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Towards a Unified Requirements Modeling Language

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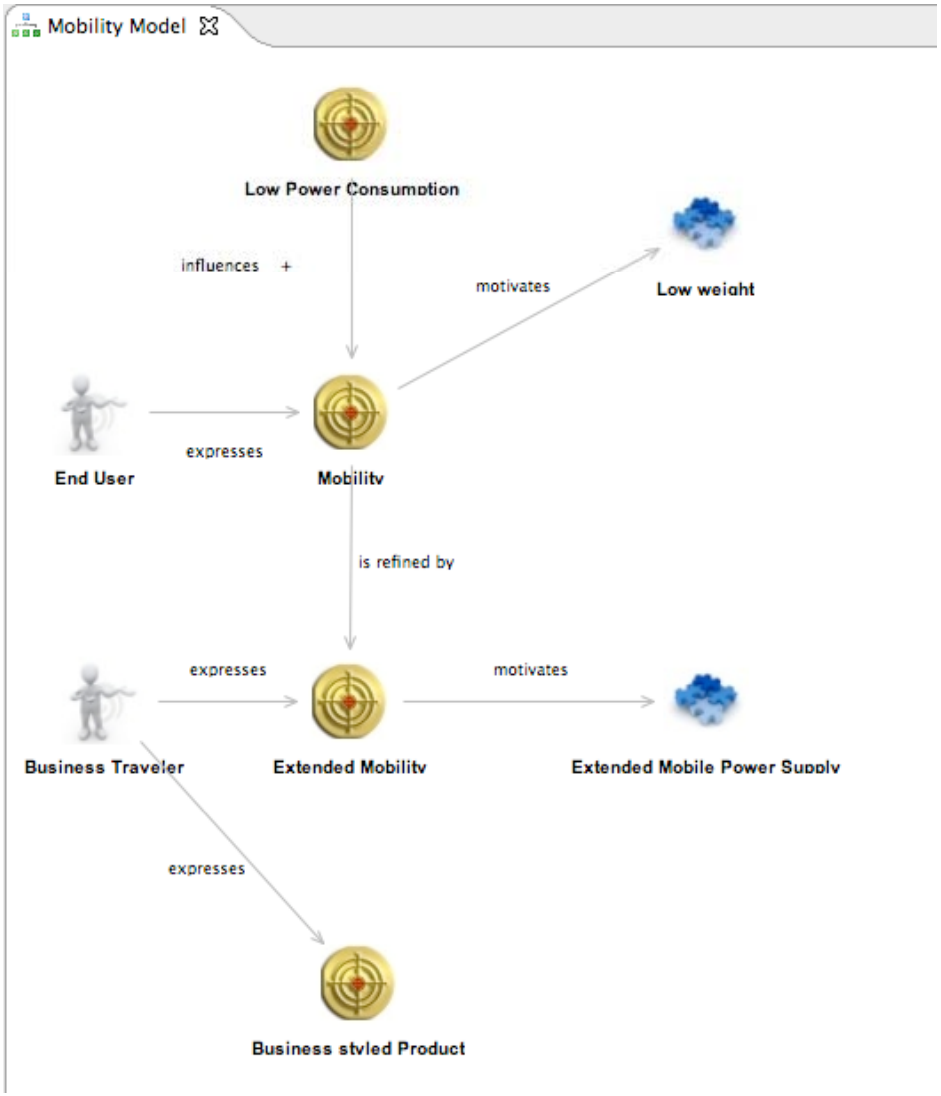

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URML – Why is a visual language needed?

UML and SysML

- do not follow visualization heuristics
- do not provide a homogeneous or interdisciplinary comprehensible visualization
- provide isolated solutions for specific aspects like feature modeling or hazard modeling
- do not provide integrated and inter-disciplinary traceability

Unified **R**equirements **M**odeling **L**anguage

- models early requirements of a system consisting of hardware and software components from a business level to subsystem decomposition
- current version of the URML focuses on the application domain, not the solution domain
- provides abstract and solution independent concept of services
- focuses on visualization, which is intuitively understandable by non-software engineers and therefore fosters inter-disciplinary collaboration.
- our goal is to derive a defined grammar for URML from the meta-model.

