

Integrating written policies in Business Rule Management Systems

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July 20, 2011

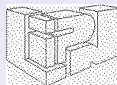
Introduction

The core structure

Acquiring a
business rule
model

Results of
acquisition

Exploiting and
exploring the
resulting index



Outline

Integrating
written policies in
Business Rule
Management
Systems

A. Nazarenko, A.
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Szulman

Introduction

The core structure

Acquiring a business rule model

Results of acquisition

Exploiting and exploring the resulting index

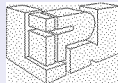
Introduction

The core structure

Acquiring a
business rule
model

Results of
acquisition

Exploiting and
exploring the
resulting index



The goals

rule applications



- ▶ providing a methodology and tools
- ▶ specifying at the business model level
- ▶ supporting users

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written policies in
Business Rule
Management
Systems

A. Nazarenko, A.
Guisse, F. Lévy,
N. Omrane, S.
Szulman

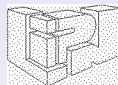
Introduction

The core structure

Acquiring a
business rule
model

Results of
acquisition

Exploiting and
exploring the
resulting index



- ▶ Knowledge elicitation
- ▶ More and more texts involved in BR are electronically available
- ▶ No fully automated extraction.

Existing:

- ▶ Either controlled input (O.P.A., SPARCLE, Attempto)
- ▶ or syntactic analysis + human translation (UPenn)

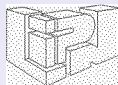
Introduction

The core structure

Acquiring a
business rule
model

Results of
acquisition

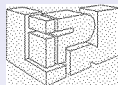
Exploiting and
exploring the
resulting index



- ▶ Separate phases for ontology and rules
 - ▶ Assisted and not automated work
 - ▶ Relying on
 - ▶ annotation of text
 - ▶ navigation in ontology / rules / text
- ▶ aimed at
 - ▶ acquiring the BR models,
 - ▶ explaining decisions (reference to texts rather than formal translation),
 - ▶ bringing models up to date when regulations change.

Two use cases:

- ▶ AAdvantage use case (classification)
- ▶ Audi use case (conformance)

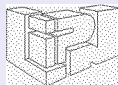


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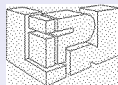
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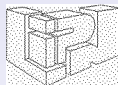
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Outline

Integrating
written policies in
Business Rule
Management
Systems

A. Nazarenko, A.
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N. Omrane, S.
Szulman

Introduction

The core structure

Acquiring a business rule model

Results of acquisition

Exploiting and exploring the resulting index

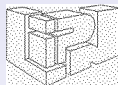
Introduction

The core structure

Acquiring a
business rule
model

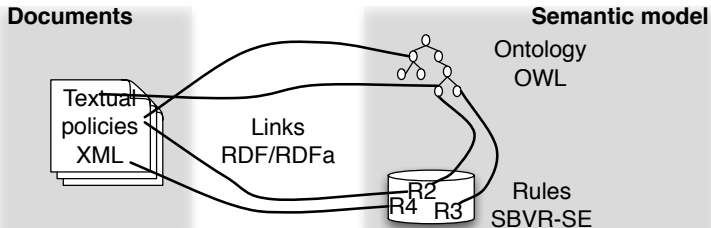
Results of
acquisition

Exploiting and
exploring the
resulting index



Documented business rule model

- ▶ Progressively built during the acquisition phase
- ▶ Datastructure linking source document, ontology and rules - called index



Integrating
written policies in
Business Rule
Management
Systems

A. Nazarenko, A.
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Szulman

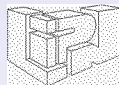
Introduction

The core structure

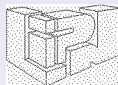
Acquiring a
business rule
model

Results of
acquisition

Exploiting and
exploring the
resulting index



- ▶ Document model
- ▶ Ontology model: OWL
- ▶ Rule model:
 - ▶ *Candidate* rules progressively refined
 - ▶ Functionnal classification: static constraint, operative rule, policy rule, ...
 - ▶ From plain english to structured english (SBVR-like)



Outline

Integrating
written policies in
Business Rule
Management
Systems

A. Nazarenko, A.
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N. Omrane, S.
Szulman

Introduction

The core structure

Acquiring a business rule model

Results of acquisition

Exploiting and exploring the resulting index

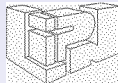
Introduction

The core structure

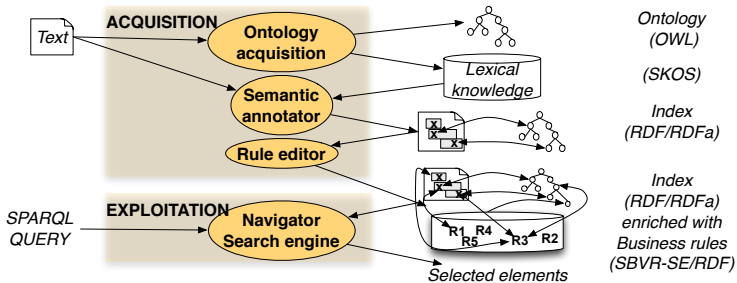
**Acquiring a
business rule
model**

Results of
acquisition

Exploiting and
exploring the
resulting index



Overall of the acquisition process



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A. Nazarenko, A. Guisse, F. Lévy, N. Omrane, S. Szulman

