Modeling Actors' Goals – The Intentionality Panels Construction - (IP Diagrams)

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Abstract: The i* Framework, differently from similar methods, explores the collaboration of actors based on their intentionality. This is achieved by dependence relations on intentions, either as a goal or as a softgoal. Notwithstanding, there is the challenge of dealing with the scalability problem. Different researchers have been proposing different strategies to deal with this problem. With the evolution of the ERi*c Method, we have devised a strategy to use the Intentional Panel as a way of treating the scalability problem. This strategy provides a more abstract view of the interactions among actors, towards their intentionality.

Keywords: goals, early requirements, elicitation, modeling, GORE, Goal-Oriented Requirements Engineering, ERi*c, goal modeling.

1 Introduction - Contextualizing the ERi*c Method.

In this section, we explain in a concise way the elicitation process used in the ERi*c Method. Figure 1 shows details of three steps of the ERi*c Method, which is comprised of six steps.

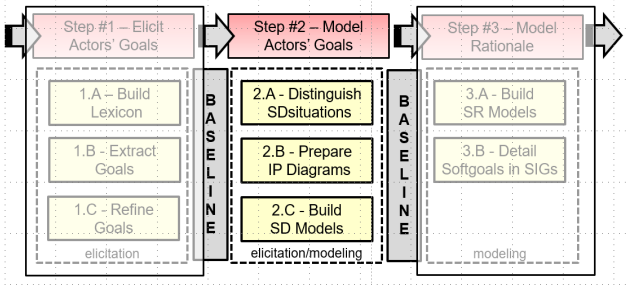

Figure 1 – ERi*c Method parts of "Model Actors' Goals".

The first step ***"Elicit Actors' Goals"*** demands that the RE (Requirements Engineers) team captures goals and softgoals. The elicitation strategy used in Actors' Goals from Lexicon – AGFL [4], considers all kinds of actions revealed by the Language Extended Lexicon (LEL) [11] and performed inside the organization selected context.

In the second step ***"Model Actors' Goals"***, which is the central object of this work, the RE team, in the first part (2.A) identifies goals arrangements that are strongly interconnected to implement situations of dependency named SDsituations – Strategic

Dependency Situations [3]. In the second part (2.B) the RE team builds diagrams, similar to Statecharts, that consider actors as heading chains of goals (and softgoals). These diagrams are called "Intentionality Panels" (IP) [5]. The main benefit of Intentionality Panels is the representation of the association among goals, either from the same actor or among different actors at the beginning of modeling. The perspective of different actors' goals association is of major importance to help the RE team designate which dependum is better for each dependency. In the third part (2.C) the RE team, based in the IP diagrams, makes the SD Models.

The third step ***"Model Rationale"***, demands that the RE team produces the detailed models. One SR Model for each SDsituation and refines softgoals using Softgoal Interdependency Graphs (SIG) models [12].

In the fourth step ***"Specify Requirements"*** the RE team recognizes the requirements, writes the requirements and reviews the requirements.

In the fifth step ***"Specify SDsituations"*** the RE team describes SDsituations applying a Scenarios based strategy. This step is supported by the C&L software tool, which is a management tool for Lexicons and Scenarios.

In the sixth step ***"Analyse iStar Models"*** RE team and stakeholders diagnoses each model in order to bring questions that challenge the consistency and completeness and creates a report matching discovered problems with impacted goals.

This paper uses "the toll road control system" (TRC System) [1] [7] [8] [9] to illustrate the strategy. Section 2.A describes the idea of SDsituations for the modularization of iStar models; Section 2.B give details about the iStar arrangements of goals into IP Diagrams and explains the procedure of preparing IP Diagrams, Section 2.C explains the advantage of preparing SD models based on IP Diagrams, and Section 3 concludes emphasizing the ERi*c Method progress applying tools.

2 Objective of the research: Modeling actors' goals.

For modeling actors' goals, the RE team uses the list created by step #1. See Fig. 2.

