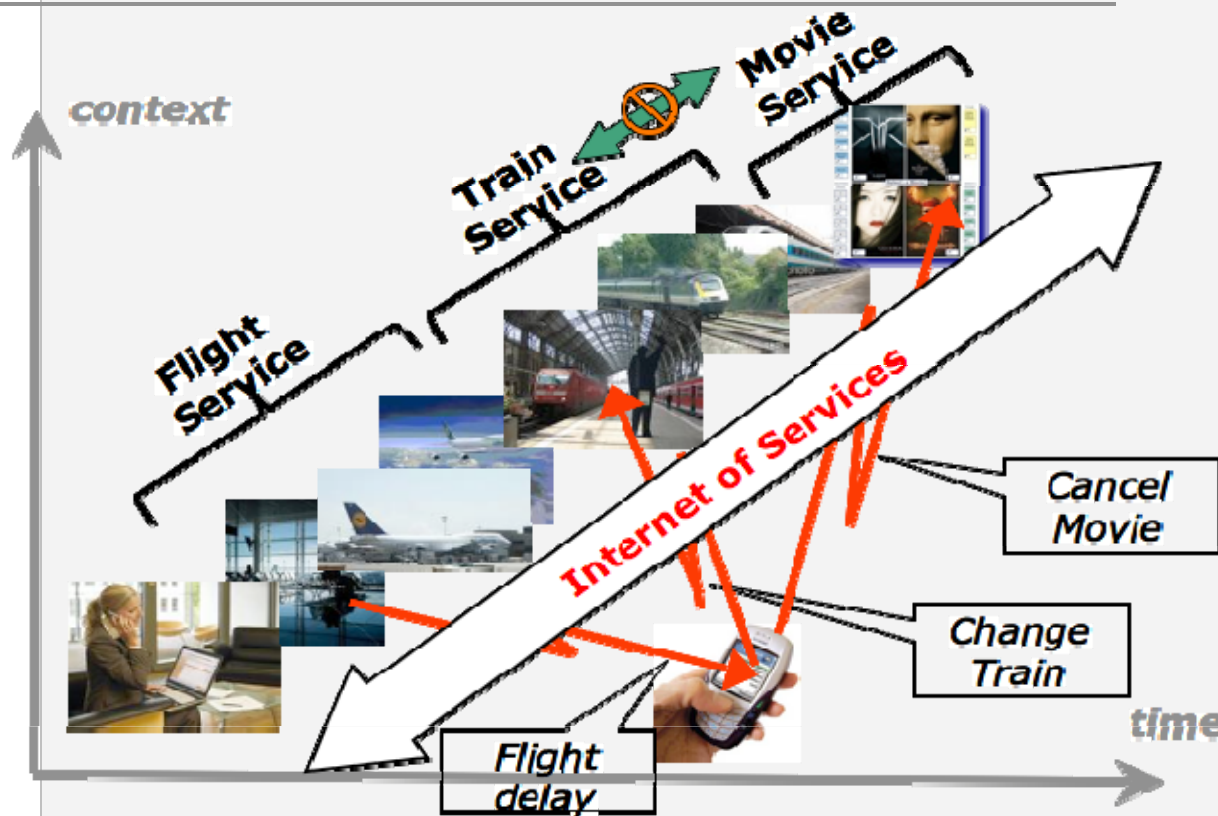# A Design Methodology for *Real Services*

Alessandro Marchetto, Cu D. Nguyen, Chiara Di Francescomarino,

Nauman A. Qureshi, Anna Perini, Paolo Tonella

Software Engineering Research Unit

Fondazione Bruno Kessler, IRST-CIT, Trento, Italy

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Anna Perini *FBK - IRST CIT, perini @fbk.eu*

"Real Services" are …

[Pistore09,Kazhamiakin09]

- a combination of actual services and software services that: (i) provide electronic access to an actual service (e.g. properties; purchasing); (ii) inform the user in real time about events that maybe crucial for her (e.g. flight cancellation)

  – Tailored to each specific user … user-centric

  – asset-driven, user's assets, such as time, money, social relations that are fundamental in our choices

  – … from minutes to days … diversity of time scale

  – Reactive to events and highly-adaptive

  – Ubiquitous …

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Research questions

- Which methods and techniques are appropriate for the engineering sw applications based on *real services*?

- More concretely, how shall we do Requirements Engineering; Specification&Design; ... Testing of Service-Based Application (SBA) for *real services*, taking into account their peculiarities?

Our Focus

- Conceptual modeling of real services for the purpose of requirements analysis, specification ... and early validation of spec. of SBA for real services through simulation

  - Identify suitable conceptual paradigms for modeling real services taking into account their key features
  - Define guidelines for real services modeling

Opera scenario

Hans and Herbert are going to enjoy a performance at the Munich Opera. Hans lives in Munich while Herbert lives in Frankfurt.