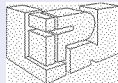
Introduction

The core structure

Acquiring a business rule model

Results of acquisition

Exploiting and exploring the resulting index



Acquisition of a domain ontology

TERMINAE method

- ▶ Automatic extraction of the textual units.
e.g. *airline participant*, clustered with *Airline participant*, *participant*
- ▶ Normalizing \leftrightarrow a termino-conceptual network + linguistic properties
e.g. *participant*
 - ▶ linked to the termino-concept **Participant**
 - ▶ also linked to the termino-concept **Member**
- ▶ Formalization into a conceptual or ontological structure.
e.g. Creating two concepts: **Participant** son of **Company** and **Member** son of **Client**

Integrating
written policies in
Business Rule
Management
Systems

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Szulman

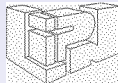
Introduction

The core structure

Acquiring a
business rule
model

Results of
acquisition

Exploiting and
exploring the
resulting index



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Integrating
written policies in
Business Rule
Management
Systems

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Szulman

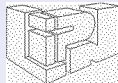
Introduction

The core structure

Acquiring a
business rule
model

Results of
acquisition

Exploiting and
exploring the
resulting index



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Integrating
written policies in
Business Rule
Management
Systems

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Szulman

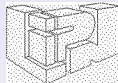
Introduction

The core structure

Acquiring a
business rule
model

Results of
acquisition

Exploiting and
exploring the
resulting index



A tool for the expert

Integrating
written policies in
Business Rule
Management
Systems

A. Nazarenko, A.
Guisse, F. Lévy,
N. Omrane, S.
Szulman

Introduction

The core structure

Acquiring a
business rule
model

Results of
acquisition

Exploiting and
exploring the
resulting index

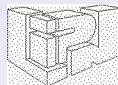
The screenshot shows the Terminae project AA software interface. The main window is titled "Terminae project AA" and has a menu bar with "Perspective", "Search", "TerminoConceptual actions", and "Help". Below the menu bar are three tabs: "Terminae Terminological level (Filtering-step 1)", "Terminae Terminological level (Analysis-step 2)", and "Terminae TerminoConceptual level".

The interface is divided into several panes:

- TerminoConcept list:** A tree view on the left showing a hierarchy of concepts. The "Sapphire" concept is selected and highlighted in blue. Other concepts include "AAAdvantageAwardFee", "Benefits", "Bonus", "EliteMember", "GoldMember", "PlatinumExecutiveMembe", "PlatinumMember", "Location", "NumericalQuantity", "MilesQuantity", "PointsQuantity", "SegmentsQuantity", "Person", "account", "airlineParticipant", "AADvantageParticipant", "airport", "bonusMileage", "creditCard", "fee", and "root". A status bar at the bottom left indicates "number of lines : 24".
- TerminoConcept features:** A pane on the right showing details for the selected "Sapphire" concept. It includes a "Term ID" field with the value "Sapphire". Below this is a table with two columns: "Synonyms" and "Links".

Synonyms	Links
AAAdvantage platinum	Brother
	Brother
	Father
	Executive Platinum
	General AAdvantage Program
	Person
- NL Definition:** A text area containing the definition: "Sapphire is a title of a privilege for frequent fliers on American Airlines."
- Occurrences of a term:** A text area showing three occurrences of the term "Sapphire" in context. Occurrence 1: "ID occ2338 doc 0 sent 230 AAdvantage Platinum is equivalent to oneworld **Sapphire** .". Occurrence 2: "ID occ1012 doc 0 sent 242 AAdvantage Platinum and AAdvantage Gold members earn four 500-mile electronic upgrades for every 10,000 qualifying base miles flown (including guaranteed minimum miles) during your membership year (March 1 or the date you qualify for elite status , through the last day of February) .". Occurrence 3: (partially visible).
- RTC r...:** A small pane on the right with a "Domain" label and a scrollable area.

Figure: Termino-concept *Sapphire*



Annotating more texts

- ▶ Linguistic knowledge available in SKOS format
- ▶ can automatically cast annotations on new versions, added texts of the domain.

e.g.

