Process of Transforming Requirements Elicited with MindMaps into iStar models*

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Abstract. It is unlikely that the system will be better than the requirements identified in the design phase. So it is obvious that the quality of the software is closely related to the quality of the development process - from design to programming. The software requirements are a decisive factor for the software quality. The development of a computer system is not a task for a layman. Software development is a complex process composed of activities and steps that follow patterns and models developed by Software Engineering - SE. A requirements engineering - RE, a subfield there SE seeks a translation of customer needs through requirements elicitation. To have a greater chance of success for a successful software project, the activities da RE must not be neglected. This search aims to develop guidelines for building a strategy in the process of transforming requirements elicited using the MindMaps technique into iStar models. For the development of this search, a Systematic Literature Review - SLR was conducted to analyze the frequency of the use of MindMaps in the elicitation process and their transformation into more complex models. As a result of this research, templates and guidelines for the necessary routing for the process of transforming the requirements identified through the MindMaps into iStar models were created. The main contribution of this paper is to propose this routing in the process of converting the elicited requirements (MindMaps) into iStar models.

Keywords: Requirements Engineering · iStar models · MindMaps.

1 Introduction

Developing a computer system is not a task for a layman. Software development is a complex process composed of activities and steps that follow patterns and models developed by Software Engineering - SE (from the initial phases of specification to the maintenance and evolution of the software) [1]. A Requirements Engineering - RE, a subfield there SE seeks a translation of customer needs through requirements elicitation. To have a greater chance of success for a successful software project, the activities da RE must not be neglected [2]. About RE, it is pointed out in [3] that it is

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the discovery, analysis, documentation and management of requirements. Therefore, in [4] it is pointed out that the problem starts with the task of adding value to the requirements, since they ultimately define the parameters and focus of the solution to be developed. Furthermore, [4] states that the system is unlikely to be better than the identified requirements, and by the same logic, a product and/or service can only be as good as the process that produces it [5]. In their report CHAOS 2015 [6], the Standish Group - TSG uses statistical data to show that requirements-related failures are among the top three reasons for software project failure. In modern RE phases (Early Requirements and Late Requirements) are proposed, especially in Goal-Oriented Requirements Engineering - GORE [7]. For the first phase, requirements elicitation, conducting customer interviews is often used. However, [8] points out that although this is an effective technique, it should not be used in isolation (but in conjunction with other techniques, e.g. MindMaps).

For the first phase, requirements elicitation, an initial approach commonly used is to conduct customer interviews. While this is an effective technique, it should not be used in isolation (but in conjunction with other techniques, such as MindMaps) [8]. MindMaps were developed by [9] to provide a simplified graphical mechanism for information management. The technique has been widely used and accepted in various knowledge domains. As for RE, there is no denying the complexity of this phase, especially in terms of translating the customer needs expressed by the requirements into models and diagrams that contribute to the creation of the software. If we focus on the models, there are those that express intentionality and other typically important aspects in the early requirements phase, such as iStar (i*) [10]. According to [10], his framework represents a goal-oriented approach based on the intentions, relationships, and motivations of the stakeholders, allowing for a better understanding of the organization and the relationships between the stakeholders. In addition, iStar models can also be used to support the process of specifying functional and non-functional requirements of systems using Unified Modeling Language - UML [11] with UML techniques [12]. However, the creation of iStar models is not a trivial task [13] [14] [15]. Therefore, the research problem is guided by the following question: How can we find a way to facilitate the process of translating customer needs through the various identified requirements into models of intentions (iStar) that reflect the essence of those needs? It is important to emphasize that this complexity begins with the choice of elicitation method(s) and extends to the process of requirements modeling, particularly the transition between elicited requirements and the resulting models. The objective of this paper is to provide guidance for developing a strategy for transforming requirements elicited using the MindMaps technique into iStar models. To define this guidance, a predefined questionnaire with the application of filters was used, in addition to the construction of guidelines based on the MindMaps, the iStar metamodels and a template to guide the process.

This research is aimed at academics and professionals with little experience in iStar modeling who, with the help of the recommendations, will be able to carry out the process of transforming the elicited requirements into iStar models. In addition to the introduction (Section 1), this paper is divided into the following sections: Section 2 - Background; Section 3 - Related Work; Section 4 - The Proposal and Validation -

Forwarding to the Requirements Transformation Process through MindMaps in iStar Models; Section 5 - Final Considerations and Future Work.

