

The User Requirements Notation (URN) and Industrial Applications



Daniel Amyot and Gunter Mussbacher

Université d'Ottawa | University of Ottawa



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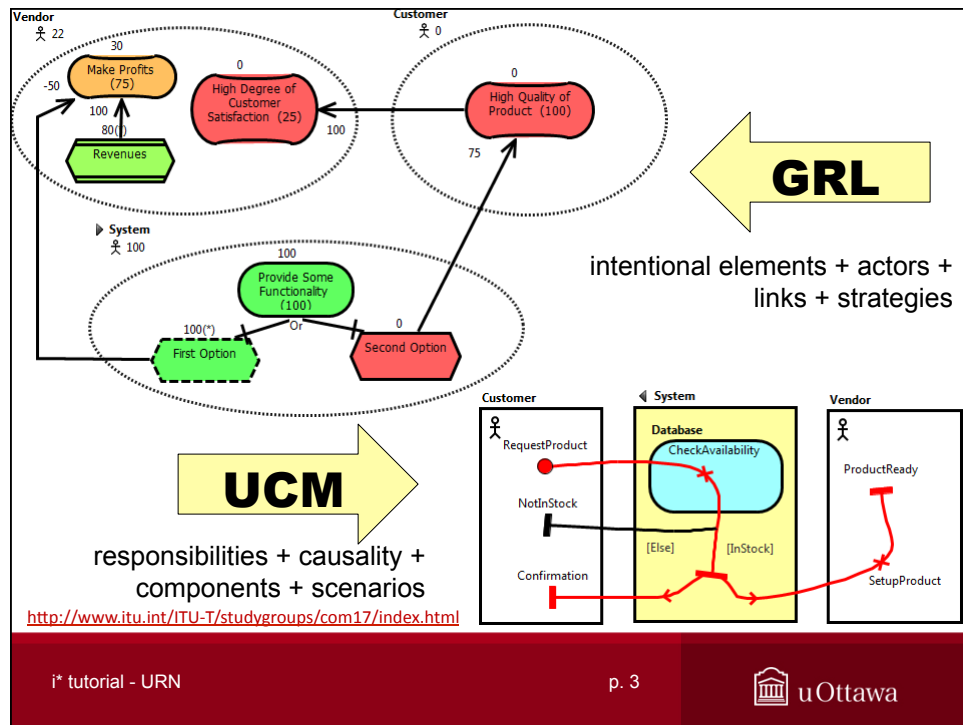


iStar Tutorial, RE 2013
www.uOttawa.ca

Some Application Domains

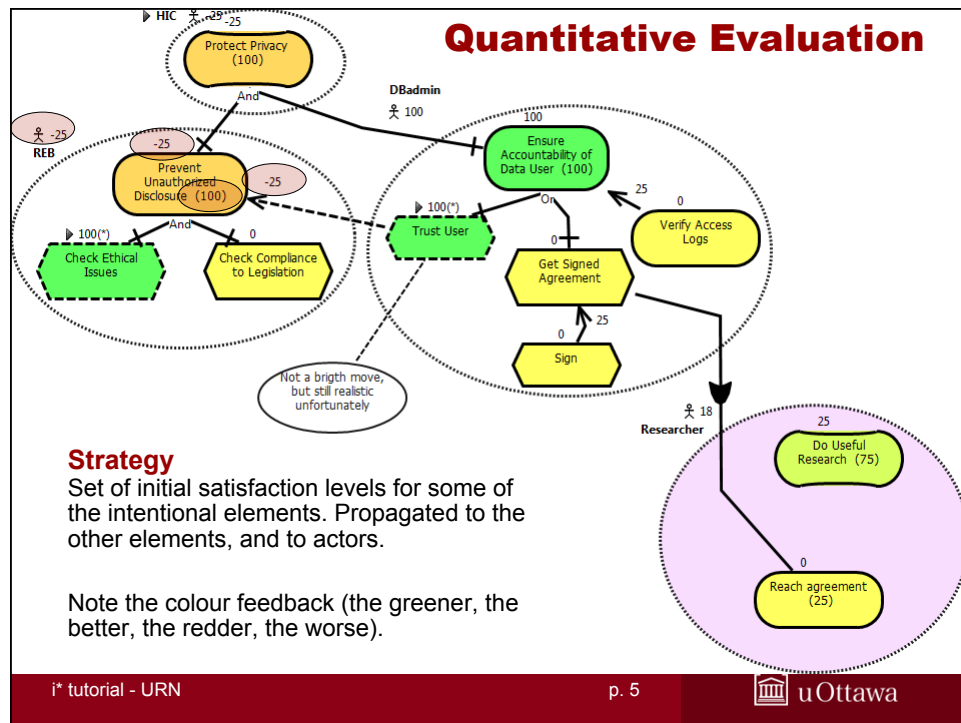
- Telecommunication / telephony services
- Wireless systems
- Object-oriented software
- Multi-agent systems
- Web applications and Web services
- Railway control systems
- Embedded systems
- User interfaces
- Access control procedures
- Network protocols
- e-Business applications
- Supply chain management
- e-Health applications
- **Business process management**
- Software product lines
- Information retrieval systems
- **Legal compliance**
- **Context-aware and adaptive Systems**
- ...