Hans buys tickets using the Opera ticketing service and adds a corresponding event to the agenda. By using the TelCo services the information about the event is shared also with Herbert, who may use it in order to book a ticket for himself.
Herbert books a return ticket to Munich by exploiting the Lufthansa Mobile Services.

Since the performance takes place in the evening, Herbert may or may not decide to stay in Munich for one night. In the case, he needs to reserve a room in a hotel (Booking.com).
Before leaving for the airport, Herbert receives a message about the flight cancellation (Lufthansa's SMS messaging).
By taking another flight, he would be late for the performance, therefore he prefers to get the flight money back and take an alternative transportation to Munich. He can: take the train (DB Rail Navigator) or go by car (Via Michelin or Google Maps services for the route planning).

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Goals

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preferences

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preferences

OR

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preferences

OR

Uncertain / unforeseen situations

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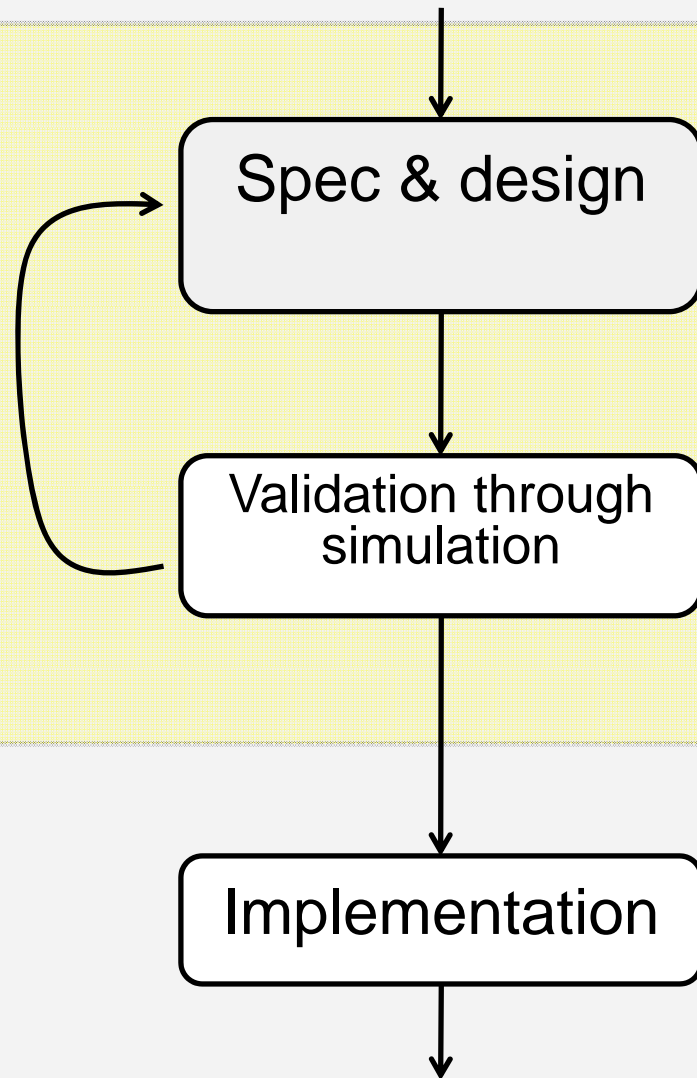
Goals

