On the Alignment between Goal Models and Enterprise Models with an Ontological Account

nemo

ontology & conceptual

modeling research group

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Previous Background

- **B.Sc. in Computer Engineering (2002 - 2007)**
  - **Monograph Title**: A Comparison Between System Requirements Obtained With the Application of Process Modeling Techniques With System Requirements Obtained With the Application of Conventional Techniques of Requirements Engineering (in Portuguese)

- **Master in Computer Science (2007 - 2009)**
  - **Dissertation Title**: On the Alignment Between Goal Models and Enterprise Models with an Ontological Account

- **Phd in Computer Science (2011/4 – 2013/4)**
  - **Topic:** Goal-oriented business process management

Outline

- Introduction
  - Background;
  - Motivation;
  - Research Objectives;
  - Approach;
  - Scope and Non-Objectives;
- Case Study
  - The Goal and Enterprise Elicitation/Modeling Phase;
  - The Harmonization Phase ;
  - The Alignment Phase;
- Conclusions and Future Work;
- Just a flavor of my PhD work.

Introduction

Background

- The increasing competitiveness drives organizations to promote changes;

- Enterprise Architecture (EA) helps one to tackle the complexity of a given enterprise environment;

- EAs are structured in terms of *architectural domains* or *viewpoints* which focus on specific concepts of enterprises such as business processes, organizational structure, applications, infra-structure;

Motivation

- Among the viewpoints, the *goal domain* receives special attention;

- Why using goal modeling?
  - Captures motivations behind the elements of the Enterprise Architecture (why am I executing this process?);

  - Expresses the choices behind multiple alternative strategies (is this particular process the most suitable one to achieve my goal?)

  - Enables synchronized changes between the EA and the organizational strategy (what happens if my goals change? Or what happens if my processes change?)

Research Objectives

- – To understand the relations between the **goal domain** and the **other domains of the EA**, such as business processes, roles, data information and so forth;

- – To proposing a framework which characterizes the possible relations between the **goal domain** and **other enterprise architecture domains** as well as the **semantics** of these relations.

Approach

- We have conducted an exploratory case study in the Rheumatology Department of the Cassiano de Moraes University Hospital, which is part of the Federal University of Espírito Santo in Vitória, Brazil;

- The development of our research has been decomposed into the following main phases:
  - The Goal and Enterprise Elicitation/Modeling Phase;
  - The Harmonization Phase;
  - The Alignment Phase;

- In each phase, we have used a different approach to tackle the research problem under consideration.

Scope and Non-Objectives

- We are concerned with the problem of relating goal models and enterprise models in an AS-IS situation;

- We are not concerned with:

  - Exhaustively identifying the relationships between AS-IS goal models and AS-IS business process models;

  - Proposing methodologies for designing particular enterprise architecture structures that satisfy particular goals;

  - Proposing systematic steps for the generation of TO-BE business process models from TO-BE goal models.

- From this point on, we describe the phases of the case study, but we do not explore the details related with the achieved results.

