Improving the Modularity of i* Models

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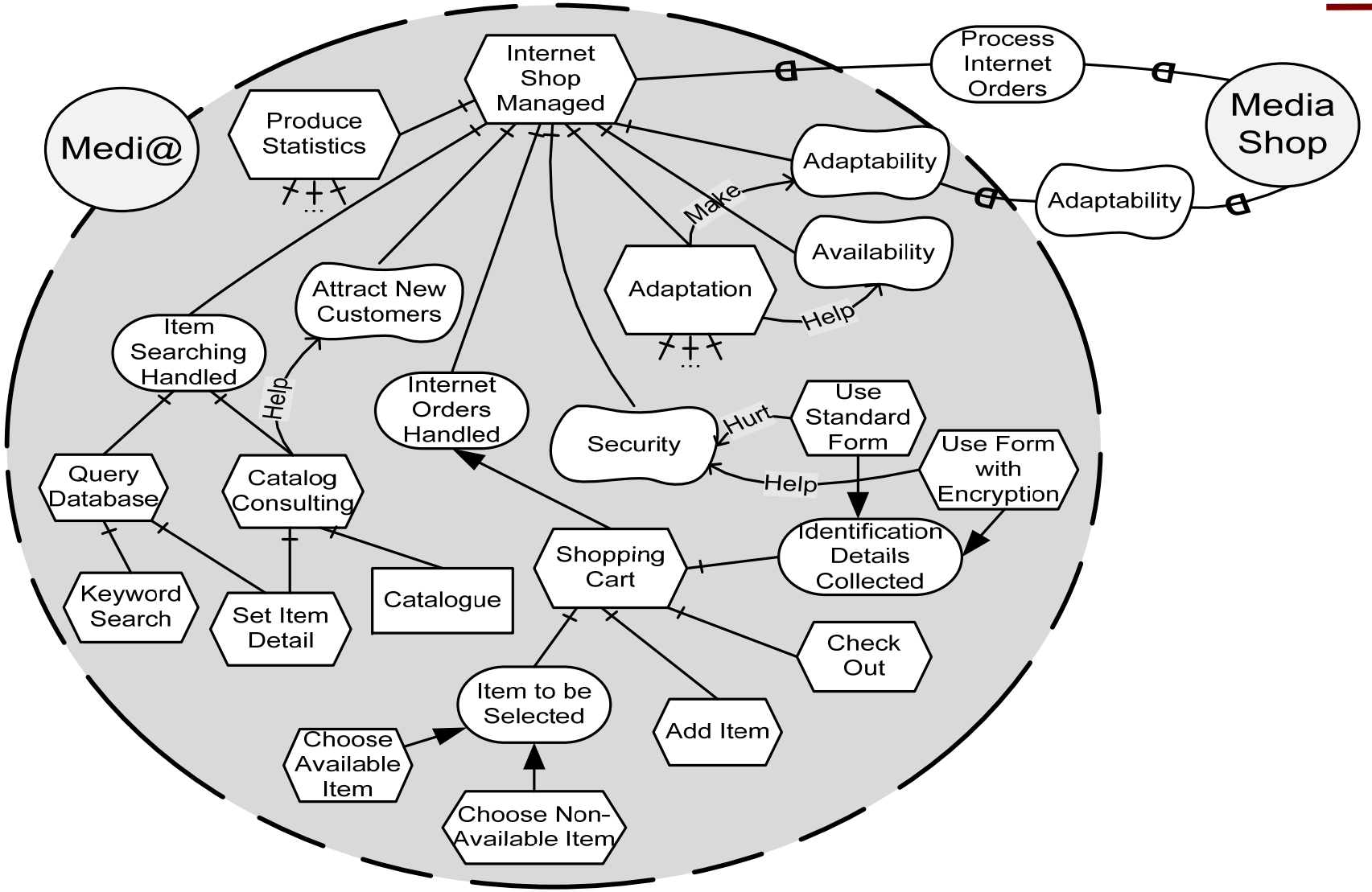
Agenda

- Problem Statement
- Proposal
- Modularizing i* with Aspects
- Modularizing i* by means of Model Transformations
- Discussion
- Ongoing and Future Work

