# Practical Applications of i* in Industry: The State of the Art

Mini-tutorial @ RE'13 Rio de Janeiro
July 19, 2013
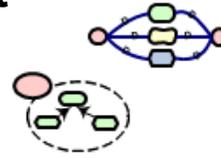
Eric Yu
U. Toronto
Canada

Daniel Amyot
U. Ottawa
Canada

Gunter Mussbacher
McGill Univ.
Canada

Xavier Franch
U.P. Catalunya
Spain

Jaelson Castro
U.F. Pernambuco
Brazil

A quick survey

- You …
  - Have never heard of i*/GRL/Tropos …until RE13
  - Know about "Goal-Oriented" RE (i*, KAOS, NFRf, …)
  - Have used i* … at least on paper
  - Have used i* in real-world projects
  - Have questions or issues about i* /Tropos /GRL…
  - Attended MIP session (Wed @ 16:30) talk on i*

Agenda

- Eric
  - Quick overview about i*
  - i* tools, resources
  - Small Exercise
- Jaelson
  - Agile
  - Software product lines
- Xavier
  - System architecture
  - Software ecosystems
- Daniel & Gunter
  - Business process and performance modeling (KPIs)
  - Compliance monitoring
  - Context-aware & adaptive systems
- Renata
  - Ontology development for systems interoperability

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*i**

strategic actors relationships modeling – an overview

Eric Yu
University of Toronto
Toronto, Canada
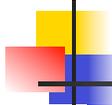
"Early" Requirements Engineering

- Concerned about …
  - Understanding the socio-technical context
  - Uncover hidden assumptions - avoid solving the wrong problem
  - Relating systems options to business and organizational objectives
  - Exploring alternatives, analyzing consequences
  - Supporting change

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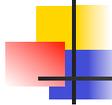
Usage contexts of i* modeling

- Early RE
- Business process modeling
  - Business modeling
- Security, Privacy, Trust,
  - Compliance
- Software methodologies (eg. Tropos)
  - Software processes (e.g., agile)
  - Software ecosystems
- Requirements to architecture
  - Software product lines

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Industry applications presented at
iStar Showcase 2011 (London)

- **Using i* Modelling as a Bridge between Air Traffic Management Operational Concepts and Agent-Based Simulation Analysis**
  - **James Lockerbie** (City University London), David Bush (NATS, UK), Neil Maiden (City University London), Henk Blom (National Aerospace Laboratory (NLR), The Netherlands), Mariken Everdij (National Aerospace Laboratory (NLR), The Netherlands)

- **Evaluating the Impact of Evolving Requirements in HIV/AIDS monitoring systems in the UK**
  - **Jorgen Engmann** (Health Protection Agency/UCL), Neil Maiden (City University London), James Lockerbie (City University London)

- **Agile Software Practices - Pre-adoption Analysis Using Strategic Modeling and Empirical Knowledge**
  - Hesam Chiniforooshan (University of Toronto), Eric Yu (University of Toronto), **Maria Carmela Annosi** (Ericsson Research Italy)

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... Business and innovation

- **Designing the Trentino Innovation Network: Applying Tropos to TasLab**
  - **Fabiano Dalpiaz** (University of Trento, Italy), Paolo Giorgini (University of Trento, Italy), Valentina Ferrari (Informatica Trentina, Italy), Stefano Tinella (Informatica Trentina, Italy)

- **Analyzing Requirements for Online Presence**
  - S. M. Easterbrook (Department of Computer Science), E. Yu (Faculty of Information, University of Toronto), J. Aranda (Department of Computer Science, University of Victoria), **J. Horkoff** (Department of Computer Science, Faculty of Information, University of Toronto, CA), M. Strohmaier (Knowledge Management Institute, Faculty of Computer Science at Graz University of Technology), Y. Fan (Department of Computer Science), M. Leica (Department of Computer Science), and R. A. Qadir (Faculty of Information, University of Toronto)

- **Using URN and Key Performance Indicators for Performance Management in Small and Medium Enterprises**
  - Alireza Pourshahid (IBM Canada and SITE, University of Ottawa), Daniel Amyot (SITE, University of Ottawa), Greg Richards (Telfer School of Management, University of Ottawa), Heather Meek (Boomerang Kids)

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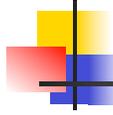
... Healthcare

- **Proactive Adverse Event Management in Healthcare**
  - Saeed Ahmadi Behnam and Daniel Amyot (University of Ottawa), Alan J. Forster (The Ottawa Hospital)

- **Collaborative social modeling for designing a patient wellness tracking system in a Nurse-Managed Health Care Center**
  - Y. An (iSchool at Drexel), P. Gerrity (College of Nursing and Health Professions), P. W. Dalrymple (Institute for Healthcare Informatics, iSchool at Drexel, Drexel University, Philadelphia USA), **J. Horkoff** (Department of Computer Science, Faculty of Information, University of Toronto, CA), M. Rogers (iSchool at Drexel), E. Yu (Faculty of Information, University of Toronto, CA)

- **Bridging User Privacy Goals and the Privacy Features of Personal Health Records Systems**
  - Reza Samavi (University of Toronto, Canada), Thodoros Topaloglu (Rouge Valley Health System, Ontario, Canada)

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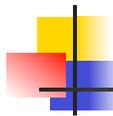
... Civil and mechanical engineering

- **Modelling Requirements for an Integrated Management System for Civil Construction**
  - Fernanda Alencar (Dep. Eletrônica e Sistemas), **Jaelson Castro** (Centro de Informática), José Roberto R de Menezes (Dep. Engenharia Civil,
  - Universidade Federal de Pernambuco, Brazil), José Jeferson R Silva3, Emanuel Santos (Centro de Informática)

- **Managing Requirements Knowledge - a Case Ctudy on Control Cystems**
  - **Dominik Schmitz** (RWTH Aachen University), Matthias Jarke (RWTH Aachen University and Fraunhofer FIT), Hans W. Nissen (Cologne University of Applied Sciences), Thomas Rose (Fraunhofer FIT)

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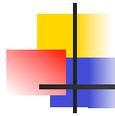
... Software and system development

- **Architecting hybrid systems: the Etapatelecom and Cuenca Airport cases**
  - Juan Pablo Carvallo (Universidad del Pacífico, Cuenca, Ecuador), **Xavier Franch** (Universidad Politècnica de Catalunya, Barcelona, Spain)

- **Modeling Requirements with i* in the Development of a Data Warehouse for a University**
  - Paul Hernández (Lucentia Research Group Universidad de Alicante, Spain), Alicia Castro (Universidad de La Frontera, Chile), Jose-Norberto Mazón (Lucentia Research Group Universidad de Alicante, Spain), Juan Trujillo (Lucentia Research Group Universidad de Alicante, Spain), Carlos Cares (Universidad de La Frontera, Chile)