Case Study: The Goal and Enterprise Elicitation/Modeling Phase
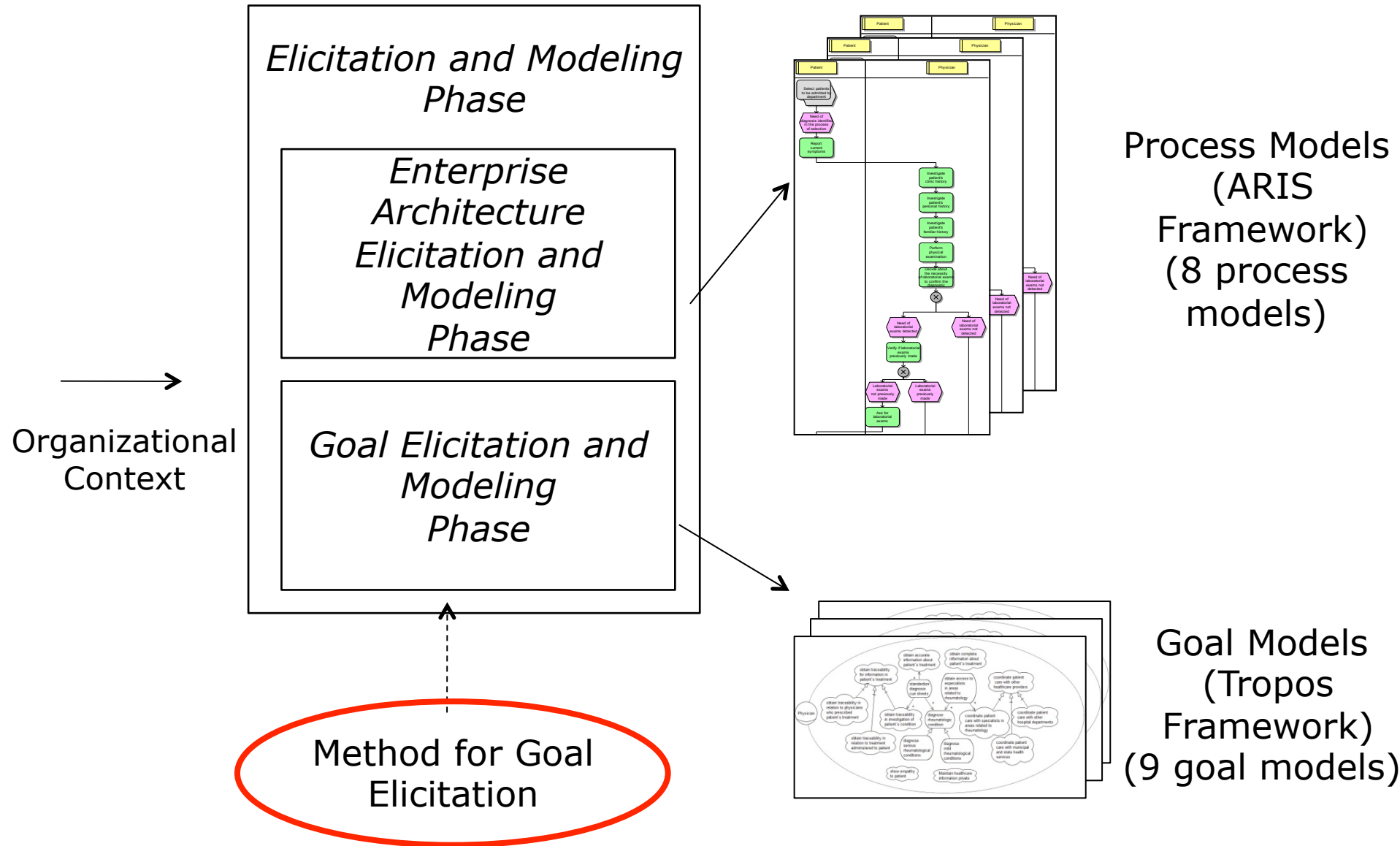