DEPENDER	(SDsituation)					DEPENDEE
SOFTGOAL		**GOAL**				
ADMINISTRATION						
Quality [road]	(1), (2)	road	BE	administrated		
	(1)	permission	BE	granted	by	GOVERNMENT
Quality [road]	(2)	permission	BE	renewed	by	GOVERNMENT
Quality [road]	(2)	toll	BE	approved	by	GOVERNMENT
Fare [toll]	(2)	toll	BE	calculated		
Quality [road] = Fast [road], Safe [road], Reliable [road]	(3)	road	BE	maintained	by	OPERATOR
Quality [road]	(4)	road	BE	maintained		
	(4), (5)	toll	BE	computed	by	OPERATOR
Honest [payment]	(4)	toll	BE	paid	by	DRIVER
	(4)	toll	BE	charged		
GOVERNMENT						
	(1), (2)	permission	BE	granted		
Quality [road]	(1), (2)	road	BE	maintained	by	ADMINISTRATION
	(2)	permission	BE	renewed		
Fare [toll]	(2)	toll	BE	calculated	by	ADMINISTRATION

Figure 2 – Part of Toll Road System Goals List prepared by AGFL strategy.

2.A - Distinguish SDsituations – Modularizing SD Diagrams.

This sub-step aims the modularization of i* models by using context dependency situations. SDsituations work to maintain the problem of complexity under control [6], it is a modularization strategy to develop SD and SR models. The SDsituation idea can also be used to re-organize old i* models into new simpler models.

Figure 2 shows the Toll Road System list of goals prepared in the first step by the AGFL strategy. The focus is on two i* elements: "DEPENDER" and "DEPENDEE". DEPENDER is the first actor, the LEL subject of the actions, and DEPENDEE is the second actor who appears in the elicitation process as an actor from whom the subject ("DEPENDER") depends on to achieve one goal. This idea of "DEPENDER" and "DEPENDEE" is the same used by i* Framework models.

Each frontier between two SDsituations can be discovered because a "time interruption" occurs in the business cycle. Definition: An SDsituation is a dependency construct with one situational intentionality which is temporarily shared by some actors [3]. Figure 2 shows a column with the SDsituation "ID" for goals in the list.

In the case of the Toll Road we distinguished five SDsituations: (1) **Toll Road Permission**, (2) **Permission Renewing**, (3) **Road Maintenance**, (4) **Toll Charging**, and (5) **Toll Liberation**. ERi*c sustains that intentionality should be mapped in parts, based on SDsituations, in a new diagram called "Intentionality Panel" – IP Diagram.

2.B – Prepare IP Diagrams – Simplifying the SR Diagrams.

This section introduces the IP (Intentionality Panel) Diagram, using SDsituation construct, to make simpler i* SR models. The motivation for preparing IP Diagrams [5] is the advantage of getting the intentionality represented in a homogeneous diagram (only goals and softgoals) for perceiving which dependum is the best candidate in each SD dependency. The IP Diagram (see Figure 6) can be considered an SR Model reduction because the IP Diagrams show only goals that will appear in SR Models. Furthermore, the line below the actor gives the actor´s timeline. As such, it complements SR models with the time arrangement of goals. The timeline gives a notion of time, in the sense that there is an ordering among goals.

As in StateCharts, in order to change or finish a goal (state), that goal must be achieved. Consequently, there are chains of goals, represented by different types of associations: ***refinement***, ***dependency***, and ***contribution***. These are described below.

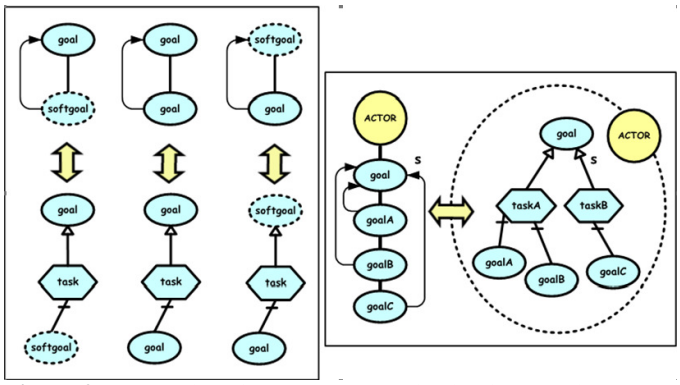

Figure 3 – Examples of "means-end" reduction into IP diagram.

