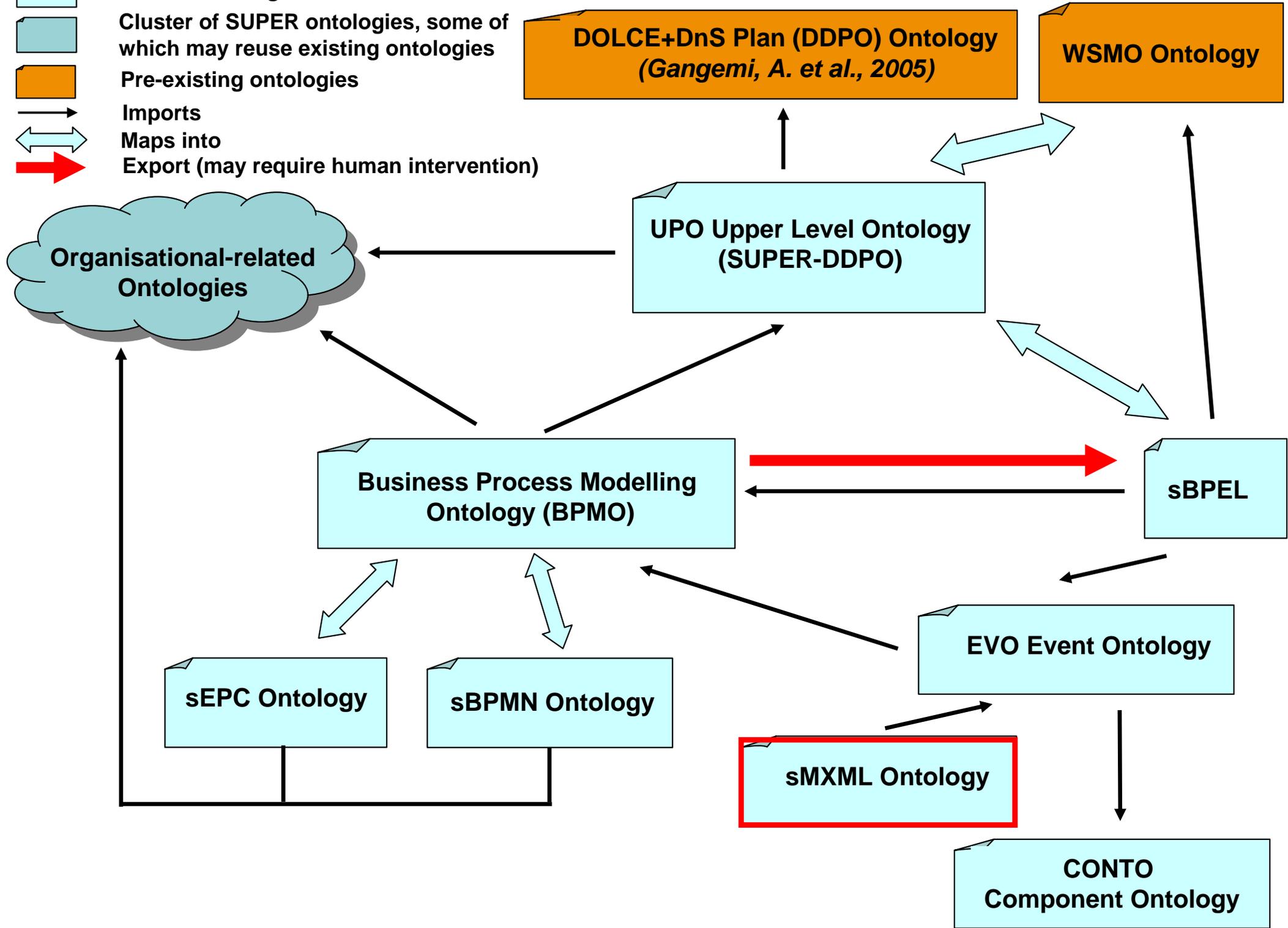




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SUPER

semantics utilised for
process management
within and between
enterprises

European Integrated Project

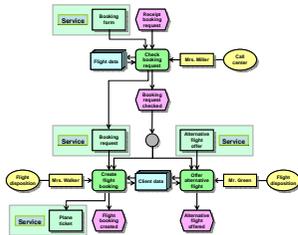
Mapping from Business Processes to BPEL



- Making sense of a domain\problem
- Communication tool
- What is it all about?

- Solution maps
- Mind maps
- Ad-hoc modelling techniques
- ...

Digital Rights Management & Content Procurement



- Visualizing\specifying business process
- Focus: Business Problem
- Who does what, when, how and why?
- Usually multiple layers

- Business Scenario Maps
- Event-driven process chains
- Flowchart techniques
- BPMN
- ...



Digital Rights Management & Content Procurement

```

<process name="Mediation Example - Ordering BPEL Snippet - 1" suppressJoinFailure="yes" targetNamespace="...">
  <sequence>
    <receive name="Initial_Receive" createInstances="true"/>
    <invoke name="Invoke_Check_Order_Consistency"/>
    <switch>
      <case condition="bpws:getVariableData('consistency', '') = 'OK'">
        <flow>
          <invoke name="Invoke_Update_Provisioning_Systems_Subprocess"/>
          <invoke name="Invoke_CustomerReply_Confirmation_Note"/>
        </flow>
      <otherwise>
        <invoke name="Invoke_CustomerReply_Rejection_Note"/>
      </otherwise>
    </switch>
    <reply name="Final_Reply"/>
  </sequence>
</process>

```

- Process execution specification
- Formal, clearly specified grammar
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- BPEL
- ...



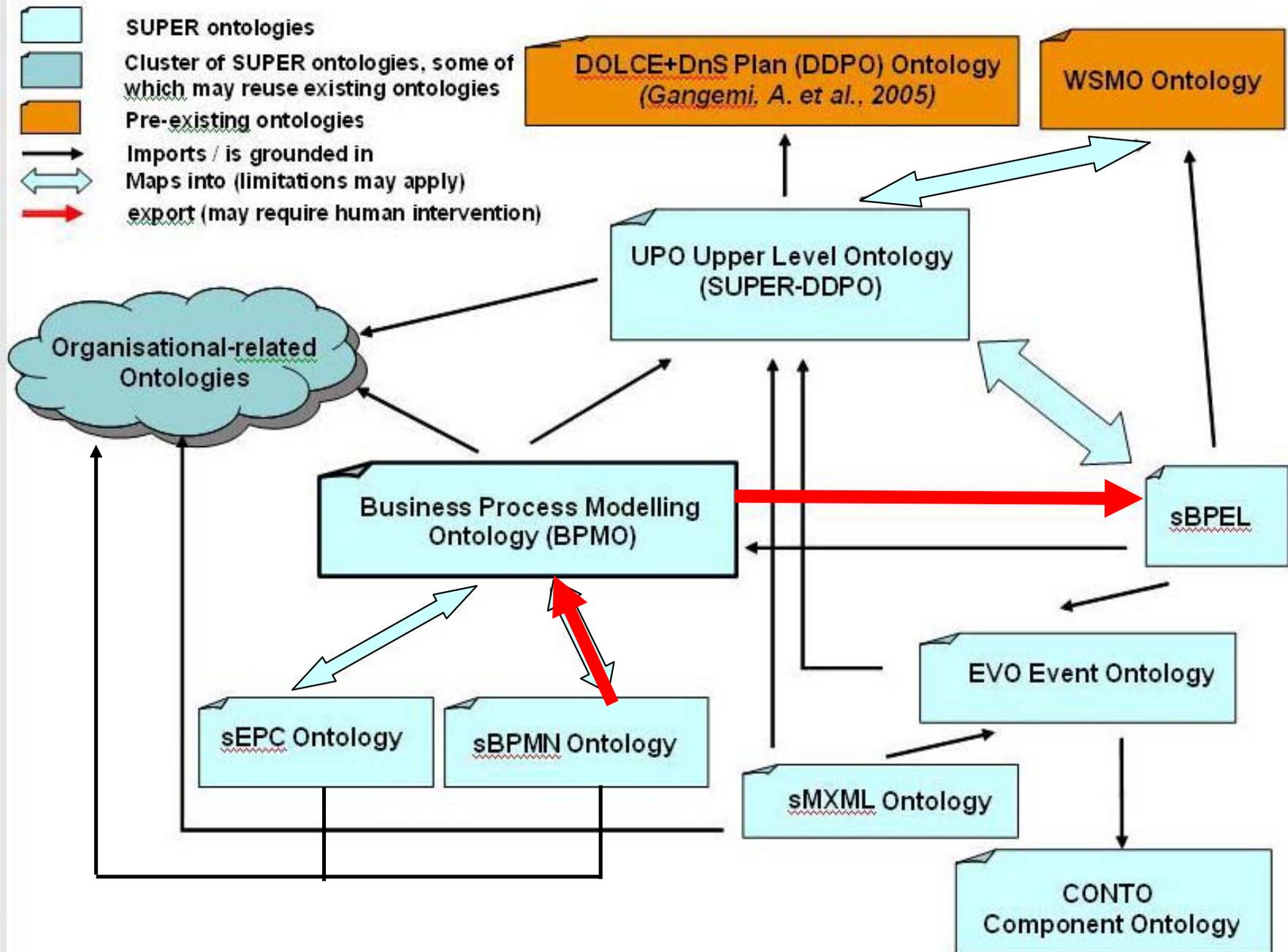
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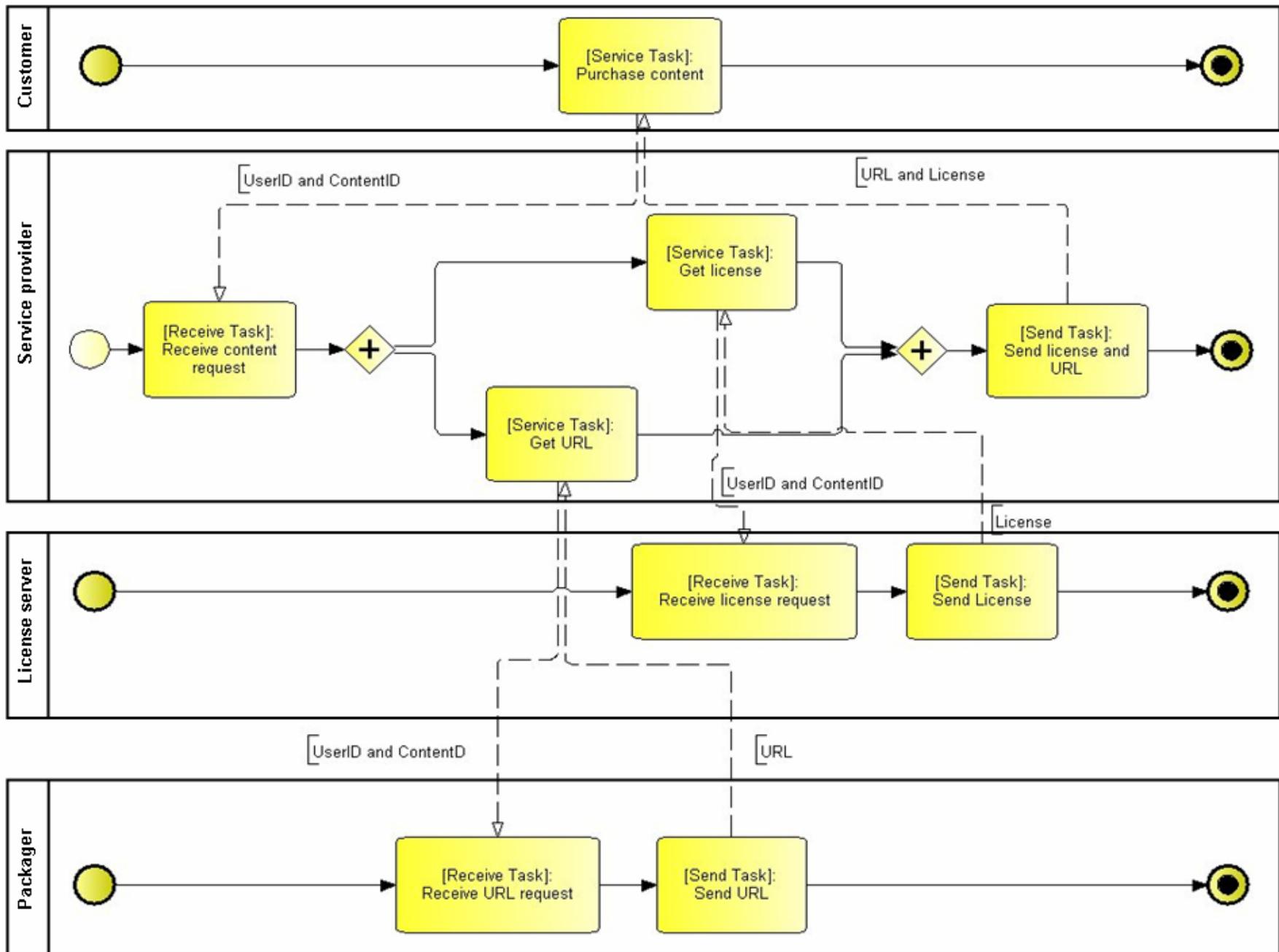
- Implementation of components

