SBVR - Semantics of Business Vocabulary and Business Rules

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Content of the SBVR Standards

- SBVR is an OMG standard for formally describing business rules
- SBVR defines the vocabulary and rules for documenting the semantics of
  - business vocabularies (chapter 11)
  - business rules (chapter 12)
- The SBVR consists of a large number of definitions: What is
  - a business rule?
  - a rule statement?
  - level of enforcement?
  - a vocabulary?
  - a definition?
  - …
- SBVR also specifies the logical semantics of expressions and rules (chapter 10)
What does SBVR do?

SBVR realizes the ‘Business Rules Mantra’:

“Rules are built on Facts. Facts are built on Terms.”

… to describe the business language of the activities of organizations
… in a way that is easily understandable by business people  

(Chapin et al. 2008)
SBVR is a Vocabulary, not a Language Standard

- SBVR is a vocabulary consisting of interrelated sub-vocabularies
  - meaning and representation vocabulary
  - vocabulary for describing business vocabularies
  - vocabulary for describing business rules
- The SBVR vocabulary permits to capture the semantics of sentences commonly used to express business rules
- SBVR-compliant tools capture the meaning of business vocabularies and rules
How to read the SBVR Specification

- The SBVR specification describes a vocabulary using terminological entries.

- Each entry includes a definition, along with other specifications such as notes and examples.

- Example:

  - **concept type**
    - Definition: object type that specializes the concept ‘concept’
    - Note: A **concept** is related to a **concept type** by being an **instance** of the **concept type**.
    - Example: **fact type, role, concept type**

- Often, the entries include rules (necessities) about the particular item being defined.
Notations for Business Rules

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

rental has driver
driver is qualified

The noun concept ‘driver’ is a facet of the noun concept ‘person’.

- SBVR does not prescribe a specific language for terms, facts and rules
- Terms and facts can be represented, for example, in
  - SBVR Structured English
  - Unified Modelling Language (UML)
  - Object-Role Modeling (ORM)
- The SBVR specification itself uses SBVR Structured English to describe its vocabularies
Excursion: RuleSpeak

- RuleSpeak is another de facto standard for writing business rules
  - developed by Ron Ross at Business Rules Solution
  - widely used and understood by business rules practitioners
  - compatible with several business rules tools
  - consistent with SBVR Structured English

<table>
<thead>
<tr>
<th>Structural business rule</th>
<th>RuleSpeak version</th>
</tr>
</thead>
<tbody>
<tr>
<td>It is necessary that each rental has exactly one requested car group.</td>
<td>Each rental always has exactly one requested car group.</td>
</tr>
</tbody>
</table>

<table>
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<tr>
<th>Operative business rule</th>
<th>RuleSpeak version</th>
</tr>
</thead>
<tbody>
<tr>
<td>It is obligatory that the rental duration of each rental is at most 90 rental days.</td>
<td>The rental duration of a rental must not be more than 90 rental days.</td>
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Clause 8: Meaning and Representation

Vocabulary
Some important definitions

**meaning**
Definition: what is meant by a word, sign, statement, or description; what someone intends to express or what someone understands

**concept**
Source: ISO 1087-1 (English) (3.2.1) ['concept']
Definition: unit of knowledge created by a unique combination of characteristics
General Concept: meaning
Reference Scheme: a designation of the concept

**noun concept**
Definition: concept that is the meaning of a noun or noun phrase
Concept Type: concept type
Reference Scheme: a closed projection that defines the noun concept

**fact type**
Definition: concept that is the meaning of a verb phrase that involves one or more noun concepts and whose instances are all actualities
Synonym: verb concept
Note: For each instance of a fact type, each role of the fact type is one point of involvement of something in that instance.
Concept Type: concept type
Necessity: Each fact type has at least one role.
Noun Concepts: General and Individual

Noun Concepts

- General Concept
  - Car
- General Concept
  - Country
- Individual Concept
  - Switzerland

Things in the real world

- Countries
  - France
  - Germany
  - UK
  - Switzerland
  - Netherlands

- Cars
  - VIN# 12345
  - VIN# 13872
  - VIN# 13991
  - VIN# 16277
  - VIN# 17002
  - VIN# 17456
  - VIN# 19334
  - VIN# 20113