Although URML is an integrated model, we structure this section by aspects. For every aspect we also describe the relationships to other aspects of URML. Since a description of the meta-model of URML including all attributes would go beyond the scope of this paper we will focus on the model elements and their interrelations and avoid describing all attributes in detail. Terms referencing elements of our meta-model are formatted with italic font style upon their first occurrence.

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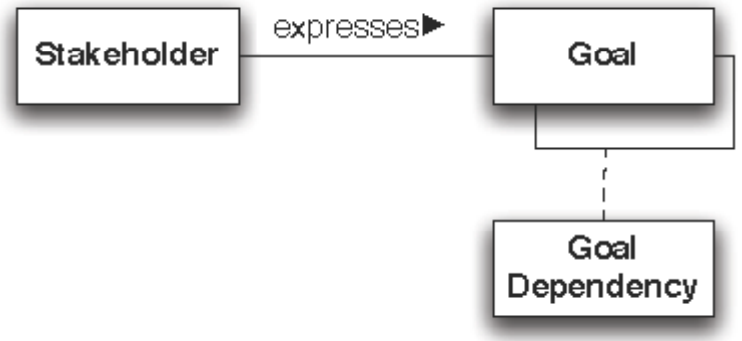
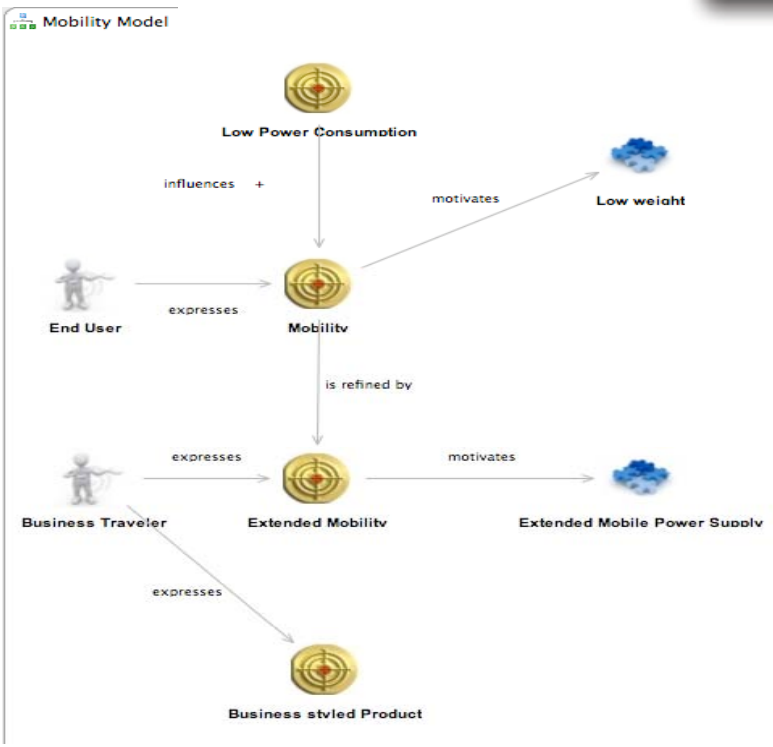
Goal Modeling

- URML allows the deriving of realizing features for feature modeling.
- *Goal Dependencies* allow defining relationships among goals by either decomposing a goal into sub-goals or modeling additional dependencies