- **Understanding Stakeholders' Viewpoints in Enterprise SOA**
  - **Daniel Gross**, Eric Yu (University of Toronto), Sharon Volk (The Pheonix Insurance, Tel Aviv, Israel), Sharon Al-Al (The Pheonix Insurance, Tel Aviv, Israel)

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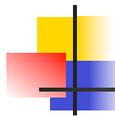
... Compliance and Assurance

- **Regulatory Compliance of Requirements of Health Care Information Systems - Experience with Nomos**
  - Alberto Siena (University of Trento), G. Armellin (GPI srl), G. Mameli (FBK-irst, Trento, Italy), John Mylopoulos (University of Trento),) **Anna Perini** (FBK-irst, Trento, Italy), Angelo Susi (FBK-irst, Trento, Italy)

- **Assurance Requirements for Public Serivces**
  - **André Rifaut**, Eric Dubois, Sylvain Kubicki, Sophie Ramel (Public Research Centre Henri Tudor, Luxembourg)

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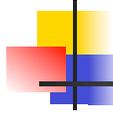
... Security and Trust

- **Modelling Trust and Security Requirements: the Air Traffic Management Experience**
  - Elda Paja (University of Trento, Italy), **Fabiano Dalpiaz** (University of Trento, Italy), Paolo Giorgini (University of Trento, Italy), Stéphane Paul (Thales Research and Technology, France), Per Håkon Meland (SINTEF, Norway)

- **Using Secure Tropos to Develop a Pre-Employment Screening System**
  - **Shareeful Islam** (School of Computing, IT and Engineering, University of East London), Haralambos Mouratidis (School of Computing, IT and Engineering, University of East London), Miao Kang (PowerchexLtd)

- **Modeling and Analysis of White-Box Security Patterns in i***
  - **Golnaz Elahi** (University of Toronto), Eric Yu (University of Toronto), Yuan Xiang Gu (Irdeto Canada)

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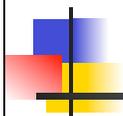
*i** basic concepts

Fundamental questions for each strategic actor

- What do I want?

- How can I achieve what I want?

- Who do I depend on to achieve what I want?

Strategic Dependency Relationship

I want ...

I can ...

Actor A

Car Be Repaired
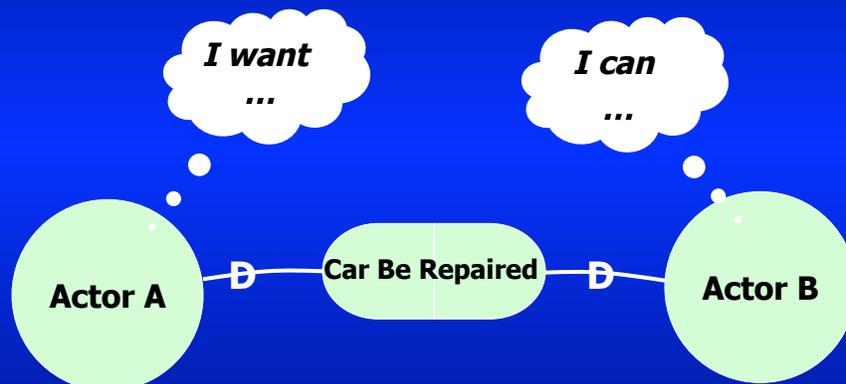
Actor B

Modelling Strategic Actor Relationships and Rationales
- the i^* modelling framework

Strategic Actors
- have goals, beliefs, abilities, commitments
- are semi-autonomous
  - freedom of action, constrained by relationships with others
  - not fully knowable or controllable
  - has knowledge to guide action, but only partially explicit
- depend on each other
  - for goals to be achieved, tasks to be performed, resources to be furnished

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Two levels of strategic actors modeling

- **Strategic Dependency (SD) model:**
  To analyze relationships among actors with strategic intent
  - includes humans and machines

  SD model

- **Strategic Rationale (SR) model:**
  To decompose the intentionality of each actor
 - Means-ends analysis

  SR model

- What i^* does not aim to do
  - Execution level analysis
  - Temporal dimension
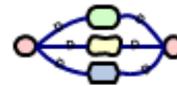
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The Strategic Dependency Model

automobile insurance – example 1
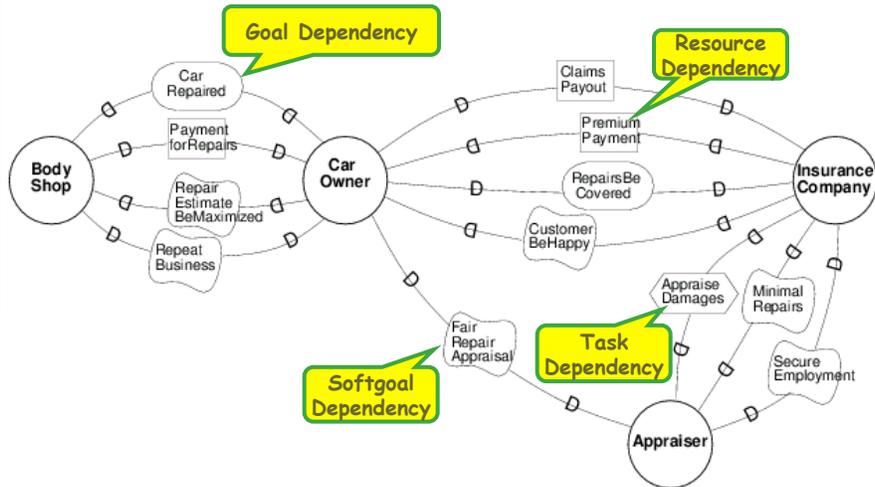
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Strategic Dependency Model
dependency types

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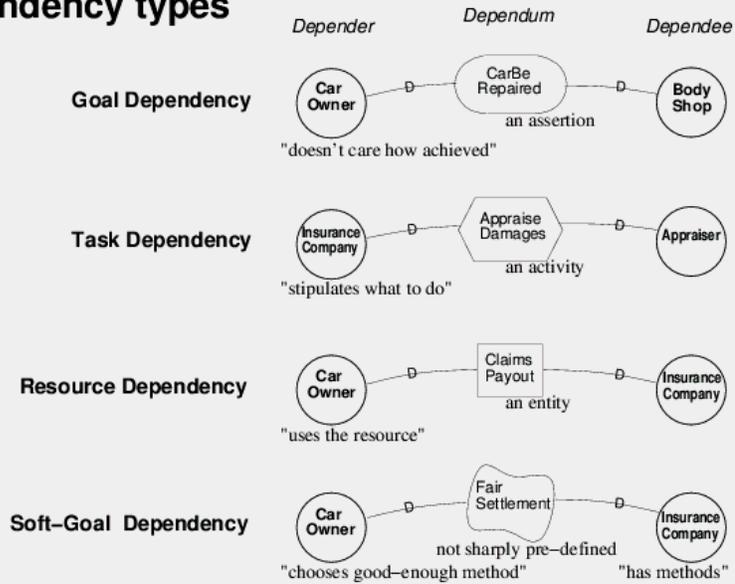
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The Strategic Dependency Model

auto insurance − example 2
"Let the Insurance Agent handle it."

examples taken from: Hammer & Champy 1993 − Reengineering the Corporation, pp. 137−143.