Problem Statement

- i* incorporates a decomposition mechanism based on strategic actors, but often used in an unsuitable way
  - Current methods for i* modeling represent the rationale of an actor in a monolithic way.
- Several actor refinements are described in a scattered and tangled form (also known as crosscutting)
  - It is hard to visualize the boundaries of sub-graphs related to specific domains.
- Poor modularity compromise the management of the complexity of the models
  - An important pre-requisite for the adoption of i* in industrial settings

Problem Statement



Proposal

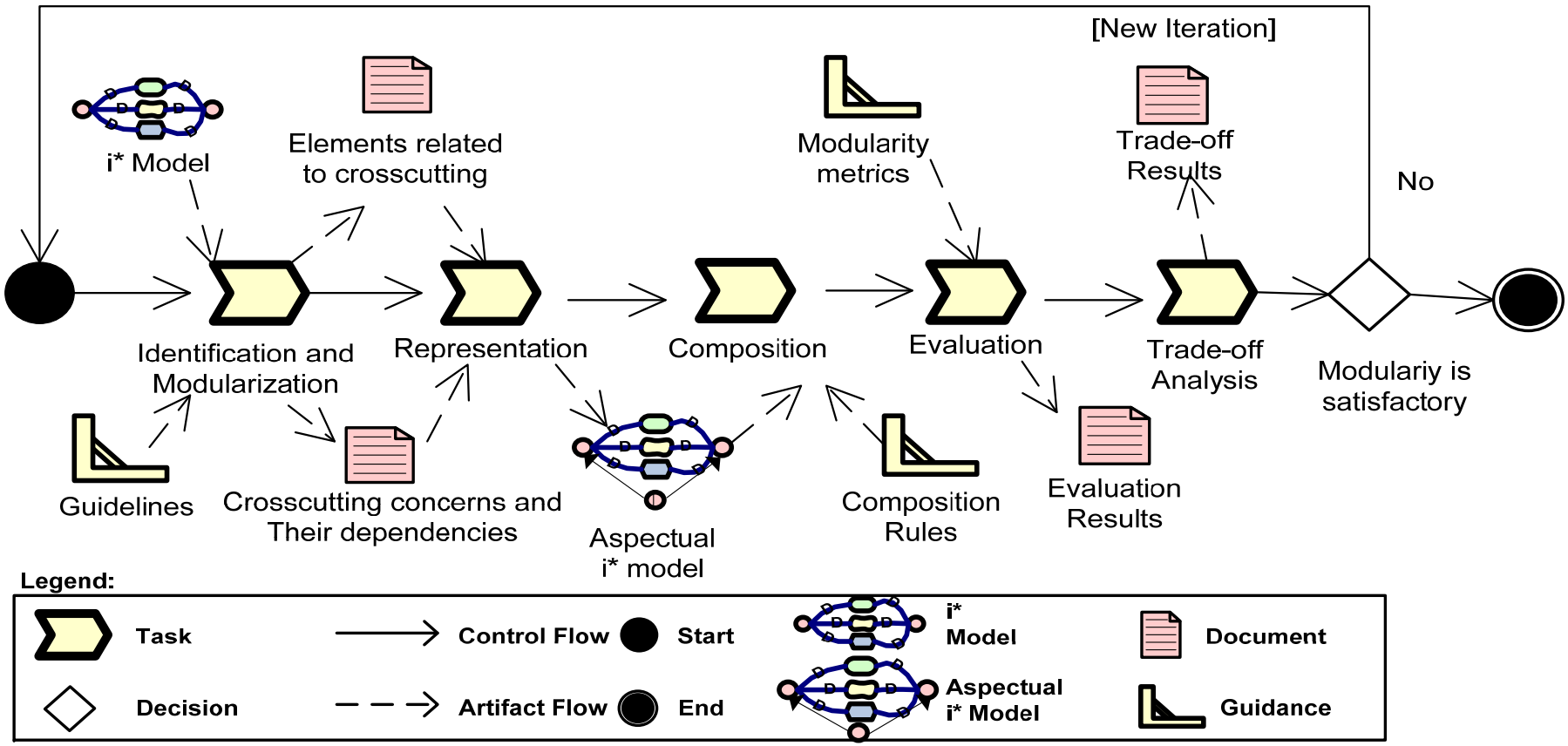
- To reduce the complexity of i* models and increase their modularity, we proposed two strategies:
  - the use of aspect oriented principles
  - the adoption of a model transformation strategy

Modularizing i* with Aspects

- The modularity of i* models can be improved by removing tangled and scattered information into aspectual actors together with some weaving mechanisms.
- Our aspectual approach consists of :
  i. a set of guidelines to identify crosscutting concerns in i* models; and
  ii. an extension of the i* modeling language by adding aspectual constructors to modularize crosscutting concerns and to allow its graphical composition with other system modules.