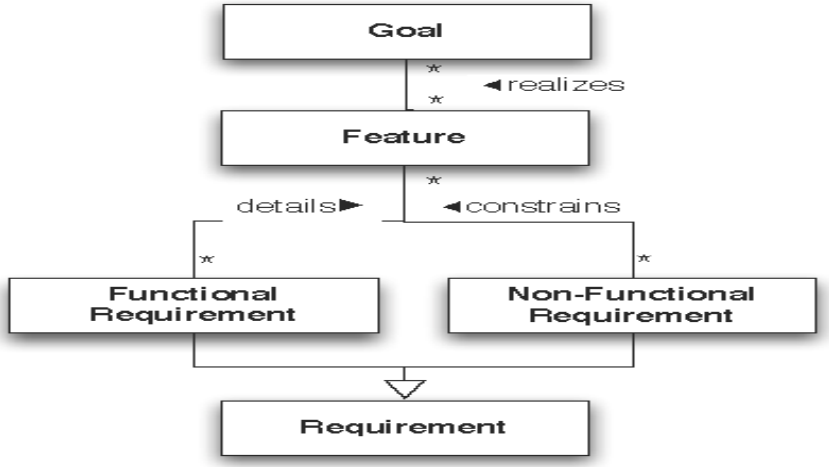


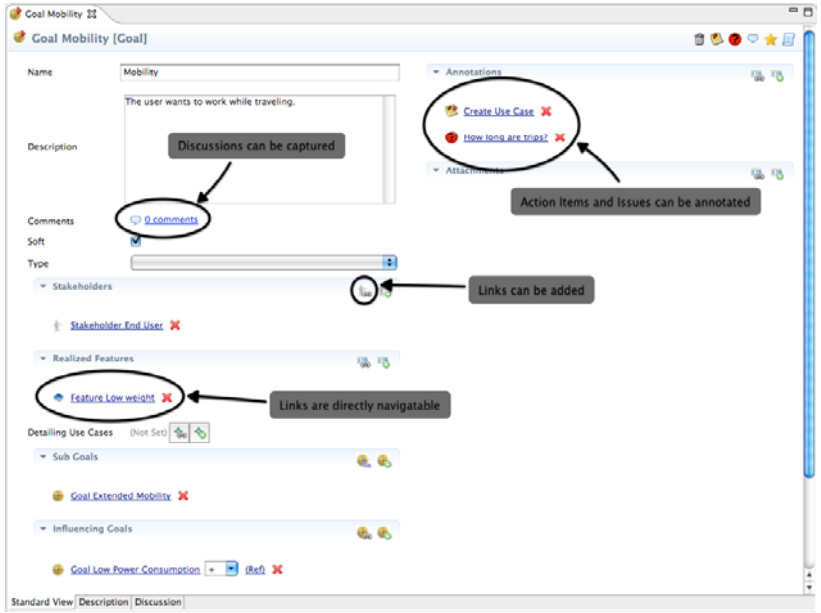
Goal Modeling

- Is a prerequisite for requirements engineering
- offers ways to express business, customer and end user goals and how those goals influence each other
- refines goals down to a level of functional and non-functional requirements
- goals modeled independently from a concrete deliverable.



Feature Modeling





- typically used to model product lines and the features of different products of the same product line.
- can be used to express complex variation in a single *product*.
- features realize goals that were set forth in goal modeling. They can be refined into sub-features until they are small and feasible enough to be detailed into *functional requirements* and attached to their constraints that are modeled as *non-functional requirements.* Functional and non-functional requirements are not necessarily end-user visible, and more important, they are testable.
- Apart from decomposition, features can also be related by a *feature dependency*.

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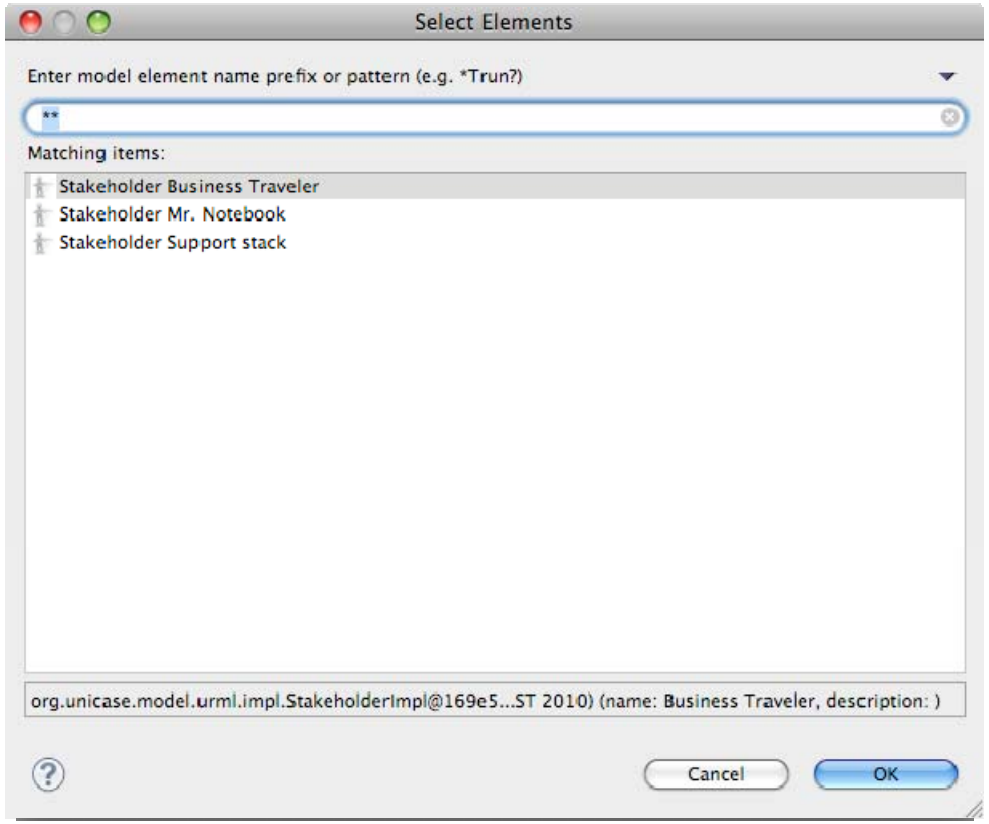
Subsystem Decomposition