Virtual Library: <http://www.usecasemaps.org/pub/>



GRL in a Nutshell

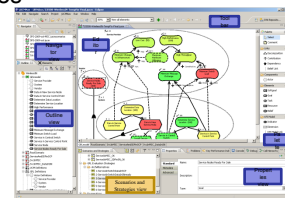
- Goal-oriented Requirement Language
- Part of URN standard (ITU-T Rec. Z.151)
- Variant of *i** with
 - Qualitative and **quantitative** evaluation scales
 - [-100..100] or [0..100] for satisfaction
 - Evaluation **strategies**
 - **Indicators**
 - **Profiling** mechanisms
 - Integration with Use Case Map (UCM) **scenarios** within URN.



URN Tool: jUCMNav










- **Free** (EPL), open-source plug-in for Eclipse
- Supports most of GRL and UCM notation elements
- 6 **GRL evaluation algorithms**, with colour highlight
- 1 path traversal mechanism, with export to flat UCMs and MSCs
- Also:
 - Import/Export in URN Z.151 XML format
 - Integrated MSC viewer
 - Integration with DOORS for requirements Management
 - GRL diff, contribution overrides, and value ranges
 - Extensions for Aspect-oriented URN
 - Verification of user-defined (OCL) rules
 - Report generation (RTF, PDF, HTML)
 - Multilingual (available *en français!*)



Industrial Applications

- **Business process and performance modeling**
- Compliance monitoring
- Context-aware & adaptive systems

URN for Business Process Modeling?

- For Business Process Modeling, we need to answer the W5 questions
 - *Where, What, Who, When and Why*
- Goal-oriented Requirement Language (GRL)
 -  Business or system goals and rationales (**Why**)
 -  Qualities (**Why**)
 -  Solutions/Tasks (**What**)
 -  Stakeholders/Actors (**Who** and **Where**)
- Use Case Maps (UCMs)
 -  Responsibilities (**What**)
 -  Components (**Who** and **Where**)
 -  Scenarios and processes (**When**)
- GRL & UCMs
 - Link (→) processes to business goals, for traceability, completeness, alignment, compliance, what-if scenarios, and evolution

Experience with URN 2008 for BPM

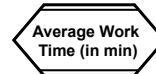
- Several **clinical and administrative processes** at a teaching hospital in Ottawa, from 2007 to 2010
 - Interested in process improvement, with privacy concerns
 - People with medical research and management background
 - Not much modeling experience
 - Patient discharge, data warehouse access, adverse event management, antimicrobial stewardship..
- Interested in documenting processes and at capturing alternative (and measurable) ways of **improving** them
- Similar in small enterprise (franchise of resale stores)