Pre-defined population – represented in vocabulary

General population – represented in database

(CHapin & Hall 2006)
Noun Concepts

Examples:

- The ‘**general concept**’ that denotes the set of countries in which EU-Rent does business

  **Operating country**
  - Concept Type: **role**
  - Definition: **country** in which EU-Rent does business
  - Necessity: Each **operating country** has exactly one **currency**

- The ‘**individual concept**’ that denotes the country Switzerland

  **Switzerland**
  - Concept Type: **individual concept**
  - General Concept: **country**
  - Synonym: **CH**
**Object Type = General Concept**

object type  

Definition: noun concept that classifies things on the basis of their common properties  
Source: based on ISO 1087-1 (English) (3.2.3) ['general concept']  
Concept Type: concept type  
Synonym: general concept  
Necessity: The set of characteristics that are incorporated by an object type is not the set of characteristics that are incorporated by another object type.  
Note: An object type incorporates a set of characteristics which are a unique combination that distinguishes that object type from all other object types. See ‘concept incorporates characteristic’. If an object type A and an object type B have the very same incorporated characteristics, they are the same concept. If they have the very same necessary characteristics, they are logically equivalent and they denote the same things in all possible worlds.  
Example: the concept ‘rental car’ corresponding to cars that are rented  
Example: the concept ‘car’, the concept ‘number’, the concept ‘person’
Individual Concept

**Individual concept**

**Source:** ISO 1087-1 (English) (3.2.2) ['individual concept']

**Definition:** concept that corresponds to only one object [thing]

**General Concept:** noun concept

**Concept Type:** concept type

**Necessity:** No individual concept is an object type

**Necessity:** No individual concept is a fact type role

**Note:** While each referring individual concept has exactly one and the same instance in all possible worlds, there can be multiple individual concepts that correspond to the same thing. Different definite descriptions of the same individual thing can represent different individual concepts that correspond to that thing.

**Example:** The individual concept ‘California’ whose one instance is an individual state in the United States of America
Fact Types – Examples

- Fact Types
  - Unary (characteristic): flight is full
    - 1 placeholder, filled by ‘flight’
  - Binary: aircraft is assigned to flight
    - two placeholders, filled by ‘aircraft’ and ‘flight’
  - N-ary: reassigned flight replaces missed flight after late arrival
    - three placeholders representing roles, filled by ‘flight’, ‘flight’ and ‘late arrival’

(Chapin et al 2008)
Role and Fact Type Role

**role**

Definition: noun concept that corresponds to things based on their playing a part, assuming a function or being used in some situation

Concept Type: *concept type*

Example: the *role* ‘drop-off location’ of the fact type ‘shipment has drop-off location’

Example: the *role* ‘shipment’ of the fact type ‘shipment has drop-off location’, which should not be confused with the general concept ‘shipment’ (which generalizes the role)

Example: the *role* ‘sum’ – a *role* of a number in relation to a set of numbers

Note: A role can be an object type or a fact type role. A role is always understood with respect to actualities of a particular fact type or to other particular situations.

**fact type role**

Definition: role that specifically characterizes its instances by their involvement in an actuality that is an instance of a given *fact type*

Concept Type: *concept type*

Necessity: Each *fact type role* is in exactly one *fact type*.

Necessity: No *fact type role* is an *object type*.

Note: A fact type role is fundamentally understood as a point of involvement in actualities that correspond to a fact type. Its incorporated characteristics come from the fact type – what the fact type requires of instances of the role. It is possible that two fact type roles incorporate the same characteristics, such as when a binary fact type means the same thing when roles are reversed, as in ‘*person* is married to *person*’. 
Relations between Concepts

- **is coextensive with**
- **specializes**
- **generalizes**
- **ranges over**
- **is in**
- **incorporates**
Examples of Relations

**concept₁ specializes concept₂**

Definition: the concept₁ incorporates each characteristic that is incorporated by the concept₂ plus at least one differentiator

Synonymous Form: concept₂ generalizes concept₁

Example: The individual concept ‘Los Angeles’ specializes the concept ‘city’, the differentiator being that Los Angeles is one particular city in California.

**concept₁ is coextensive with concept₂**

Definition: the extension of the concept₁ is always the extension of the concept₂

Example: The individual concept defined as “the thirtieth president of the United States” is coextensive with an object type defined as “president of the United States in 1925.” The two concepts have the same extension (which includes only Calvin Coolidge) but they are different concepts.