preferences

OR

Uncertain / unforeseen situations

Domain objects / user's assets

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Goals

preferences

OR

Uncertain / unforeseen situations

Domain objects / user's assets

Actions/ Bus. Processes

Approach overview

Spec & design

Validation through simulation

Implementation

1. Goal-Oriented RE (Tropos): actors, roles, goals, softgoals, social dependencies
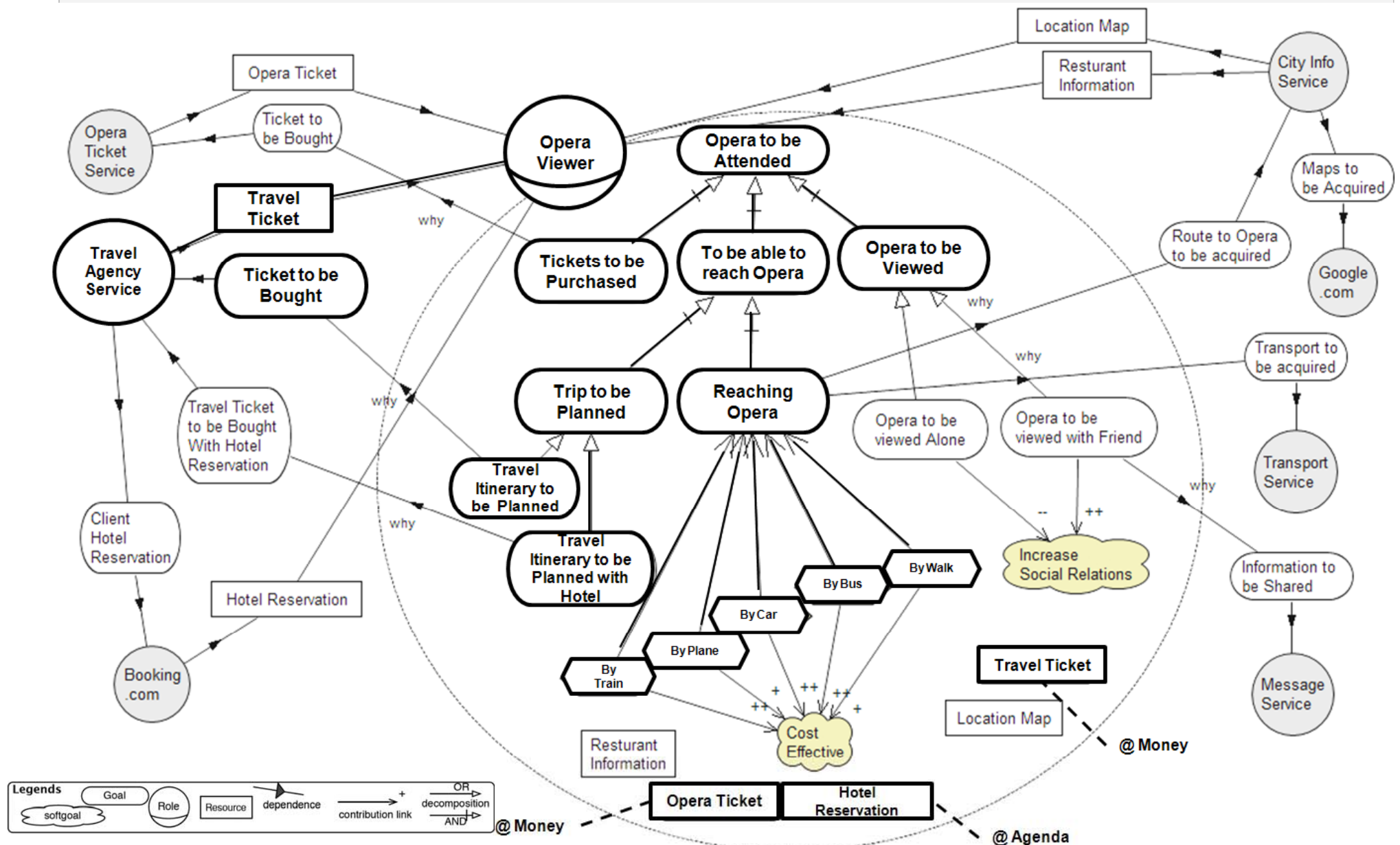
2. BPMN: service modeling

3. Ontology: user assets, asset modifiers and domain entities

4. OCL constraints: effect of activities on user assets

.. and linking rules that enable reasoning / traceability across views

Example of goal/preferences /alternatives model

Domain objects and assets

user assets (Money, Agenda), and **asset Modifiers** (AddEventToAgenda and SpendMoney)

Supporting concepts (Location, Time, Event) which enable to describe specific contexts
E.g. Agenda is a user-asset that is a composition of Events (rel. *AgendaComposedOf*) and an Event has some properties such as starting time, duration and location (i.e., *hasEventStartingTime*, hasEventDuration and *hasEventLocation*).