Experience with URN 2008 for BPM

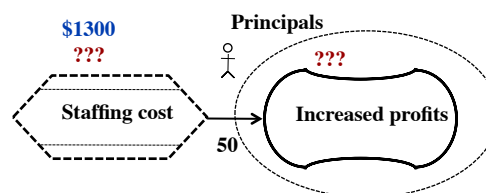
- Used GRL + UCM, with jUCMNav
- **Good feedback** in general
 - Easy to understand and communicate, harder to produce, tool ok for modeling but still weak for analysis/scalability...
- **But** we learned that two important concepts were missing
 - Exception/Failure handling in UCM (complexity)
 - **Indicators** in GRL
- Both were added to the latest standard (2012)
- jUCMNav improved since then (analysis, usability, scalability)

Indicators in Goal Models

- Need to better relate observations about the **real world** and goal models:
 - Currencies (e.g., revenues in \$)
 - Durations (e.g., waiting time in hours)
 - Counts (e.g., number of new students admitted)
- GRL now includes **indicators**
 - Often called KPIs
- KPIs help **measure** goals and NFRs with quantifiable metrics

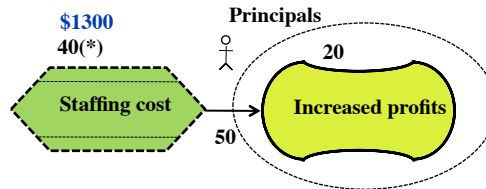


GRL and KPI for Business Modeling



Attribute	Value	GRL Satisfaction
Target	\$1000	100
Threshold	\$1500	0
Worst-case	\$2500	-100
Current	\$1300	???

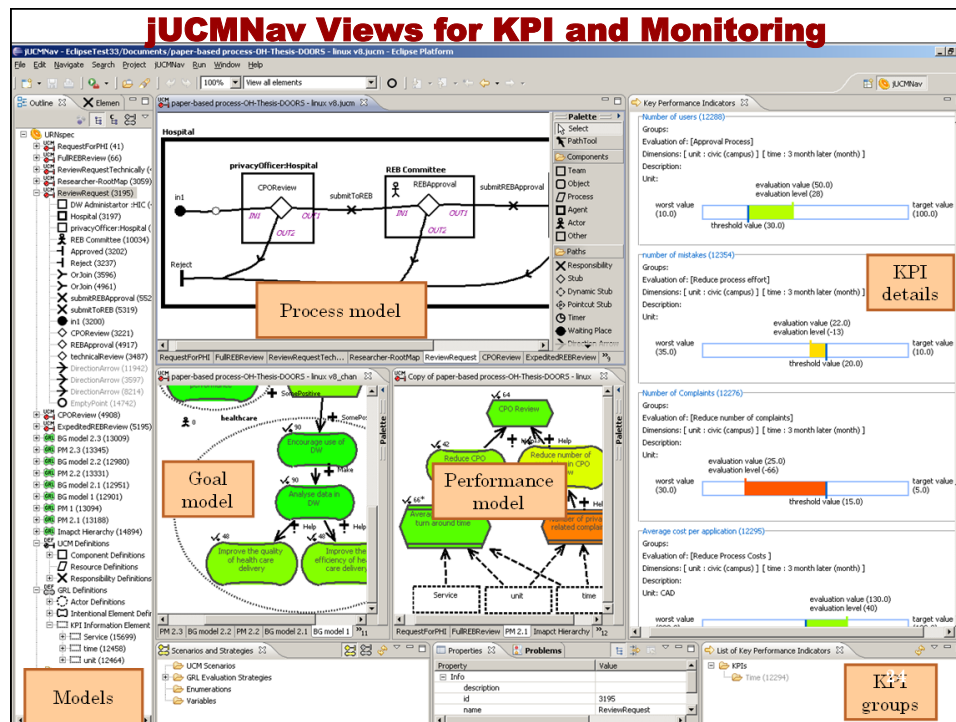
GRL and KPI for Business Modeling



Attribute	Value	GRL Satisfaction
Target	\$1000	100
Threshold	\$1500	0
Worst-case	\$2500	-100
Current	\$1300	40