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The Strategic Dependency Model

auto insurance − example 3
"Let the Body Shop handle it."

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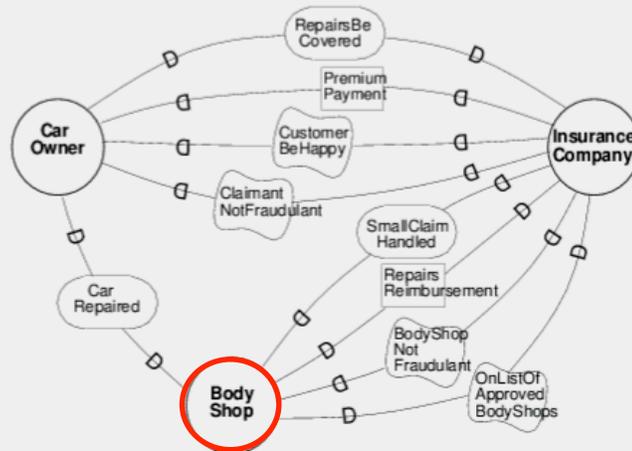
The Strategic Rationale Model

means–ends links and
task decomposition links

Task Decomposition Link

What does the task consist of?

What are the means for achieving the desired end?

Means-Ends Link

LEGEND
Goal
Task
Resource
Softgoal

Means–Ends link
Task–Decomposition link
Contribution to softgoal
Actor
Actor Boundary
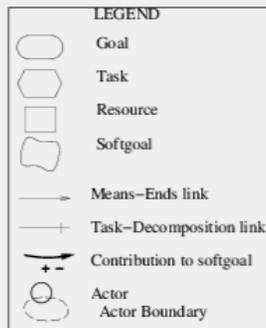
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The Strategic Rationale Model

"Functional" Alternatives

Means-Ends Links
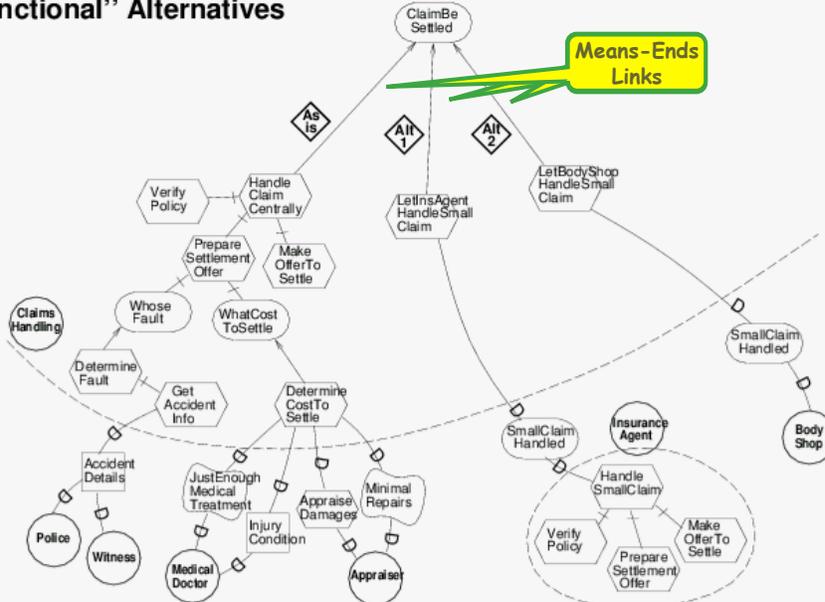
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The Strategic Rationale Model

"Non-Functional" Rationales

How do the alternate courses of action (tasks) **contribute** to the various softgoals?

Contribution Link
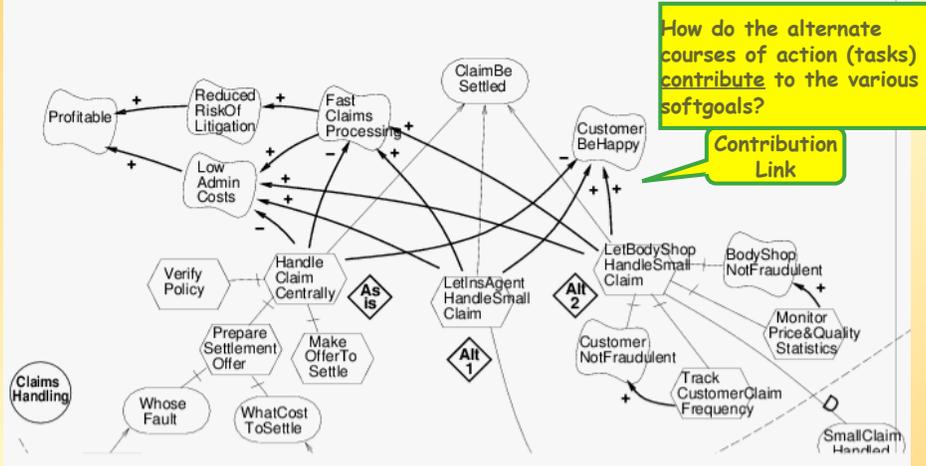
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i* main concepts

Actor

Goal   Task

Softgoal   Resource

Means-Ends link

Decomposition link

Dependency link

Make

Help

Unknown

Hurt

And

Contribution link

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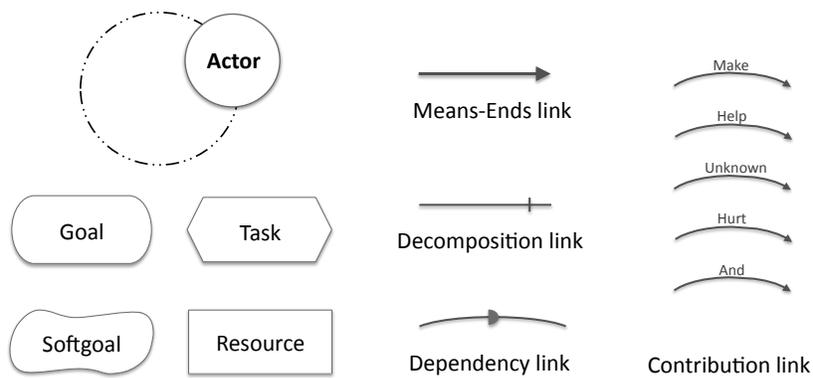
Analyzing the models

Analyzing vulnerabilities

- Example of enforcement mechanism
  - Reciprocal dependency
- Loop analysis

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Analyzing vulnerabilities
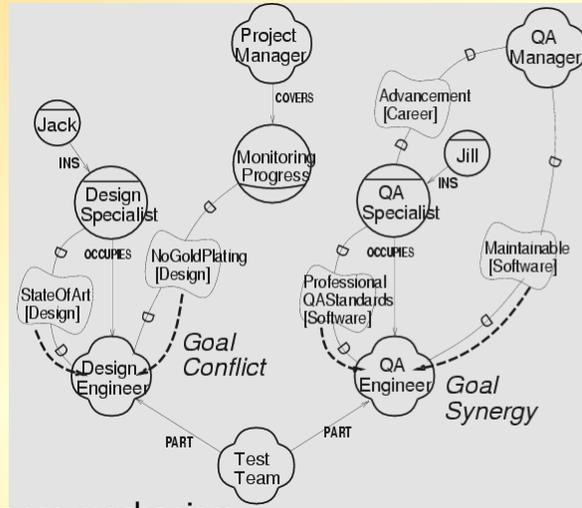
- Example of assurance mechanism
  - Goal synergy or conflict
- Node analysis

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Are Actors' Strategic Goals Met?