In Figure 3 shows the main line of i* goals association, the ***refinement***. This association appears in the means-end construction, inside of an SR model. On the left, we show three varieties of refinement. Following the yellow arrow, we derived the correspondences between the SR model and the IP diagram. On the right, we represented one more elaborated arrangement: while goalA and goalB together are associated with the main goal to be achieved, goalC (with "ID=s") has an alternative refinement to the main goal to be achieved.

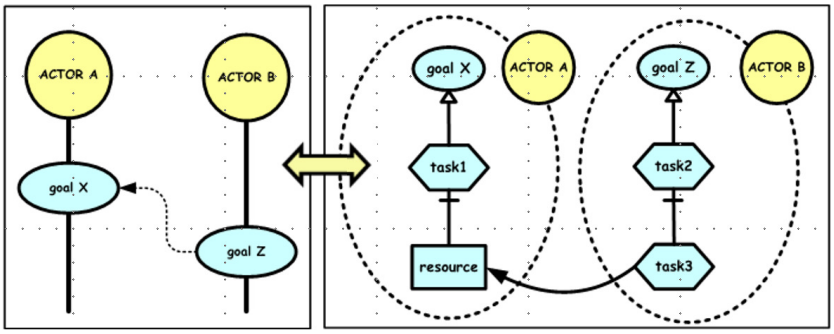

Figure 4 – Example of actors' dependency - from SR model to IP diagram.

Furthermore, i* maintain two other goals associations. The first occurs when one actor depends on another actor; each ***dependency*** in the IP Diagram projects one dependency in the SR Model as mapped in Figure 4; the dependum can be either the task3 or the resource. The second association (see Figure 5), the ***contribution*** occurs equivalent in both representations, (IP Diagram and SR Model) when one softgoal contributes (positively or not) to another softgoal.

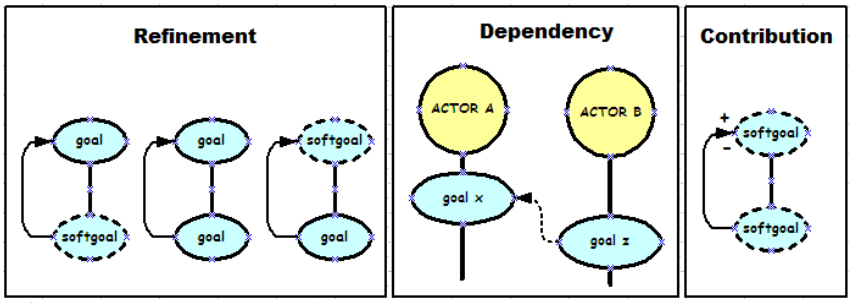

Figure 5 – Three categories of goals associations mapped through IP diagrams.

Figure 5 shows the three categories of goals associations represented in IP diagrams: (i) on the left, the three types of refinements, (ii) in the central part, the dependency link between goals from different actors, and (iii) on the right, the contribution link between softgoals.

Using IP Diagrams has a positive side effect: it enables the uncovering of needed intermediary goals to facilitate the achievement of SDsituation main goal. It makes it easier to elaborate on the rationale for distinct alternatives.

2.C - Build SD Model - Modeling Actors' Goals

For each SDsituation (part 2.B) the RE team should prepare the IP Diagram and (part 2.C) build the SD Model considering the dependencies defined in the IP Diagram.

- Each dependency association mapped by a dotted line in the IP Diagram is one strategic dependency association. The dependency shows the direction from dependee to depender.

Figure 6 shows, on the left, the SDsituation named "Toll Road Permission" represented by one IP Diagram. It represents that the government depends on administration to have "road BE maintained" and "Quality [road]". By other hand, administration depends on government to have "permission BE granted". Those 3 (three) associations created 3 (three) strategic dependencies mapped in the SD Model (see Figure 7).