i* tutorial - URN

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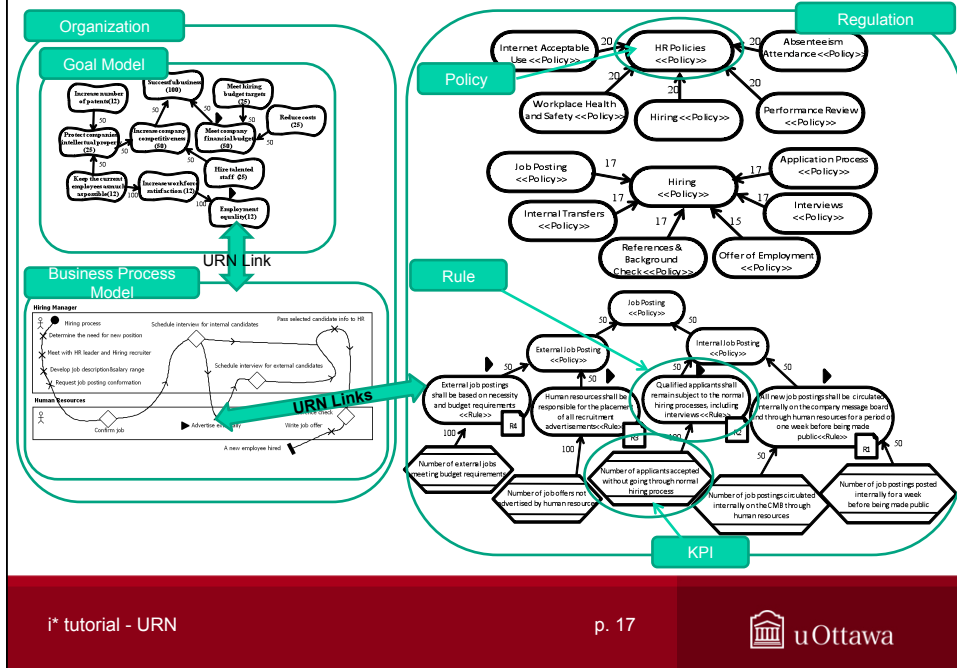
Industrial Applications

- Business process and performance modeling
- **Compliance monitoring**
- Context-aware & adaptive systems

BPM and Compliance: Motivation

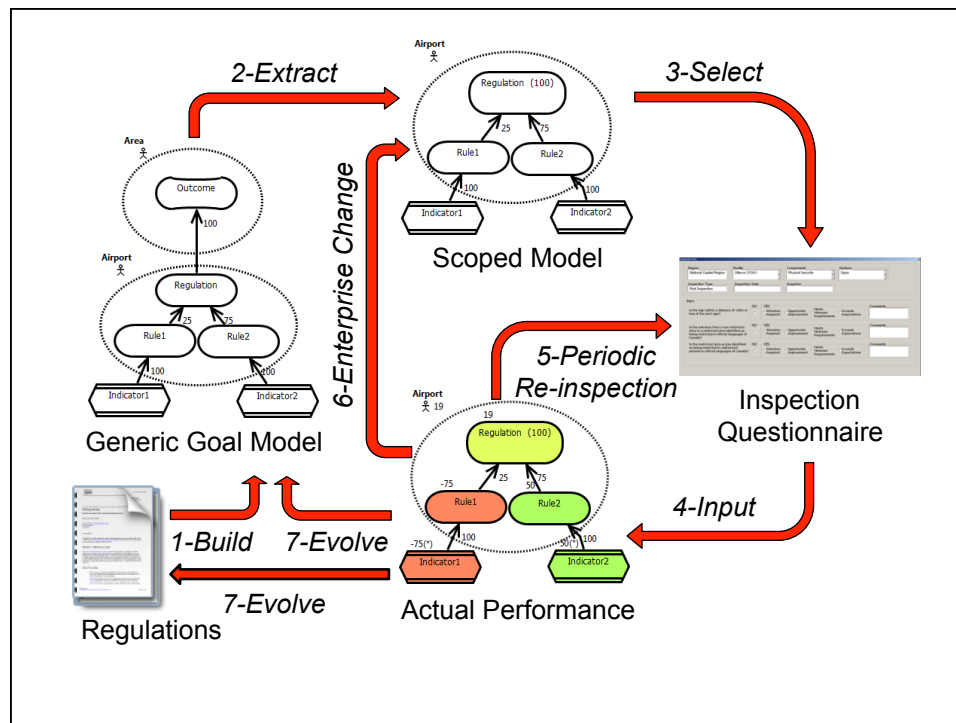
- **Organizations** are subjects to laws & regulations
- To avoid penalties, organizations need to:
 - Design processes that comply with laws
 - Ensure that running processes obey their design
- **Regulators** want to improve regulations too!
- Can we use the same notation to model regulations and organizations?
- Can we assess/monitor compliance, handle evolution, and suggest improvements?