[Yu Deng IWSECO'11
Understanding Software Ecosystems
Using Strategic Modeling]

✓ satisfied
✓. weakly satisfied
✗ denied
✗. weakly denied

*What if the vendor's platform
is not easy-to-use from
the developer's viewpoint?*
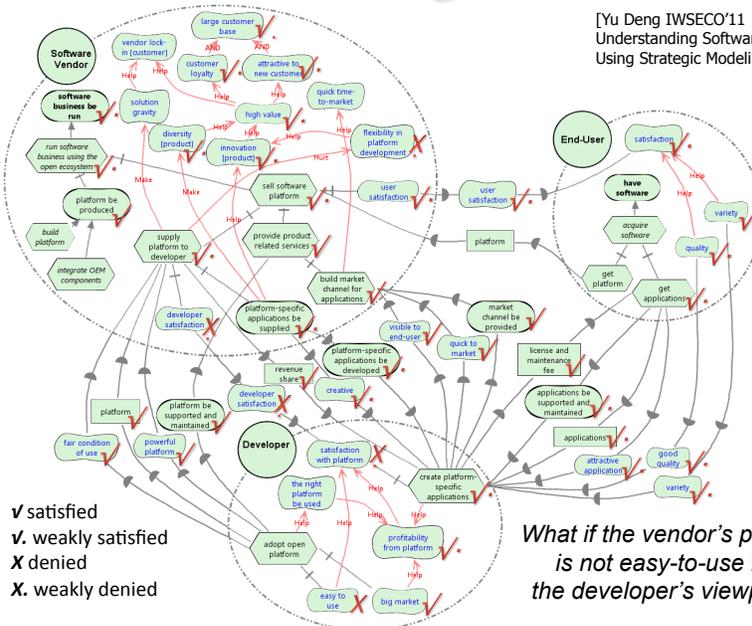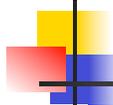
Open Research Issues

- Tools & Environments
  - Visualization
  - Scalability
- Empirical Studies
- Process & Methods
- Concepts
  - Time dimension
  - Ontology
- Education
- Standards
- Integration & Interoperability

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i*-related resources

E Yu, D Amyot, G Mussbacher, X Franch, JB Castro

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*i**

- ITU-T recommendation Z.151 (2008, 2012)
  User Requirements Notation (URN)
  - Goal Requirements Language (GRL)
    - http://www.itu.int/rec/T-REC-Z.151/en

Click to LOOK INSIDE!

Social Modeling for Requirements Engineering

edited by
Eric Yu, Paolo Giorgini, Neil Maiden, and John Mylopoulos

MIT Press 2011. 742pp.

Figure 3/Z.151 GRL specification concepts

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Web sites

- *i** Wiki **- Fostering Investigation, Collaboration, and Evaluation**
  http://istarwiki.org
  - Publication listings
    - PhD theses
  - Overview and Comparison of *i** Tools
  - The *i** Quick Guide
  - *i** Usage Guidelines
  - Who's Who
  - Events

- i-star group library on CiteULike

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4.1.1.5 Do not include an Actor within another Actor

i* Usage Guidelines

i* Guide > Guidelines > Level > Beginner
i* Guide > Guidelines > Type > Concept

This Guideline Wiki Page displays the guideline as per the i* Style of the University of Toronto. Use Comment tab above to read or write comments about this guideline. Scroll down to see variations of this guideline for other i* modeling styles.

4.1.1.5 Guideline (Beginner,Concept) Do not include an Actor within another Actor.

Discussion: Actors are active and autonomous entities that should be modeled separately. "Sub-system" in the illustration can be modeled as actors that have Dependency Links with the main system and/or other actors. They can also be modeled with Association Links such as "is-part-of" and "ISA", to the higher-level system.

Any Actor type can not be included within another Actor's boundaries using any type of Links. Internal Actors need to be drawn outside as another Actors, Agents, Roles, or Positions with the proper Actor Association Link between them such as ISA, Is Part Of, INS, Plays, Covers, or Occupies.

Registration sub-system — Is part of — Online Education System — **Correct**

Invoice Generator — Is part of — **Correct**

Course Be Provided — Registration sub-system — **Wrong**

Provide courses — Register students — Invoice Generator

Hire education experts — Develop e-Learning Website — Generate invoices — **Wrong**

Return to iStarGuide document

Tools

istarwiki.org

Available i* Tools

- Canada (U Toronto)
  - OME, OpenOME
- Canada (U Ottawa)
  - jUCMnav for URN
- England & Spain
  - REDEPEND- REACT
- Italy
  - TAOM4E , GR Tool, T Tool , ST Too[l]
- Spain
  - GR-Tool , J-PRiM
- Germany
  - Snet Tool
- Brazil
  - Istar Tool, xGOOD, GOOSE
- Belgium
  - DesCARTES

See a table summary of the features exhibit by this tools in the section Comparing the i* Tools.
See the published metamodels in the section i* Metamodels.

- OpenOME
  - As a standalone application and as a plug-in for other popular tools, such as Ec[lipse] modeling and analysis tool.
- OME
  - A graph editor to support goal-oriented and/or agent-oriented modeling.
- REDEPEND-REACT-BCN
  - REDEPEND-REACT is a tool that supports i* modelling and the analysis of the res[ult] on the representation of the information system using the i* framework and prov[ides] for the modelled information system.
- TAOM4E
  - TAOM4E supports a model-driven, agent oriented software development and, in[...] Architecture (MDA) reccomandations.
- GR-Tool
  - Forward and backward reasoning is supported in Tropos by a Goal Reasoning[...] goal models and run the algorithms and tools for forward and backward reason[ing] embedded in the GR-Tool.
- T-Tool

22 listed on i* wiki
http://istarwiki.org/tiki-index.php?page=i*+Tools&structure=i*+Wiki+Home

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*i** variants & extensions

- Tropos – Mylopoulos, Giorgini, Perini, Castro, Kolp, ...
- GRL – Amyot, Yu, Liu, Mussbacher, Weiss, ...
- TCD – Gans, Lakemeyer, Kethers, Jarke, Schmitz, ...
- REF – Donzelli, Bresciani
- HUCRE – Gregoriadis, Shin, Sutcliffe,
- ERA - Sutcliffe
- RESCUE – Maiden, Jones, ...
- Nomos - Siena, Ingolfo, Perini, Susi, Mylopoulos...
- ...
- Secure Tropos UK – Mouratidis, Giorgini, ...
- Secure Tropos Italy – Giorgini, Massacci, Zannone, ...
- Secure i* - Elahi, Yu, Liu
- Si* - Zannone, Massacci, ...
- ...