**concept incorporates characteristic**

Definition: the characteristic is an abstraction of a property of each instance of the concept and is one of the characteristics that makes up the concept

Example: The concept ‘qualified driver’ incorporates the characteristic ‘driver is licensed’ because it is necessary (by the definition of ‘qualified driver’) that each qualified driver is licensed.

**role ranges over object type**

Definition: each characteristic that is incorporated by the object type is incorporated by the role

Example: The role ‘company’ of the fact type ‘company employs person’ ranges over the object type ‘company’.
Kinds of Definition
**Definition**

**intensional definition**

Source: ISO 1087-1 (English) (3.3.2) ['intensional definition']

Definition: **definition** which describes the intension of a concept by stating the superordinate concept and the delimiting characteristics

General Concept: **definition**

Necessity: No **intensional definition** is an **extensional definition**.

**definite description**

Definition: **intensional definition** of an individual

Example: the car movement that has the movement id “UK-12345-abc-xyz”

Necessity: Each **definition of an individual concept** is a **definite description**.

Necessity: Each **definite description** is the **definition of an individual concept**.

Necessity: Each **definite description** uses a **reference scheme** for the individual.

**extensional definition**

Source: ISO 1087-1 (English) (3.3.3) ['extensional definition']

Definition: description of a concept by enumerating all of its subordinate concepts under one criterion of subdivision

General Concept: **definition**

Necessity: No **extensional definition** is an **intensional definition**.
Epressing Definitions

One Definition Form (e.g. Intensional)

- The sales tax rate for a rental is the sales tax rate at the pick-up branch of the rental on the drop-off date of the rental.

can be expressed in many language, notation & speech community combinations:

- Expressed in English
  - The sales tax rate for a rental is the sales tax rate at the pick-up branch of the rental on the drop-off date of the rental.

- Expressed in French
  - Le taux de taxe de vente pour une location de voiture est le taux de taxe de vente à l'agence de départ de la location à la date de retour de la voiture

- Expressed in SBVR Structured English
  - The sales tax rate for a rental is the sales tax rate at the pick-up branch of the rental on the drop-off date of the rental.

(Chapin & Hall 2006)
Clause 12: Business Rules

- (Surprisingly) small part of SBVR
- Contains definitions for
  - Business Rules
  - Level of Enforcement
  - Rule Statements
**Business Rules**

**rule**

Definition: proposition that is a claim of obligation or of necessity

Dictionary Basis: one of a set of explicit or understood regulations or principles governing conduct or procedure within a particular area of activity ... a law or principle that operates within a particular sphere of knowledge, describing, or prescribing what is possible or allowable. [ODE]

**business rule**

Definition: rule that is under business jurisdiction

General Concept: rule, element of guidance

Note: A rule’s being “under business jurisdiction” means that it is under the jurisdiction of the semantic community that it governs or guides - that the semantic community can opt to change or discard the rule. Laws of physics may be relevant to a company (or other semantic community); legislation and regulations may be imposed on it; external standards and best practices may be adopted. These things are not business rules from the company’s perspective, since it does not have the authority to change them. The company will decide how to react to laws and regulations, and will create business rules to ensure compliance with them. Similarly, it will create business rules to ensure that standards or best practices are implemented as intended. See subclause A.2.3

**business rule is derived from business policy**

Synonymous Form: business policy is basis for business rule
**Kinds of Business Rules**

**structural rule**
- Definition: A *rule* that is a claim of *necessity*.
- Synonym: *definitional rule*

**structural business rule**
- Definition: A *structural rule* that is a *business rule*.
- Necessity: Each *structural business rule* is *practicable*.
- Synonym: *definitional business rule*

**operative business rule**
- Definition: A *business rule* that is a claim of *obligation*.
- Definition: An *element of governance* that is *directly enforceable*.
- Dictionary Basis: A prescribed, suggested, or self-imposed guide for conduct or action: a regulation or principle — *his parents laid down the rule that he must do his homework before going out to play*; *a very sound rule for any hiker is to mind his own business* — *F.D. Smith & Barbara Wilcox made it a rule never to lose his temper* — *MWU (1a) ‘rule’*.
- Dictionary Basis: A prescribed guide for conduct or action — *MWCD ‘rule’*.
- Necessity: No *operative business rule* is a *structural business rule*.
- Synonym: *behavioral business rule*
Kinds of Business Rules