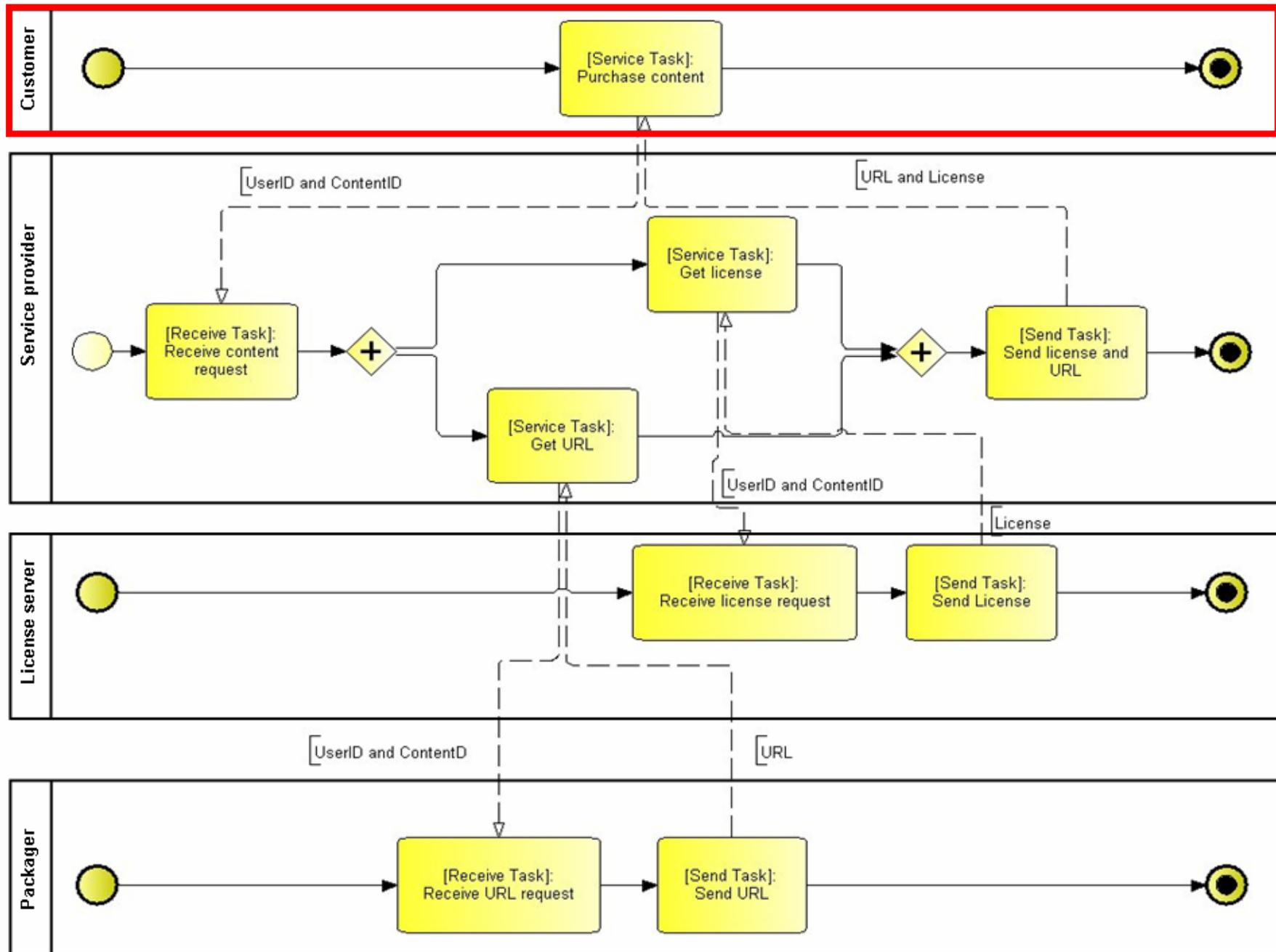
- Programming languages
- ...

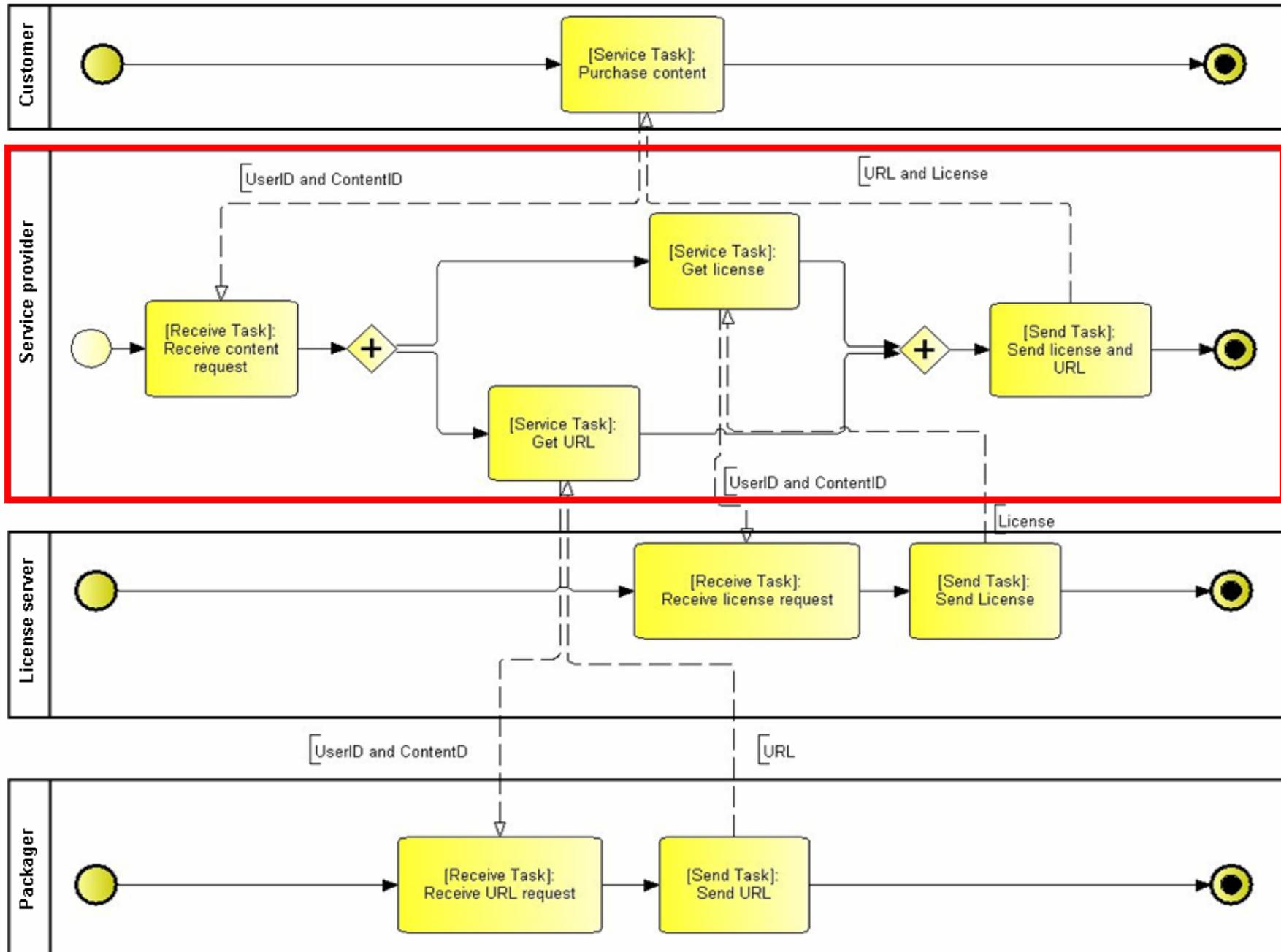


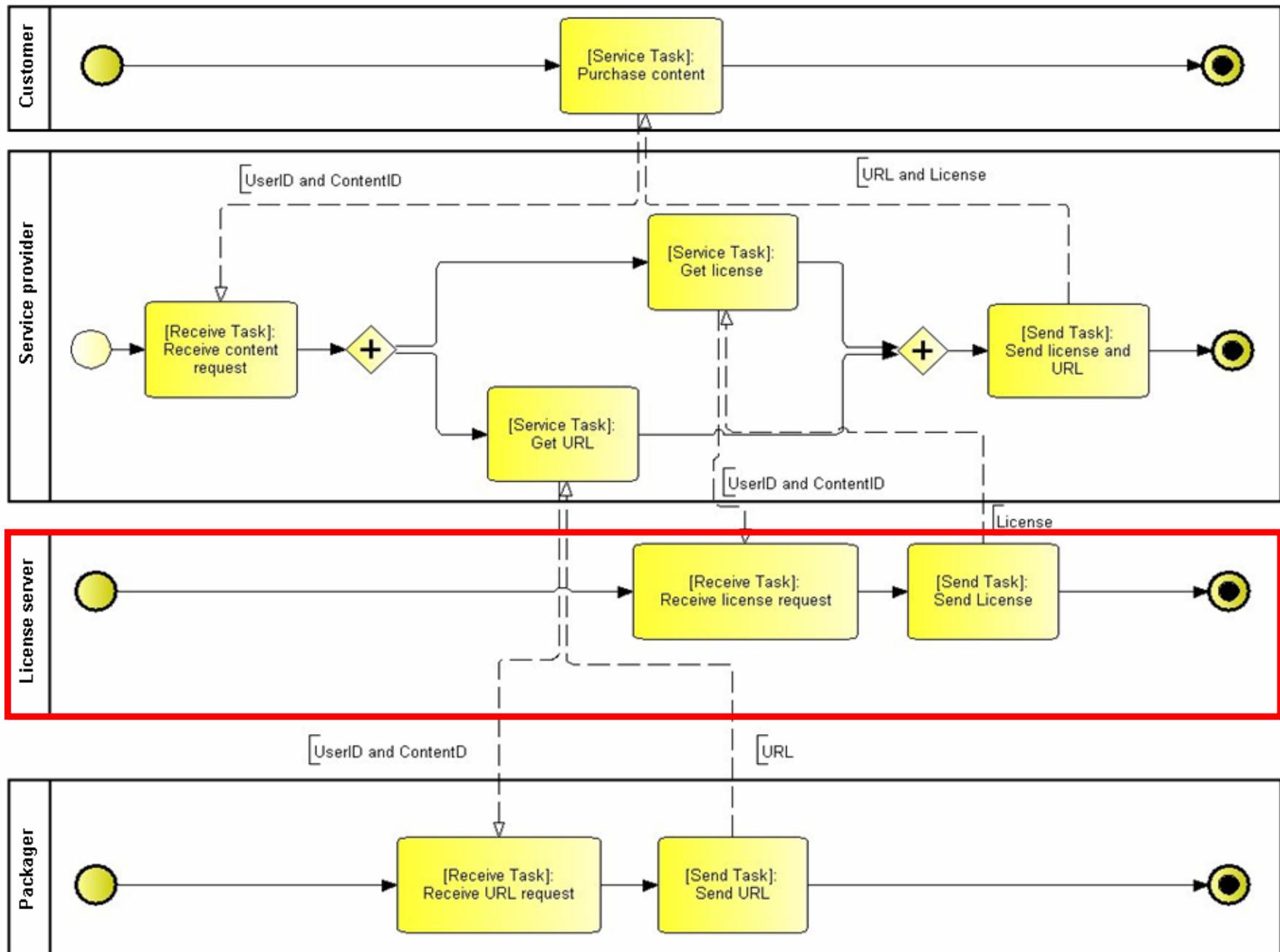
- Discovery of block-based process fragments from sBPMN and generation of corresponding block pattern instances in BPMO
 - ▶ Based on a formalisation and algorithm given in (Ouyang et al., 2006).
- Block patterns in BPMO translated to sBPEL
 - ▶ Continued extension of the above algorithm using sBPEL;
 - ▶ sBPEL is an ontologization of BPEL processes, where control is expressed as *activities*;
 - ▶ The blocks identified translate unambiguously to the following BPEL activities:
 - Sequence, flow, switch, pick, while, repeat-until.
- Process in sBPEL translated to BPEL4SWS
 - ▶ BPEL4SWS is a BPEL 2.0 compliant extension where 'extension activities', and extended attributes, are used for semantic information.

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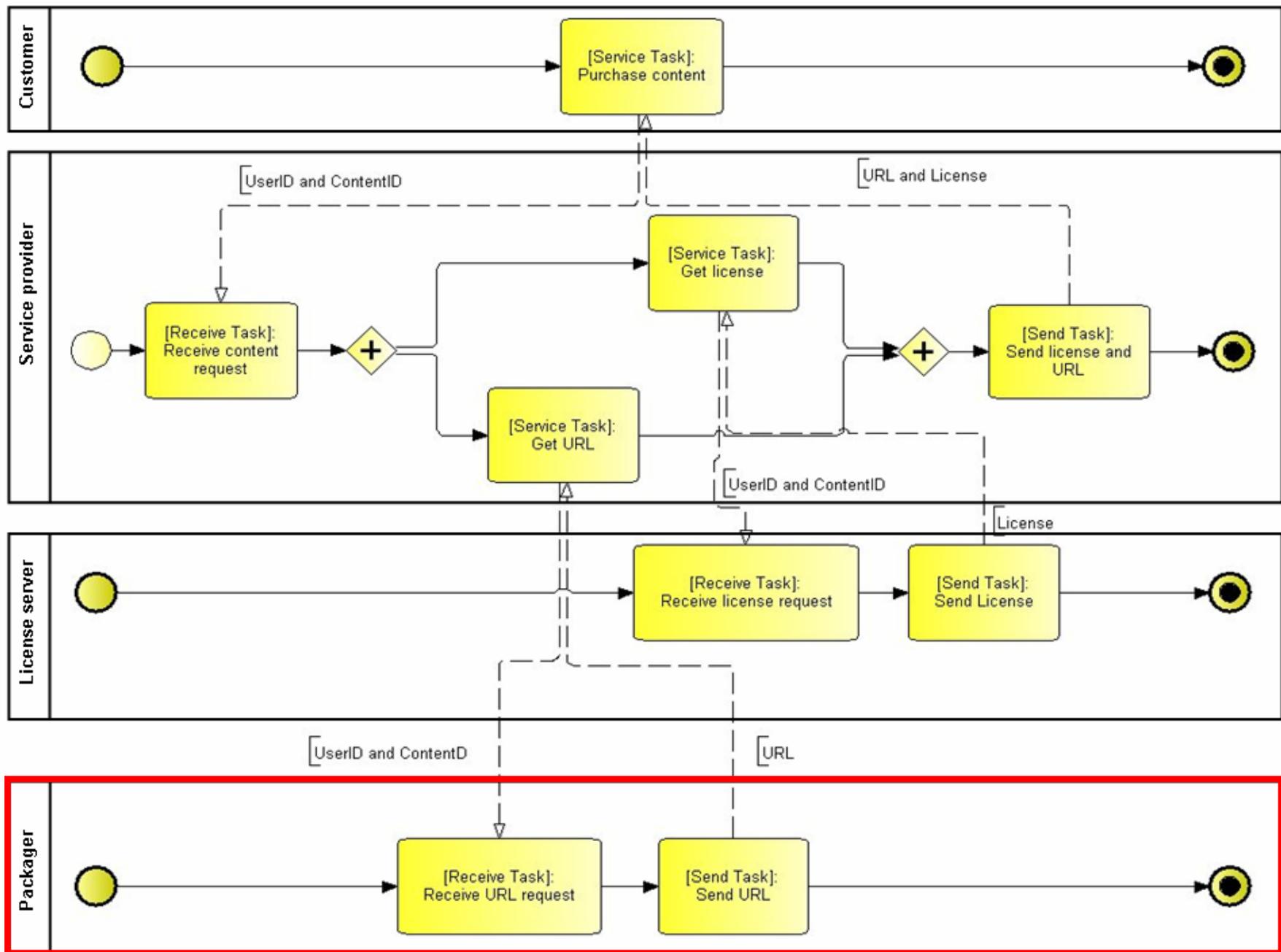