- BASSiE – vdRaadt, Gordijn, Yu
- SBMO – Samavi, Yu ,...
- PRiM, RiSD – Grau, Franch,...
- CASL – Lesperance, Wang, Lapouchnian,
- ...
- Q-MOPP - Briand, Seaman, Basili,...
- KTA – Strohmaier, Horkoff, Yu ,...
- ...

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Tag cloud

citeulike

Group: i-star 114 tags

All tags in this group's library

_adaptive-systems[20] __agent-oriented[6] __agent-oriented-system-development[24] __air-traffic[4] _aourn[13] __aspect-oriented[19] __bim[6] __business-intelligence[13] __business-modeling[23] _comparison[21] __compliance[18] __data-warehousing[6] __e-services[5] __e3value[3] __elicitation[11] _empirical-case-study[24] __enterprise-architecture[3] __environmental[2] __evolution[11] __experiment[1] __formal-specification[1] _goal-model-reasoning[56] __goal-oriented[60] __grl[85] __healthcare[4] __i-star[9] _indicators[17] __industry-led[4] __industry-partnered[26] __intellectual-property-management[2] __istar[245] _istar-discussed[9] __istar-mentioned[29] __istarfordws[3] __jucmnav[19] __kaos[2] __knowledge-management[13] _language[30] __metamodel[28] __method-engineering[11] __metrics[4] __model-checking[4] __modeling[38] _multi-agent[4] __nfr[11] __non-functional[13] __ontology[16] __organization-architecture[5] __patterns[13] _personalization[8] __privacy[2] __process-modeling[27] __process-reengineering[7] __project-management[1] __quantitative[5] _requirements[28] __requirements-engineering[129] __reuse[1] __safety[1] __scenario-oriented[8] _sd-model[17] __security[45] __service-oriented[5] __simulation[2] __socio-tech-system-design[10] _software-process-improvement[5] __software-process-modeling[11] __software-product-lines[5] __sr-model[25] _system-architecture[17] __system-development-methodology[26] __thesis-masters[2] __thesis-phd[8] __tool[1] _trade-off[10] __tropos[36] __trust[16] __uml[15] __uncertainty[1] __urn[45] __usage-methodology[22] __use-cases[3] _validation[3] variability[10] __visualization[1] web-engineering[8] web-modeling-methods[6] __cots[1] acme[1] conceptual[1] context-aware[1]

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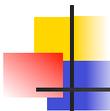

References

- Yu, E. **Social Modeling and i***. In: Conceptual Modeling: Foundations and Applications, LNCS 5600, Springer, 2009.
- Yu, E., Giorgini, P., Maiden, N., Mylopoulos, J. (eds) **Social Modeling for Requirements Engineering**. MIT Press, Jan 2011.
- **i* homepage** http://www.cs.toronto.edu/km/istar/
- **i* wiki** http://istarwiki.org
- **iStar showcase'11** http://tinyurl.com/istarshowcase11
- ITU-T Z.151 User Requirements Notation.
  http://www.itu.int/rec/T-REC-Z.151/en
- **CiteULike** http://www.citeulike.org/group/14571

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Exercise

- Consider a small problem domain, with:
  - a few actors/stakeholders
  - potential software application
  - Eg: visitor accommodation: hotel -> AirBnB?
- Ask:
  - Who are the actors?
  - What do they want?
  - How do they achieve what they want?
    - Dependencies on other actors?
  - Goals not achieved?
  - What alternatives to explore?
 - What consequences for various stakeholders?

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Strategic Dependency (SD) model ("As-Is")

Meeting Scheduling Example

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"To-Be", alternative 1

Attends Meeting (p,m)

MeetingBe Scheduled (m)

EnterAvail Dates(m)

Meeting Initiator

Meeting Scheduler

Meeting Participant

EnterDate Range(m)

Proposed Date (m)

Agreement (m,p)

ISA

Attends Meeting (ip,m)

Assured (Attends Meeting (ip,m))

Important Participant
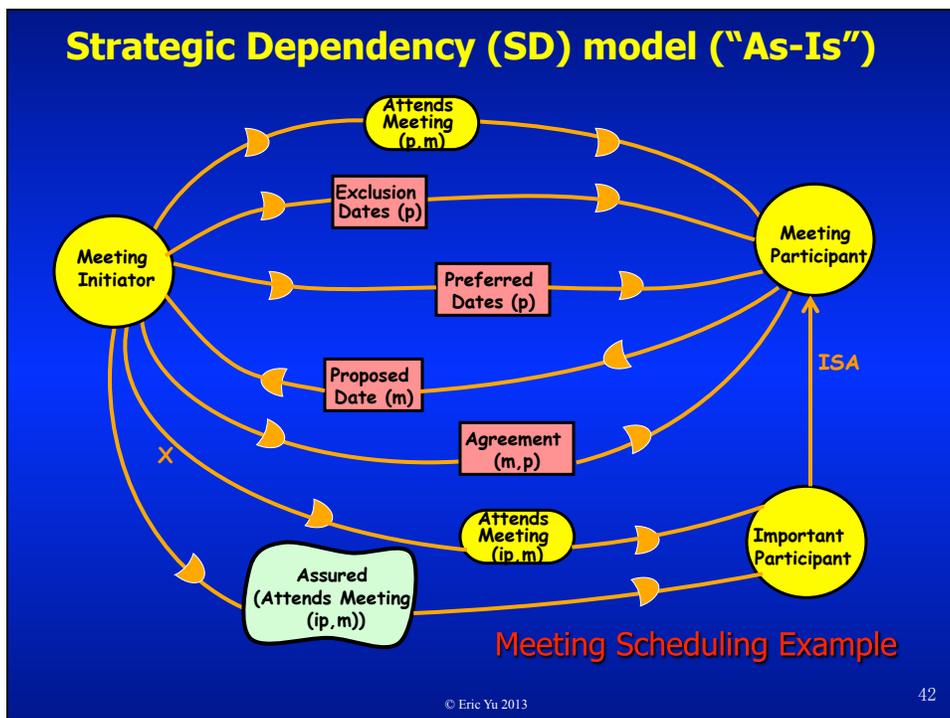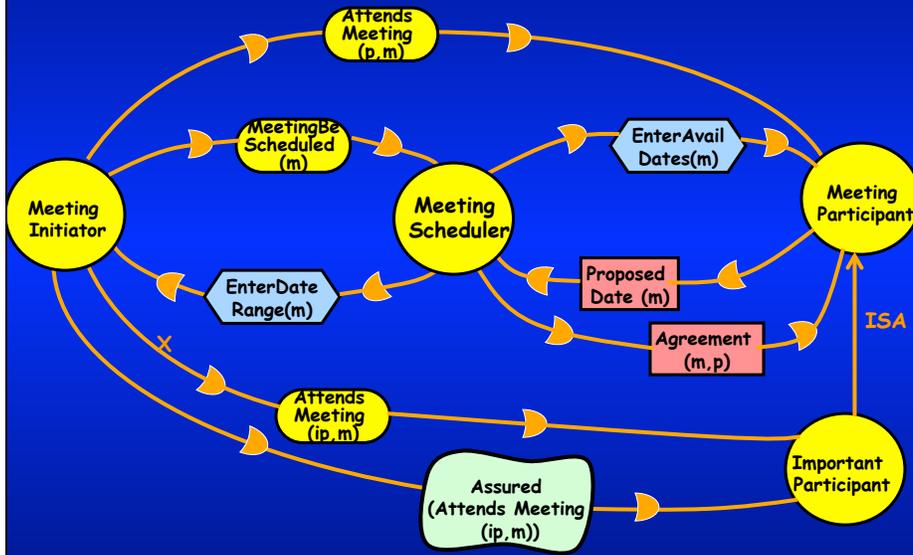
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Strategic Rationale (SR) model ("As-Is")