Termino-concept ↔ *Label*

Adjusting device

↔ *adjusting device/belt adjustment device*

Low-temperature chamber

↔ *low-temperature chamber/refrigerated cabinet*

Integrating
written policies in
Business Rule
Management
Systems

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N. Omrane, S.
Szulman

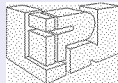
Introduction

The core structure

Acquiring a
business rule
model

Results of
acquisition

Exploiting and
exploring the
resulting index



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Business Rule
Management
Systems

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Szulman

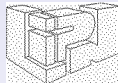
Introduction

The core structure

Acquiring a
business rule
model

Results of
acquisition

Exploiting and
exploring the
resulting index



Acquisition of business rules

- ▶ Strategy : analysis and exploration of the text.
- ▶ SemEx: another tool designed for rule progressive elicitation and exploration, supports the following steps:

semantic exploration

The screenshot shows the SemEx application window. On the left is a 'Hierarchy' tree with categories like Space, Source, Agent, Function, Attribute, Safety, Humidity, Temperature, Number, Device, Dimension, Conditioning, Method, VirtualMethod, and PhysicalMethod. The main area displays a corpus of text with several numbered entries (7.3, 7.3.1, 7.3.2, 7.3.3, 7.3.4, 7.3.5) containing technical descriptions of tests. Key terms in the text are highlighted in blue and underlined, such as 'Micro-slip test', 'atmosphere', 'temperature', 'humidity', 'test bench', 'adjusting device', 'strap', 'daN load', and 'belt'. The interface includes a 'Rule Editor' and 'Navigator' at the top, and a 'Corpus' tab with a file path and an 'Ontological entity' dropdown.

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written policies in
Business Rule
Management
Systems

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Szulman

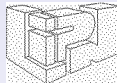
Introduction

The core structure

Acquiring a
business rule
model

Results of
acquisition

Exploiting and
exploring the
resulting index



- ▶ linguistic markers are emphasized
- ▶ select a rule → copy in a rule editor

The screenshot shows the SemEx software interface. The main window is titled "SemEx" and contains a menu bar (File, Edit, View, Settings) and a toolbar. Below the toolbar is a "Rule Editor" window. On the left side of the Rule Editor, there is a "Rule" list showing various rules (R24, R25, R26, R27, R28, R18, R19, R20, R23, R22, R21, R13, R14, R15, R16, R17, R5, R6, R7, R10, R9, R8, R12). Rule R25 is selected. The main editor area shows the "Initial version" and "Editor" text for rule R25. The "Initial version" text is: "In that case, when the dynamic test has been carried out for a type of vehicle it need not be repeated for other types of vehicle where each anchorage point is less than 50 mm distant from the corresponding anchorage point of the tested belt." The "Editor" text is: "In that case, when the dynamic test has been carried out for a type of vehicle it need not be repeated for other types of vehicle where each anchorage point is less than 50 mm distant from the corresponding anchorage point of the tested belt." The right panel shows parameters for the selected rule: Type: (empty), Pattern: (empty), Premise: (empty), Conclusion: (empty), Revisions: (empty), Refers to: R24, R25, R26, Subrule of: R24, R25, R26, User name: (empty), Editing date: 06/02/2011. At the bottom of the interface, there is a "Type : Concept" label.

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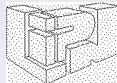
Introduction

The core structure

Acquiring a business rule model

Results of acquisition

Exploiting and exploring the resulting index



- ▶ new versions are added to solve ambiguities, etc.
- ▶ a rule can be decomposed into several subrules

- R13 The test shall be carried out at a temperature between 15 and 30 C.
- R14 The micro_slip_test shall be carried out at a temperature between 15 and 30 C.
- R15 The temperature of the micro_slip_test must be between 15 and 30 C.
 - R17 The temperature of the micro_slip_test must be lesser than 30 C.
 - R16 The temperature of the micro_slip_test must be greater than 15

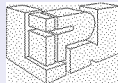
Introduction

The core structure

Acquiring a
business rule
model

Results of
acquisition

Exploiting and
exploring the
resulting index



Outline

Integrating
written policies in
Business Rule
Management
Systems

A. Nazarenko, A.
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Szulman

Introduction

The core structure

Acquiring a business rule model

Results of acquisition

Exploiting and exploring the resulting index

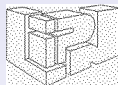
Introduction

The core structure

Acquiring a
business rule
model

**Results of
acquisition**

Exploiting and
exploring the
resulting index



Short documents (5750 and 3700 words) but hard to read

The ontology

Use case	Concepts	Individuals	Roles
<i>AAdvantage</i>	210	25	74
<i>Audi</i>	77	31	19

The rules

Use case	Initial rules	Revised rules	Decomposed rules	Total
<i>AAdvantage</i>	101	0	0	101
<i>Audi</i>	40	27	16	83

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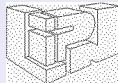
Introduction