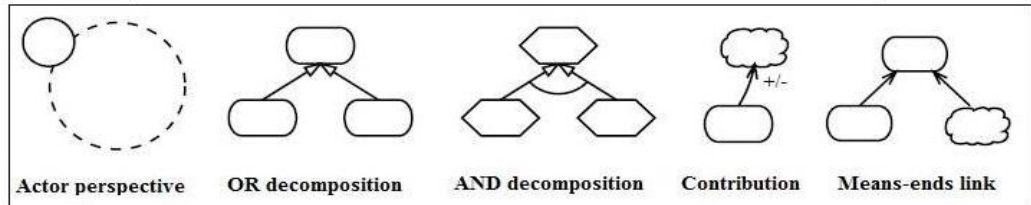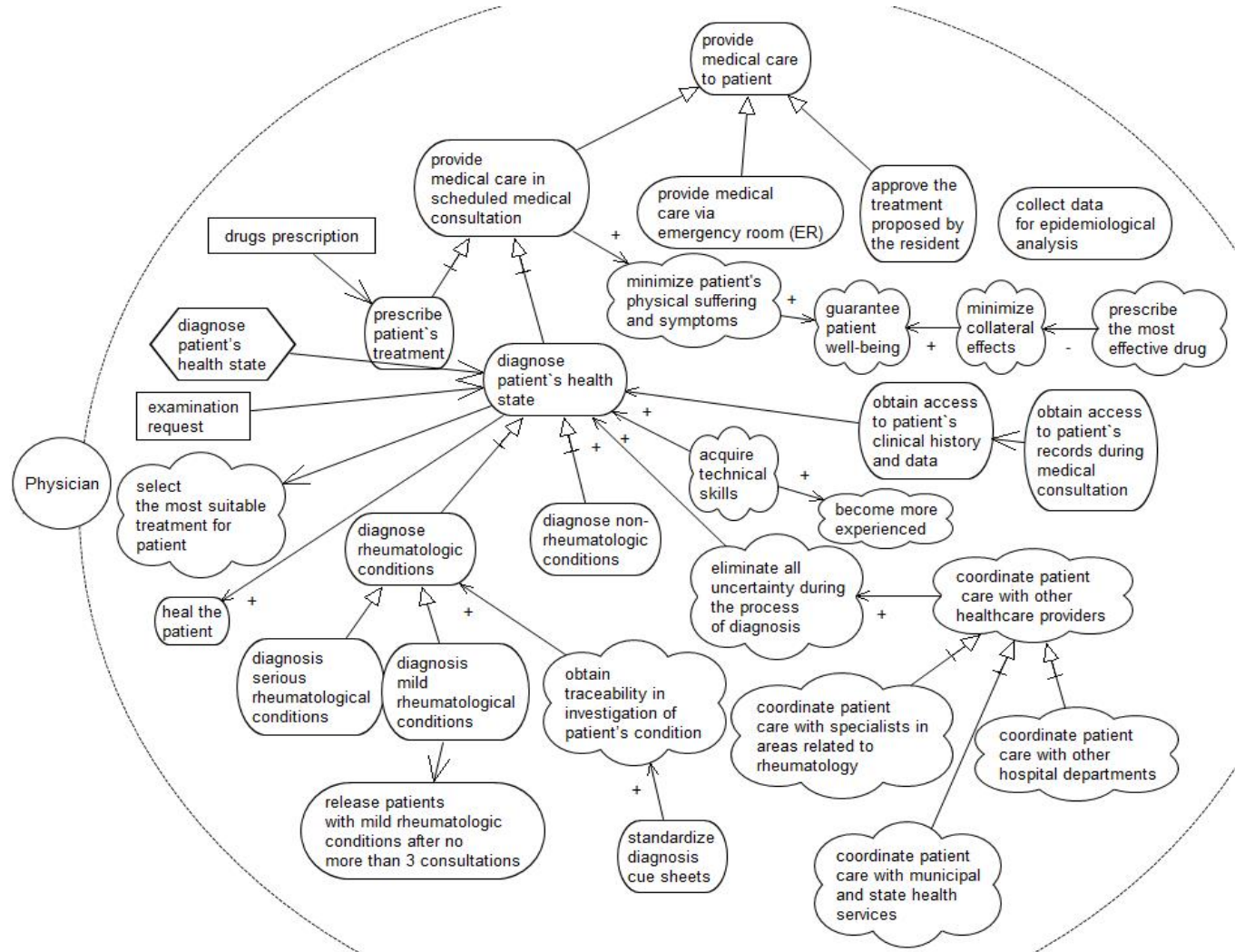
The Elicitation and Modeling Phase