The ontology can be obtained by extending an existing ontology or it can be built form scratch, incrementally.
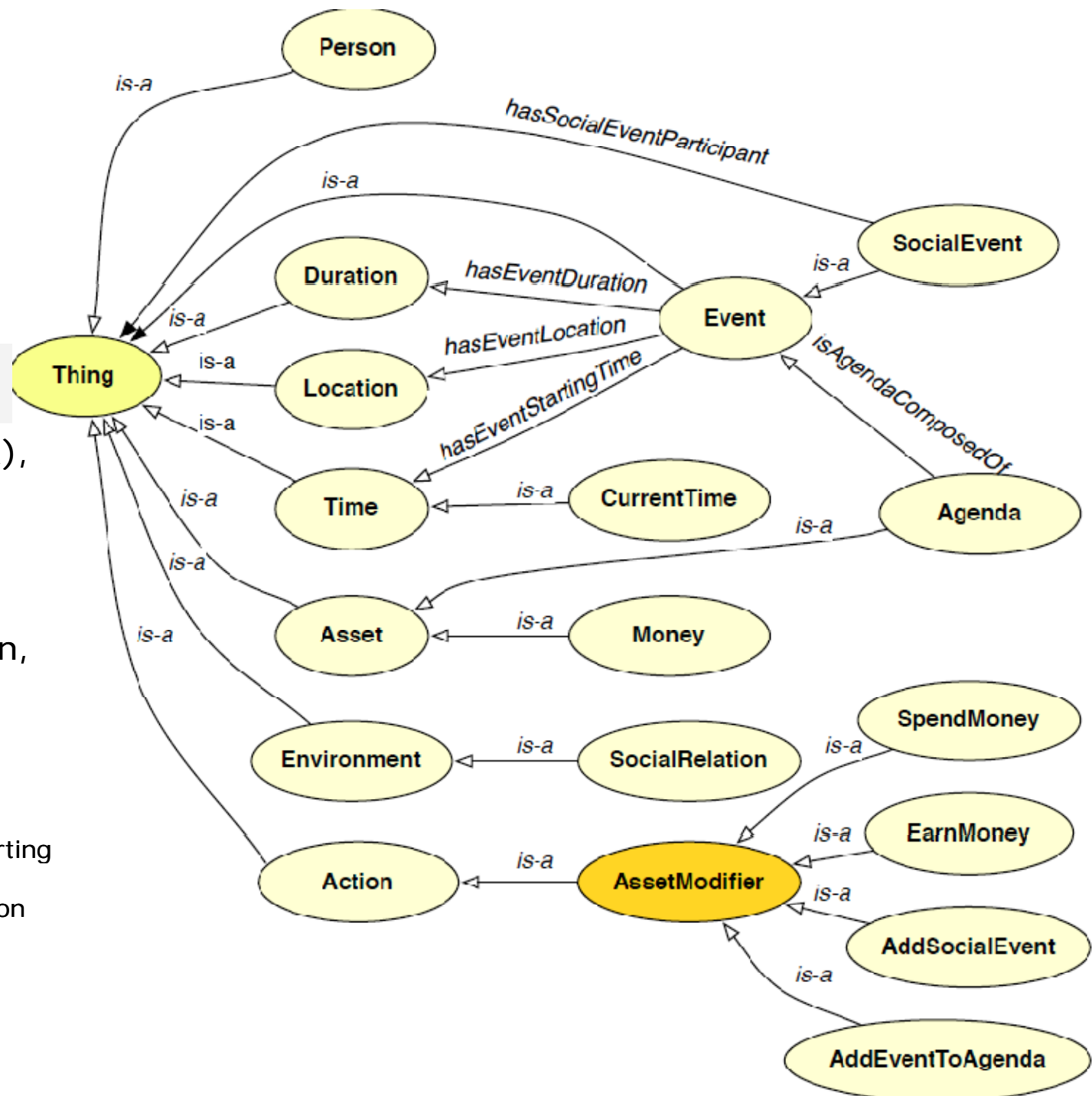
Dynamic Semantics by constraints