2 Background

The requirements elicitation process requires the professional to use one or more techniques to gather the necessary information from stakeholders. This phase is primarily concerned with understanding the needs that arise from the problem, a situation that is to be addressed with a technological solution. In requirements elicitation, the most commonly used techniques are the interview and forms. The first is a more abstract technique and can lead in any direction, depending on the focus and objectivity of the professional conducting it. The second is more focused (depending on the methodology used to create the form) but can be very limited. According to [9], a requirements elicitation should not be conducted using only one technique. Therefore, in this search, we chose to use the Interview, prepared Form and MindMaps techniques together. To apply the Interview and form techniques, focusing on the problem/situation reported by the stakeholders and on the organizational aspect (for the later generation of iStar models), we used the form defined and validated by [16]. However, we have adapted this form and proposed five questions (filtres) to obtain the essential information needed to create the iStar model from MindMaps.

2.1 iStar Model

The iStar framework enables the specification of the organizational model that helps in the development of the computerized system. According to [17], the model is composed of two models, the strategic dependency model - SD - and the strategic rationale model - SR. The model SD describes a special configuration of dependencies between the participants of the organization, i.e. the model is used to specify the dependencies between the participants in the organizational environment [18].The model SR describes the relationships between the actors adopting one or another configuration, i.e., the model is used to specify the interests and concerns of the participants, the use of different systems, and the configuration of the environment that connects them [18]. In addition to the SR and SD views, a hybrid view is also proposed in iStar 2.0. This view is adopted when only some of the actors are open (extended), with the strategic logic of decomposing the internal reasons focused on these actors.

The SD model is defined by links, nodes and the actors in their environment are represented by nodes, while the dependencies between them are represented by links. To achieve its goals, the actor develops actions, tasks and obtains resources in this organizational context. In the dependency relationship at SD, there is the Depender, i.e., the actor who is dependent on another, while the Dependee is responsible in this dependency relationship, who has to fulfill it. In this relationship, there is also the dependency focus, the Dependum, which is characterized by the element or object of dependency between the actors. Then the situation Dependent→Dependum→Dependee occurs. In the case of SR, alternative means and forms of dependents can be specified that are required to fulfill their dependencies. The last version of iStar is presented in [19]. We consider this version (iStar 2.0) in our work. In the iStar 2.0, there are two categories of actors: that of the agent, which denotes a person, a department or an organization - concretely - and that of the role. In the latter case, they are more abstract expressions of the behavior of a social actor inserted in the domain or in a specific specialized context. There are still circumstances - the modeling phase or the scenario in question - in which the notion of actor (generic actor) can be used. Also, there are two possible types of relationships between actors, namely: is-a (already existed in the original version and represents the concept of generalization / specialization - only actors of type role and generic / actor can be specialized); participates-in (represents a type of association, in addition to generalization / specialization, between two actors, replacing the nomenclatures is part-of, plays, occupies-covers that existed in the original iStar [17]).

A dependency is defined as a relationship with five arguments: Depend (is the actor that depends on something - Dependum - being provided - e.g..: Customer in target withdraw money using Automatic Teller Machine System - ATM); DependElmt (is the intentional element within the Depend actor boundary where the dependency begins and that explains why the dependency exists); Dependum (is an intentional element that is the object of the dependency - e.g.: Target money withdrawal); Dependee (is the actor who must provide the Dependum - e.g.: ATM); DependeeElmt (is the intentional element that explains how Dependee intends to provide the Dependum).

Actor intentions used in both the SD model (as Dependum) and the SR model (internal reasons) can be of the types listed below: Goal (a state of the system that the actor wants to achieve and for which there are clear requirements to achieve); Quality (an attribute for which the actor aims at a realization at a certain level - basically the softgoal); Task (refers to the actor, more specifically to the desire to develop his actions, generally aimed at achieving a goal); Resource: (it is a requirement of an actor for the development of a task, which can be considered as an entity - informational or physical).

As for the links between intentions, there are the following types: Refinement, Required by (necessary in), Contribution (contribution), and Qualification (qualification). For ease of adoption, iStar 2.0 defines a more general relationship called refinement that links tasks and goals hierarchically. Refinement is an n-ary relationship that links a parent to one or more children. There are two types of refinement that apply to any type of parent that can be a goal or task, and they are defined by the logical operator in the parent-child relationship: AND (the parent is fulfilled when the fulfillment of the n children - all - occurs); Included OR (the parents are fulfilled when the fulfillment of the n children - at least one - occurs).