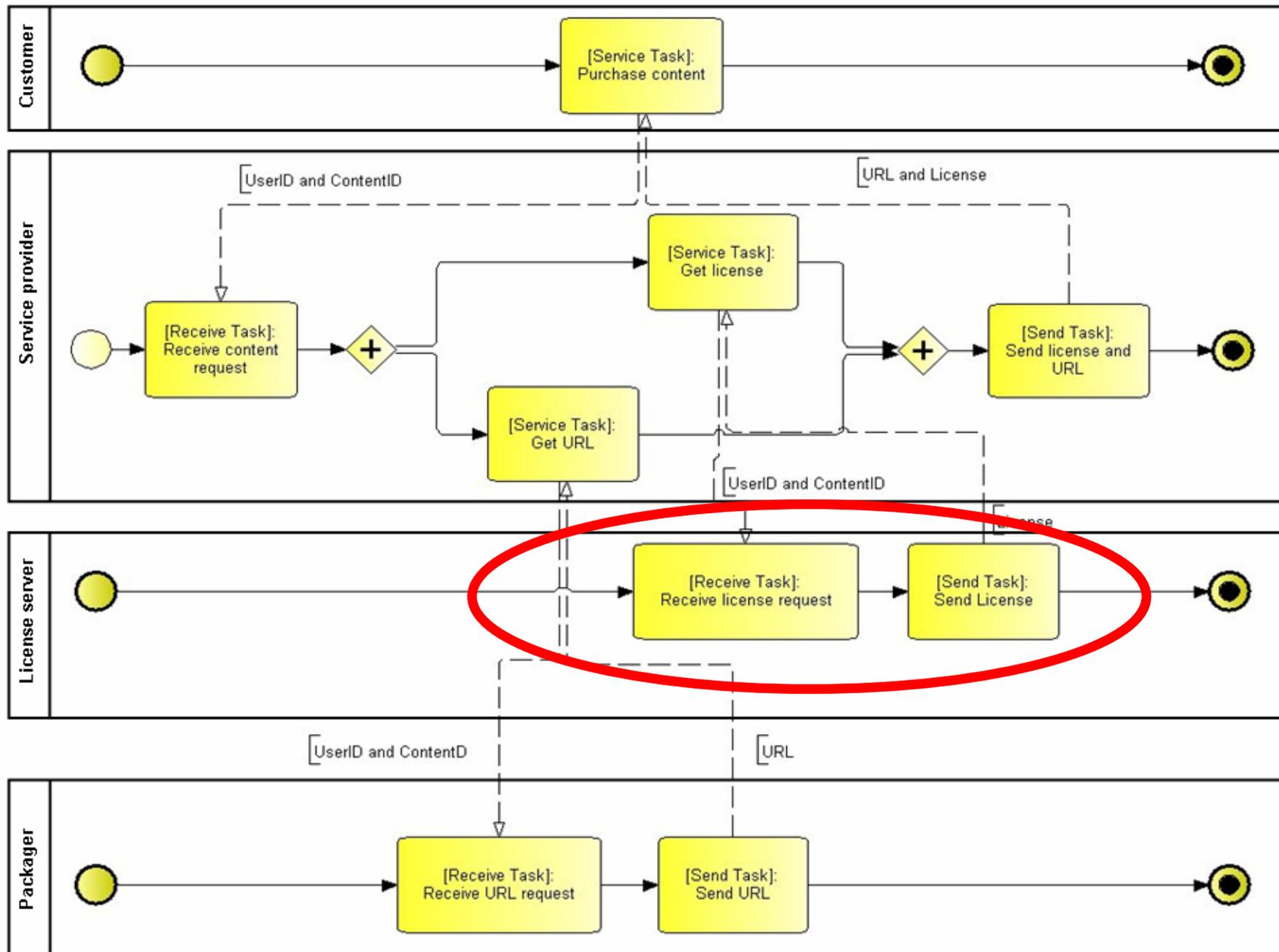


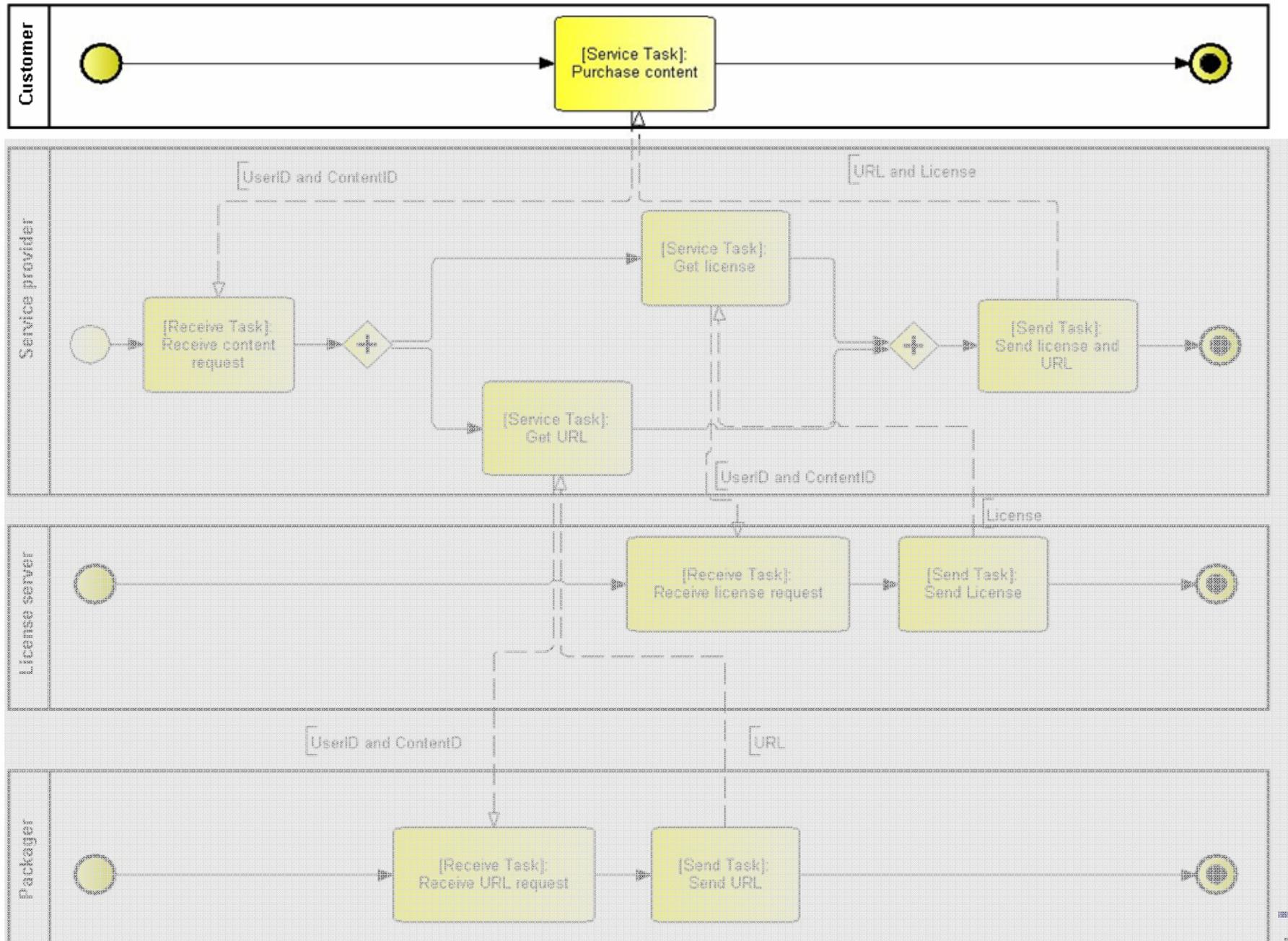




sBPMN to BPMO transformation

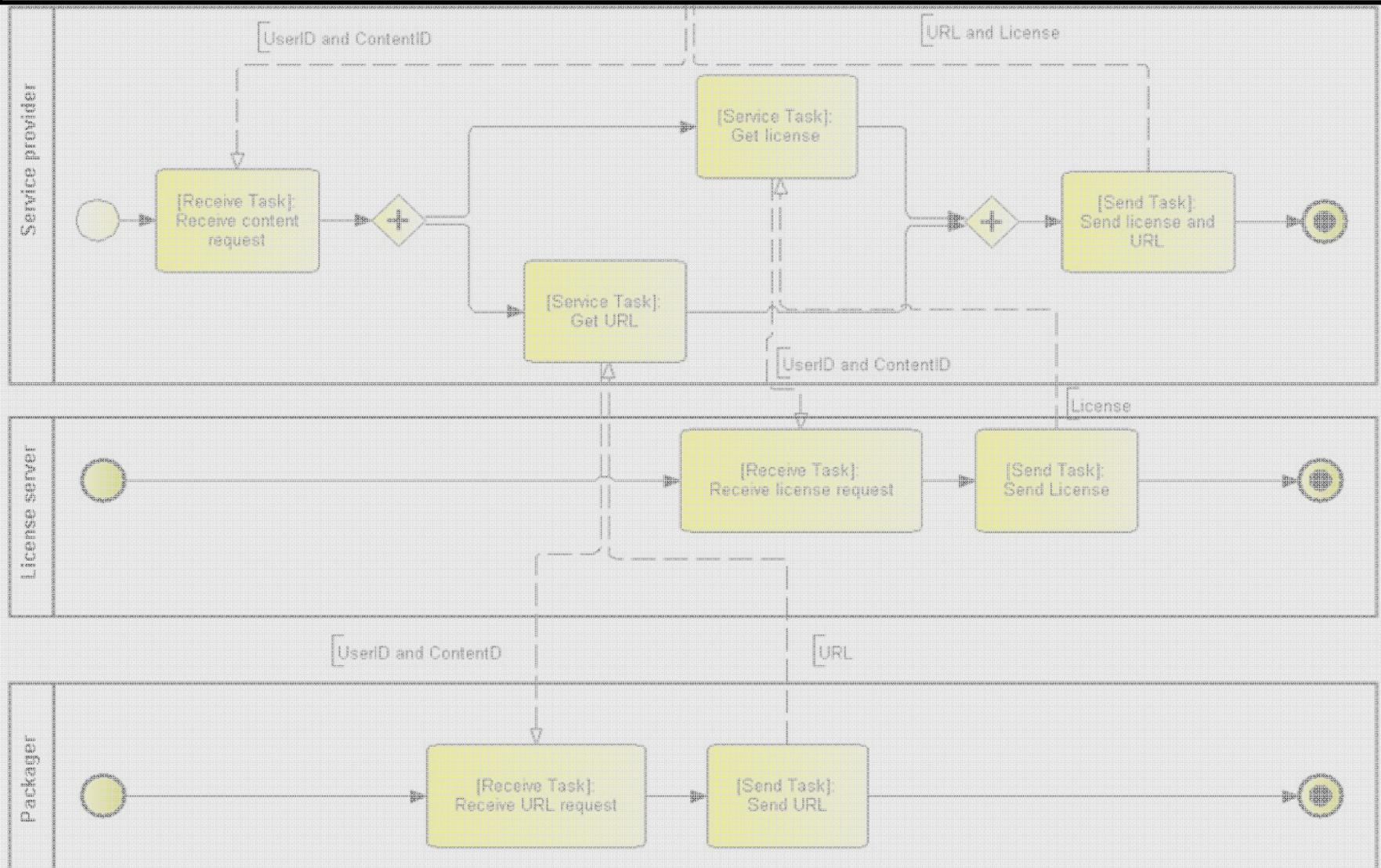


