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

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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

- 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.

- Behavioral semantics formalized via a specialized Fluent Calculus (an LP-based action language).

- 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

- 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 \textit{and} semantic annotation
- Compliance
  - Checking domain specific business rules
- Retrieval
  - Querying process fragments described in a declarative way
- Composition
  - Completion of a BP \textit{skeleton} by subprocesses specified via local and global constraints
Software Platform

BPMN Editor (Eclipse SOA Tools) → BPMN2LP → BP Schemas

Ontology Browser → OWL2LP → BRO ∪ A

Annotation Panel

Set up phase

BPKB Editor

Query Prompt

QueryManager

?-q(x) → Results

XSB Prolog

Run-time

BPKB Reasoner

Annotation Panel

BPMN2LP

OWL2LP

BPKB

OWLRL

CTL

M

Meta-model

T

Trace theory

B

BP Schemas

OWLRL

OWL rule-set

CTL

Model Checker

BRO

Ontology
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
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Demo....

(a) Navigator

(b) Process Model

(c).owl Repository

(d) Prolog

(e) Query

(f) Variables