Organizational Context

Elicitation and Modeling Phase

Enterprise Architecture Elicitation and Modeling Phase

Goal Elicitation and Modeling Phase

Method for Goal Elicitation

Process Models (ARIS Framework) (8 process models)

Goal Models (Tropos Framework) (9 goal models)

Figure 1 The elicitation and modeling phase schematically

The Physician's Perspective

Figure 3. Goal
Diagram in Tropos
which focuses on
the Physician's
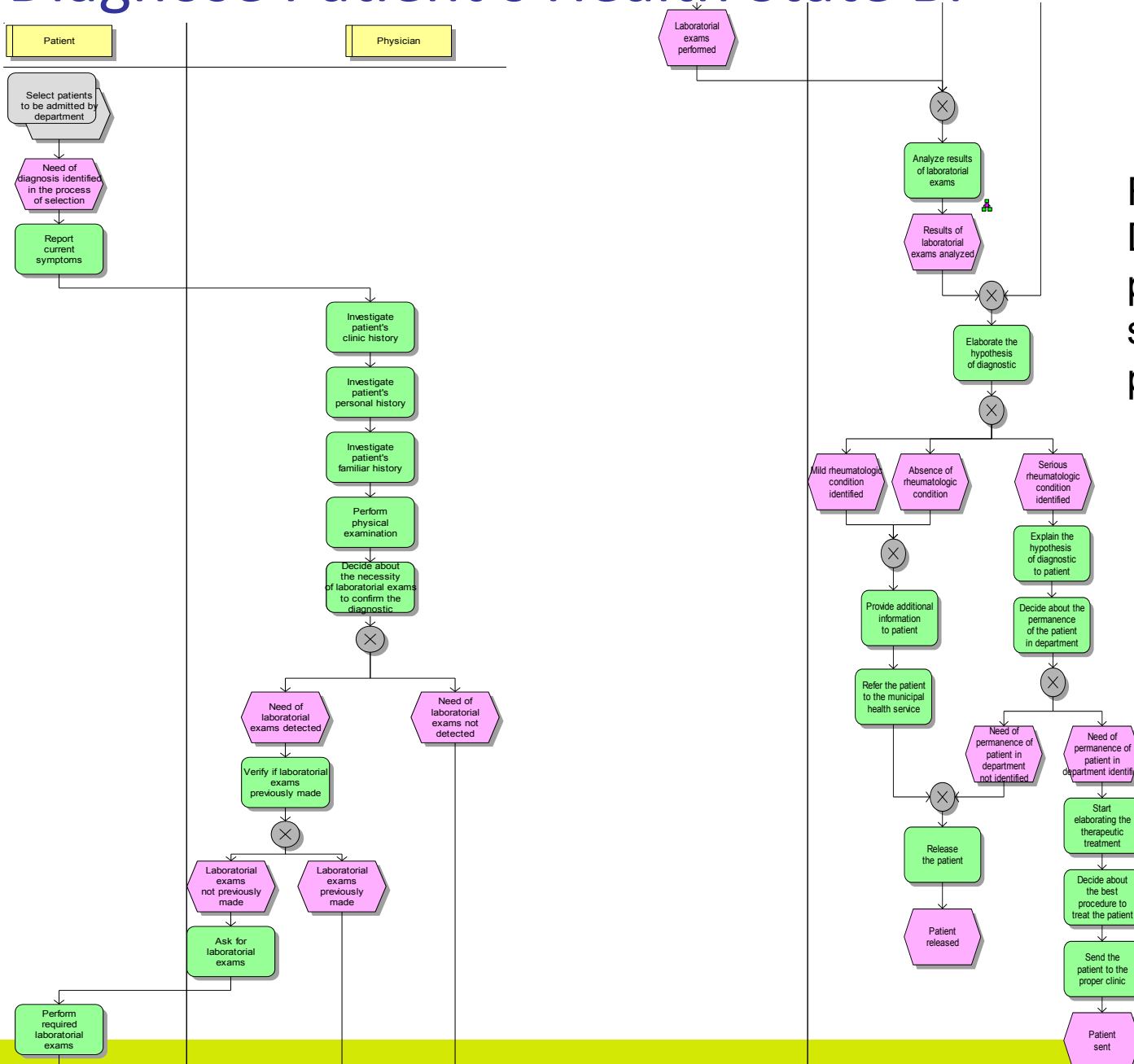perspective