The relationship needed-by is a new element proposed in the iStar framework that links a task (any) to a resource (any), indicating in this case that the actor needs the resource to develop the task. This relationship is represented graphically as an arrow with a circular arrowhead pointing at the task.

The contribution relationship is represented by the effects on the properties of the intended elements. This relationship can help analysts in decision making when deciding on alternative tasks or objectives while considering the impact on quality aspects in the environment. This effect of the intended element in terms of qualities can be: Make (the source provides a positive contribution sufficient to meet the objective); Help (The source makes some positive contribution to the satisfaction of the objective); Hurt (The source makes a weak negative contribution to the satisfaction of the target); Breaking (The source makes a sufficient negative contribution to the target).

Finally, the Qualification intent link relates a Quality to the element linked to it: task, goal, or resource. This relationship expresses a quality that is desired in terms of the development of a task, a goal achieved, or even a resource provided. The Qualification relationship is represented graphically by a dotted line connecting the Quality to the element being qualified.

2.2 MindMaps

Although mind mapping has ancient roots, the notation technique, called MindMap, was first developed by Tony Buzan in the 1960s. MindMap encourages people to think, organize, and represent information within a radial hierarchy by placing what is most important in the center of a given diagram and relating it to other concepts-or to details of the first concept, or both [9]. In [20], MindMaps hierarchize information and make it easier to identify and classify, as it is a technique for capturing information visually and conceptually. According to [8], a MindMap is a combination of drawing and text that attempts to represent information in the same way the brain does, mimicking the brain's memory mechanism by using connections between words and images that represent the information. MindMaps are used to take notes when stakeholders are asked about their requirements, and the benefit of using them in these situations is perceived when your stakeholder informs you about the features, functions of your work, and the new product. In [8], a list of techniques for requirements elicitation with their strengths is presented, which also include MindMaps. According to [9], the creation of a MindMap is divided into five phases: Creation of the central idea; Addition of branching; Adding keywords; Adding colors to branches; Incorporation of images.

3 Related Works

In [21], an Systematic Literature Review - SLR was performed to find works that use MindMaps as a technique for eliciting software requirements. In defining the protocol (planning the review), the focus in the research questions phase was on using MindMaps as a requirements elicitation technique in conjunction with meta-models to transform into models of organizational intent. The defined questions were (Q1) What are the suggestions for constructing iStar models using MindMaps? (Q2) Is there any use of metamodels in transforming requirements elicited via MindMaps into iStar models? (Q3) Are there any suggestions that support the construction of iStar models from MindMaps? In the next step, the search strategies, the Population Intervention Comparison Outcome Context - PICOC approach was used and the descriptors with their variants (Requirements Elicitation, Mind Maps, Organizational Modeling, iStar, Meta Model, Approach, Technical, Model Construction Process, Proposition and Requirements Engineering) were defined with the logical operators AND and OR. The search was performed in databases of reviewed literature (Computing Machinery Digital Library - ACM-DL, Compendex Engineering Village, Scopus and Web of Science - WoS) for documents of Full Papers type published in conferences or journals, following selection and evaluation criteria. The data extraction and analysis focused on the data title of the document, year of publication of the document, name of the author(s), nationality of the author(s), focus area (submission) of the document, event/journal in which the document was published, objectives/proposals of the document, methodology used in the document and approach presented. To conclude this phase, the synthesis of the data, the State of the Art instrument was used. the synthesis of the data, the state of the art through systematic review - StAr[1], from the LAPES, from the Federal College of São Carlos - UFSCAR. In the execution phase of the protocol, after creating specific search strings for each database of the reviewed literature, 4,138 documents were analyzed in the duplicate removal and quality analysis phase. After this analysis, 4,096 studies were excluded, leaving 42 documents that were subjected to in-depth analysis. After the 42 documents were fully read, 36 documents were removed, and 06 documents remained after this exclusion. Relevant documents found through a manual search of repositories of publications from reputable congresses in the field of RE such as the Annals of Computer Science Workshops CEUR[2] and dblp Computer Science Bibliography[3] were included. In this SLR, the same works related to proposal were identified. In [22], the MindMaps technique is used to elicit system requirements and map them to the Keep All Objectives Satisfied - KAOS model. Metamodels and seven mapping rules are used for the mapping process. The rules are defined to take into account different elements such as agents, goals, and object concerns. This process has been applied to an industrial case study. On the other hand, in [23] a MindMaps structuring strategy is presented to improve the understanding of the modeled information. Some elements of this strategy are very interesting and will be considered in our work. In [24] a formal MindMaps model is proposed consisting of the features structure, content and semantics. In our work, we used the MindMaps metamodels proposed in [22] and the iStar metamodel described in [19]. These metamodels are considered in the proposed guidelines for mindmap creation used to derive iStar models.