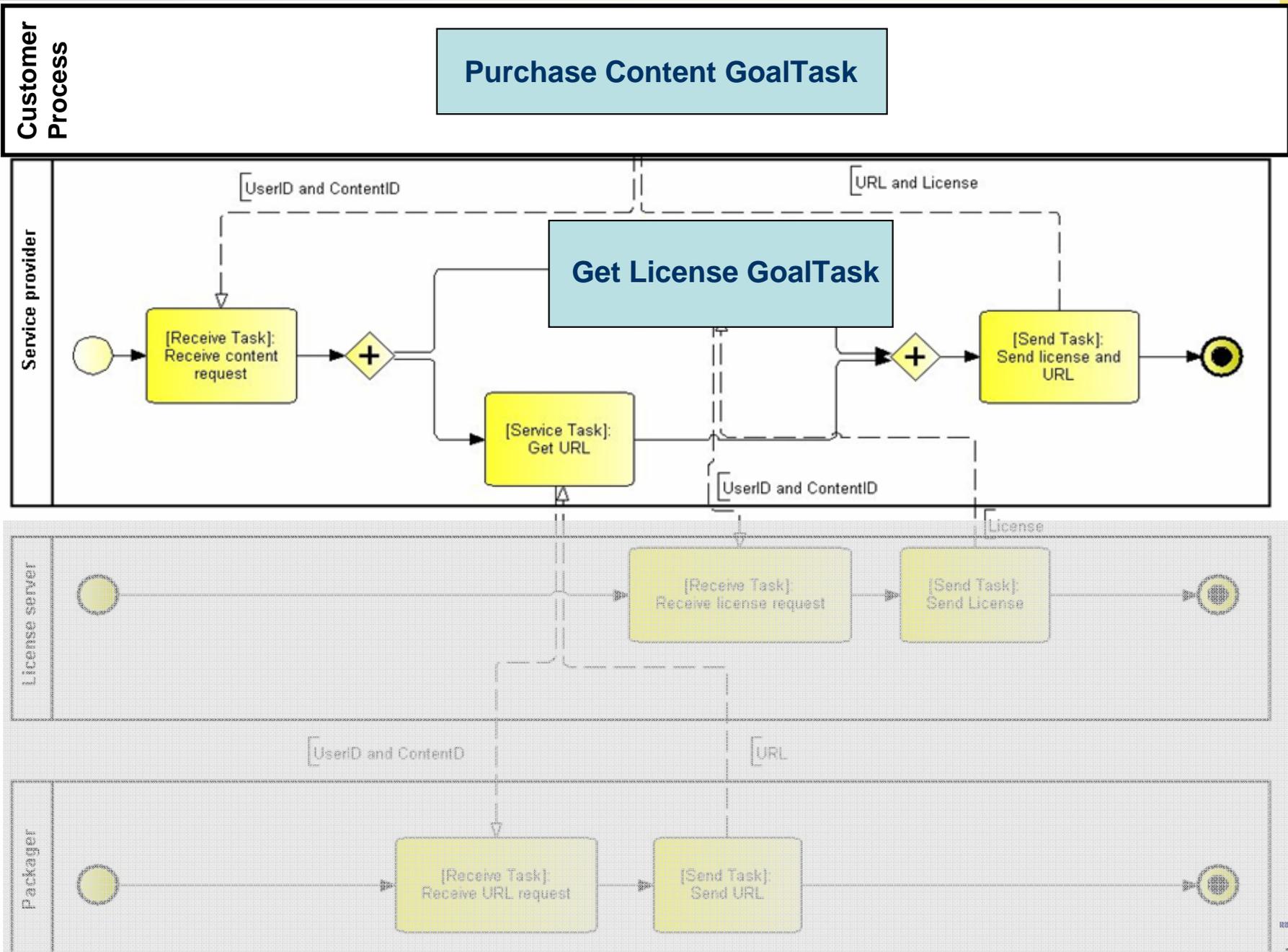


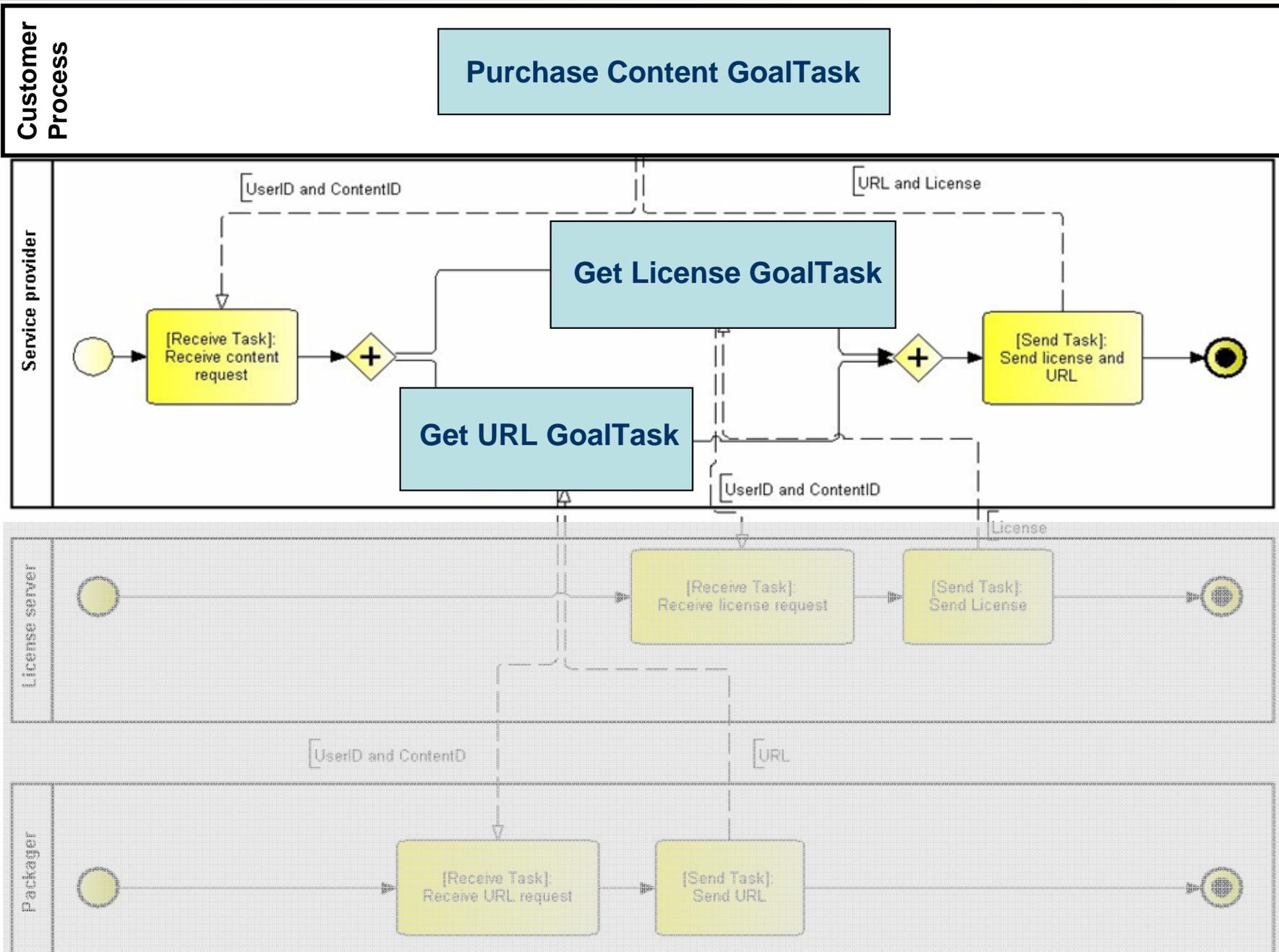


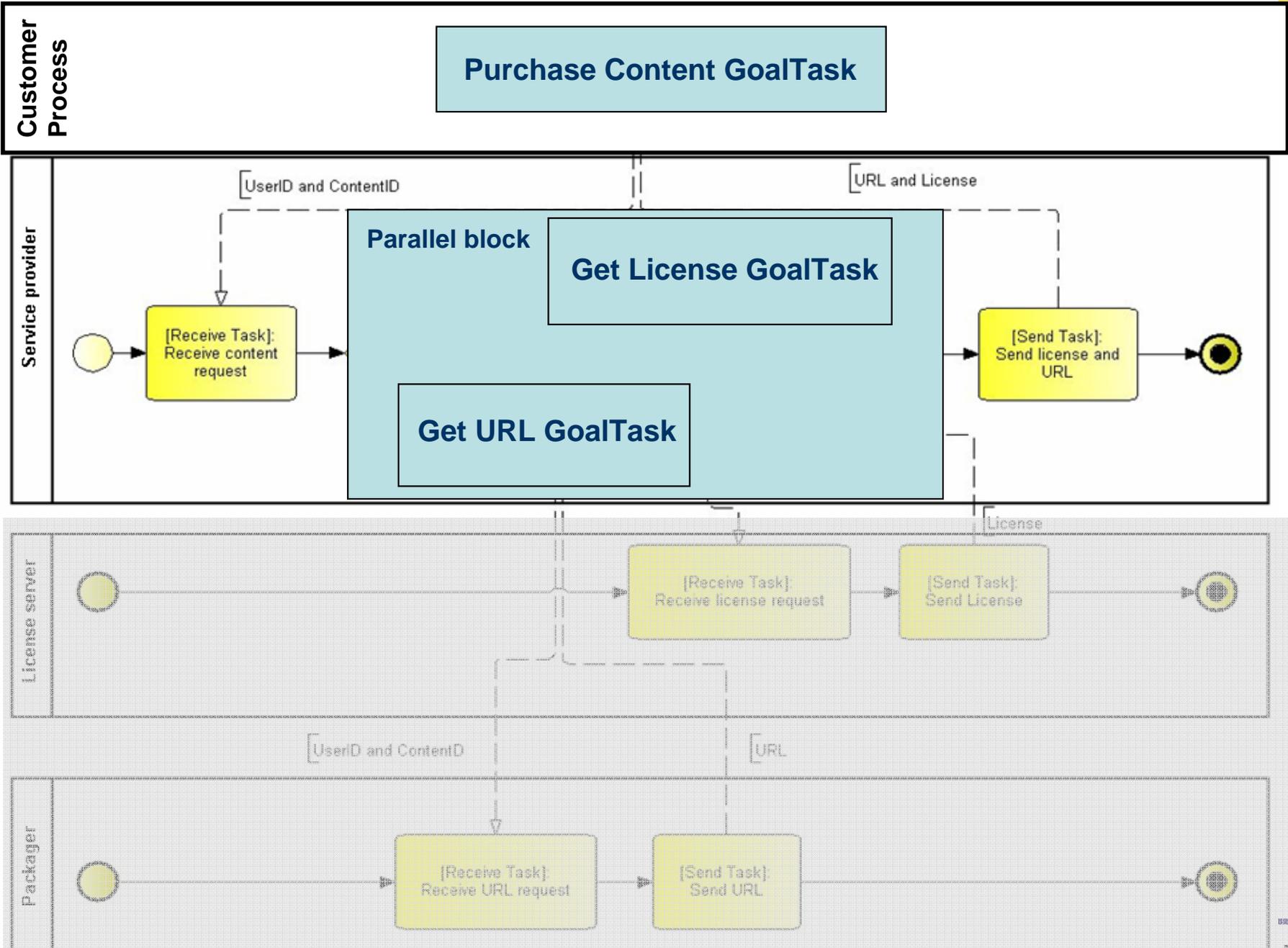
Customer Process

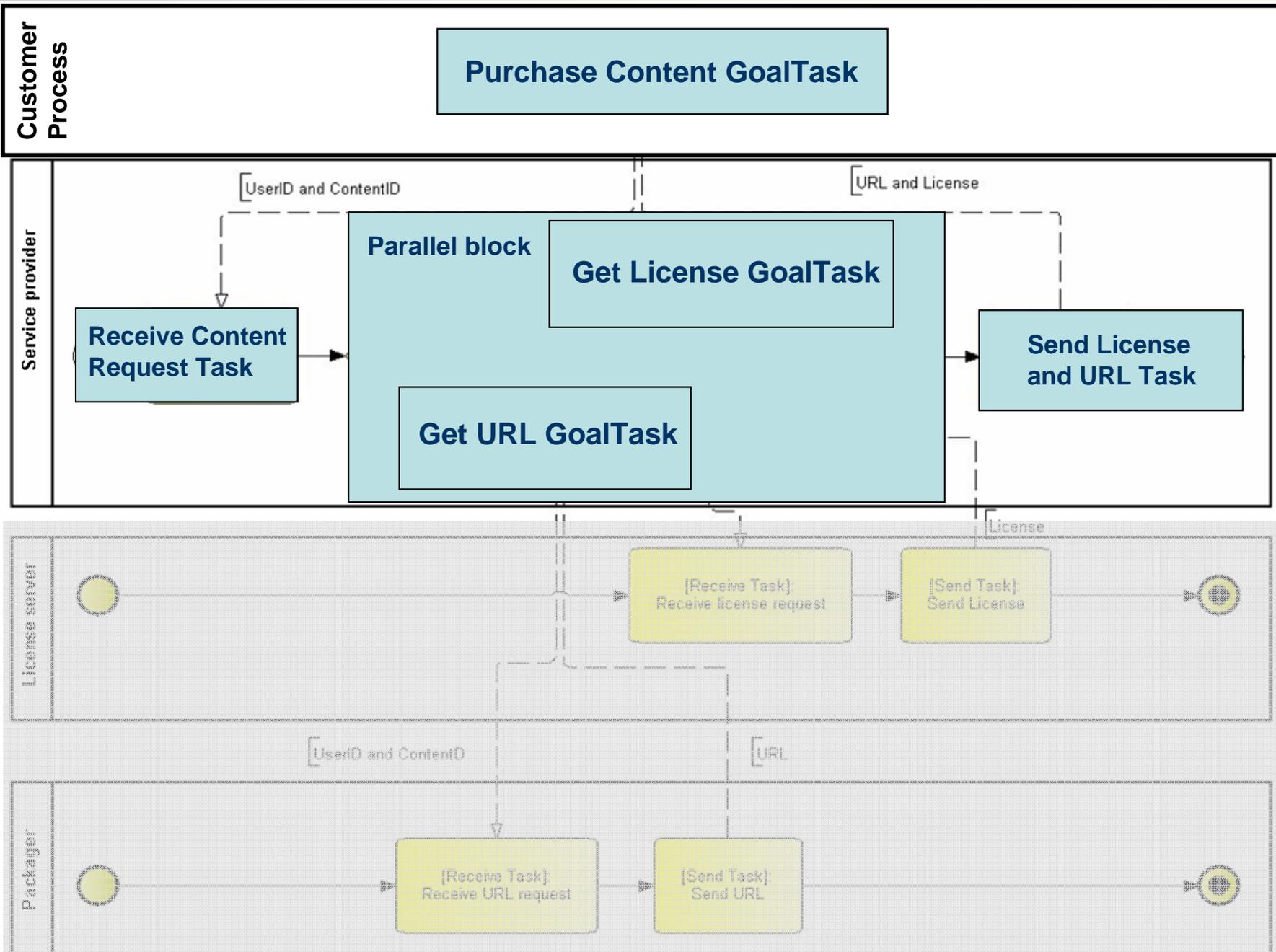
Purchase Content GoalTask