- *Services* describe which particular functionality is offered by the system. Therefore a service is related to a functional requirement that is satisfied by that service. *Services can be decomposed into sub*-services.
- That allows us to describe exactly where the functionality is implemented and provides an abstraction to aggregate services into units of related functionality.



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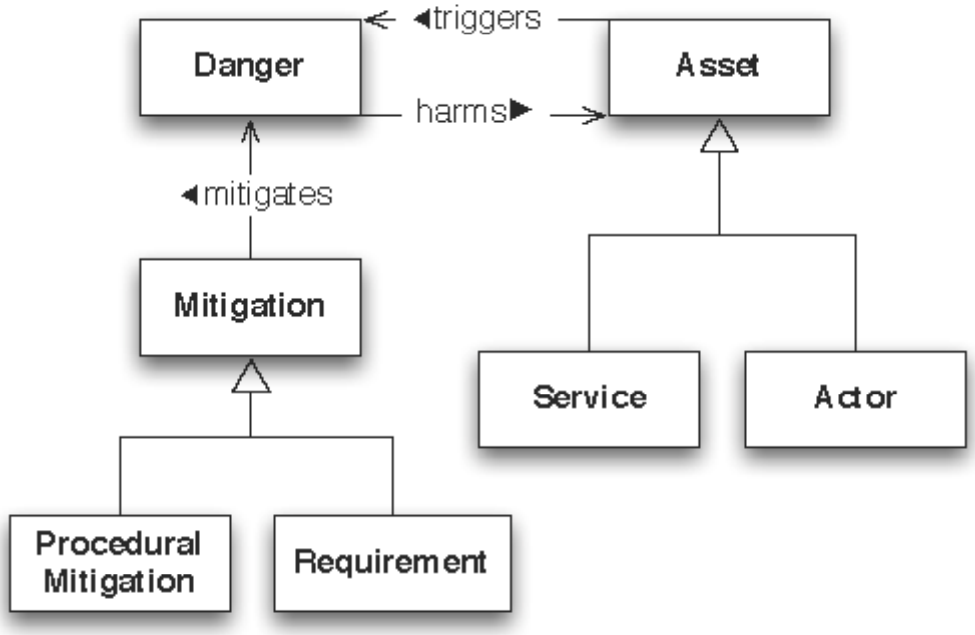
Danger Modeling

- integrates Hazard Modeling, Risk Modeling and Threat and Security Modeling into one joined set of abstractions. URML merges them into ***DANGER***.
- A **Danger** can be mitigated by a requirement from the requirement model or by a procedural mitigation.



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Visual Notation

- URML has a visual notation that is intended to be intuitively understandable by non-engineers and to foster inter-disciplinary collaboration.
- The main design is cognitive effectiveness.
- All components, for example Stakeholders, Goals, Features or Requirements, are represented by distinct symbols.
- While there are unique symbols for each component, there must not be too many at once.
- The hardest part in constructing adequate icons is to find the simplest symbol. The decision for certain proposed icons must be based on an evaluation among users from different disciplines and is part of future work.
- Another related issue is the determination as to when to use a new symbol vs. when to apply overlays to an existing symbol

Four proposed visualizations of a goal. Which is best???