4 Proposal and Validation

To develop the proposal of this research, two main pillars were defined: (i) the requirements elicitation process/technique and (ii) the definition of guidelines and the template for MindMaps based on the MindMaps and iStar metamodels. For the first pillar, requirements elicitation, the different existing techniques were analyzed and compared with the MindMaps technique to understand the limitations and potential of the technique. In performing some preliminary validations using the principles of analysis of techniques used by [5], the MindMaps technique was found to have

[1] StAr - Research Laboratory of Software Engineering - LAPES - https://www.lapes.ufscar.br/resources/tools-1/start-1
[2] CEUR WS - Free Open-Access Proceedings for Computer Science Workshops - http://ceur-ws.org/
[3] International i* Workshop (iStar) https://dblp.org/db/conf/istar/index.html

potential for requirements elicitation. However, because it is a comprehensive application technique, it was necessary to use forms that were already structured to support the requirements elicitation process [16]. The second pillar, in addition to the forms, it was necessary to define guiding filters for identifying key elements in the iStar models and to create a guide and template for constructing MindMaps models for later transformation into iStar models. The transformation process, translating one model, diagram into another, is a complex task because there are a number of essential elements in the source model, diagram that need to be transferred into the target model, diagram. For this transformation, processes are used that are embodied in metamodels that define the structures that describe the syntax of how the models should be constructed. In [22], the constructed metamodel was developed to transform MindMap into KAOS models. To achieve the goal of this search, we have considered the metamodel developed by [22] and the study [24] to support the construction of MindMap transformation guidelines in iStar models. To validate the proposal of this paper, the following steps were followed: Requirements elicitation (scenario II analysis) and the application of the requirements of the scenario II in the MindMaps template using the guidelines. To illustrate the proposed template and validate the proposed MindMaps technique, the scenario II (example problem) proposed in [25] was used in conducting a quasi-experiment with students of the Requirements Engineering discipline of the Computer Science course at the Western Paraná State University - UNIOESTE, Cascavel Campus. This scenario refers to the development of a web application (SiStagios) to manage the internship process in a vocational training center.

4.1 Requirements Elicitation

The filters presented here are guides for conducting interviews with stakeholders that focus on aspects that contain the necessary information for subsequent construction of the iStar model (organizational modeling). These filters do not exclude (let alone provide) other aspects of RE. Thus, we proposed five questions (filtres) to obtain the essential information for the iStar model as follows. The five filtres: **1-What is the global problem/situation? - 2-Who are the stakeholders/actors involved? - 3-What is the relationship/interdependence of these actors? - 4-What actions are these actors taking? - 5-Are there interactions with other systems?**. By applying the filters (guiding questions after applying the interview forms) presented in the problem situation proposal (scenario II), we try to extract as much information as possible, objectifying it into elements that will be the basis for the model. It is important to note that the scenarios presented in [26] were subjected to pre-treatment [16], that is, the "raw" text of the interview was segmented to facilitate understanding. Shortly after segmentation, the filters were applied in this scenario to focus specifically on iStar modeling.

4.2 Template and Guidelines

In this phase of the requirements elicitation process, after conducting the interview guided by the filters, the construction of the MindMap model begins using the template and guidelines for the iStar model. To create this template, the tool diagrams.net (formerly Draw.io) was used with a base model 'maps' that applies the MindMap concept[4]. To guide the assisted construction of these models (iStar), a guide for developing iStar models and a MindMap template for using the iStar modelling guidelines were designed. The MindMaps technique used consists of intuitive and easy to understand graphical elements that allow the elaboration of a graphical scheme that simplifies the construction of the iStar models (SD and SR). For this process, a standard template was created to use the MindMaps technique for the subsequent construction of iStar models. In addition to the standard template (see figure 1), it is necessary to define guidelines for the construction of the MindMap aimed at organizational modeling to be later transformed into an iStar model. The template was created according to the following logic: there is a division into colors (shades of gray) representing the SD model (light gray) and the SR model (dark gray). The root node iStar Base will be the solution itself. The first branch contains the actor,

