Semantics of Business Vocabulary and Business Rules (SBVR), v1.4

Annex J - The ORM Notation for Verbalizing Facts and Business Rules

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Annex J - The ORM Notation for Verbalizing Facts and Business Rules

(informative)

J.1 General

Annexes C and F discussed how to verbalize facts and business rules in the SBVR Structured English and RuleSpeak notations. This annex briefly presents a third approach to verbalization that is based on Object-Role Modeling (ORM) [Halp1998, Halp2001], a conceptual modeling approach that has been used productively in industry for over 30 years. While this approach has been localized to other languages (including Japanese, German, and French), we restrict ourselves here to the English version.

Business rules may be specified in ORM using graphical and/or textual languages. We confine ourselves here to just part of ORM’s textual language. We regard a static business rule to be a constraint or derivation rule that applies to each individual state of the business, taken one state at a time. This annex focuses on the verbalization of static business rules, ignoring dynamic rules relating to state transitions or workflows. In the interests of brevity, only a few of ORM’s rule verbalization patterns are illustrated here, mainly using examples from the EU-Rent case study. A detailed discussion may be found in the references [Halp2003a, Halp2003b, Halp2003c, Halp2003d, Halp2004c, Halp2004d, Halp2004e, Halp2004f, Halp2004g, Halp2004b].

J.2 Criteria for Business Rule Verbalization in ORM

Static business rules are best applied to a fact model that identifies the fact types of interest to the business. Table J.1 shows some fact types with arities from 1 to 4. Each fact type role corresponds to an object placeholder (depicted here as an ellipsis “…” in the predicate. Here predicates are displayed in mixfix notation, allowing object terms to be placed in a sentence at any position. Higher arity predicates (quinary, etc.) are also possible.

<table>
<thead>
<tr>
<th>Fact Type</th>
<th>Predicate</th>
<th>Arity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Person smokes</td>
<td>… smokes</td>
<td>1 (Unary)</td>
</tr>
<tr>
<td>Person was born in Country</td>
<td>… was born in …</td>
<td>2 (Binary)</td>
</tr>
<tr>
<td>Person played Sport for Country</td>
<td>… played … for …</td>
<td>3 (Ternary)</td>
</tr>
<tr>
<td>Person introduced Person to Person on Date</td>
<td>… introduced … to … on …</td>
<td>4 (Quaternary)</td>
</tr>
</tbody>
</table>

Table J.1 Examples of fact types of different arity

The ORM textual language for verbalizing fact instances, fact types, and business rules is based on the following criteria:

- **expressibility** - the language is able to express a wide range of business rules
- **clarity** - the rules are understandable by non-technical domain experts
- **flexibility** - the language directly supports predicates of any arity
- **localizability** - the language constructs are expressible in different native languages
- **formality** - the rules are unambiguous, and should ideally be executable
Apart from its graphical language, ORM uses a textual language that is both formal and conceptual, so that it can serve for communication and validation with domain experts, as well as being executable. Relevant dimensions used in ORM for rule verbalization are listed in Table J.2, along with the choices available. For detailed discussion of these criteria, see the references.

Table J.2  Classification schemes for rule verbalization

<table>
<thead>
<tr>
<th>Dimension</th>
<th>Choices</th>
</tr>
</thead>
<tbody>
<tr>
<td>Form</td>
<td>Positive, Negative, Default</td>
</tr>
<tr>
<td>Modality</td>
<td>Alethic, Deontic</td>
</tr>
<tr>
<td>Style</td>
<td>Relational, Attribute, Mixed</td>
</tr>
<tr>
<td>Context</td>
<td>Local, Global</td>
</tr>
<tr>
<td>Formality</td>
<td>Informal, Semiformal, Formal</td>
</tr>
</tbody>
</table>

ORM’s verbalization language applies to mixfix predicates of any arity, with predefined patterns to cater for a very wide range of constraints found in business domains. Unlike some other approaches, ORM leaves the verbalization of the underlying fact model unchanged (e.g., no need to pluralize noun phrases and related verb phrases).

Every constraint has an associated modality, determined by the logical modal operator that functions explicitly or implicitly as its main operator. In practice, the modality is typically either alethic or deontic (see Table J.3). Logical negation may be used to obtain the usual equivalences (e.g., not necessary ≡ possible, not obligatory ≡ permitted, not permitted ≡ forbidden).

Table J.3 - Alethic and deontic modal operators

<table>
<thead>
<tr>
<th>Alethic</th>
<th>Deontic</th>
</tr>
</thead>
<tbody>
<tr>
<td>It is necessary that</td>
<td>It is obligatory that</td>
</tr>
<tr>
<td>It is possible that</td>
<td>It is permitted that</td>
</tr>
<tr>
<td>It is impossible that</td>
<td>It is forbidden that</td>
</tr>
</tbody>
</table>

The next two sub clauses present some simple examples. Far more complex examples may be found in the references.

J.3 Some Basic Rule Examples in ORM

Simple uniqueness constraint

Positive form:

Each rental car is owned by at most one branch.
In positive verbalizations, the modality is often assumed (as above), but may be explicitly prepended (“It is obligatory that” for deontic modality; “It is necessary that” for alethic modality).