Business goal and end user goal

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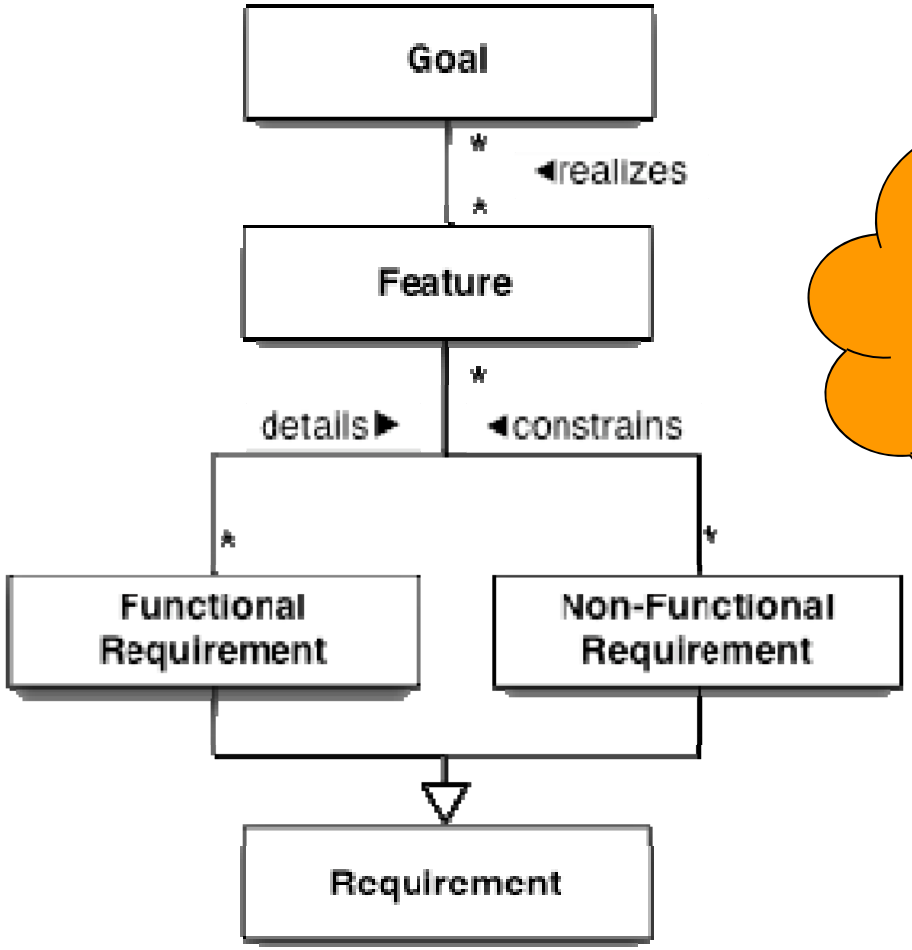
We are pressed to clearly define relationships



Is this representation correct?