OCL-based constraints are used to describe the dynamic semantics of each asset modifier. Constraints quantifies the impact of such activities on user assets.

```
context AddEventToAgenda(agenda : Agenda, event : Event, env : Environment)
    pre presentAndFuture : event.time.DateTime >= env.currentTime.DateTime
    post updatedAgenda : agenda = agenda@pre → including(event)

context SpendMoney(currentMoney : Money, money : Money)
    pre enoughBalance : currentMoney.MoneyBalance >= money.MoneyBalance
    post decreasedMoney : currentMoney.MoneyBalance =
            currentMoney.MoneyBalance@pre − money.MoneyBalance

context IncreaseMoney(currentMoney : Money, money : Money)
    post increaseBalance : currentMoney.MoneyBalance =
            currentMoney.MoneyBalance@pre + money.MoneyBalance

context AddSocialEvent(se : SocialEvent, relations : SocialRelations,
            env : Environment)
    pre presentAndFuture : event.time.DateTime >= env.currentTime.DateTime
    pre participantFriend : (se.participants → intersection(relations.person.friends))
            →size() >= 1
    post newRelation : relations = relations@pre → including(se)
```
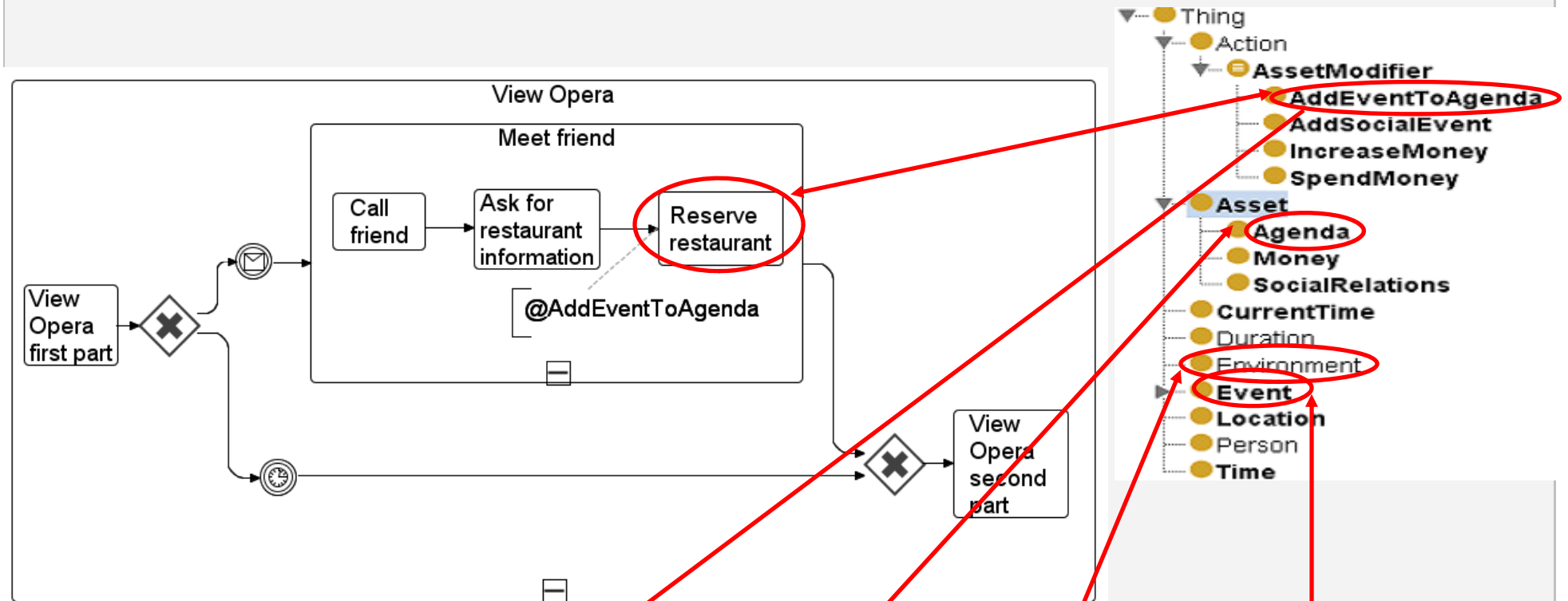
Example of **business process model**


Semantic annotation

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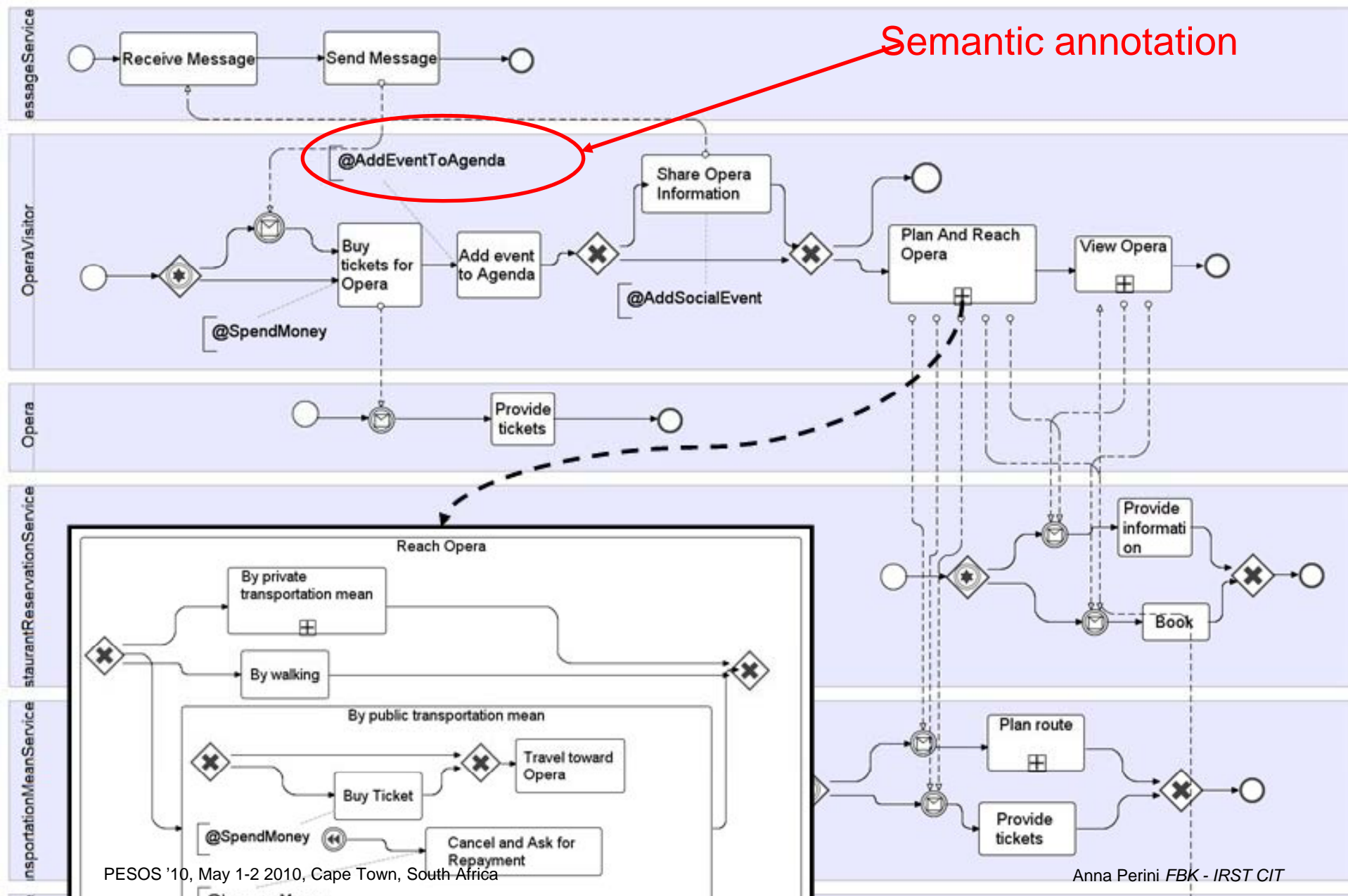
Business Process Model Annotation