- Ask "Why", "How", "How else"

Meeting Initiator

Meeting Participant

Organize Meeting

Attends Meeting

Participate InMeeting

Quick

Meeting Be Scheduled

Low Effort

Attend Meeting

Arrange Meeting

Convenient Meeting, Date

Schedule Meeting

Exclusions Dates

Quality (Proposed Date)

Agreeable (Meeting, Date)

Low Effort

Find Suitable Slot

Obtain Avail Dates

Preferred Dates

Find Agreeable Date

User Friendly

Obtain Agreement

Proposed Date

Min Interruption

Merge AvailDates

Agreement

AgreeToDate

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"Strategic Rationale" Model ("To-Be")
With Meeting Scheduler

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1) Using i* with Scrum
2) Using i* in Software Product Lines

Jaelson Castro
U.F. Pernambuco, Brazil

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Agility

AGILE

i*

GORE

SCRUM
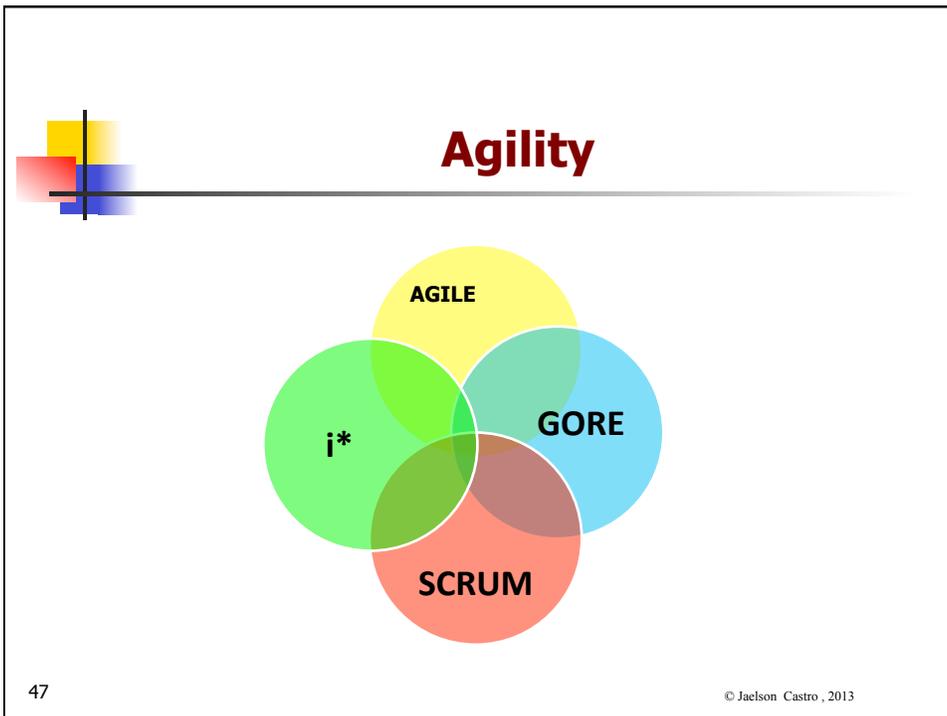
Problem

- Failure of Software Projects

- Lack of Agility

- Organizational Requirements

Objectives

- Explore the use of i* models as a means to enrich / complement User Stories
    - Relating requirements presented as User Stories to i* models
- A graphical and comprehensive view of User Stories and their relationships by means of i* Models

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Scrum i*

50
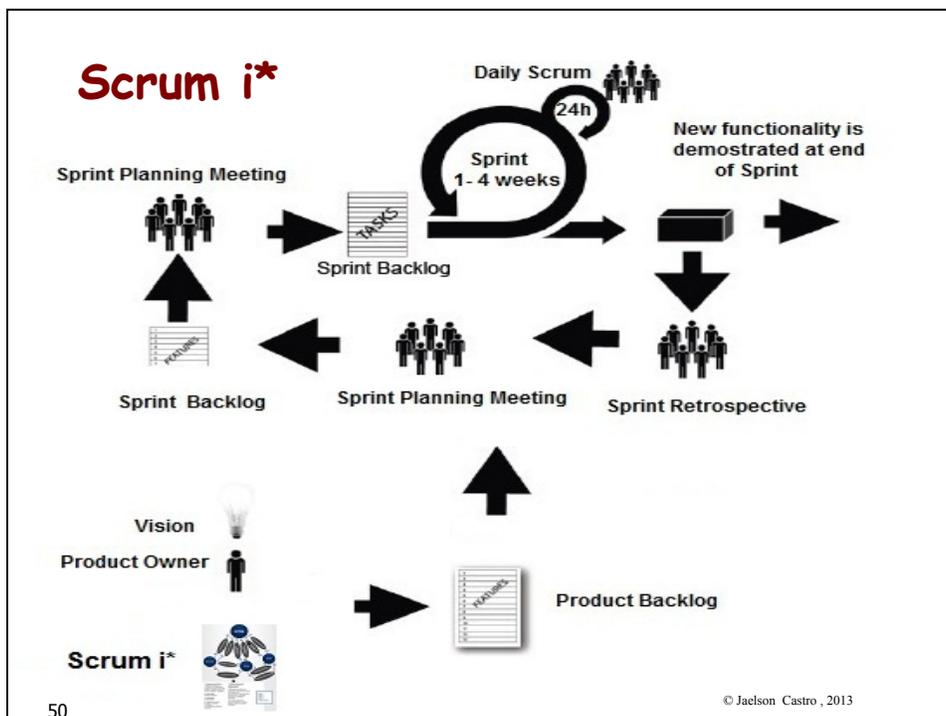
Case Study

Agile @ Brazil

Government Sector

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Scrum i*

1. Requerimento diversos
(requisições originárias, contratual e de pagamento) Criação de processo Gestão de pedidos (consultas diversas e fornece subsídio) Tramitação