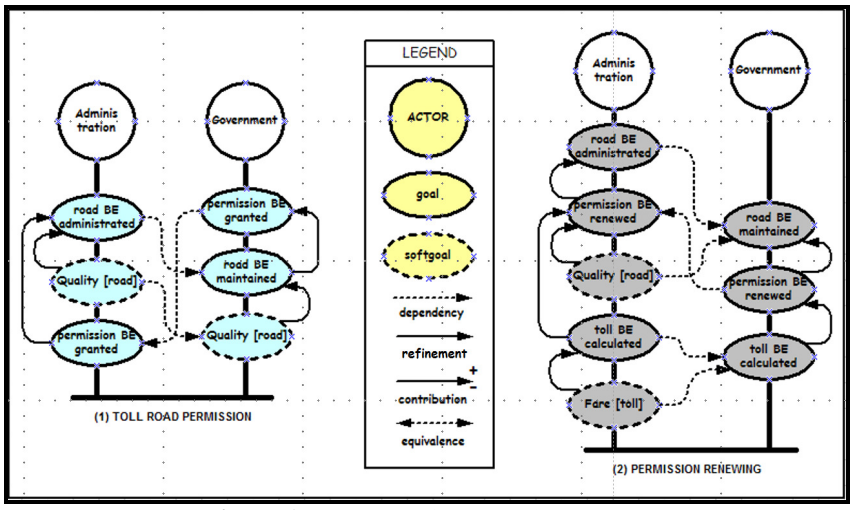

Figure 6 – Example of two IP Diagrams.

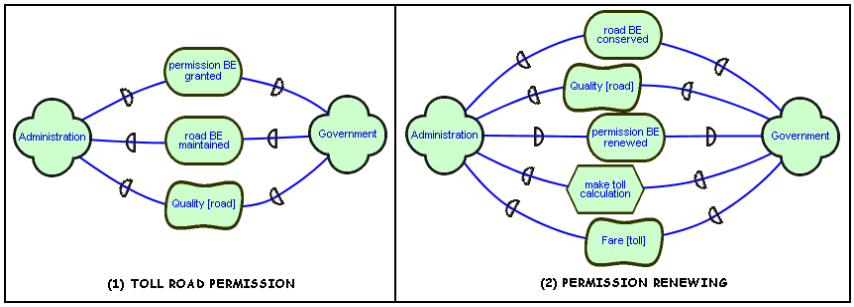

Figure 7 – Example of two SD Models based on IP Diagrams.

Figure 7, on the right, shows the SDsituation named "Permission Renewing". It shows that the GOVERNMENT depends on ADMINISTRATION to have "road BE

conserved" and "Quality [road]". GOVERNMENT depends on ADMINISTRATION, "make toll calculation" and "Fare [toll]. ADMINISTRATION depends on GOVERNMENT to have "permission BE renewed". This SD Model has the same 5 dependencies showed in IP Diagram (see Figure 6). Note that goals in the IP Model on the timeline will be mapped in the corresponding SR model. In this task, RE team can select which "dependum" is more appropriate for each goal dependency.

3 Conclusion - Applying modeling tools for ERi*c Method progress.

The first author experience in i* education for undergrads points out to some resistance by many students. However, his recent experience at UERJ with supporting tools, developed in-house, has diminished student resistance. These tools do support the creation of IP diagrams and SDsituations. The idea of separating the system modeling problem in parts, using the idea of SDsituations, can be understood as a "small is beautiful" strategy and has contributed towards simple models. AGFL and IP Diagram tools improved the understanding of i* Framework so that students could better explore i* strengths.

The **IP Diagram Tool** was developed using PHP, Javascript and MySQL, it has 4500 lines of code and required 8 man-months effort. IP Diagram Tool will be available on the i* wiki.

We have taught i* Framework with the ERi*c Method applying IP Diagrams asking graduated students for verifying classmate's diagrams. Future work is aimed at integrating the AGFL and IP Diagram tools.

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