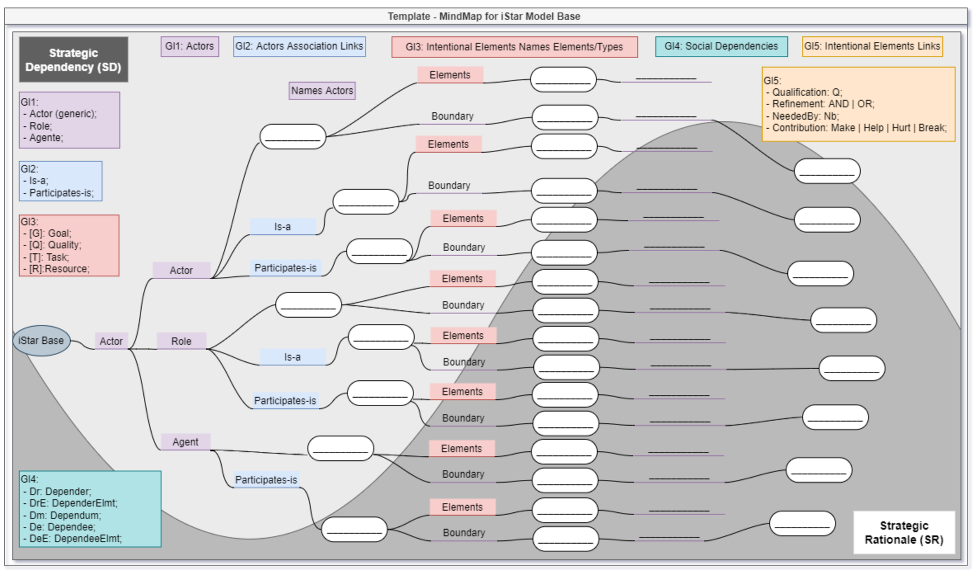

Fig. 1. MindMap Template.

which unfolds into three new branches depending on the type (generic actor, role or agent). The next branch level already refers to the association of the actor and can be without association definition, is-a or even participates-in, so only in the next branch level the names of the actors have to be specified. In the next branching level the elements (**Elmt**) are defined (outside or inside a boundary) and in the next level the names of the elements must be specified with their respective types: **Goal** [**G**]; **Task** [**T**]; **Quality** [**Q**]; **Resource** [**R**] which are already characterized with Dependum those outside the Boundary. At the next level, the social dependencies are defined by the abbreviations: **Depender** [**Dr**]; **DependerElmt** [**DrE**]; **Dependum** [**Dm**]; **Dependee** [**De**]; **DependeeElmt** [**DeE**]. Starting from the next branching level,

[4] Diagrams - Security-first diagramming for teams - https://www.diagrams.net/

the elements belonging to the boundary and the links of the intended elements are processed. Five guidelines are defined for the construction of the model, which are described below. They are the central elements of the social modeling language and in the language actors are active entities that perform actions to achieve their goals. In [25] the problem scenario "SiStagio" is presented, where the proposed guidelines were applied based on the template. The guidelines and the results of their application in problem scenario SiStagio are presented below.

The Guideline 1 (Gl1) - Definition of actors and their types - actors depend on each other to achieve their goals, perform tasks, and provide resources. When applying the guide, the results found are actors: Coordinator (Role), Company (Generic Actor), Student (Generic Actor) and SiStagio (Generic Actor). Application details can be seen in figure 3.a.

The Guideline 2 (Gl2) - Actor Association Linkages - actors are often linked to each other, and this is done through linkages between actors that define/describe these relationships. The linkages are binary, i.e. they connect a single actor to a single other actor, and these linkages are defined by two different types: is-a: and participates-in. In the application of the SiStagio scenario there are no association links. An example of use would be a staff actor specializing in a Coordinator actor and a Secretary actor that would use is-a association links. The figure 2 shows Guideline 3 (Gl3), which is described below.