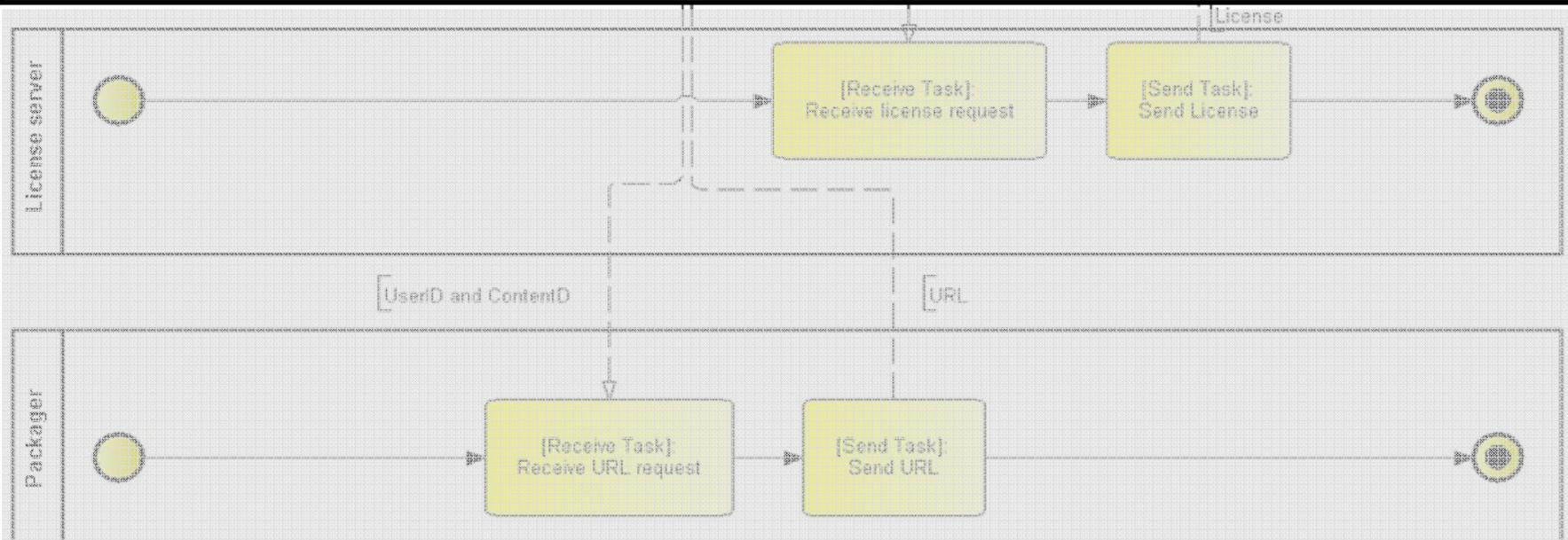
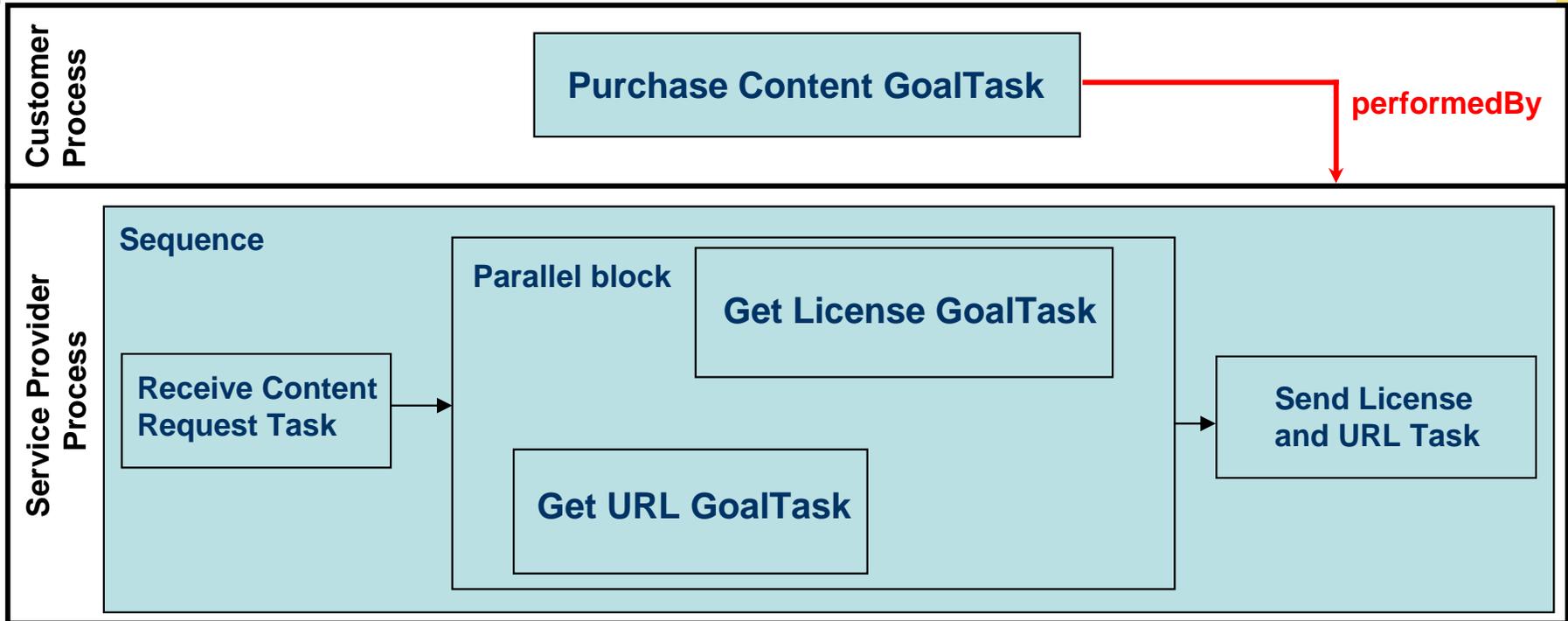


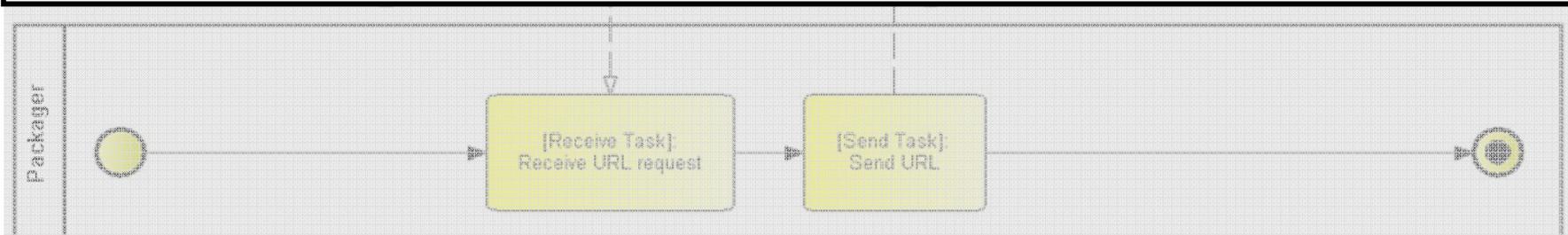
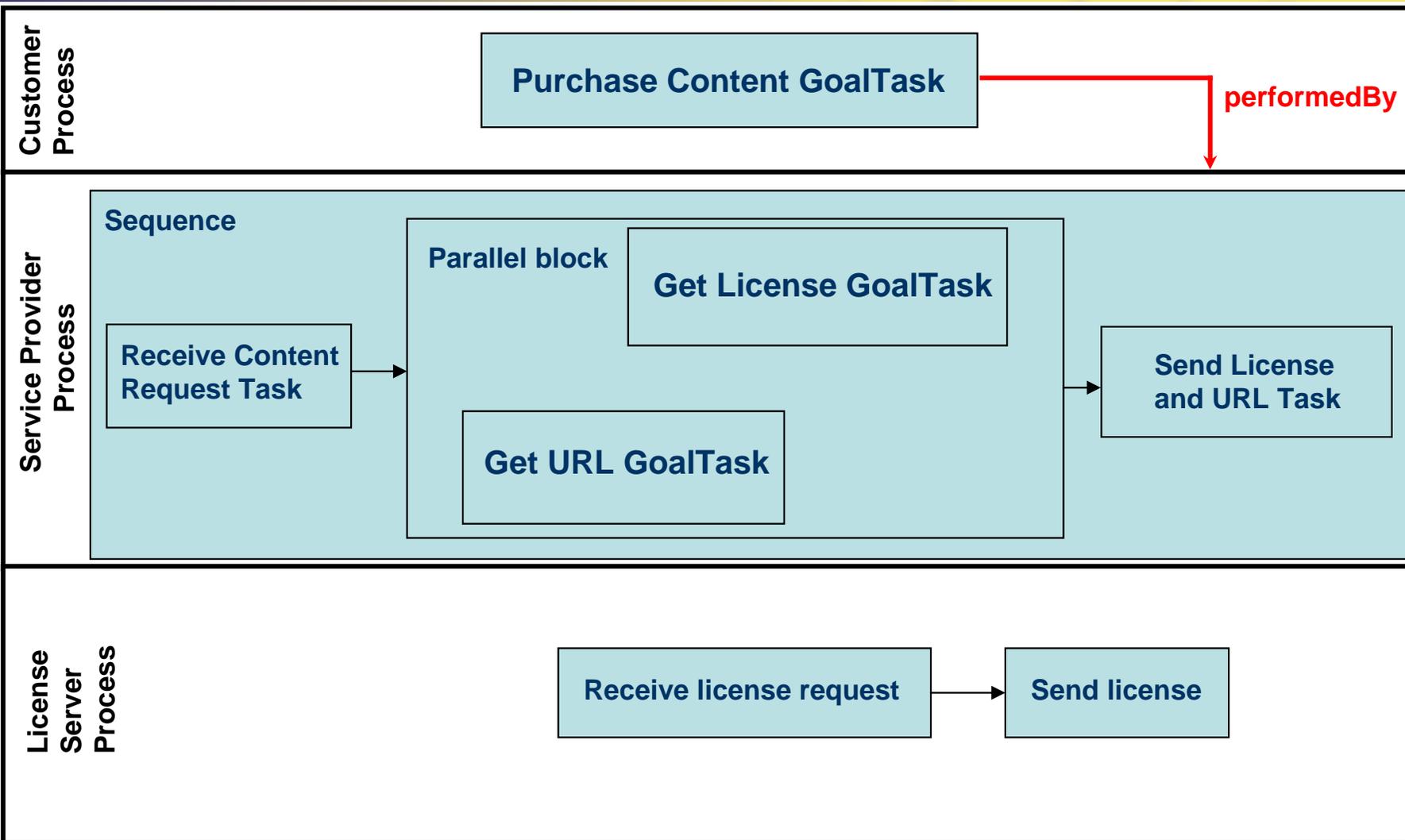