context AddEventToAgenda(agenda: Agenda, env: Environment, event: Event)
pre presentAndFuture **:** event.time.DateTime >= env.currentTime.DateTime
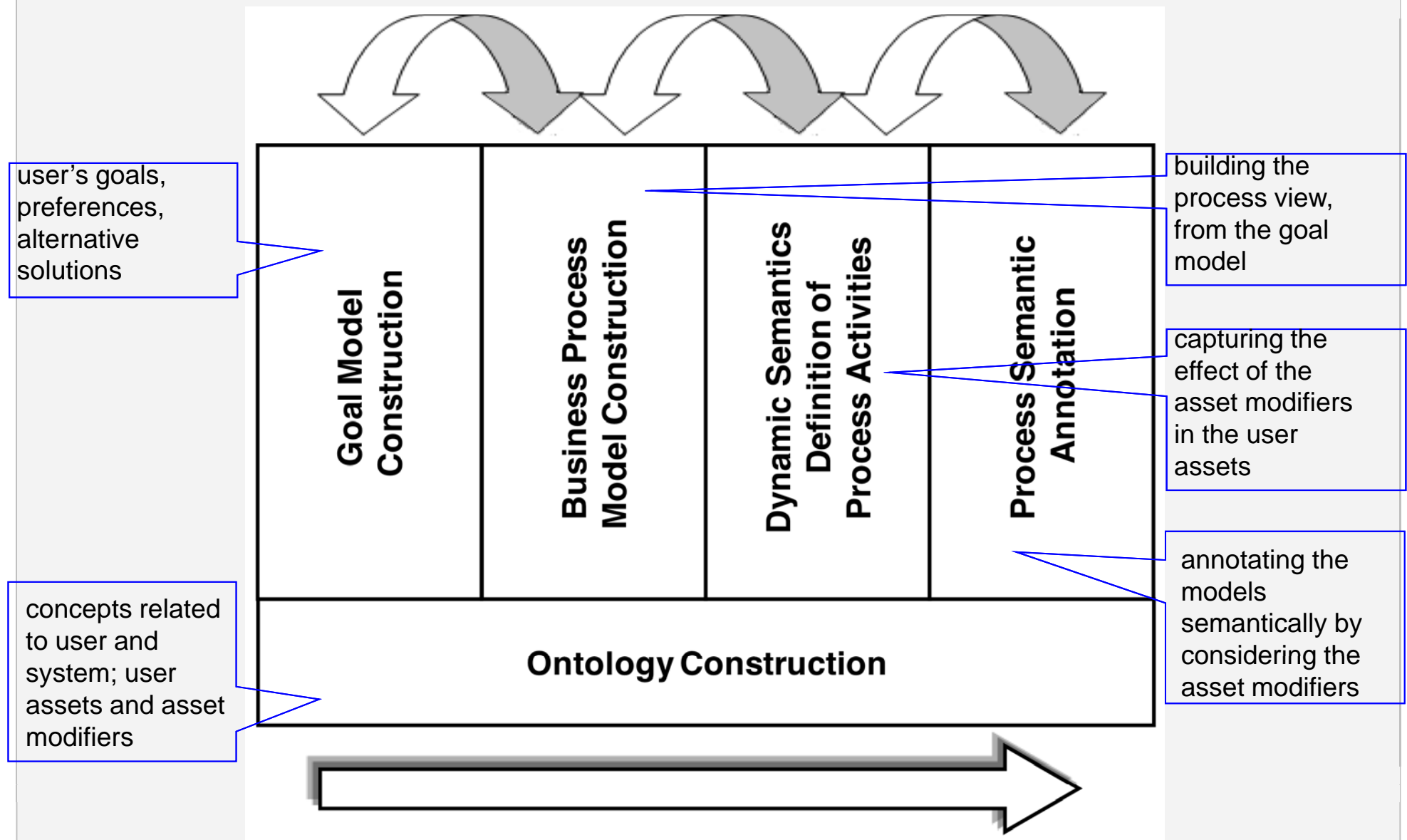**post** updatedAgenda**:** agenda = agenda@**pre→including**(event)