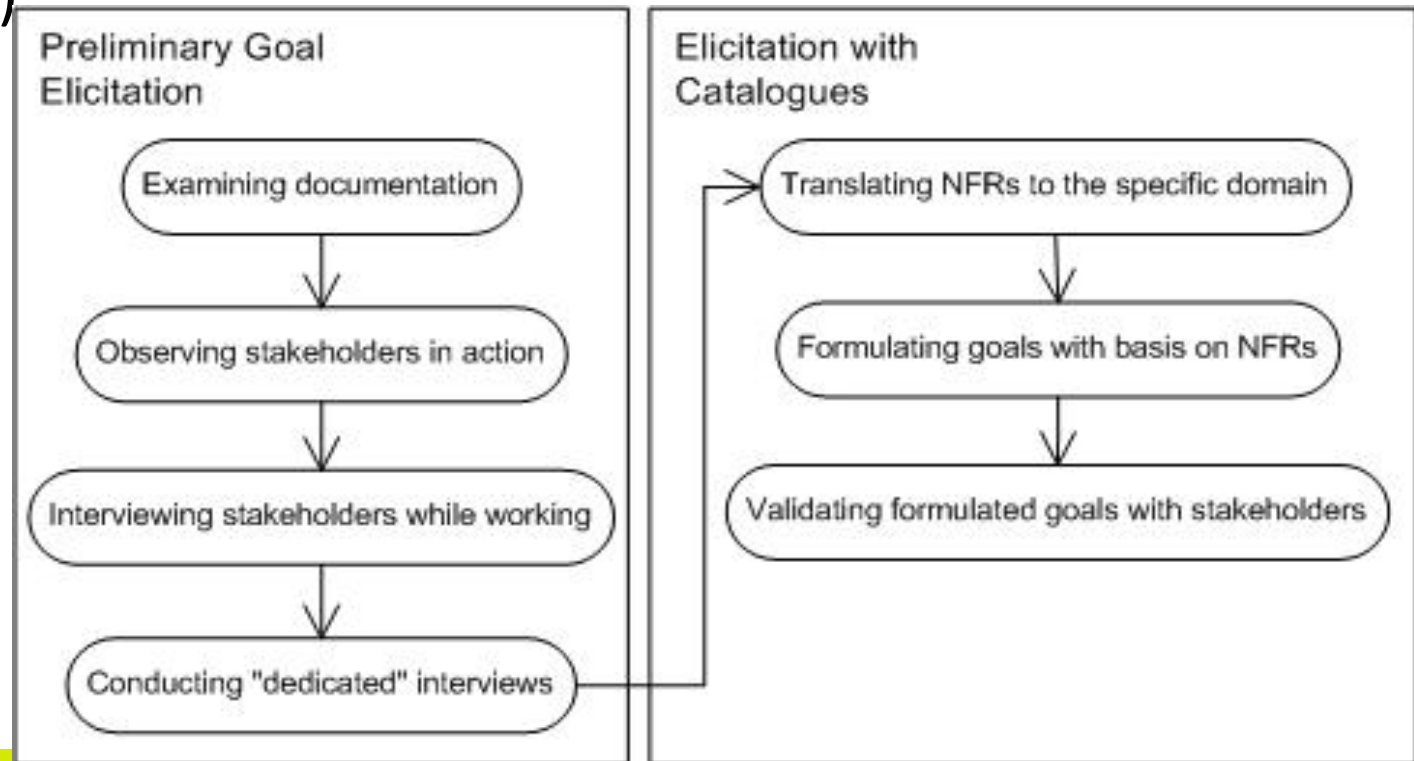# Diagnose Patient's Health State BP

Figure 4 Diagnosis patient's health state business process

The Elicitation and Modeling Phase

- The deficiency in the current literature in goal elicitation and modeling has motivated us to propose a **method for goal elicitation**;

- **Approach**: The **method for goal elicitation** uses the Non-Functional Framework (NFR) catalogues (NFR types catalogues)

Figure 2. Goal
Elicitation Method

Preliminary Goal Elicitation
- Examining documentation
- Observing stakeholders in action
- Interviewing stakeholders while working
- Conducting "dedicated" interviews

Elicitation with Catalogues
- Translating NFRs to the specific domain
- Formulating goals with basis on NFRs
- Validating formulated goals with stakeholders

Research Contribution in this Phase

- A method of goal elicitation
- To know more details about this work, please, refer to the following references:

  - Cardoso, E.C. S., Almeida, J. P., Guizzardi, G., Guizzardi, R.S.; Eliciting Goals for Business Process Models with Non-Functional Requirements Catalogs. *Proceedings of 10th International Workshop BPMDS and 14th International Conference EMMSAD at CAiSE 2009*, Amsterdam, The Netherlands, June/2009.

  - Cardoso, E. C. S., Almeida, J. P, Guizzardi. G., Guizzardi, R.S.; A Method for Eliciting Goals for Business Process Models based on Non-Functional Requirements Catalogues. *International Journal of Information System Modeling and Design (IJISMD)*, 2011.
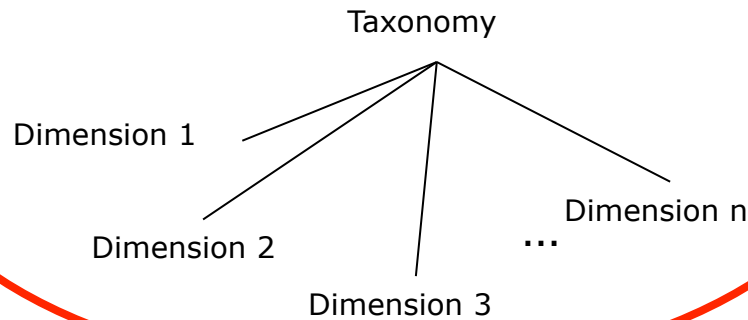
Case Study: The Harmonization Phase

Motivation and Definition of the Harmonization Phase

- **Motivation**: goals have different natures (goals may refer to various aspects of an organization and its processes). These differences impact in the way goals are evaluated;

- **Approach:** literature review to find the different natures of goals

- In the **Harmonization Phase**, we propose a goal taxonomy to classify the goal domain according to some criteria in order to:
  - To address the different characteristics of goals in the goal domain;
  - To discuss how the different natures of goals impact in the way they are evaluated (consequently impacts the structure of the business processes which support these goals)
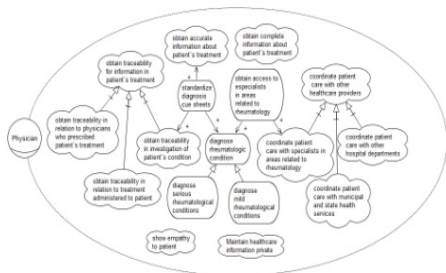
The Harmonization Phase
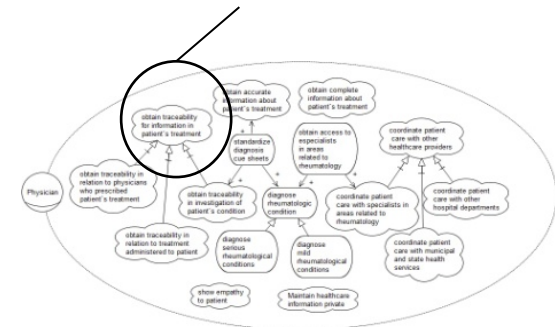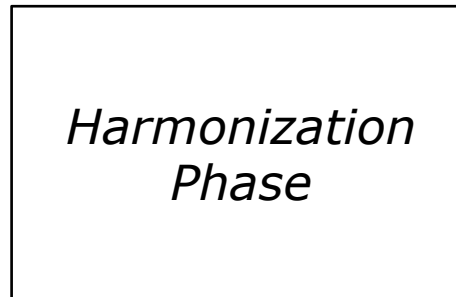
Goal Taxonomy (6 dimensions)