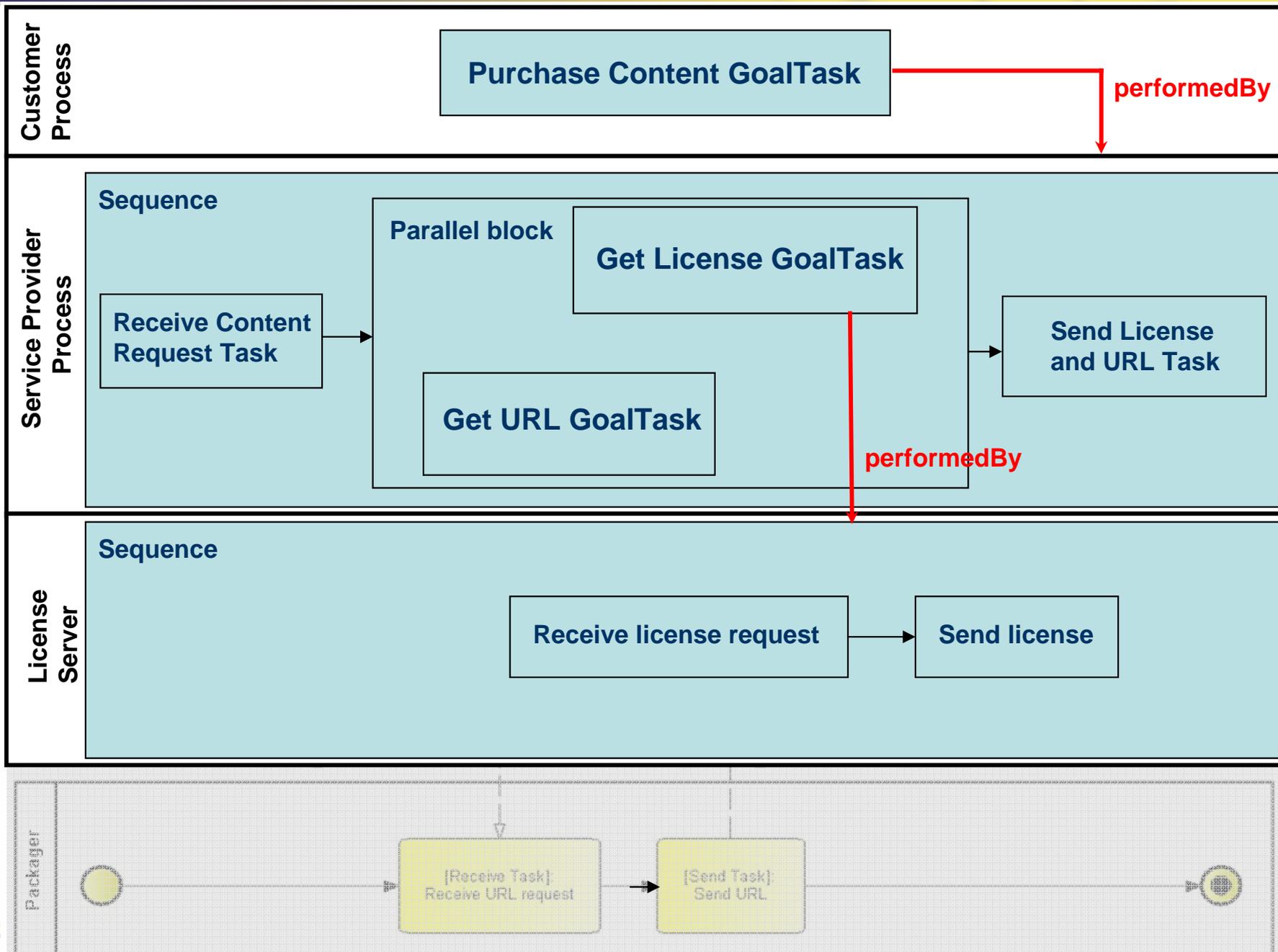


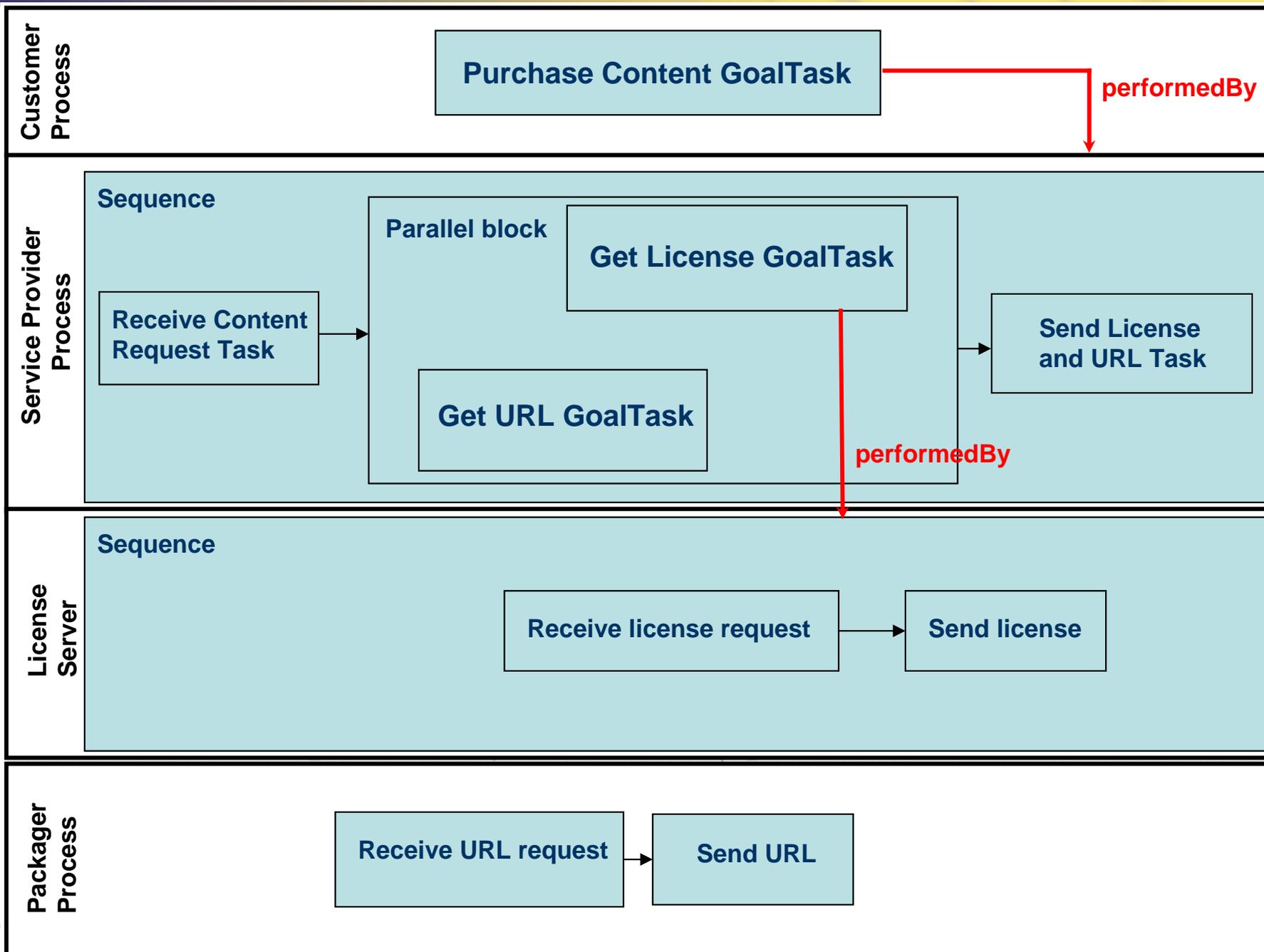


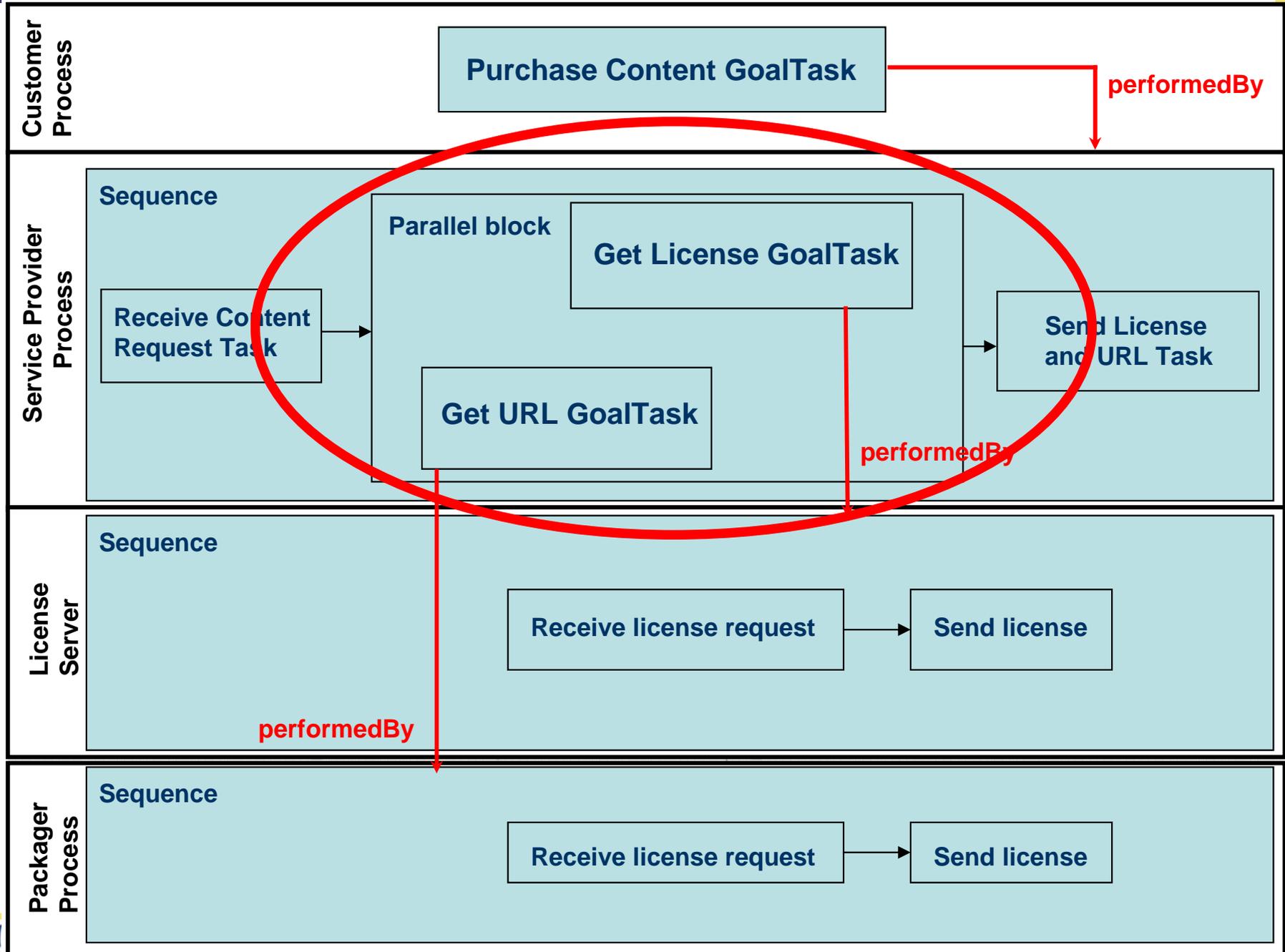


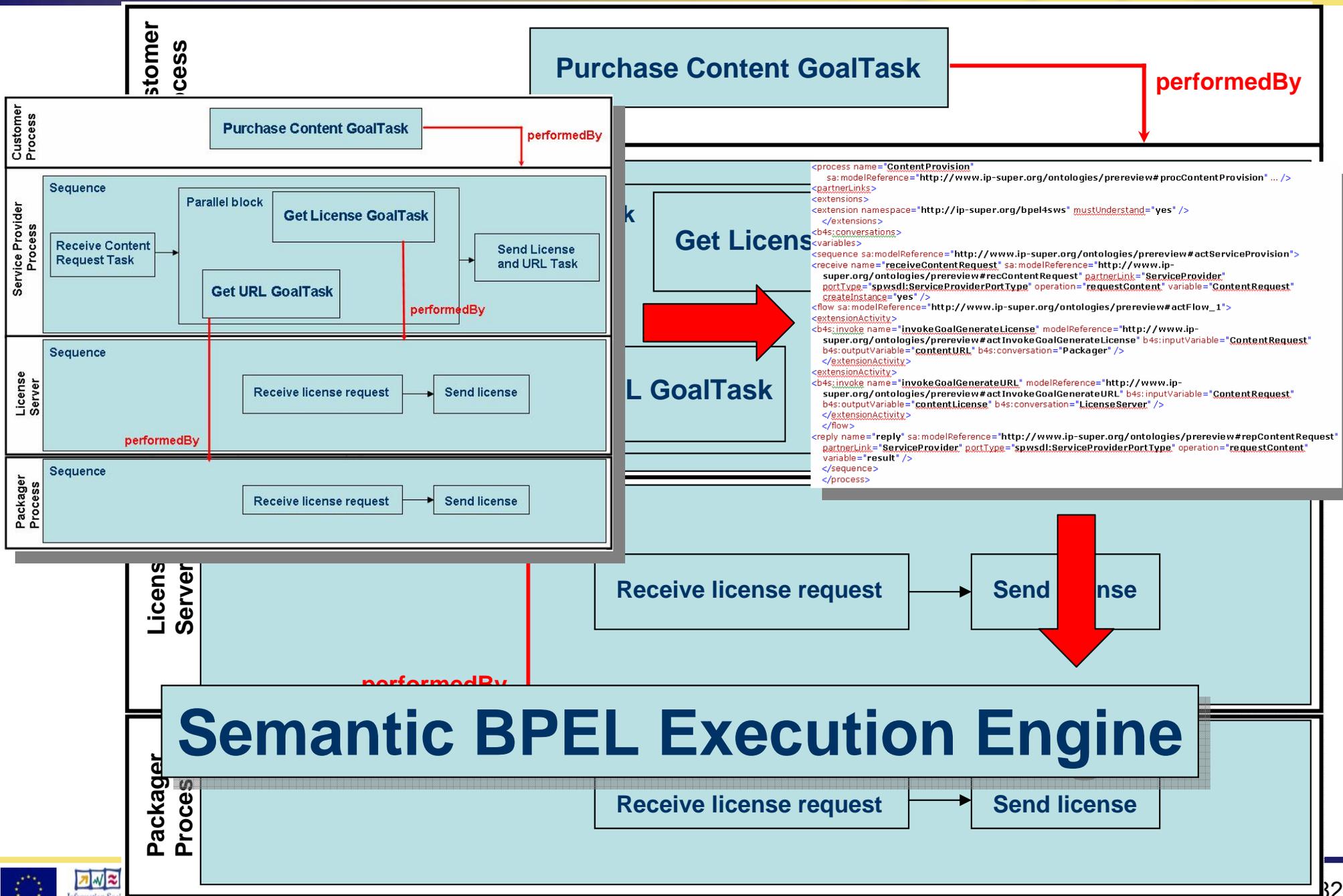












```

<process name="ContentProvision"
  sa:modelReference="http://www.ip-super.org/ontologies/prereview#procContentProvision" ... />
<partnerLinks>
<extensions>
<extension namespace="http://ip-super.org/bpel4sws" mustUnderstand="yes" />
  </extensions>
<b4s:conversations>
<variables>
<sequence sa:modelReference="http://www.ip-super.org/ontologies/prereview#actServiceProvision">
<receive name="receiveContentRequest" sa:modelReference="http://www.ip-
  super.org/ontologies/prereview#recContentRequest" partnerLink="ServiceProvider"
  portType="spwsdl:ServiceProviderPortType" operation="requestContent" variable="ContentRequest"
  createInstance="yes" />
<flow sa:modelReference="http://www.ip-super.org/ontologies/prereview#actFlow_1">
<extensionActivity>