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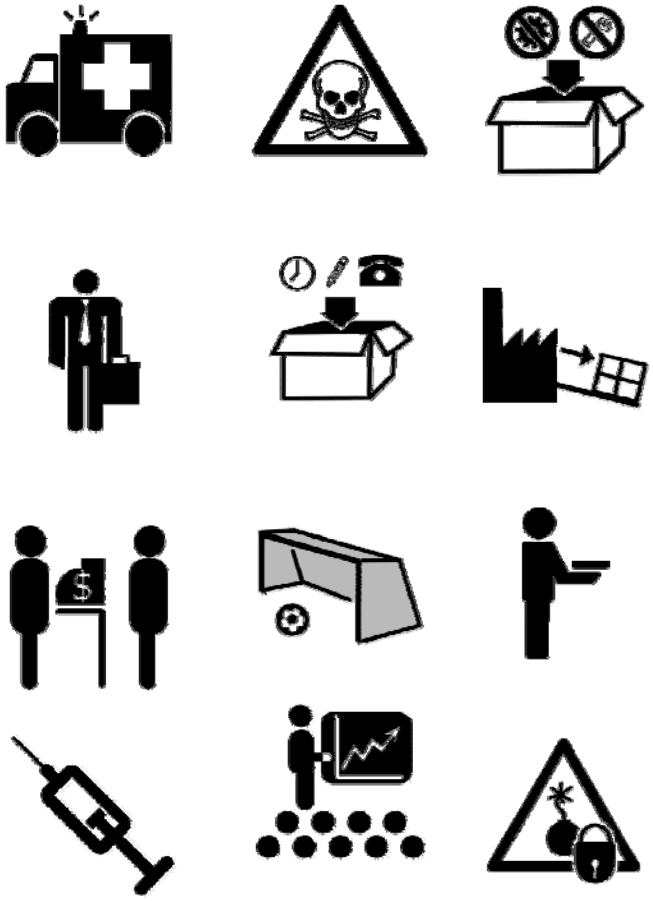
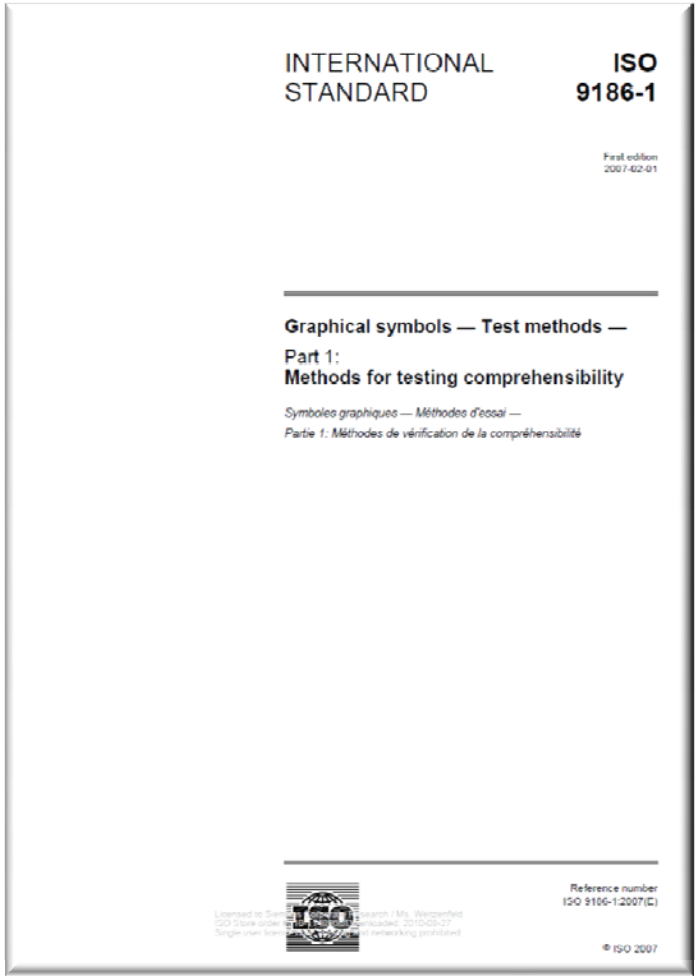
And a viable set of icons





INTERNATIONAL STANDARD

ISO 9186-1

First edition
2007-02-01

Graphical symbols — Test methods —

Part 1:
Methods for testing comprehensibility

Symboles graphiques — Méthodes d'essai —
Partie 1: Méthodes de vérification de la compréhensibilité

Reference number
ISO 9186-1:2007(E)

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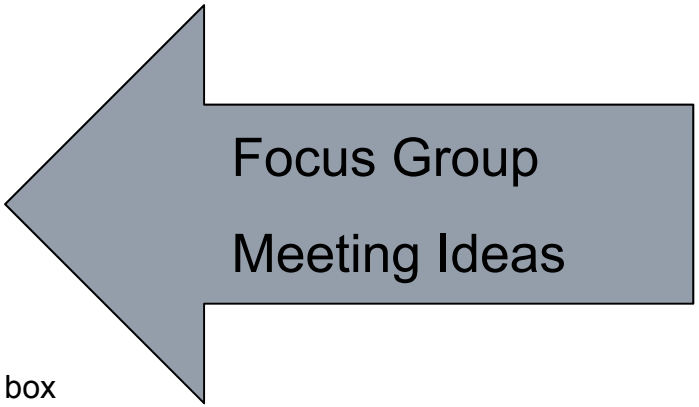
We are still getting input on Icons

A “Nonfunctional Requirement” describes quality of performance constraints for a system.