Each goal is classified according to all the dimensions of the taxonomy

Dimension 1	activity
Dimension 2	AS-IS
Dimension 3	Functional
Dimension n	Hardgoal

Harmonization Phase

Goal Models

Resulting Goal Models

Figure 5 The harmonization phase schematically

The Goal Taxonomy

Dimension	Classification	Example
Level of abstraction	**Fundamental**	Provide medical care to patient
	Means-ends	Provide medical care in scheduled medical consultation
	Process (associated with a specific business process)	Diagnose patient's health state
	Process (partially satisfied within multiple business process)	Acquire technical skills
	Activity	Prescribe patient's treatment
Functional/Non-functional	**Functional**	Diagnose rheumatologic conditions
	Non-functional	Release patients with mild rheumatologic conditions after no more than 3 consultations
Hardgoals/Softgoals	**Hardgoal**	Diagnose patient's health state
	Softgoal	Select the most suitable treatment for patient
Scope aspect	**Restricted scope goal**	Approve the treatment proposed by the resident
	Broad scope goal	Collect data for epidemiological analysis
Temporal aspect	**AS-IS goal**	Approve the treatment proposed by the resident
	Change goal	Standardize diagnosis cue sheets
	TO-BE goal	Coordinate patient care with other healthcare providers
Desire		Eliminate all uncertainty during the process of diagnosis

Running Example

- Consider the following goals:
  - Diagnose rheumatologic conditions
  - Release patients with mild rheumatologic conditions after no more than 3 consultations

- Classify each goal with respect to the proposed taxonomy;

- In this case:
  - Diagnose rheumatologic conditions (process, functional, hardgoal, restricted scope goal and AS-IS goal)
  - Release patients with mild rheumatologic conditions after no more than 3 consultations (process, non-functional, hardgoal, broad scope goal and AS-IS goal)

Research Contribution in this Phase

- A goal taxonomy
- To know more details about this work, please, refer to the following references:

  - Cardoso, E.C. S., Guizzardi, R.S., Almeida, J.P.; Aligning Objectives and Business Process Models: A Case Study in the Health Care Industry. *International Journal of Business Process Integration and Management (IJBPM)*, 2010.
  - Cardoso, E.C.S.; On the Alignment Between Goal Models and Enterprise Models with an Ontological Account. *Master Dissertation*, Federal University of Espírito Santo, Vitória/ES, Brazil, December/2009 (pp. 125)

Case Study: The Alignment Phase

# The Method for Alignment between the Goal Domain with the Enterprise Domain

- We had an initial assumption that the satisfaction of goals could be done by business processes;

- Based on this assumption, we tried to relate each AS-IS goal from the goal model with its respective business process;

- The mapping from goals to processes has been a established by humans on the basis of the semantic of the domain (acquired during the interview with the stakeholders);
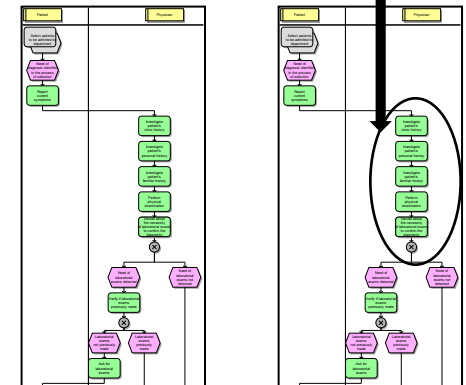
The Alignment Phase

Each goal is classified according to all the dimensions of the taxonomy in previous phase

Dimension 1	activity
Dimension 2	AS-IS
Dimension 3	Functional
Dimension n	Hardgoal

Goal Domain
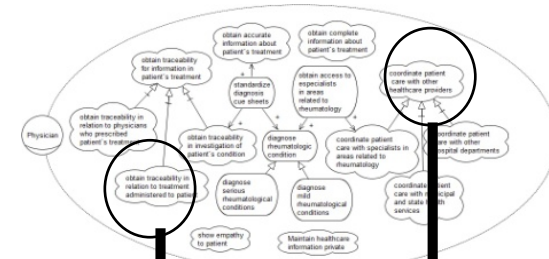
Goal Domain

Alignment Phase

Business processes

Figure 6 The alignment phase schematically

The Alignment Phase

- The mapping from goals to process started taking one goal and mapping to either of one these elements:
    - One business process
    - Several business processes
    - An activity
    - A particular instance of one business process;
    - A set of instances of one business process;
    - A set of instances of several business processes.

- During the mapping, we realized this assumption does not hold!