The core structure

Acquiring a business rule model

Results of acquisition

Exploiting and exploring the resulting index



Coverage

Use Case	Ontology to text (O2T)	Ontology to rules (O2R)	Rule to Text (R2T)
<i>AAdvantage</i>	46.4 %	54.8 %	41 %
<i>Audi</i>	33.8%	40 %	33.8 %

$$O2T = \frac{\# \text{ of annotated occurrences}}{\# \text{ of wd occurrences}} \text{ in the text}$$

$$O2R = \frac{\# \text{ of annotated occurrences}}{\# \text{ of wd occurrences}} \text{ in the rules}$$

$$R2T = \frac{\# \text{ of rule sentences}}{\# \text{ of sentences}} \text{ in the text}$$

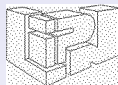
Introduction

The core structure

Acquiring a
business rule
model

Results of
acquisition

Exploiting and
exploring the
resulting index



Outline

Integrating
written policies in
Business Rule
Management
Systems

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Szulman

Introduction

The core structure

Acquiring a business rule model

Results of acquisition

Exploiting and exploring the resulting index

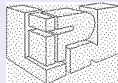
Introduction

The core structure

Acquiring a
business rule
model

Results of
acquisition

Exploiting and
exploring the
resulting index



Semantic search

- ▶ Traditional text search (words, structure if encoded)
- ▶ Ontology exploration
- ▶ Browsing the rule base
- ▶ Navigating from a resource to another
 - ▶ from concepts to sentences involving them
 - ▶ from concepts to rules involving them
 - ▶ between sentence and rules through common concepts

Used all along the acquisition

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written policies in
Business Rule
Management
Systems

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Szulman

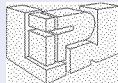
Introduction

The core structure

Acquiring a
business rule
model

Results of
acquisition

Exploiting and
exploring the
resulting index



SPARQL queries on the whole index

The screenshot shows the SemEx application interface. On the left, a SPARQL query is displayed in a text area. The query is as follows:

```
SPARQL query
PREFIX schema: <http://ipn.univ-paris13.fr/RCLN/schema#>
PREFIX audirules: <http://ipn.univ-paris13.fr/RCLN/ontorule/Audi/#>
select distinct ?rule ?content ?concept
where{
  audirules:R19 schema:annoted ?link.
  ?link schema:defineResource ?resource.
  ?resource schema:realizeConcept ?concept.

  optional{
    ?rule schema:ruleText ?content.
    ?rule schema:annoted ?textlink.
    ?textlink schema:defineResource ?resource2.
    ?resource2 schema:realizeConcept ?concept.
  }
}
ORDER BY ?rule
```

At the bottom left of the query area is a "Run query" button. On the right side of the application, the results of the query are displayed in a table-like format. The table has three columns: "The number of results : 21", "rule", and "content". The results are grouped into four sections, each starting with a "result" label. The content of the results is as follows:

Result	rule	content
result 1	http://ipn.univ-paris13.fr/RCLN/ontorule/Audi/rules#R10	If the strap breaks at or within 10 mm of either of the clamps then the TestOfBreakingStrengthOfStrip shall be invalid
result 2	http://ipn.univ-paris13.fr/RCLN/ontorule/Audi/rules#R11	If the strap slips then a new TestOfBreakingStrengthOfStrip shall be carried out on another strap .
result 3	http://ipn.univ-paris13.fr/RCLN/ontorule/Audi/rules#R12	If the strap breaks at or within 10 mm of either of the clamps then a new TestOfBreakingStrengthOfStrip shall be carried out on another strap .
result 4	http://ipn.univ-paris13.fr/RCLN/ontorule/Audi/rules#R18	A 5 daN load shall be attached to the lower end of the section of strap . The other end shall be subjected to a back and forth motion, the total amplitude being 300 + 20 mm (see figure).

Integrating written policies in Business Rule Management Systems

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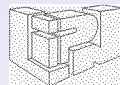
Introduction

The core structure

Acquiring a business rule model

Results of acquisition

Exploiting and exploring the resulting index



Related tasks

- ▶ Support for consistency checking
 - Tracing back to the origin of inconsistency
 - Looking for some types of anomaly
- ▶ Maintenance
 - Updated regulations → impacted rules

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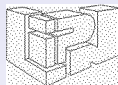
Introduction

The core structure

Acquiring a
business rule
model

Results of
acquisition

Exploiting and
exploring the
resulting index



Conclusion

- ▶ methodology for Integration of the source text in a full platform (until execution) ;
- ▶ enables the business expert to build domain ontologies and BR ;
- ▶ relies on annotation as well as OMG and W3C standards ;
- ▶ builds a semantic space of sources, ontologies and rules ;

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Introduction

The core structure

Acquiring a
business rule
model

Results of
acquisition

Exploiting and
exploring the
resulting index