Compliance Monitoring with KPIs



Experience with URN for Compliance

- Healthcare processes at a teaching hospital
 - **Privacy laws** (HIPA and others)
 - From the angle of the **regulated party** (many laws)
 - Increased compliance, without killing the business?
 - Thesis S. Ghanavati
- Outcome-based compliance with national regulator
 - **Aviation security regulations**
 - From the angle of the **regulating party** (many organizations)
 - New regulations: less prescriptive, and more goal-oriented!
 - How to measure different things? Need to evolve regulations?
 - Thesis of A. Shamsaei



Some Lessons

- Modeling is **beneficial**
 - Helps identify indicators and agree on contributions
- Capturing whether compliance goals are **exceeded**
 - Important for spotting best practices
 - Important for creating opportunities to improve regulations
- Separate** compliance objectives from performance ones
- Regulation as a new **dimension** for Business Intelligence
- Cultural change**
 - Iterate modeling and regulation drafting?

Tool Improvements Implemented Because of Industrial Collaboration

- **Advanced** analysis features needed in jUCMNav
 - “Strategy Diff”
 - Special **profiles** and propagation for compliance, with support for user-defined OCL constraints
- **Sensitivity analysis** through ranges of satisfactions and contributions for
- **Uncertainty management** via contribution overrides
- **Goal families** for variability of target organizations
- **Trends** based on a group of strategies (à la BI)
- Creation and navigation of typed **traceability links**
- **Partial automation** of GRL model construction from tables
- **Multi-lingual** models!

Industrial Applications

- Business process and performance modeling
- Compliance monitoring
- **Context-aware & adaptive systems**

Combining Goal- and Rule-Based Reasoning for Context-Aware Systems

- Context-aware systems:
 - **highly adaptable** class of industrial applications
 - without explicit user intervention
 - to increase runtime usability and effectiveness
 - significant use of wireless appliances
- **Mobile systems, hospitals, homes for the elderly, smart homes**
- Rule-based reasoning is often used to make sense of the contextual information