Suggestions
wagging forefinger
wooden framework
measuring tape
reliability lab
paragraph sign §
Brick paper
periphery
thermometer
X OVER LIMITING ITEM / "x"
empty field
images changing behind a screen
crossed out: technical stuff which is thrown into a box
crossed out maths "F"
stop sign
pipelines
oil can
battery
gauge (Anzeigegerät)
stopwatch



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Tool Support

✓UNICASE Research Modeling Tool

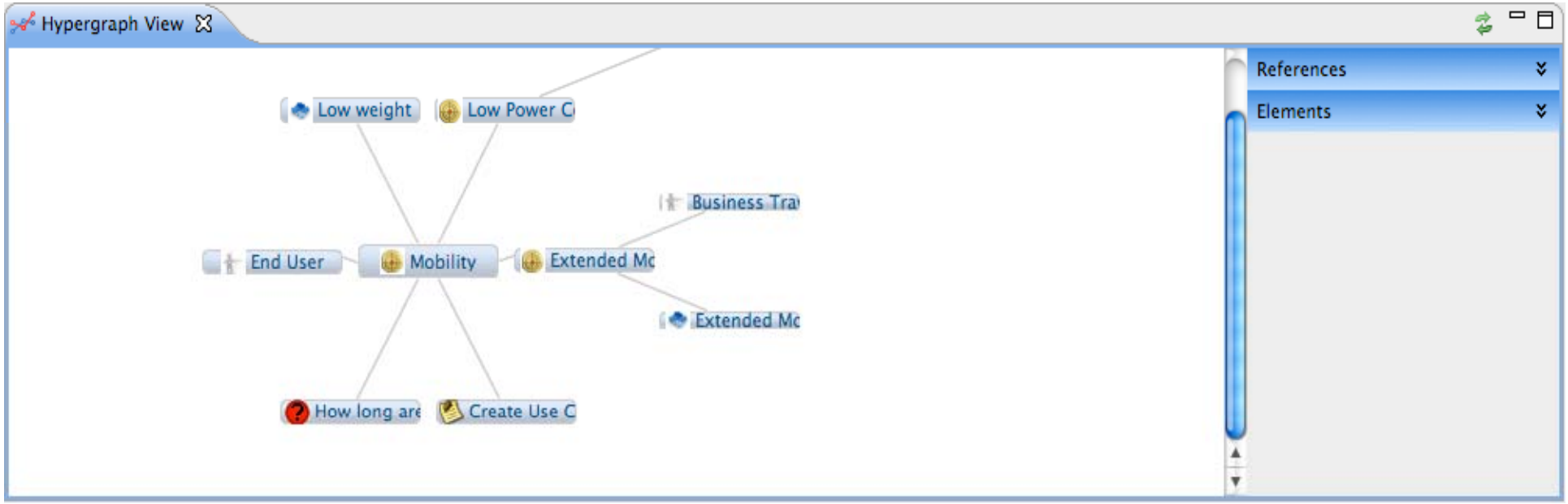
✓ The complexity of URML requires tool support for an evaluation of the approach.

✓ First planned implementation of the URML is UNICASE.

✓ UNICASE offers support for collaboration on model elements and versioning. UNICASE offers support for tool instrumentation and project analysis based on historical data.

✓ Model elements can be directly linked to each other, offering user visible traceability.

✓ UNICASE allows constructing diagram editors for arbitrary meta-models.



Current Research Activities

- Surveys and Focus group meetings to improve requirements
- Completing a draft taxonomy
- Creating a draft meta-model
- Implementing in UNICASE
- Complete the semantics

- Future: Pilot on a live Siemens project

Open research questions

- Which visual representation including shape and style provides the best Semiotic Transparency and Expressiveness?
  - How are references between entities visualized?
  - Which entities are represented as distinct icons, which families are represented by altered tokens?
- How to achieve Graphic Economy on complex models?

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Questions?