Origin Actor	Intentional Elements	Target Actor
Company (Generic)	Register Job **[G]**	boundary
	Submit Job Information **[T]**	boundary
	Request Partnership **[G]**	boundary
	Send Informations **[T]**	boundary
	Submit Request Partnership **[G]**	**Cordinator (Role)**
	Submit Request Job **[G]**	**Cordinator (Role)**
	Safe **[Q]**	boundary
Cordinator (Role)	Register Company **[G]**	boundary
	Validate Partnership **[T]**	boundary
	Manage Company **[G]**	boundary
	Register Job Company **[G]**	boundary
	Register Intership **[G]**	boundary
	Register Course **[G]**	boundary
	Register Student **[G]**	boundary
	Validate Student Informations **[T]**	boundary
	Easy to Use **[Q]**	**SiStagio (Generic)**
	Safe **[Q]**	**SiStagio (Generic)**
	Submit Register Company **[G]**	**SiStagio (Generic)**
	Manage Companie **[Q]**	**SiStagio (Generic)**
	Submit Register Job **[G]**	**SiStagio (Generic)**
	Submit Register Intership **[G]**	**SiStagio (Generic)**
	Submit Register Courses **[G]**	**SiStagio (Generic)**
	Submit Register Students **[G]**	**SiStagio (Generic)**
	Manage Students **[G]**	**SiStagio (Generic)**
Student (Generic)	Request Register **[G]**	boundary
	Submit Request Information **[T]**	boundary
	Search Jobs **[G]**	boundary
	Safe **[Q]**	boundary
	Submit Request Register **[G]**	**Cordinator (Role)**
	Search Jobs Active **[G]**	**SiStagio (Generic)**

Fig. 2. The Guideline 3 (Gl3) - Intentional Elements.

The Guideline 3 (Gl3) - Intentional Elements - these are elements that represent the intentions of actors and model different types of requirements, therefore they are central elements for the iStar model. An intentional element that appears within the boundaries of an actor and denotes something that is desired by that actor. Intentional element can also appear outside the boundaries of an actor, as part of a socially dependent relationship between two actors (Guideline 4 - Gl4). This guide presents the intended elements (taken from the problem scenario) and defines the types of each element and the actors in the relationship (see figure 2 and figure 3.a). In this guide, intentional elements must be defined, both the elements that establish dependencies between actors and the elements that form the boundaries of an actor. Any element that provides an important feature for achieving the goals and how they can be achieved.

The Guideline 4 (Gl4) - Social Dependencies - dependencies represent social relationships in iStar (version 2.0). Together with the assumption that actors can be people, organizations, technical systems (hardware, software), or any combination thereof, this makes iStar a sociotechnical modeling language. This guide defines the "meanings" of dependencies between actors, as well as the dependency element, making it possible to determine the origin and destination of each dependency element. With guideline application the results Social Dependencies (can see in table 1).

Table 1. Guideline 4 - Gl4: Social Dependency [SD]

Origin Actor	SD Intentional Elements SD	Target Actor
Cordinator (Role)	[**Dr**] Easy to Use [**Q**] [**De**]	**SiStagio (Generic)**
	[**Dr**] Safe [**Q**] [**De**]	**SiStagio (Generic)**
	[**Dr**] Submit Register Company [**G**] [**De**]	**SiStagio (Generic)**
	[**DeE**] Register Company [**G**] [**Dr**]	**Company (Generic)**
	[**Dr**] Manage Companie [**Q**] [**De**]	**SiStagio (Generic)**
	[**DrE**] Manage Company [**G**] [**De**]	**SiStagio (Generic)**
	[**Dr**] Submit Register Job [**G**] [**De**]	**SiStagio (Generic)**
	[**Dr**] Submit Register Intership [**G**] [**De**]	**SiStagio (Generic)**
	[**Dr**] Submit Register Courses [**G**] [**De**]	**SiStagio (Generic)**
	[**Dr**] Submit Register Students [**G**] [**De**]	**SiStagio (Generic)**
	[**DrE**] Register Student [G] [**De**]	**SiStagio (Generic)**
	[**Dr**] Manage Students [**G**] [**De**]	**SiStagio (Generic)**
	[**DrE**] Register Course [G] [**De**]	**SiStagio (Generic)**
	[**DrE**] Register Intership [G] [**De**]	**SiStagio (Generic)**
Company (Generic)	[**DrE**] Register Job [**G**] [**De**]	**Cordinator (Role)**
	[**Dr**] Submit Request Partnership [**G**] [**De**]	**Cordinator (Role)**
	[**Dr**] Request Partnership [**G**] [**De**]	**Cordinator (Role)**
	[**Dr**] Submit Request Job [**G**] [**De**]	**Cordinator (Role)**
Student (Generic)	[**Dr**] Submit Request Register [**G**] [**De**]	**Cordinator (Role)**
	[**DrE**] Request Register [G] [**De**]	**Cordinator (Role)**
	[**Dr**] Search Jobs Active [**G**] [**De**]	**SiStagio (Generic)**
	[**DrE**] Search Jobs [G] [**De**]	**SiStagio (Generic)**

The Guideline 5 (Gl5) - Intent Element Linkages (IEL) - in this guideline there are four types of linkages between intent elements, namely refinement, needed by, contribution, and qualification. After applying the five guidelines in the II scenario, there is a completed MindMap model using the template and the instructions for building an iStar model. The information for the basic construction of the iStar model is organized graphically in the MindMap template (figure 1) so that this MindMap can be translated into an iStar model through the "conversation" between the MindMaps and the iStar metamodels. In this guide, intent element linkages finded in the problem scenario (see in table 2).