The Alignment Phase

- We have found that many other EA elements impact in goal satisfaction, such as roles, agents, information, etc.

- For instance, organizational policies regarding the remuneration of employees (which are not tied to a specific business process) may affect goal satisfaction;

- Further, goal satisfaction is often partial and only partially defined by certain operational elements

The Alignment Phase - Revisited

- We tackle this problem by using *organizational ontologies*;
- No single ontological account of the enterprise covers the range of phenomena that we analysed → survey of enterprise ontology approaches
- With this survey, we established the *semantic layer* of our approach,
- Semantic layer:
  - Provides us the relevant concepts in each of the architectural domains;
  - Support us in understanding the **semantics of goals and enterprise elements** as well as the **nature** of their relations
  - Used to relate strategic and operational aspects of an enterprise

The Alignment Phase – Revisited

Each goal is classified
according to all the
dimensions of the taxonomy

Dimension 1	activity
Dimension 2	AS-IS
Dimension 3	Functional
Dimension n	Hardgoal

Goal Domain

Alignment Phase

UFO + other Organizational Ontologies
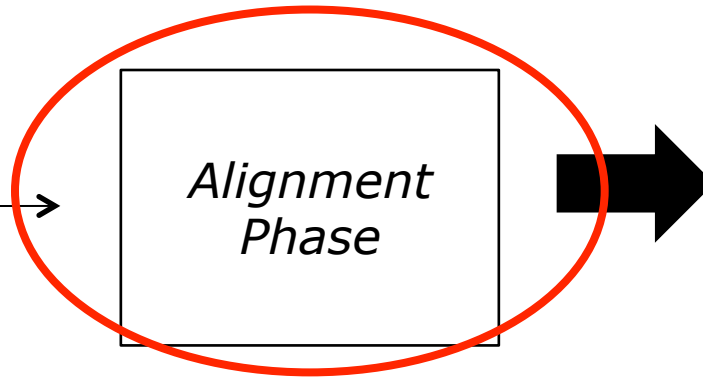
Semantic domain

Goal Domain

Enterprise Architecture Domain
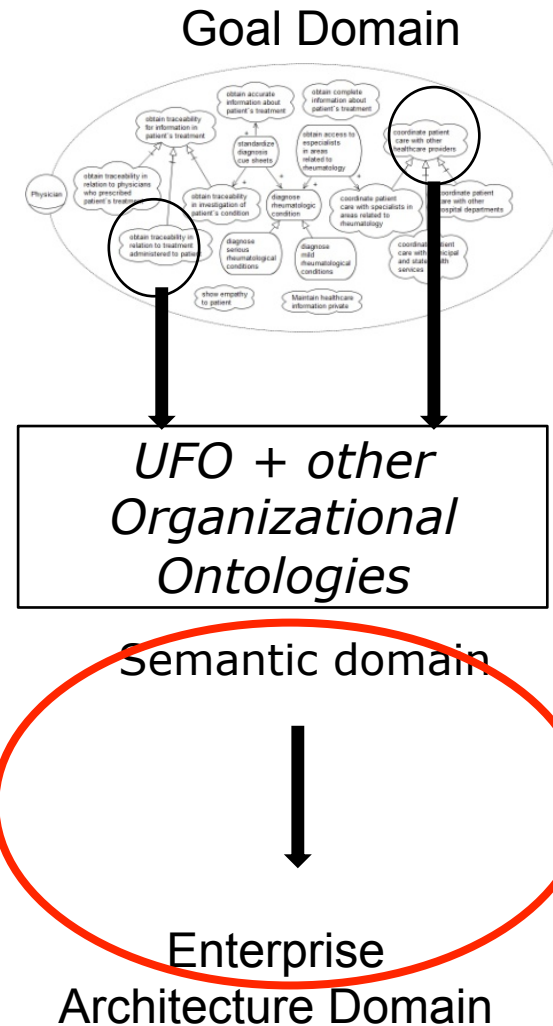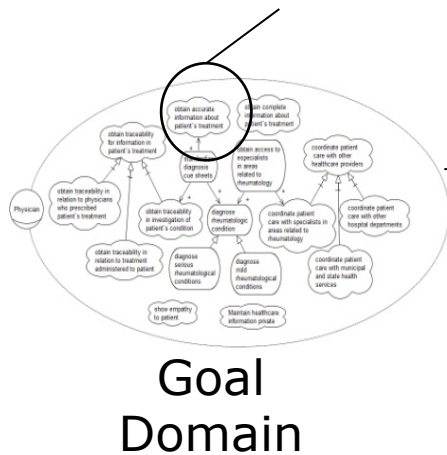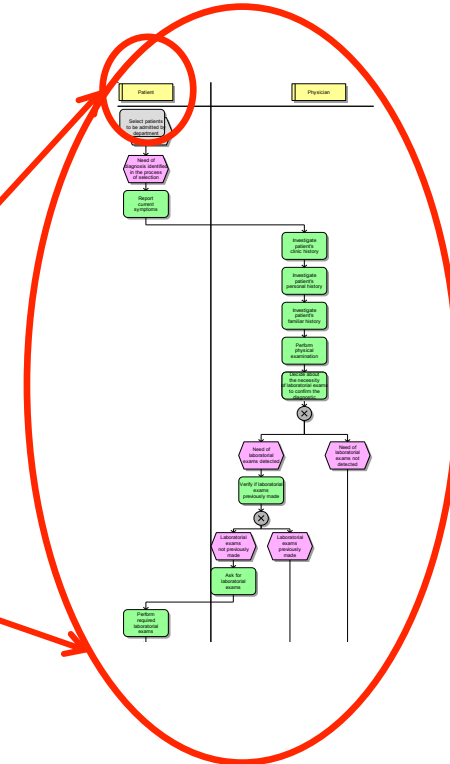
Figure 7 The alignment phase schematically