Modularizing i* with Aspects

Alencar et al. SAC 2010

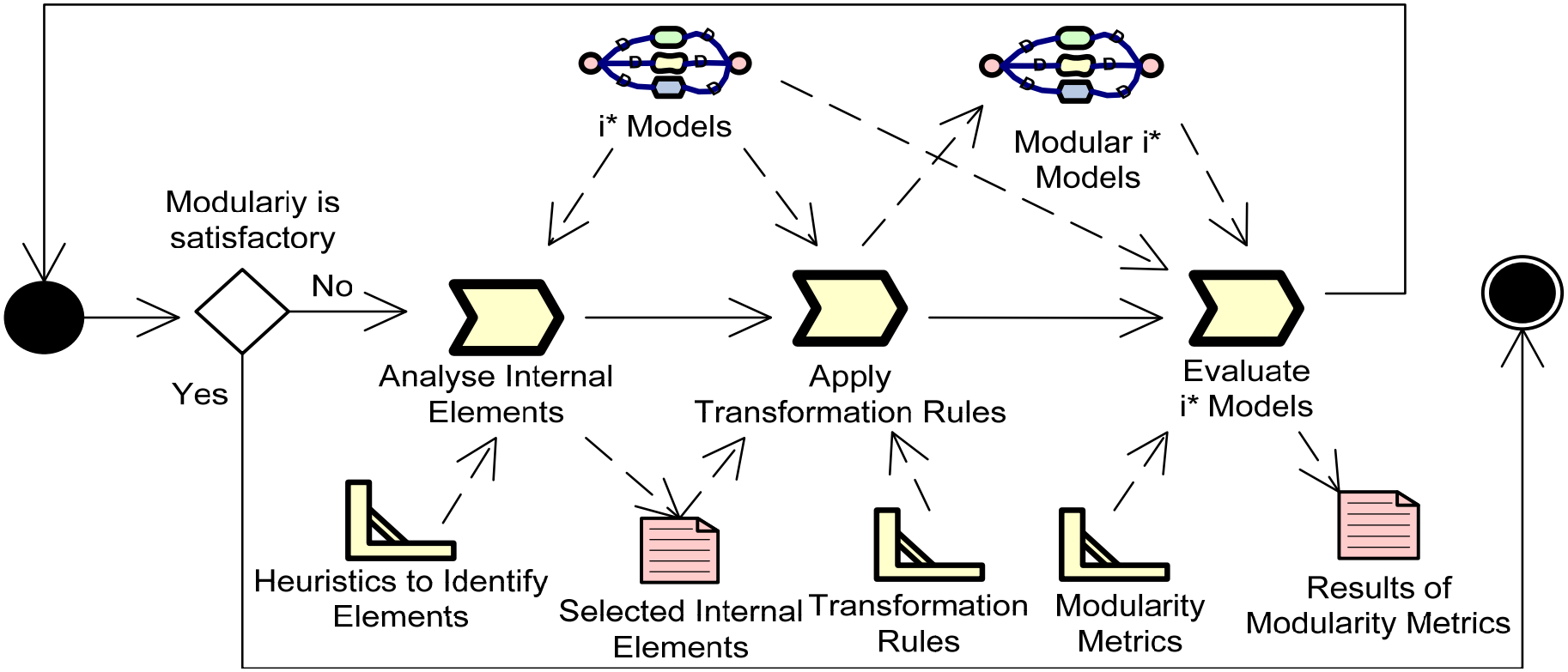


Modularizing i* by means of Model Transformations

- Restructuring i* models by extracting from the system actor the information that are not fully related to the application domain and delegate it to new system actors
- The model transformation approach consists of:
  i. Analyze internal elements;
  ii. Apply Transformation rules, which relies on model transformation rules to (delegate) the identified internal elements from software actor to new actors;
  iii. Evaluate i* models, used at the beginning and the end of the process in order to evaluate the modularization of the models.

