Towards a Framework for Policy-Oriented Enterprise Management

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Introduction

Software to manage businesses has a more than 30 year tradition.

- Because module-based software was too inflexible SOA was developed.
- SOA lacks policies to modulate/constrain the application of services to achieve compliant processes.

We introduce the main ideas of POEM, an approach to realize business processes and their execution from business goals using computational logic.
Main Idea

- Semantics of services are described using standardized means.
- Rules/policies/laws are explicitly represented in the system (standardized).
- Business goals can be entered as declarations.
- Given a goal and a current context (situation, constraints), a process can be generated mainly using deductive synthesis on the basis of available services (their descriptions) and under the constraints of relevant policies.
What is POEM – Main Idea and Vision

The heart of our research approach are policies.

- Policies are the rules and regulations set by the organization.
- They can be manifested as specifications, constraints on services, or contract criteria.
- They determine the constraints and laws of a business.
The Enterprise Physics Metaphor

Hypothesis.

- Business objects are analogous to physical objects.
- Policies are analogous to physical laws.
- Services change objects within the constraints of policies.
How is a Business Process Realized in an Enterprise Physics Universe?

Business Process in Enterprise Physics Universe.

- Goal description.
  - Properties and relations of business objects of and between business objects are declared.
- The current business situation (current properties and relations of and between business objects) is known.
- Business policies are declared.
- Processes are composed by orchestration of services to transform the actual situation into a situation in which the declared goal is true under the declared policies.
Benefits of the New Approach

General benefits of the new approach.

- Processes can be “developed” fast without human programming. Human programmers do not have to deal with the complexities of process development, customization and integration.
- Fast realization of processes to meet flexibly changing ad hoc business goals.
- Complete adherence and consistent interpretation of policies during process generation (no interpretations conjectured by programmers).
- Processes can be proven with regards to their validity on the basis of theorem proving.
- Knowledge about company policies is well-maintained in the system (instead scattered in heads of experts).
POEM Example – Situation, Goal, and Process

Initial situation.
- Car tire dealer “John’s Tire Center.”
- Accepts “Dave’s” order of four “GS21” high-performance tires.
- GS21 not on stock.

Goal.
- Bill Dave for his order of four GS21 tires.

Expected business process.
- Contact tire manufacturer “Best Tire and Rubber.”
- Procure 100 GS21 due to special conditions for large orders.
- Best Tire and Rubber delivers the 100 tires, and sends invoice to John’s Tire Center.
- Pay Best Tire and Rubber’s bill.
- Ship the four GS21 and customer invoice to Dave.
POEM Example – Policies

General constraints of policy-oriented enterprise management systems.

- A bill can be issued for a shipment.
- A shipment can be executed from stock.
- If a shipment cannot be fulfilled from stock, the goods to be shipped must be acquired from an appropriate supplier.
- Goods will be procured from a supplier only if needed.
- A bill from a supplier has to be paid.
- No shipment is done without a prior order.

Constraints of John’s Tire Center

- We procure any types of tires only from Best Tire and Rubber.
- We procure GS21 from Best Tire only in amounts equal to or larger than 100 pieces in a single purchase order (due to special deals).
POEM Example – Functioning of the System

Transformation to the enterprise physics domain.

- Prerequisite.
  - Policies and situation description are logically satisfied statements.
    - Example 1: The fact that there is an order of four tires from Dave.
    - Example 2: The constraint that each ordered item not on stock must be procured.
  - Goal is logically unsatisfied statement.
    - Example: It is not yet true that there is a bill for Dave’s order.

- Goal identification.
  - Identify goal in a way that it can be decomposed into sub goals to be matched by services regulated by policies.
  - Results in business specification of the goal for transformation into technical use case description.
  - After refinement, actual use case is derived in appropriate form for processing, ranging from BPMN to first order predicate calculus (FOPC).
  - Supported by system through proposing matching services and policies.

Reaction of the enterprise physics system.

- Technically, goal constitutes inconsistency in the logical data base.
- A planner helps to organize the sequence of sub goals, assigns services to realize them under given policies / constraints.
- Executing the plan resolves the inconsistency.
Some Challenges on the Way

What functionality do we need to realize goal-driven business process realization?

How can we acquire, represent and maintain policies to be used for automated reasoning?

How is the user integrated into the policy-oriented Enterprise Management?
To keep functionality scalable, domains must be restricted and functionality well organized to reflect enterprise structures on a rather fine-grained level.

The functionality realizing business in the POEM approach are agents called Poets.
- Each poet represents a business role (maybe equivalent to an actual user role).
- Senses relevant circumstances in the business environment, according to its business role.

Functions of poets.
- Senses relevant circumstances in the environment.
  (business objects, input channels, user input, input from “fellow poets” etc.)
  - Example: Purchasing poet senses a purchase order from Dave.
- Hypothesizes a business goal which is inferred on the basis of relevant circumstances.
  - Example: Dave receives a bill for the purchase.
- Develops a plan how to achieve the business goal utilizing available services which manipulate business object instances recognizing constraining policies.
  - Example: The bill for Dave is filled with the price including all purchased goods plus all other expensing activities (shipping, taxes etc.).
Picture of a poet

**Situation Analyzer**
Forward chaining functionality performing pattern recognition on the environment on restricted business objects and channels according to the poet's role.

**Goal Hypothesizer**
Given the situational input, derives a business goal to be achieved.

**Planner**
On the basis of the business goal, plans for achieving this goal by deriving sub goals that can be achieved by services or other agents.

**Poet Knowledge Base**
Comprises “proprietary” knowledge as well as access to shared knowledge.

**Communication**
Exchange information with “fellow poets.”

**User Interaction**
Realizing communication, explanation, guidance to the user.

**Environment**
Business object instances, work lists accessible to the poet, channels to sensors, user input.
Transformation of Policies into a Form Processable by Man and Machine

Challenges.
- Policies in natural language are very complex and not processable for the machine.
- Policies hard-coded in an imperative style are not accessible for automated reasoning.
- Policies scattered over database tables are not appropriately accessible for automated reasoning.
- Policies in logic are difficult to create by a human user.

Suggestion:
Controlled natural language as a unifying form of representation for policies.
- A controlled natural language covers a strict subset of an ordinary natural language.
- It is defined by a controlled grammar and a controlled lexicon.
- A controlled natural language can be directly translated into a logic appropriate for reasoning about the expressed contents by the machine.
- New words needed can be defined “on the fly” in an ontology which shows the properties and relations of a new word to those already known.
- Intelligent authoring tools help the user write correct text in controlled natural language.
Conclusion

POEM is computational logic applied to enterprise management software is realized from specification rather than actual programming.

Programmers are rather business experts.

A declarative approach facilitates uniform representation across domains and functionality, including human users on the basis of controlled natural language.

Easy understandable declarations for humans and machines can be extended dynamically, simulation of new policies leads to easy exploration and realization of business optimization.

Found solutions can be verified / proven or explained to users in case of conflicts.

An agent-based architecture ensures scalability, flexibility and extendibility.

We see this work as a step towards next generation business software.
Thank you!

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