Two kinds of business rule:

- **Operational**: govern what the business does
  - “It is obligatory that …”
  - “It is permitted that …” (and its negation, “It is forbidden that …”)

- **Structural**: true by definition
  - “It is necessary that …”
  - “It is possible that …” (and its negation, “It is impossible that …”)
Defining a Business Rule

- Start with a fact type, e.g.
  rental has driver

- Apply an obligation or necessity to it, e.g.
  it is obligatory that rental has driver.

- Add qualifications, quantifications and conditions, if necessary, e.g.
  it is obligatory that rental has at most 4 drivers
Levels of Enforcement

- Levels of Enforcement are separated from rules

  **level of enforcement**
  
  Definition: a position in a graded or ordered scale of values that specifies the severity of action imposed in order to put or keep an operative business rule in force

  Dictionary Basis: a position on a real or imaginary scale of amount, quantity, extent, or quality [NODE ‘level’]

  Dictionary Basis: compel observance of or compliance with [NODE ‘enforcement’]

- Only operative rules have levels of enforcements

  **operative business rule** has **level of enforcement**

- SBVR does not prescribe any enforcement levels. It only gives examples (the ones also mentioned in BMM):
  
  strict, deferred, pre-authorized, post-justified, override, guidelines
Statements of Guidance

- There is a distinction between
  - rules
  - rule statements

- There are three kinds of statement to express operative business rules
  - obligation statement
  - prohibition statement
  - restricted permission statement

- There are also three kinds of statement to express structural business rules
  - necessity statement
  - impossibility statement
  - restricted possibility statement
Statements of Guidance

- Besides **rules** there are statements for other kinds of guidance
  - business policy
  - advice
Statements of Guidance

**guidance statement**

**Definition:** statement that expresses an element of guidance

**Definition:** statement that provides advice or information aimed at resolving a problem or difficulty, especially as given by someone in authority

**Dictionary Basis:** a statement that provides advice or information aimed at resolving a problem or difficulty, especially as given by someone in authority [NODE ‘guidance’]

**business policy statement**

**Definition:** guidance statement that expresses a business policy

**Necessity:** The concept ‘business policy statement’ is included in Kind of Guidance Statement.

**rule statement**

**Definition:** guidance statement that expresses an operative business rule or a structural rule

**Necessity:** The concept ‘rule statement’ is included in Kind of Guidance Statement.
Rule Statements

**structural rule statement**

**Definition:** rule statement that expresses a structural rule

**Note:** One structural rule can be expressed as various equivalent kinds of statements by introducing or removing negation. The following are examples of the same rule, expressed in three forms.

**Example:** [as a necessity statement] “It is necessary that the pick-up branch of a one-way rental is not the return branch of that rental.”

**Example:** [as an impossibility statement] “It is impossible that the pick-up branch of a one-way rental is the return branch of that rental.”

**Example:** [as a restricted possibility statement] “It is possible that the pick-up branch of a rental is the return branch of the rental only if the rental is not a one-way rental.”

**operative business rule statement**

**Definition:** business rule statement that expresses an operative business rule

**Necessity:** No operative business rule statement is a structural rule statement.

**Note:** One operative business rule can be expressed as various equivalent kinds of statements by introducing or removing negation. The following are examples of the same rule, expressed in three forms.

**Example:** [as an obligation statement] “It is obligatory that a rental that is open has no driver that is a barred driver.”

**Example:** [as a prohibition statement] “It is prohibited that a rental be open if a driver of the rental is a barred driver.”

**Example:** [as a restricted permission statement] “It is permitted that a rental be open only if no driver of the rental is a barred driver.”
Clause 11: Business Vocabulary

- Clause 11 specifies a vocabulary providing words for describing business vocabularies along with the designations and fact type forms they contain.