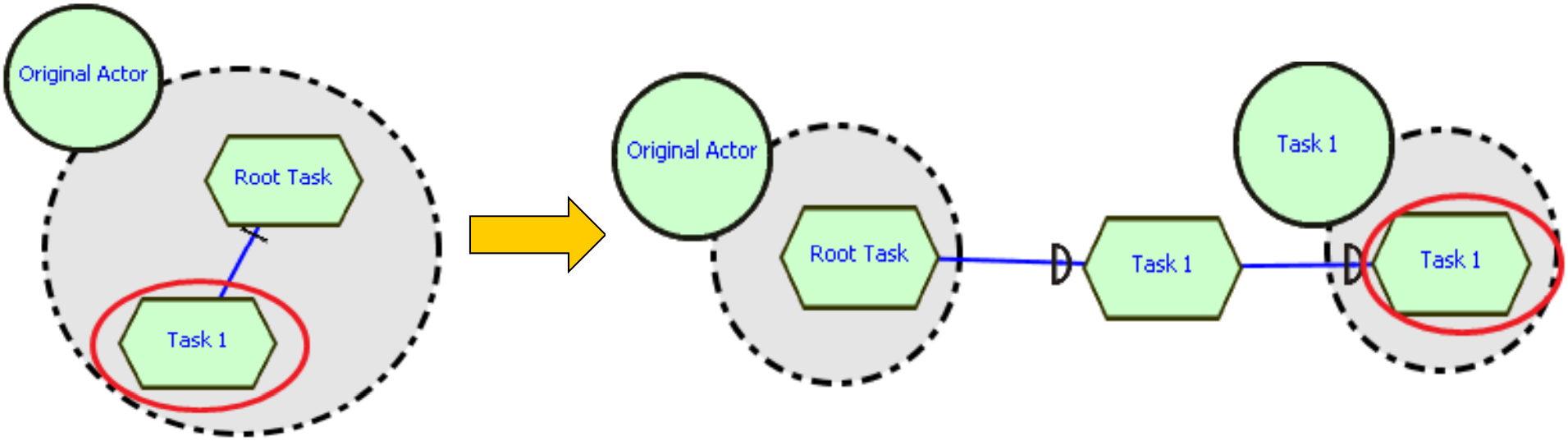
Modularizing i* by means of Model Transformations