Table 2. Guideline 5 - Gl5: Intent Element Linkages [IEL]

IEL	Actor	Intentional Elements	Element Origin
AND	**Cordinator**	Validate Student Informations [**T**]	Register Student [**G**]
	Cordinator	Validate Partnership [**T**]	Register Company [**G**]
AND	**Company**	Submit Job Information [**G**]	Register Job [**G**]
	Company	Send Informations [**G**]	Register Partnership [**G**]
Help	**Company**	Safe [**Q**]	Submit Job Information [**T**]
Help	**Company**	Safe [**Q**]	Send Informations [**T**]
AND	**Student**	Submit Register Information [**T**]	Request Register [**G**]
Help	**Student**	Safe [**Q**]	Submit Register Infomation [**T**]
AND	**SiStagio**	Insert Data of the Company [**T**]	Register Company [**T**]
	SiStagio	Save Register Company [**T**]	Register Company [**T**]
	SiStagio	Search Company [**T**]	Register Job [**T**]
	SiStagio	Insert Data of the Job [**T**]	Register Job [**T**]
	SiStagio	Save Job [**T**]	Register Job [**T**]
	SiStagio	Select Job [**T**]	Register Intership [**T**]
	SiStagio	Select Student [**T**]	Register Intership [**T**]
	SiStagio	Save Intership [**T**]	Register Intership [**T**]
	SiStagio	Insert Data of the Course [**T**]	Register Course [**T**]
	SiStagio	Save Register [**T**]	Register Course [**T**]
	SiStagio	Insert Data of the Student [**T**]	Register Student [**T**]
	SiStagio	Save Register [**T**]	Register Student [**T**]
OR	**SiStagio**	Register Company [**T**]	Manage Company [**T**]
	SiStagio	Modify Company [**T**]	Manage Company [**T**]
	SiStagio	Remove Company [**T**]	Manage Company [**T**]
	SiStagio	Search Company [**T**]	Manage Company [**T**]
	SiStagio	Register Student [**T**]	Manage Student [**T**]
	SiStagio	Modify Student [**T**]	Manage Student [**T**]
	SiStagio	Remove Student [**T**]	Manage Student [**T**]
	SiStagio	Search Student [**T**]	Manage Student [**T**]
Nb	**SiStagio**	View Courses [**T**]	SGBD [**R**]
	SiStagio	Modify Student [**T**]	SGBD [**R**]
	SiStagio	Search Student [**T**]	SGBD [**R**]
	SiStagio	View Job [**T**]	SGBD [**R**]
	SiStagio	Print Job [**T**]	Printer [**R**]
	SiStagio	View Job [**T**]	Monitor [**R**]

After applying the five guidelines in a "SiStagio" problem scenario in [25], the information for the basic construction of the iStar model is graphically organized in the MindMap template (see fig3.a) so that this MindMap can be translated into an iStar model by "translating" the MindMaps model (template).

