

BPAL: A Platform for Managing Business Process Knowledge Bases via Logic Programming

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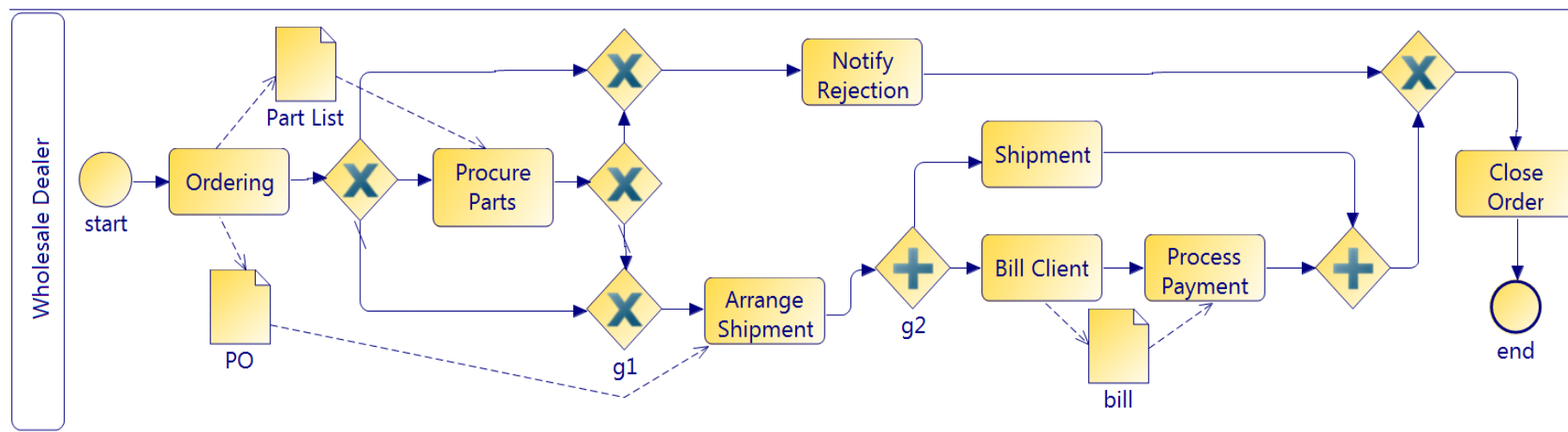
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Business Processes

⊗ A **Business Process (BP)** consists of a set of **coordinated activities** that are performed by an organization in order to achieve a **business goal**.

⊗ Graph-based notations to represent **activity workflows**

- E.g., **BPMN**, EPC, UML Activity Diagrams



Semantic Lacks in BP Models

Ⓢ Notations used in practice lack a formal **behavioral semantics**

- ambiguities in the interpretation of models
- translation into formal models needed to enable automated analysis

Ⓢ The **domain knowledge** about activities, actors, and objects is not modeled

- no adequate specification of the domain-related terminology
- behavior of individual activities given in terms of input/output only



1. Analysts have to take into account **implicit/informal knowledge** to

- consistently interpret and (re-)use BP models
- verify that a BP actually behaves as expected