Example of **business process model**

Compensation

Exceptional flow

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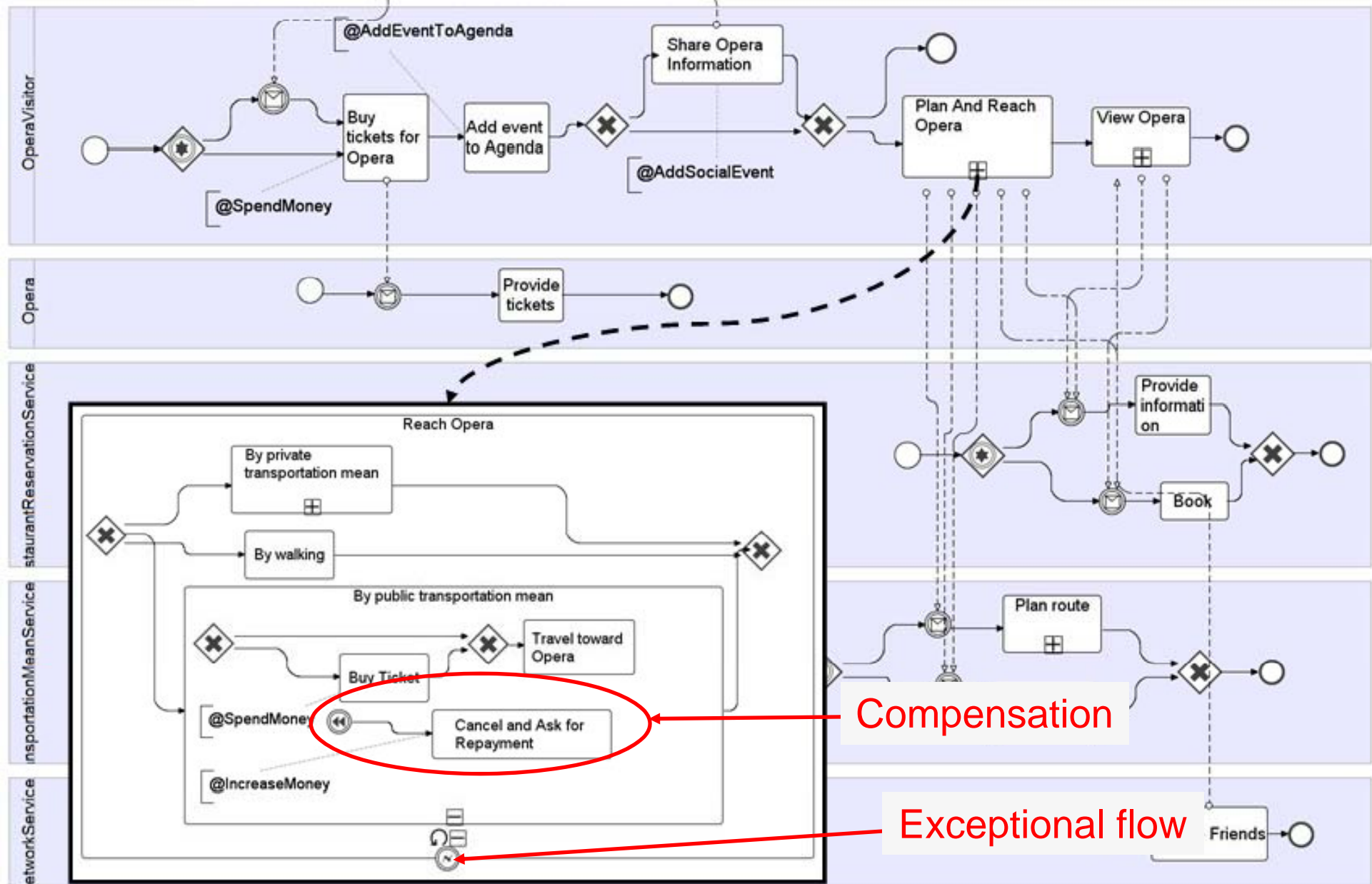
Goals to Business Process rules