2. Informações
Recebe demandas

3. Informações
Procedimentos

4. Criação de processo
Gestão de Processos Tramitação.

6. Recebimentos diversos
Relatórios

7. Análise de demanda
Autoriza despesa

8. Informações

9. Requerimentos diversos
requisições originárias, contratual e de pagamento) Fornecimento de documentação (informações e condições) Conferência / validação Tramitação

10. Criação de processo
Gestão de pedidos (consultas diversas e fornece subsídio) Tramitação

Setor 1
Setor 2
Setor 3
Setor 4
Demais setores

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Evaluation

"Reduces the learning curve of the system in case of staff turnover"

Findings
Findings
Findings
Findings
Findings
Findings
Findings
Findings
Findings

78%: easily applicable

"In my perception, the Scrum i * artifact can be applied to any software development project using agile methodologies agile or not, since its purpose is to assist the understanding of the context of the application being developed, as is the mapping of actors and dependencies between them. It Then, it could another tool to be used in the requirements capture."
"

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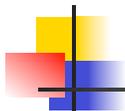
Lessons Learnt

- Not all i* constructs are used
- Provides a better view (broader and general)
- Depicts dependencies between the stories and the system,
  - contributes to a better understanding of the context of the system under development
- Allows the recognition of possible errors or omissions in the user stories

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Software Product Line

REUSE

GORE

i*-c

SPL
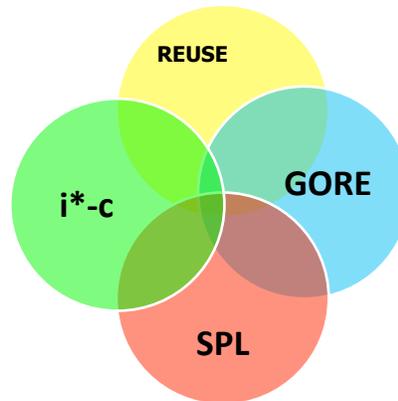
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Problem

- Need for Reuse
- Relationship between
  - Features of a software
 - Stakeholders/goals

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Objective

- To provide an approach *that integrates:*
  - *goal models,*
  - *feature models*
  - *use case scenarios*

GS2SPL: Goals and Scenarios to Software Product Lines
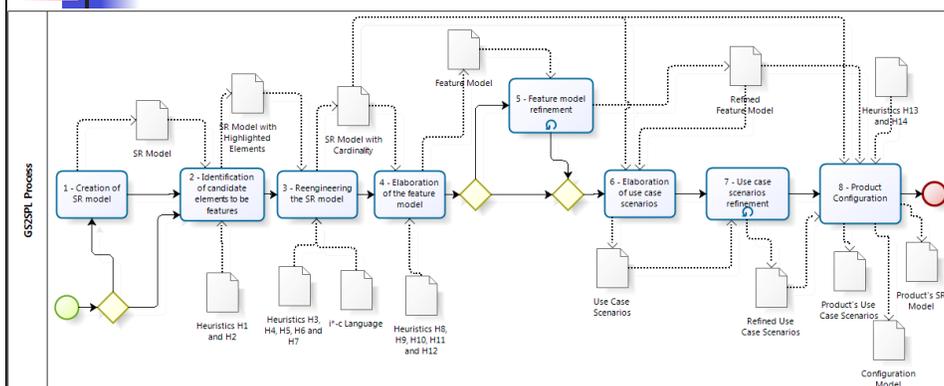
Case Study

Mobile Phones

Testing Tools

Artifacts
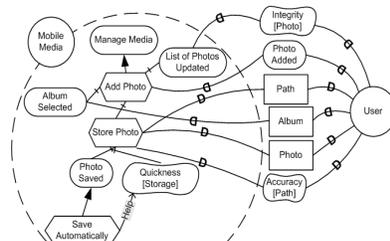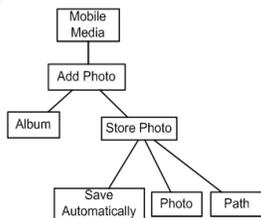
Use Case 1: Add Photo		
CHARACTERISTIC INFORMATION		
Primary Actor: User Feature: Add Photo Scope: MobileMedia Pre-condition: - Success Condition: Photo added to album		
PRIMARY SCENARIO		

ID	User Action	System Response
1	Select "Add Photo" option [Add Photo]	Present list of available albums
2	Select album [Album]	Ask User to enter the path to the photo to be added
3	Provide path of photo [Path]	Present list of photos available on the provided path
4	Select photo to be added [Photo]	Exhibit selected photo miniature.
5	-	Photo is automatically saved [Save Automatically]
6	-	List of photos is updated

SECONDARY SCENARIOS

ID	User Action	System Response
3	Provided path is invalid [Path]	Inform that path is not accessible and ask User to provided a new path
5	There is not enough space to save photo [Save Automatically]	Inform that photo could not be saved due to lack of space

RELATED INFORMATION

Non-functional requirements: Integrity [Photo], Accuracy [Path], Quickness [Storage]

Lessons Learnt

- Most relevant features and use cases to the stakeholders' goals are obtained in a systematic way
- configuration process allows the clients to configure their products on a higher abstraction level
  - select goals instead of features;
- configuration process also takes softgoals (NFRs) into account, according to the priority given by the client;

Lessons Learnt

- Need for tool support
- Not clear how feature model constraints are derived from i* models;
- Need to take feature interactions into account when generating use case scenarios

1) Using i* to architect hybrid systems
2) Managing risk in OSS ecosystems

Xavier Franch

UPC – Spain

Using i* for architecting hybrid systems

Software system built by combining components of diverse type and origins

- Legacy Systems
- Bespoke
- COTS OSS
- Services

© Carvallo & Franch, 2009
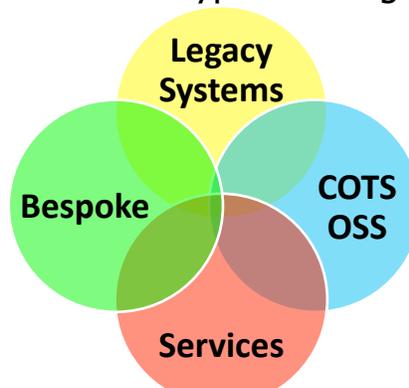
Two case studies