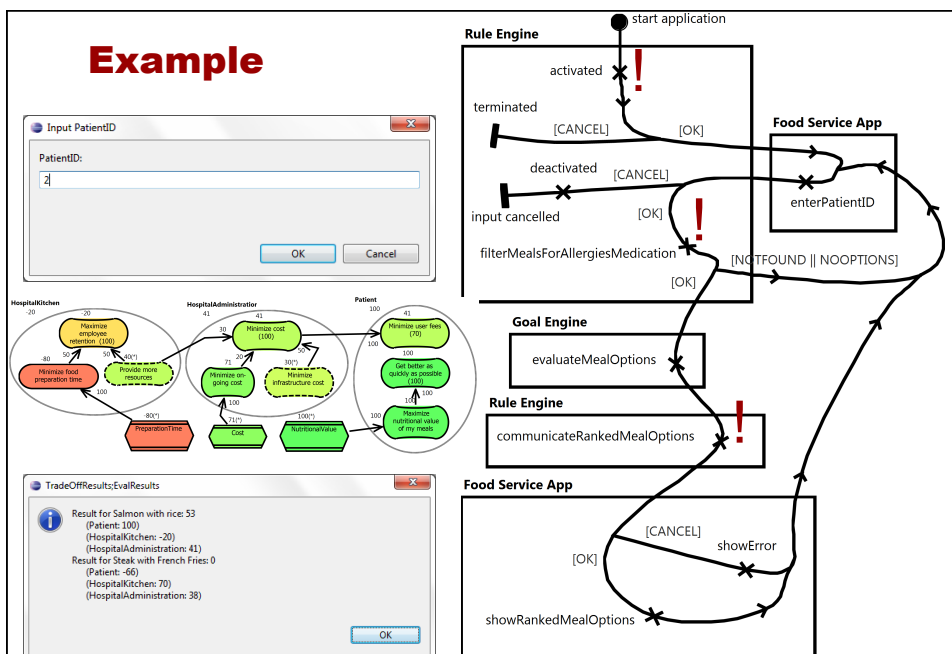
Problem and Solution Approach

- Rules excel in filtering out unsuitable solutions based on **clear** criteria
- Difficult to rank suitable solutions based on **vague, qualitative** criteria with a rule-based approach
- Leads to complex rule systems; hard to maintain understanding of what the rules do
- Goal-based modeling
 - Provides a **more intuitive** modeling environment
 - Offers **reasoning mechanism** that can assess contextual information
 - Combined with URN, it is possible to model and **execute** workflow in addition to reasoning support

Interacting with the Environment

- Explicitly **trigger** the evaluation of URN goal models **at run-time** during the traversal of a URN workflow specification
- **Dynamically define** via the workflow model what third party data should be used for the evaluation and return the results of the evaluation to the third party at run-time
- Integration with **rule-based** systems
- Interactions with the **user** (simple UI for input/output)

Example



Lessons Learned

- Proof-of-concept implementation works
- Not ideal to have two reasoning engines
 - two separate tools for rules and goals to maintain
 - communication overhead
 - integrate one into the other by automatically transforming goal-based model into rules while still reaping the benefits of a more abstract model
- A URN-based modeling/simulation/execution environment is useful for early development stages, but transformations to existing industrial-strength business process execution environments are necessary for high-performance run-time results

Thank You! For More Information...

- ITU-T Rec. Z.151 – URN:
 - <http://www.itu.int/rec/T-REC-Z.151/en>
- General Overview:
 - Amyot, D. and Mussbacher, G.: “User Requirements Notation: The First Ten Years, The Next Ten Years”. Invited paper, *Journal of Software (JSW)*, Academy Publisher, 6(5):747-768 (May 2011).
 - <http://ojs.academypublisher.com/index.php/jsw/article/download/0605747768/3030>
- Virtual Library (over 350 papers and theses):
 - <http://www.UseCaseMaps.org/pub/>
- jUCMNav (version 5.4 available):
 - <http://softwareengineering.ca/jucmnav/>
- Daniel Amyot: damyot@eecs.uottawa.ca
- Gunter Mussbacher: gunterm@eecs.uottawa.ca

Using *i** to Support Ontology Requirements Specification in a Governmental Regulatory Agency

Where: ANTT - Brazilian Ground Transportation Regulatory Agency

Problem: over 50 information systems in need to interoperate.

Solution Approach: developing domain ontologies.

Use of *i:** to support requirements specification for ontologies to overcome limitations of traditional Ontology Engineering methods.

When: 2011-2014

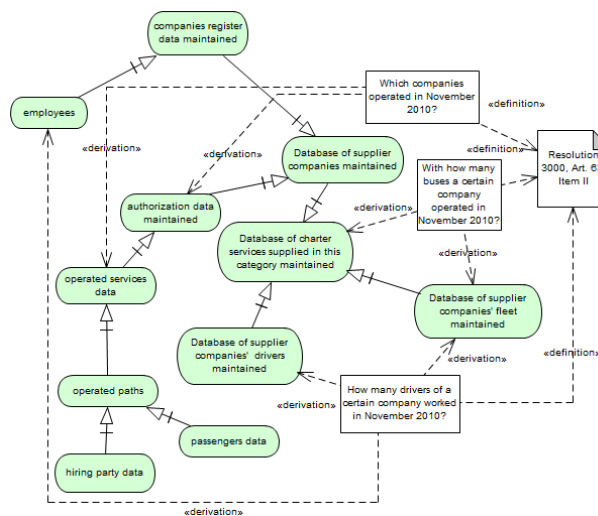


Thiago Prince, Ernani Gaspar and Renata Guizzardi
Ontologies and Conceptual Modeling Research Group, UFES

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Numbers:

- 18 departments from the agency
- 11 people from our team involved.
- 5 ontologies built without and 2 with *i**.



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