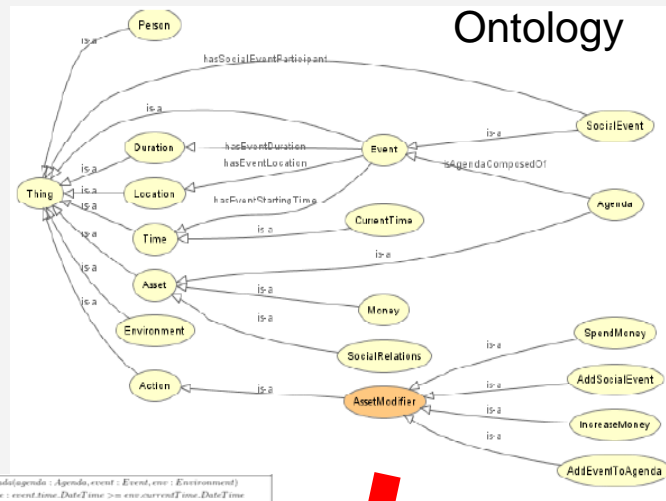| Goal Model element	BPMN Model element
Actor/User Role	Pool
Goal/Sub-Goal/Plan	Activities (i.e. Task/Subprocesses
OR decomposition	Branch of activities (i.e. OR/XOR gateway and alternative flows
Resources inside actor/role boundary	Data objects exchanged among activities in the same pool
Resources shared by actors	Data objects exchanged among activities in different pool

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Process & guidelines

user's goals, preferences, alternative solutions

building the process view, from the goal model

Goal Model Construction

Business Process Model Construction

Dynamic Semantics Definition of Process Activities

Process Semantic Annotation

capturing the effect of the asset modifiers in the user assets

concepts related to user and system; user assets and asset modifiers

Ontology Construction

annotating the models semantically by considering the asset modifiers

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Opera scenario

Natural lang. description

Goal Model

Opera example: Natural Language Description

Hans and Herbert are going to enjoy a performance at the Bavarian State Opera. Hans lives in Munich while Herbert lives in Frankfurt.
1. Hans buys tickets using the Bavarian State Opera ticketing service. He finds digital ticket in his Gmail inbox and adds a correspondent event to the agenda. This information about the event (description, relevant service information) is shared also with Herbert using the TelCo services. Herbert now may use that information in order to book a ticket for himself.

Ontology

Process Model

Annotated Process Model

OCL constraints

Contributions

- user centrality: the modeling approach enables to capture & combine specific users intentions (e.g. Hans wants to attend a performance at Opera) with "As-Is"/generic services (e.g., the Opera Ticket Service) purposes
- user assets: the modeling approach enables to model explicitly user assets and asset modifiers, with their static (by means of the ontology), and dynamic semantics (by means of the OCL constraints)
  - Connection points between the intentional and the operational perspective

Improvements

- Automation/ support in model building, e.g.
  - Derivation of BP model from goal model [Penserini07]
  - semantic annotation of goal model resources and business process model activities, providing annotation suggestions to the designer [Di Francescomarino09]
- Needs of a constraint language that allows capturing dynamic aspects
- Providing operational links from generic services to concrete services available on the Internet (taxonomy collecting concrete services, e.g. Booking.com, Venere.com)

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On going / future work

- ## Methodology for modeling /specifying IoS

  – Extended modeling of quality requirements and preferences

  – Specifications of Monitoring for qualities and preferences to drive self-adaptation at run-time

- ## RE for Real Services

  – RE at design-time vs. RE at run-time?

    - RE at design-time involves activities that aim at identifying monitoring and adaptation requirements to ensure that the SBA will be able to operate while maintaining its expected function and quality

    - RE at run-time helps acquiring information that can be treated as possible requirements. It should involve consumers and the SBA itself as primary stakeholders

- ## Tools and infrastructures for "real service" simulation

  – What to test/validate through simulation ?

  – How to simulate users, heterogeneous systems, event-based systems?

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Anna Perini *FBK - IRST CIT*

Thank you !

Anna Perini *FBK - IRST CIT*