Etapatelecom

Aeropuerto de Cuenca

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Two case studies

- Similar characteristics and problems faced
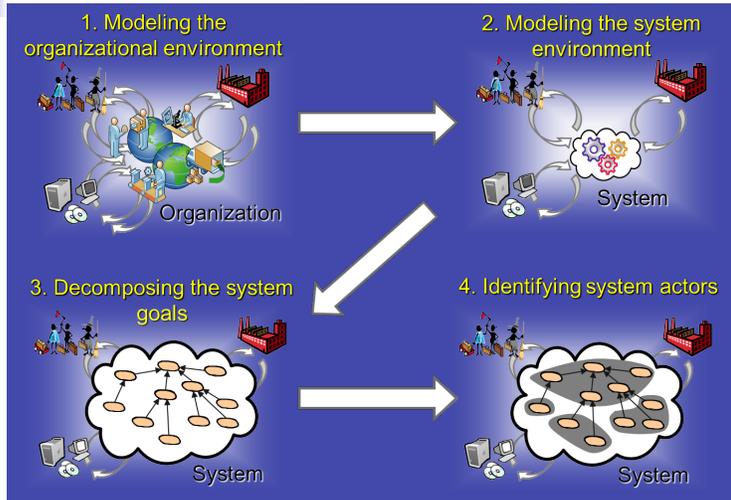
Management Software

Call

i* naturally emerged due to its strategic nature and the experience of the project leader

BSC

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The DHARMA method

1. Modeling the organizational environment — Organization
2. Modeling the system environment — System
3. Decomposing the system goals — System
4. Identifying system actors — System

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Types of models built (I)

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34
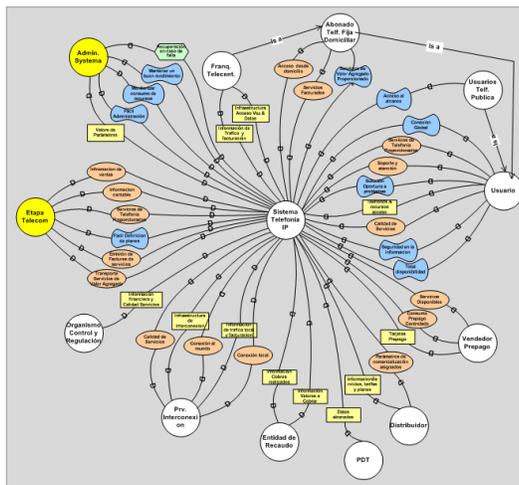
## Types of models built (II)
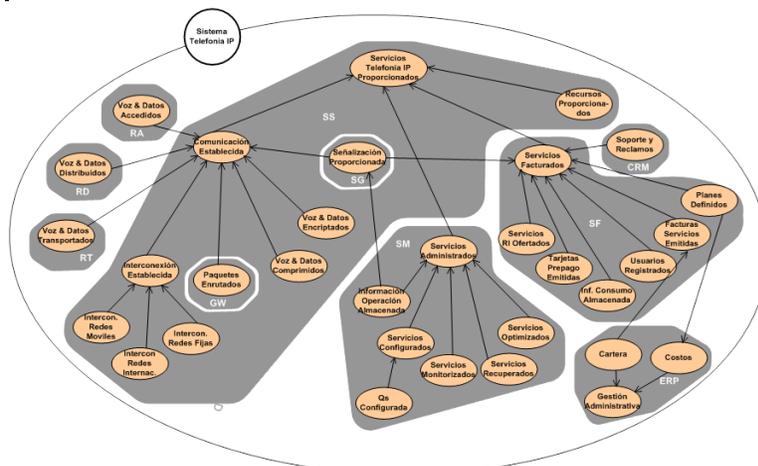
69

Lessons learned

- Non-technical stakeholders may be involved
  - financial, administrative, commercial, legal
  - training required (tutorial + brainstorming)
  - use well-known tools (MS Visio)
- Team and individual work
  - joint elicitation of most relevant dependencies
  - individual models built by stakeholders
    - expert-conducted revision/validation
  - consolidation of models in a workshop
- "Reduced" *i**, e.g.
  - just goal-decomposition in SRs
  - no *i** types of actors -> but they defined theirs!

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Risk management in OSS ecosystems

- RISCOSS: ongoing EU FP7 STREP Project (Call 8)
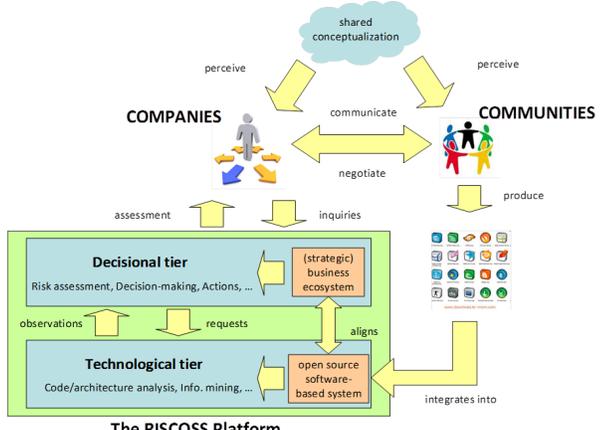
71

© The RISCOSS project, 2012

Industry application setting

- Versatile use cases with risks related to OSS


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© The RISCOSS project, 2012

i models

- Actor models
  - help managing the diversity of involved stakeholders
  - built upon a shared ontology

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i models

- SD models
  - characterise the ecosystem
  - especially the relationship with communities
  - basic for risk

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Part of a multi-model solution

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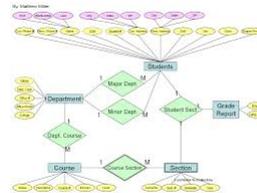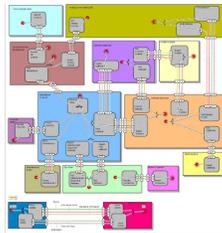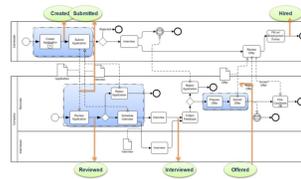
Risk identification and mitigation (I)

- Define risks over ecosystem patterns

Organi zation

New releases notified

Commu nity

Risk: communication channel not effective

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Risk identification and mitigation (II)

- Risk models to be paired with *i** models
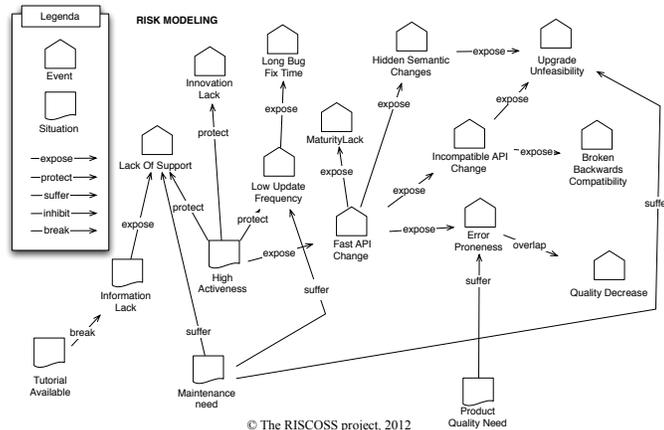
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Lessons learned: too early, but…

- Building the models have conducted to a lot of reflection in the consortium
- It has helped too to look for similarities and differences
- Stakeholders were able to intuitively validate our models
  - Although the precise semantics was difficult to understand!

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