2. Semantic **interoperability issues**

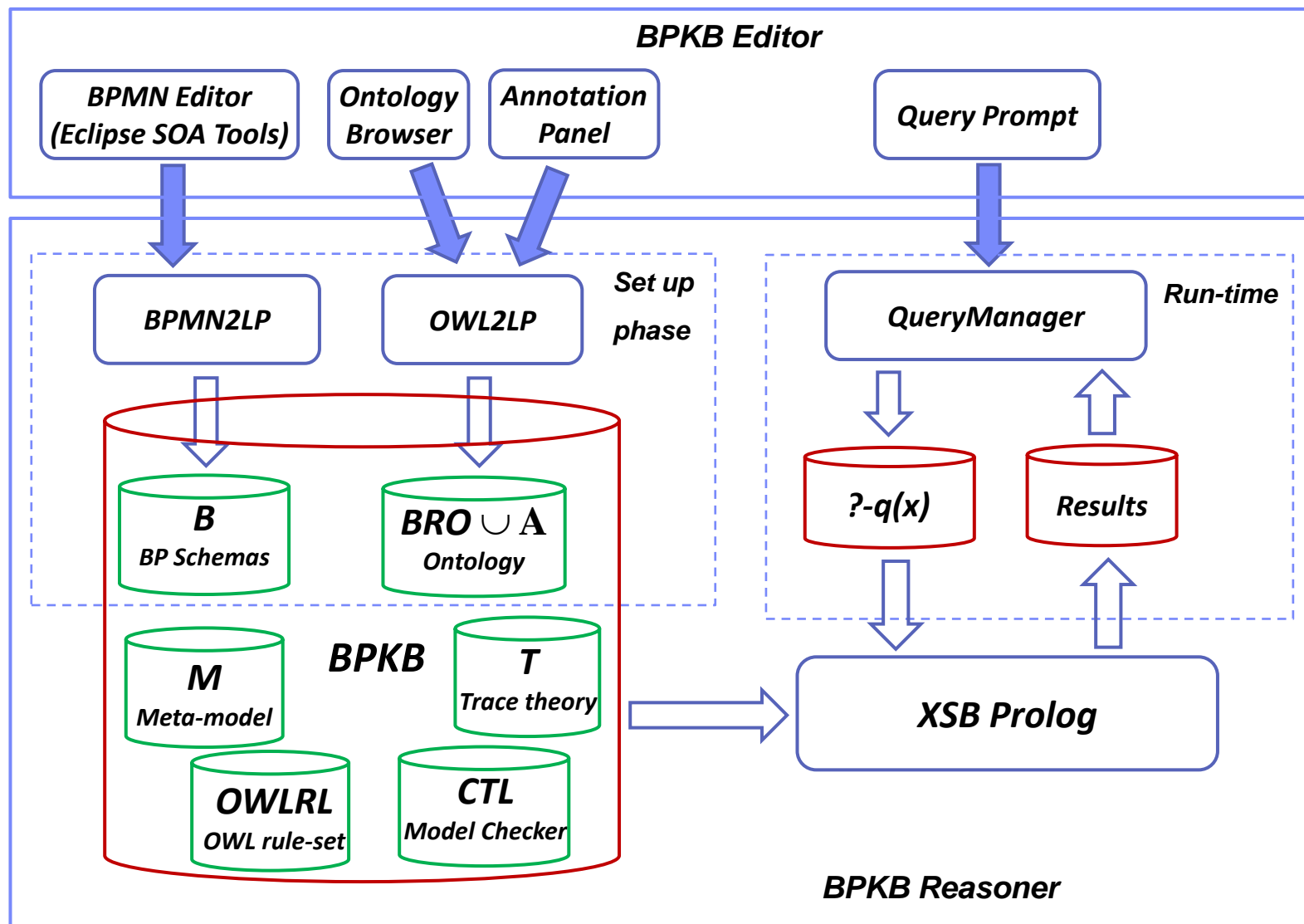
LP-based Uniform Framework

- ④ An LP language for representing a relevant fragment of BPMN
 - Representation of the **workflow** graph as a set of **LP facts**.
 - Representation of the **meta-model** as a set of **LP rules**.
- ④ **Behavioral semantics** formalized via a specialized **Fluent Calculus** (an LP-based action language).
- ④ **Semantic annotations** w.r.t. an **OWL-RL** ontology (which has an LP translation)
 - ontology-based definition of **terminology**
 - **preconditions** and **effects** of activities within a BP
- ④ **Reasoning** services
 - **CTL temporal reasoning** formalized in **LP**
 - Composite **reasoning tasks** (involving workflow graph, behavior, ontology) specified as **LP queries**

Platform Functionalities

- Ⓜ Business Process Knowledge Base Management
 - BP modeling and annotation
- Ⓜ Enactment
 - Trace generation and compliance
- Ⓜ Verification
 - Checking properties of operational behavior *and* semantic annotation
- Ⓜ Compliance
 - Checking domain specific business rules
- Ⓜ Retrieval
 - Querying process fragments described in a declarative way
- Ⓜ Composition
 - Completion of a BP *skeleton* by subprocesses specified via *local* and *global* constraints

Software Platform



Applications of the Platform

BPAL is being used as the main component of the BP knowledge management system in the following projects:

- EU FP7 *Business Innovation and Virtual Enterprise Environment* (BIVEE): modeling of production processes in manufacturing oriented networked-enterprises



- Joint CNR – SOGEI project for modeling processes that implement norms in the tax domain

Demo....

The screenshot displays the QuBPAL application interface, which is used for managing business process knowledge bases via logic programming. The interface is divided into several main sections:

- Navigator (a):** Located on the left, it shows a hierarchical tree of files and folders, including 'ICSOC2013', 'BPMNRepository', 'OntologyRepository', and 'Skeletal'. The 'HandleOrder.bpmn_diagram' file is currently selected.
- Queries (e):** The top central area shows a query window with the following SQL-like query:


```
SELECT <?p,?s,?e> WHERE task(?s::bro:RequestShipment) AND
onpath(?a::bro:Shipment,?s,?e,?p) AND
onpath(?b::bro:Invoicing,?s,?e,?p)
```

 The response time is 141 ms. Below the query is a table of results:

Var	Value
E	g10
P	'HandleOrder'
S	select_shipper
- BPMN Diagram (b):** The main workspace displays a BPMN diagram for 'HandleOrder'. It features several tasks: 'parts_auction', 'allocate_inventory', 'notify_rejection', 'select_shipper', 'delivering', 'bill_client', and 'payment'. The diagram includes various gateway symbols (diamonds with 'X' or 'O') and flow arrows connecting the tasks. Labels like 'g2', 'g4', 'g8', 'g9', and 'g10' are used to identify specific gateway elements.
- OWL Ontology (c):** The bottom-left pane shows an ontology browser with a tree of classes. The 'Order' class is expanded, showing subclasses such as 'ApprovedPO', 'ClosedPO', 'FulfilledPO', 'CancelledPO', 'Invoice', and 'SalesDocument'.
- Properties (d):** The bottom-right pane shows the configuration for a task's properties. It includes a 'Condition' field set to 'ApprovedPO(o)', an 'Effect' field set to 'Invoice(i), related(o,i)', and an 'Eff-' field set to 'empty'. There are also buttons for 'Arguments', 'Atom', and 'Empty' to configure the logic expressions.