Goal domain

Semantic domain

Continuing with our Running Example…

- Diagnose rheumatologic conditions
  - What impacts the satisfaction of this goal?

Goal domain	Semantic domain	Enterprise architecture domain	Relationship of the framework
Diagnose rheumatological conditions	Business Process (or plan)	Diagnose patient's health state business process	Organizational goals are achieved by plans
	Agent's capabilities	Physician's capabilities	Specific capabilities of specific agents are required to pursue domain-specific goals

Results of the Alignment of the Case Study

Element	Relationship	Example
One business process	The execution of business process	**Goal**: Provide medical care in a scheduled medical consultation **BP**: Diagnose patient's health state
Several business processes	The execution of several business process (simultaneously)	**Goal**: Acquire technical skills **BP**: almost all of the case study
Activity	The execution of some particular activity	**Goal**: Approve the treatment proposed by the resident **Activity**: Approve treatment (performed by the Physician)
….	…	….

Research Contribution in this Phase

- A method for mapping the goal domain to the other architectural domains
    - Cardoso, E. C. S., Almeida, J. P. A., Guizzardi, R.S.S. (2012) Analyzing the Relations between Strategic and Operational Aspects of an Enterprise: Towards an Ontology-based Approach, International Journal of Organisational Design and Engineering. v. 2, p. 271-294.

- A framework with the relations that we found between the goal domain and the other architectural domains
    - Cardoso, E.C.S.; On the Alignment Between Goal Models and Enterprise Models with an Ontological Account. *Master Dissertation*, Federal University of Espírito Santo, Vitória/ES, Brazil, December/2009 (pp. 125)

Conclusions and Future Work

General Conclusions

- The case study has enriched the literature in three major areas:
  - Goal Elicitation (Goal Elicitation Method);
  - Goal Modeling (Goal Taxonomy);
  - Enterprise Modeling (Framework with relations between goals and the other enterprise elements);

- Concerning this issue of dealing with a real world organization: this kind of experience has enriched the case study by providing extra complexity which is generally not found in theoretical examples

General Conclusions

- Each phase led us to reach a conclusion:
  - **Elicitation and modeling phase:** goals are very difficult to elicit. Stakeholders tend to express that their current operationalization is the goal, while the motivation behind still is very difficult to be expressed;
  - **Harmonization phase:** goals are different with respect to their nature (hard x soft, functional x non-functional, etc.), what impacts the way they are evaluated;
  - **Alignment phase:** processes are not the only component responsible for achieving goals. One also has to consider other architectural elements:

Future work

- The application of our method of alignment considering the introduction of computational systems in the department;

- We also believe that goal models can be used to support formal reasoning during the selection of which strategy will be adopted to attain a specific goal. This should be fruitful in the systematization of methods in business process reengineering efforts.

Just a flavor of my PhD work...

- We continued into the same topic of alignment, addressing that by working towards a goal modeling language that extends BPMN models;

- The goal taxonomy has been used. Some concepts were added, others have been dropped. For example:
  - The distinction between functional x non-functional has been dropped;
  - A evaluation period for the goal has also be added;

- Next to that, we also represent the concept of Key Performance Indicators (KPIs), that are used to (numerically) evaluate how goals are achieved;

Just a flavor of my PhD work…

- By modeling KPIs, we two main issues can be raised:
  - The target values for KPIs are captured into Service Level Agreements (SLAs) between services requester and provider
  - KPIs measure the level of achievement of goals. Goals actually pertain to stakeholders

- This lead us to a conclusion that KPIs actually measures the level of goal satisfaction of the goals that pertain to the service requester and provider;

- This led us to a conclusion that organizational services can be expressed in terms of goals models between service requester and service providers….

Questions?