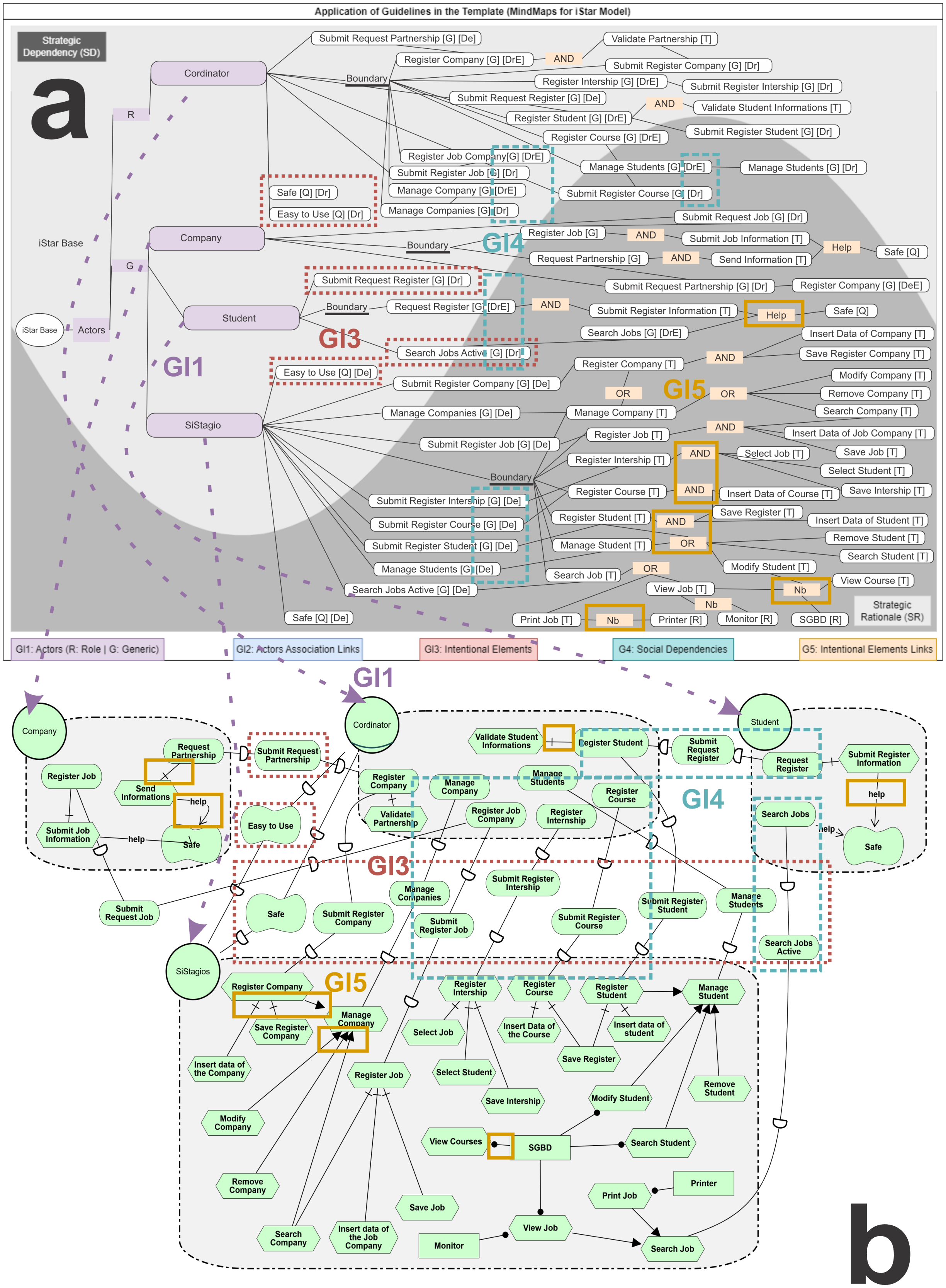

Fig. 3. Schematic of the application of the five guidelines and the model transformation.

5 Conclusions and Future Works

Software requirements can be specified in several ways, such as the goal-oriented approach GORE, which emphasizes the motivation for system development and focuses on user expectations about what the system should do or how it should behave. In this approach, one of the techniques that is represented is iStar, which proposes an actor-oriented approach that focuses on intentions, relationships, and motivations among members of the organization and provides a better understanding of organizational relationships. There are major challenges in eliciting and specifying requirements in iStar models, so the focus of this search was to present a proposal that facilitates the process of creating iStar models. The guidelines for converting requirements elicited using the MindMaps technique into iStar models were embodied in the creation of five filters to guide the results of requirements elicitation (using questionnaires/interviews) and in the five guidelines along with a template for requirements specification using the MindMaps technique. All of these implementations (filters, guidelines, and template) were based on the MindMaps and iStar metamodels to create a MindMaps model of the requirements that would be transformed into iStar models. There are several options for future work: The first is to create a complete flow, considering a higher level of abstraction (natural language) at a lower level with the objectification of the requirements expressed in the models. For this path, a strategy must be developed to analyze the terms (present in the requirements elicitation) that can be considered for the different aspects of the models (e.g., actors, connections, elements). A second way, focusing only on the phase of transforming requirements in a MindMaps model into an iStar model, would require the implementation of a tool that allows the process of creating the MindMaps model using the guidelines and template proposed in this research. Update the guidelines and template using the concept of colors in the branches, which will help to better understand the structure and levels.

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