Negative form, deontic modality:

> It is forbidden that the same rental car is owned by more than one branch.

Negative form, alethic modality:

> It is impossible that the same rental car is owned by more than one branch.

**Composite uniqueness constraint:**

Positive, deontic form of a uniqueness constraint over two fact type roles from the ternary fact type room at hour slot is booked for course.

> It is obligatory that given any room and hour slot that room at that hour slot is booked for at most one course.

**Composite Exclusion constraint:**

Relational style: No person directed and reviewed the same movie.  
Attribute style: For each movie:

> no director is a reviewer.

**Join Subset constraint:**

Each advisor who serves in a country also speaks a language that is used by that country.

**Derivation Rule:**

Relational style: Define person₁ is an uncle of person₂ as

> person₁ is a brother of person₃ who is a parent of person₂

Attribute style: For each person: uncle = brother of parent.

### J.4 Some EU-Rent Rule Examples

> It is obligatory that each rental has a car group.

> It is obligatory that each rental car that has a service reading greater than 5000 miles is scheduled for service.
It is obligatory that
if a rental car is in an international return that is to a receiving branch
that is in a local area that is in a country
then that rental car is registered in that country.

It is permitted that each renter books more than one rental.

J.5 EU-Rent Examples in ORM

This sub clause provides restatements in ORM of the EU-Rent examples presented in SBVR Structured English (Annex G.1.4) and in RuleSpeak (Annex H). The ORM rewording is displayed after the SBVR Structured English formulation, assuming that the fact types used in the ORM verbalization are defined in the model.

Conventions used

- Object types are bold and underlined.
- Verb phrases are bold.
- Components of constraints are in italics.
- Articles and referents are unadorned.
- The terms “may” and “must” indicate deontic modalities permission and obligation, respectively.
- The term “might” (as in #9) indicates alethic possibility; lack of any modal term (as in #1) indicates alethic necessity.
- The term “which” is used to provide proper English syntax to avoid ending with a preposition; the preposition immediately preceding “which” actually terminates a verb phrase in the model.

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
</table>
| 1 | It is necessary that each rental has exactly one requested car group.  

  Each rental requests at least one car group. Each rental requests at most one car group. - or, combined:  
  Each rental requests exactly one car group.  |
| Guidance Type: | structural business rule |

2 | It is obligatory that the rental duration of each rental is at most 90 rental days.  

  It must be that each rental lasts at most 90 rental days.  |
| Guidance Type: | operative business rule |
### Guidance Type: operative business rule

#### 3
It is obligatory that each driver of a rental is qualified.

*It must be that each driver that drives a rental is qualified at the date/time at which that rental actually started.*

#### 4
It is obligatory that the rental incurs a location penalty charge if the drop-off location of a rental is not the EU-Rent site that is base for the return branch of the rental.

*It must be that a rental incurs a location penalty charge, if the rented car of that rental is dropped off at a location that is different from the EU-Rent site where the return branch of that rental is based.*

#### 5
It is obligatory that the rental charge of a rental is calculated in the business currency of the rental.

*It must be that a rental charge that is incurred by a rental is calculated in a business currency that is used by that rental.*

#### 6
It is permitted that a rental is open only if an estimated rental charge is provisionally charged to a credit card of the renter that is responsible for the rental.

*It may be that a rental is open only if an estimated rental charge that is incurred by that rental is provisionally charged to a credit card that is held by the customer that acquires that rental.*

#### 7
It is obligatory that the local area that includes the return branch of an in-country rental or international inward rental owns the rented car of the rental at the actual return date/time of the rental.

*It must be that the local area that includes the return branch that is the destination of an in-country rental or an international inward rental owns the rental car that is assigned to that rental at the date/time at which that rental is returned.*

Guidance Type: operative business rule

Note: not expressible using standard ORM constraint notation
<table>
<thead>
<tr>
<th>Guidance Type:</th>
<th>Operative business rule</th>
</tr>
</thead>
<tbody>
<tr>
<td>Note:</td>
<td>not expressible using standard ORM constraint notation.</td>
</tr>
</tbody>
</table>

It is obligatory that at the actual pick-up date/time of each rental the fuel level of the rented car of the rental is full.

It must be that the rental car that is assigned to a rental has a fuel level equal to ‘full’ at the date/time at which that rental actually started.

<table>
<thead>
<tr>
<th>Guidance Type:</th>
<th>Advice of possibility</th>
</tr>
</thead>
<tbody>
<tr>
<td>Note:</td>
<td>not expressible using standard ORM constraint notation; however, possibilities are implied by the absence of other constraints - especially necessities - that preclude them.</td>
</tr>
</tbody>
</table>

It is possible that the notification date/time of a bad experience that occurs during a rental is after the actual return date/time of the rental.

It might be that the notification of a bad experience that occurs during a rental is received at a date/time that is greater than the date/time at which that rental is actually returned.

<table>
<thead>
<tr>
<th>Guidance Type:</th>
<th>Advice of permission</th>
</tr>
</thead>
<tbody>
<tr>
<td>Note:</td>
<td>implied by the model, as is (no equality constraint is specified, therefore it is permitted).</td>
</tr>
</tbody>
</table>