Lucena et al. IWSSA 2009

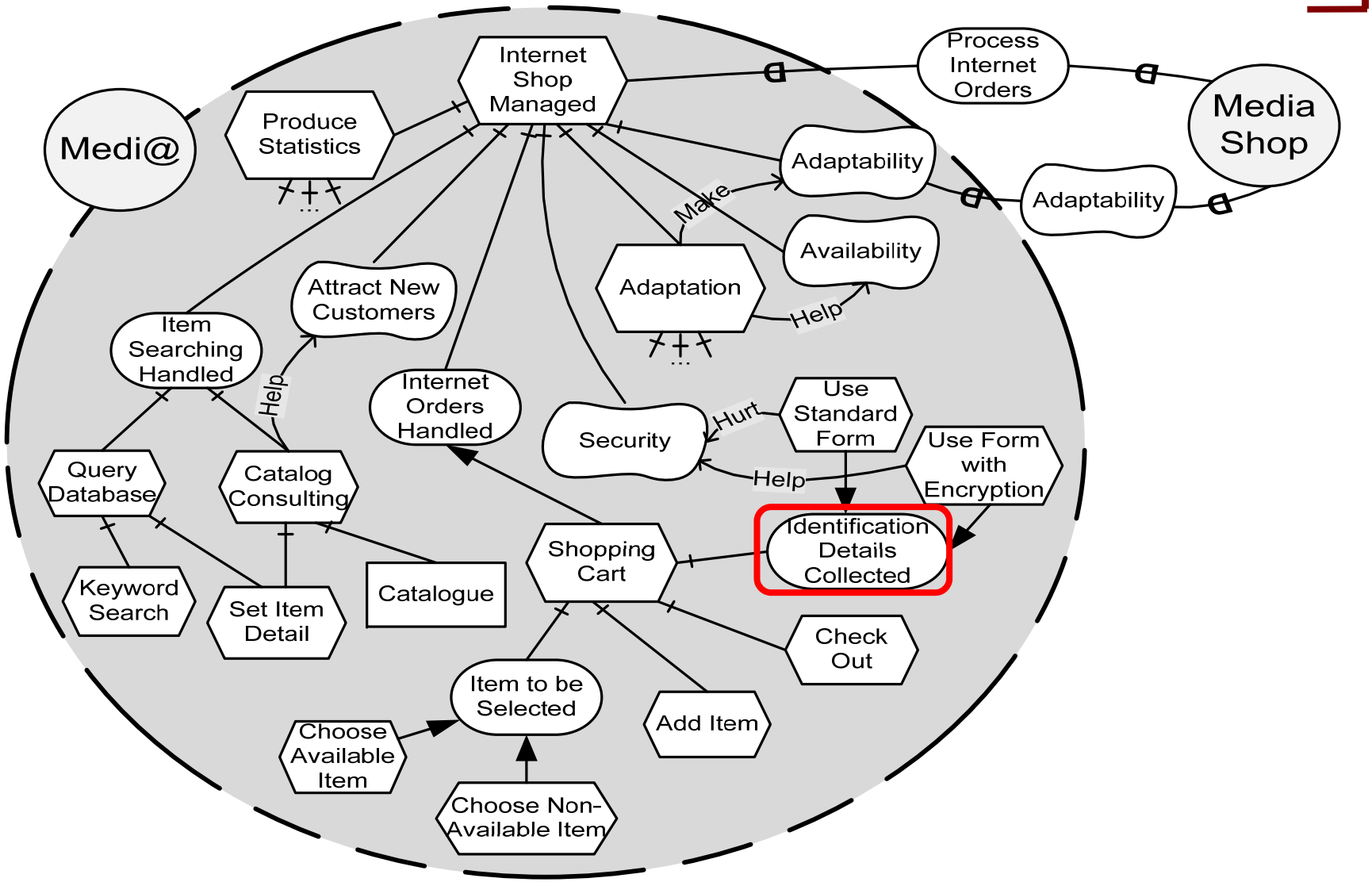


Modularizing i* by means of Model Transformations

- Apply Transformation Rules
  - TR2 – Move a sub-element in a means-end link



Case Study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Process Internet Orders
Media Shop
Adaptability
Adaptability
Make
Availability
Adaptation
Help
Attract New Customers
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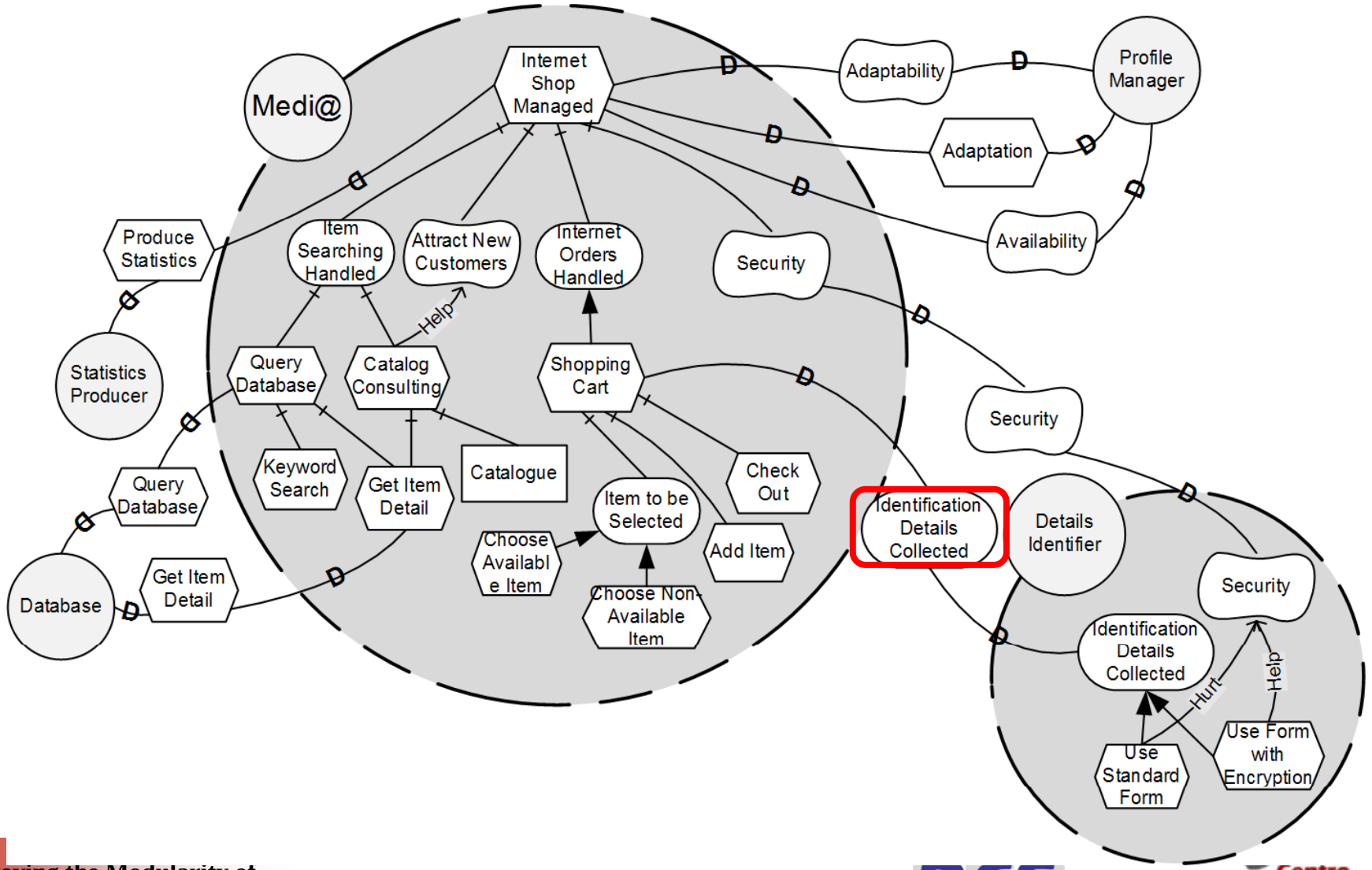
Help
Internet Orders Handled
Security
Hurt
Use Standard Form
Use Form with Encryption
Help
Query Database
Catalog Consulting
Identification Details Collected
Shopping Cart
Keyword Search
Set Item Detail
Catalogue
Check Out
Item to be Selected
Add Item
Choose Available Item
Choose Non-Available Item