<b4s:invoke name="invokeGoalGenerateLicense" modelReference="http://www.ip-
  super.org/ontologies/prereview#actInvokeGoalGenerateLicense" b4s:inputVariable="ContentRequest"
  b4s:outputVariable="contentURL" b4s:conversation="Packager" />
  </extensionActivity>
<extensionActivity>
<b4s:invoke name="invokeGoalGenerateURL" modelReference="http://www.ip-
  super.org/ontologies/prereview#actInvokeGoalGenerateURL" b4s:inputVariable="ContentRequest"
  b4s:outputVariable="contentLicense" b4s:conversation="LicenseServer" />
  </extensionActivity>
</flow>
<reply name="reply" sa:modelReference="http://www.ip-super.org/ontologies/prereview#repContentRequest"
  partnerLink="ServiceProvider" portType="spwsdl:ServiceProviderPortType" operation="requestContent"
  variable="result" />
</sequence>
</process>

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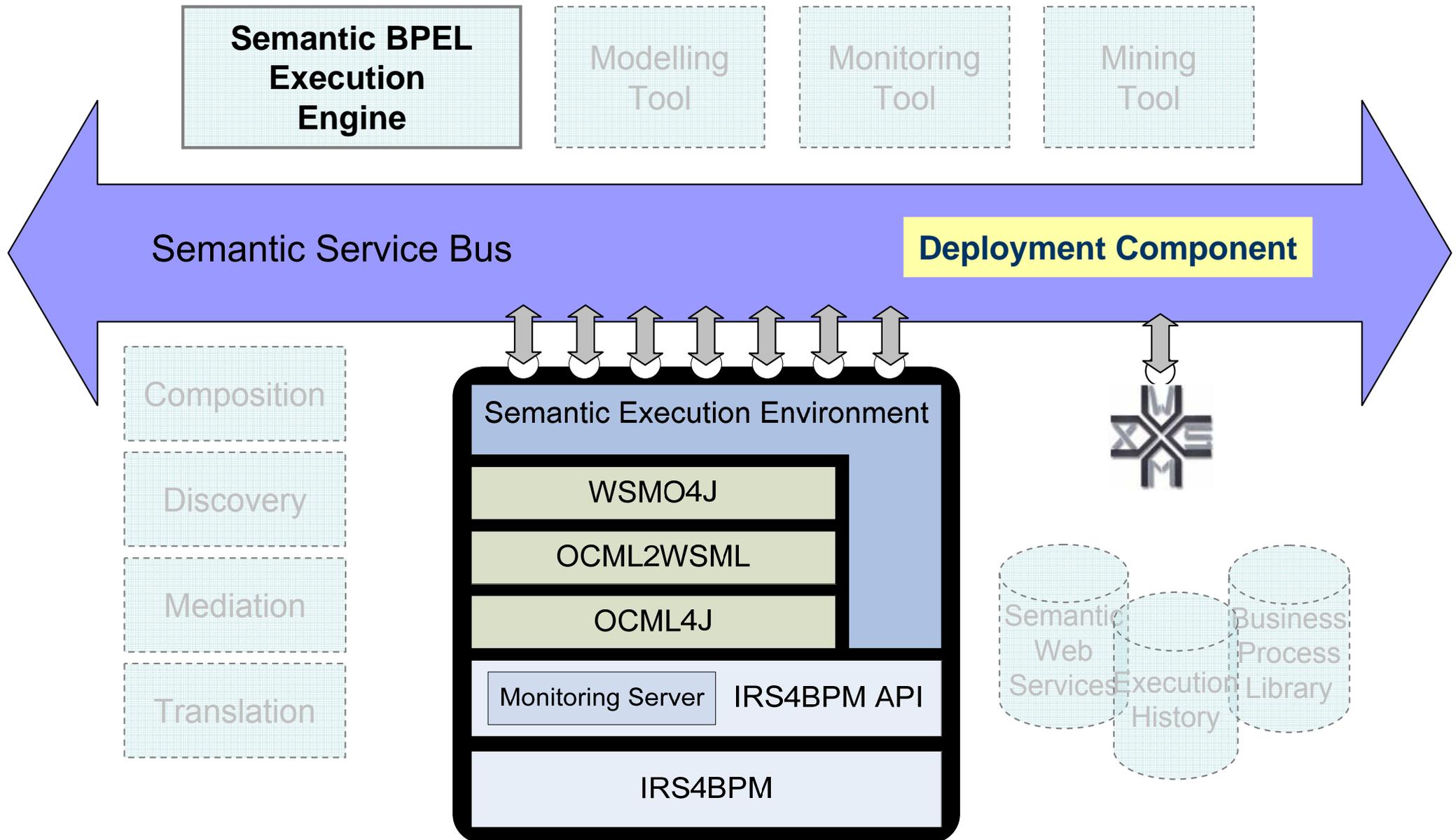
SUPER

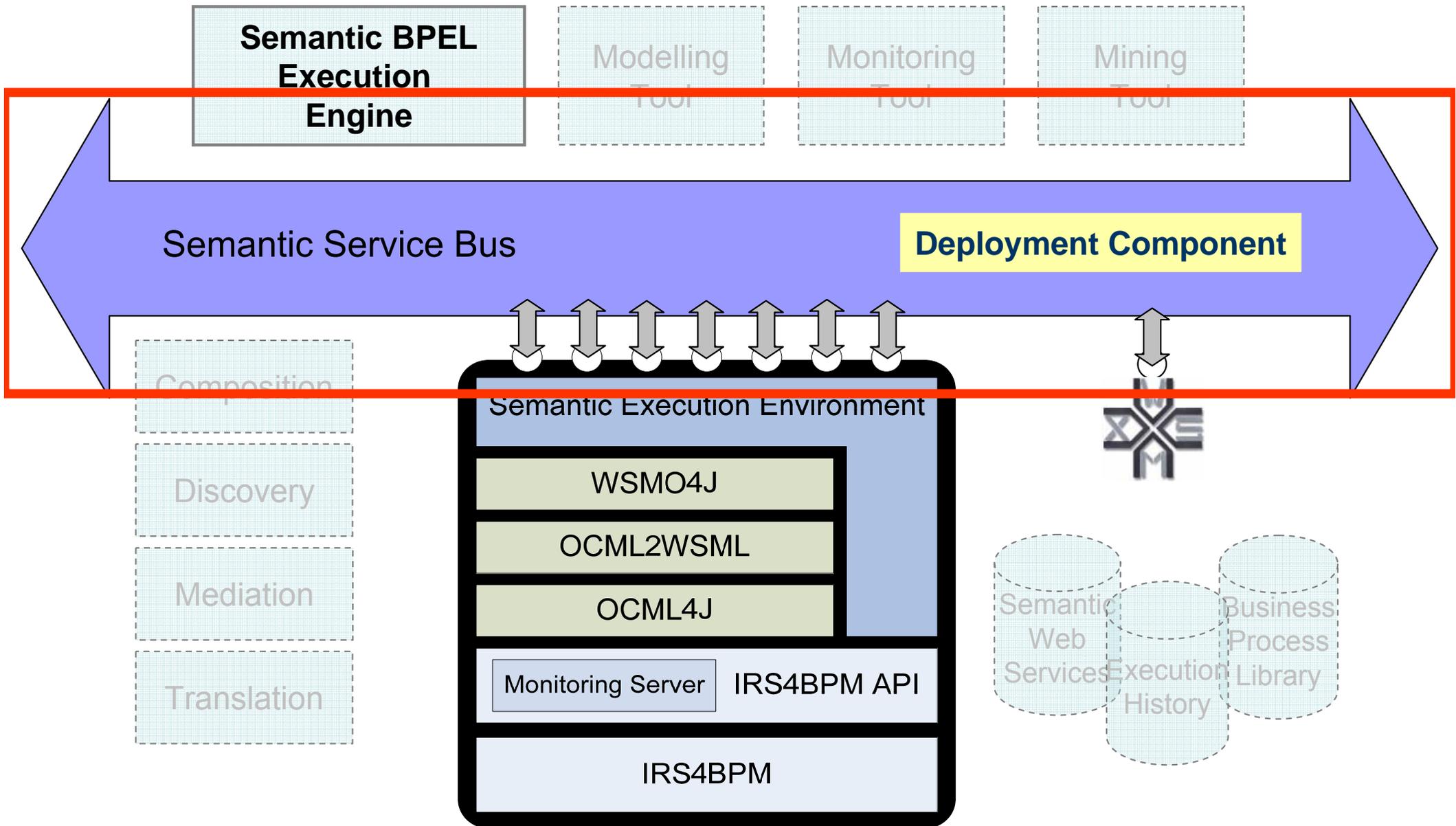
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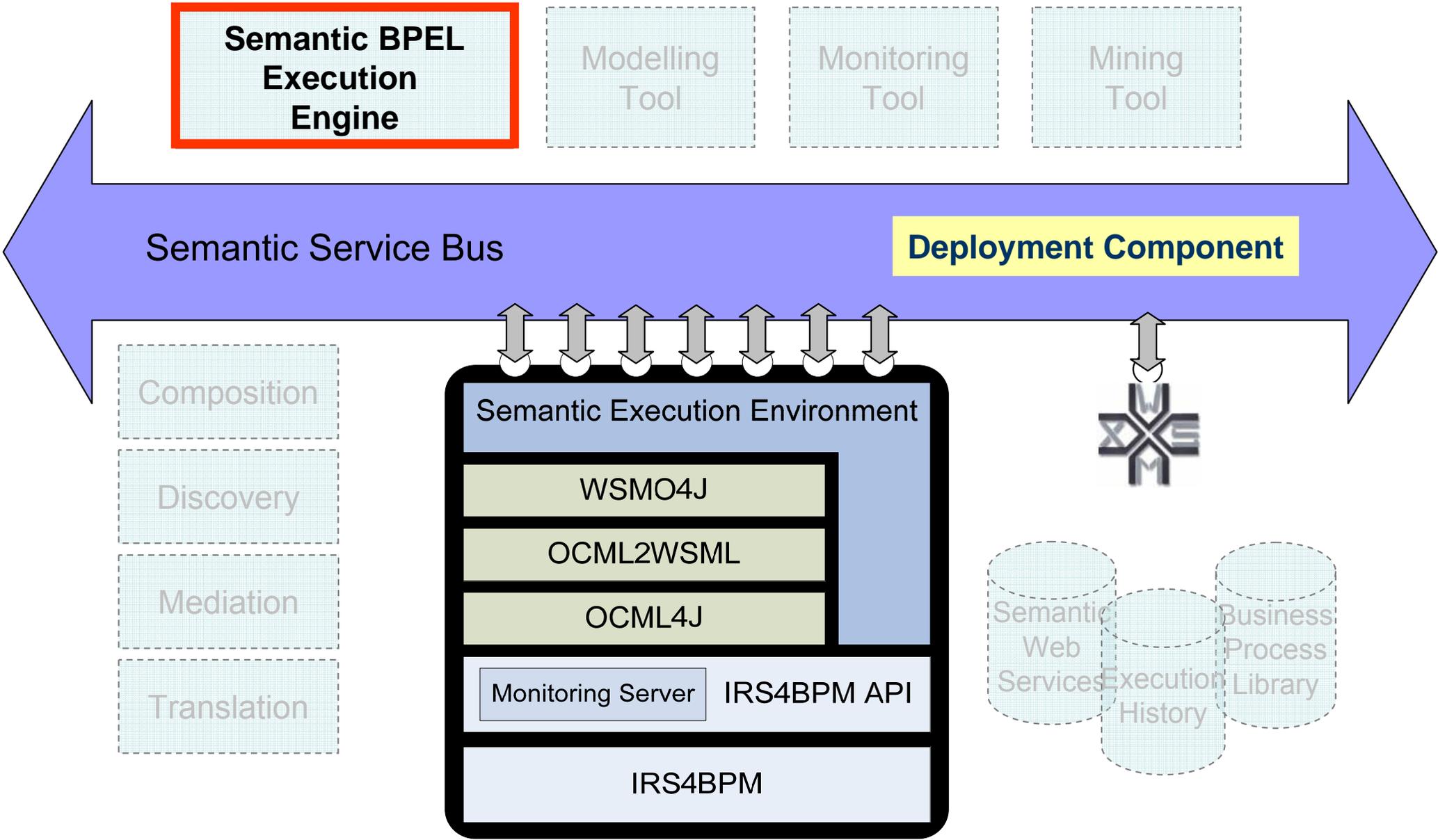
European Integrated Project

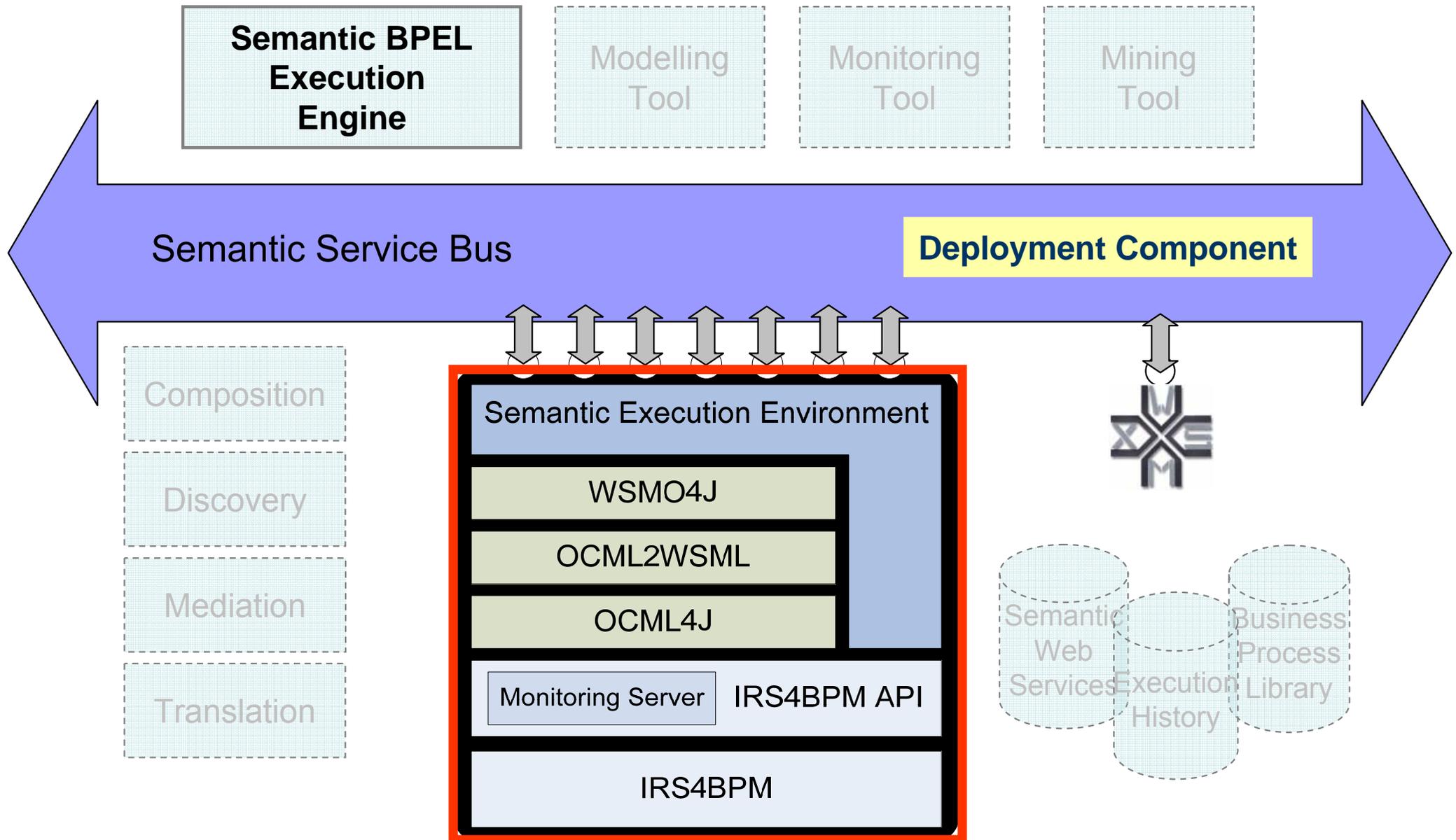
SUPER Execution and Monitoring

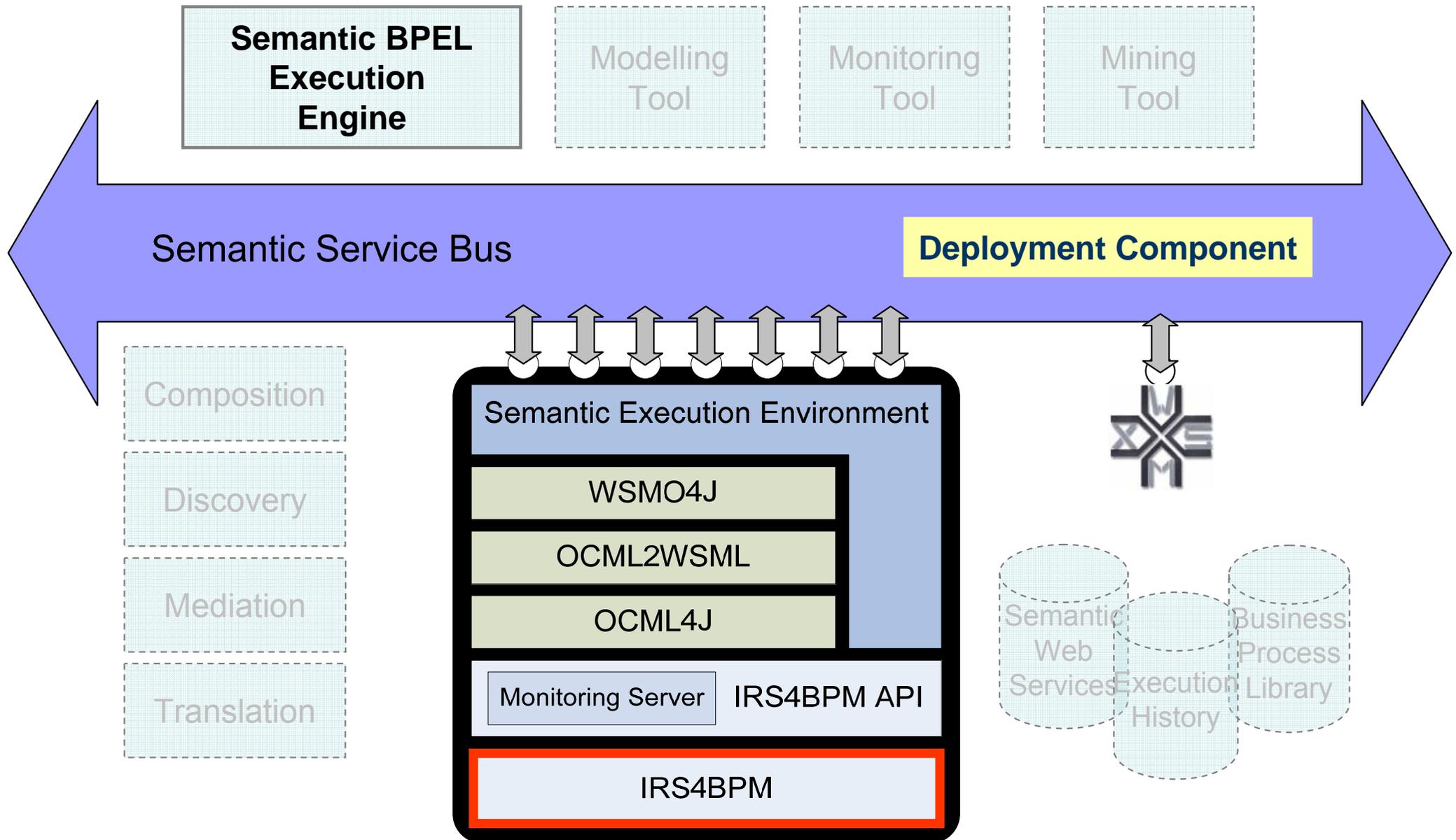


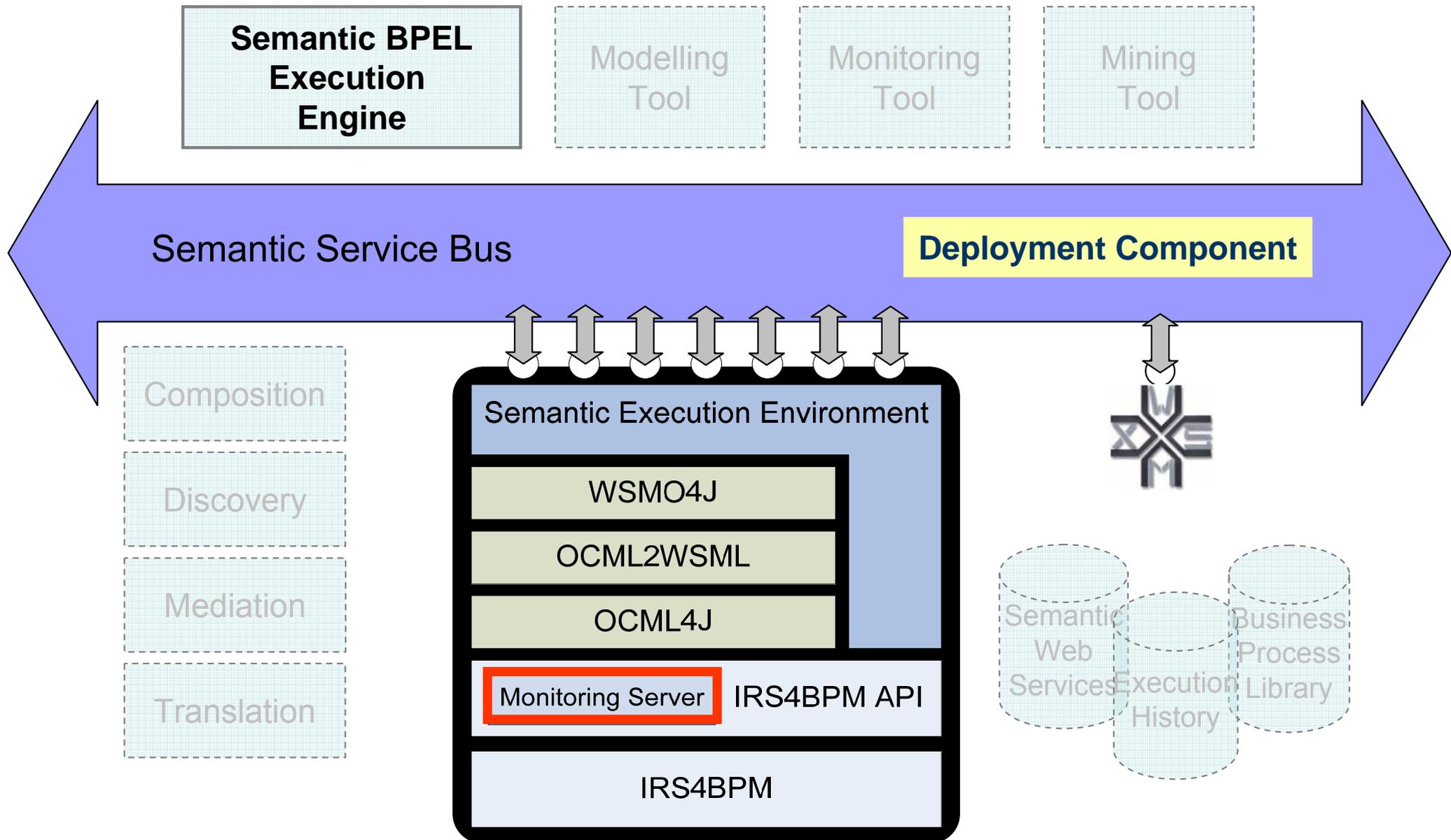


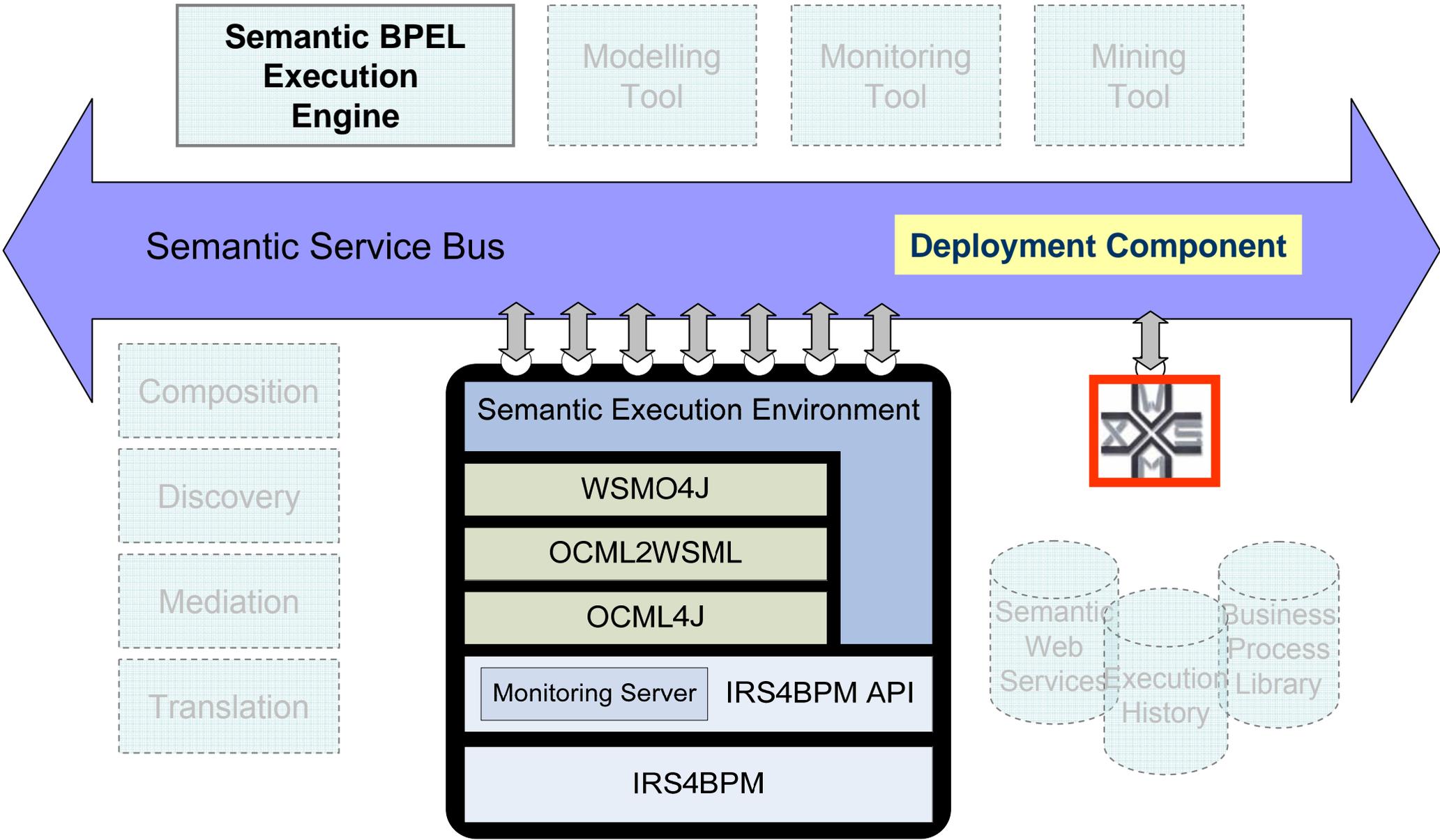














SUPER

semantics utilised for
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European Integrated Project

Digital Content Demo

- SUPER bridges the business expert/IT divide for business processes
- Approach based upon 4 layers
 - ▶ 'Sense Making' around solution maps
 - ▶ Business process modelling standards (EPCs and BPMN)
 - ▶ Web Service Workflow standards – BPEL
 - ▶ Semantic Web Services
- KMi work focussed on
 - ▶ SUPER stack of ontologies
 - ▶ IRS4BPM
 - ▶ Business Process Mediation
 - ▶ Monitoring and Mining
 - ▶ Behavioural reasoning



SUPER

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Thanks