Modular i* model



Discussion (1/2)

- **Aspectual approach's contributions:**
  - **It increases modularity of i* models;**
  - **The application of metrics has demonstrated that the number of concerns in a single module was reduced;**
  - **The models' visual complexity decreased, which may improve model understandability;**
  - **It was applied to two case studies: the meeting scheduler problem and a web-based information system.**
- **Aspectual approach's disadvantages:**
  - **It is needed to introduce new elements (namely aspects) in the original i* syntax/semantics;**
  - **Some learning curve is required.**

Discussion (2/2)

- **Model Transformation approach's contributions:**
  - **It also promotes reduction of complexity in i* models;**
  - **Definition of the rules using a model transformation language enables the semi-automatic process that can contribute to keep traceability among artifacts;**
  - **It does not introduce new elements to the i* syntax/semantics and, therefore, it is of easier adoption;**
  - **It was applied to two case studies: a web-based recommendation system and a web-based information system.**

Conclusion

- Model Transformation approach could be used to decompose a system actor overloaded of responsibilities into several new system actors,
- Aspectual approach could be used to identify the crosscutting concerns present in the i* models and separate them into aspectual elements.

Ongoing and Future Work

- Evolving the Istar Tool to support our modularity approaches;
- To unify our approaches to decrease complexity, increase modularity and separate crosscutting concerns in i* models;
- To identify suitable metrics for evaluating goal models;
  - We also need to validate the metrics;
- Performing case studies in an experimental setting.
- Defining a trade-off analysis method to complement the aspectual i* process;
- Investigating the use of modularized i* models to support early architectural design.

References

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- M. Lucena, J. Castro, C.T. Silva, F.M. Alencar, E. Santos, and J. Pimentel, "A Model Transformation Approach to Derive Architectural Models from Goal-Oriented Requirements Models," *Proceedings of the Confederated International Workshops and Posters on On the Move to Meaningful Internet Systems: ADI, CAMS, EI2N, ISDE, IWSSA, MONET, OnToContent, ODIS, ORM, OTM Academy, SWWS, SEMELS, Beyond SAWSDL, and COMBEK 2009*, Vilamoura, Portugal: LNCS. Berlin, Heidelberg: Springer, 2009, pp. 370-380.

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