- A full description of a business vocabulary involves
  - its relationship to semantic communities and speech communities,
  - its relationship to other vocabularies,
  - the concepts represented, their definitions and other information about them.
Communities, Meaning and Vocabularies
Community

**community**

**Definition:** group of people having a particular unifying characteristic in common

**Dictionary Basis:** group of people having a religion, race, profession, or other particular characteristic in common [NODE ‘community’]

**Reference Scheme:** a URI of the community

**Example:** The Car Rental Community -- people who work in the car rental business

**Example:** The EU-Rent Community -- all EU-Rent employees

**Example:** The EU-Rent German Community -- employees of EU-Rent’s German division

Semantic Community

**semantics community**

**Definition:** community whose unifying characteristic is a shared understanding (perception) of the things that they have to deal with

**Example:** The EU-Rent Community -- those who share the body of concepts about general and specific things of importance to the EU-Rent business.

- When you define rules, you do it from the perspective of the owning semantic community

- A semantic community defines the scope of an SBVR Body of Shared Meanings:
  - what concepts (both noun concepts and verb concepts) are to be included
  - what business rules it needs to build on them

(Chapin et al 2008)
Body of Shared Meanings

**Body of shared meanings**

Definition: *set of concepts and elements of guidance* for which there is a shared understanding in a given semantic community.

Example: The EU-Rent Car Rental Business has a **body of shared meanings** which contains the set of concepts of general and specific things of importance to the EU-Rent car rental business.

**Body of shared meanings unites semantic community**

Definition: the **body of shared meanings is** the set of concepts and elements of guidance for which there is a shared understanding in the semantic community.

Necessity: Each semantic community is united by exactly one body of shared meanings.

Necessity: Each body of shared meanings unites exactly one semantic community.

Note: Understanding the body of shared meanings that unites a semantic community is an obligation for participation in the semantic community. Communication within the community is based on an assumption of mutual understanding of the body of shared meaning.
Speech Community

A speech community is a subcommunity of a semantic community. It has the same “body of shared meanings”, but expresses them in a particular, shared vocabulary.

**speech community**

**Definition:** subcommunity of a given semantic community whose unifying characteristic is the **vocabulary** and **language** that it uses.

**Dictionary Basis:** group of people sharing a characteristic vocabulary, and grammatical and pronunciation patterns for use in their normal intercommunication [W3ID ‘speech community’].

**Example:** The [EU-Rent German Community](https://www.eur-german.org) shares the German-based vocabulary of designations used in EU-Rent’s business. The designations include German words for EU-Rent’s concepts plus designations adopted from other languages.

**speech community uses language**

**Definition:** the speech community communicates in the **language**

**Necessity:** Each speech community uses exactly one **language**.

**semantic community has speech community**

**Necessity:** Each speech community is of exactly one **semantic community**.
Vocabulary

- A vocabulary is drawn from one shared language, which may be:
  - A natural language, such as English, German, Dutch
  - Specialised terminology such as that used by lawyers or engineers
  - A constructed language such as the UML (or SBVR Structured English)
- Each vocabulary expresses only one Body of Shared Meanings
- A vocabulary includes
  - terms and names for the noun concepts
  - ‘readings’ for the verb concepts
- SBVR users are strongly encouraged to limit the amount of internally managed vocabulary, and:
  - use everyday natural language as much as possible, backed up with a standard dictionary
  - adopt as much as possible from authoritative sources, such as ISO standards and industry standard glossaries.
  (Chapin & Hall 2006)
Vocabulary

vocabulary
Definition: the set of designations and fact type forms primarily drawn from a single language to express concepts within a body of shared meanings.

Dictionary Basis: sum or stock of words employed by a language, group, individual, or work, or in a field of knowledge [MWCD 'vocabulary ']

Example: The sets of designations represented in EU-Rent’s internal glossaries, in the natural languages in which the company does business, together with the vocabularies it has adopted, including those defined in:

* Industry standard glossaries for car rental business,
* Standard (e.g., ISO) glossaries of business terms,
* Authoritative dictionaries for the relevant natural languages.

vocabulary is designed for speech community
Synonymous Form: vocabulary targets speech community
Definition: the vocabulary is created for use by a speech community that does not own the vocabulary

vocabulary is expressed in language
Definition: the designations of the vocabulary are primarily within the language
Synonymous Form: language expresses vocabulary
Synonymous Form: vocabulary uses language
Necessity: Each vocabulary is expressed in at least one language.
Note: Typically, the language would be a natural language, but not necessarily. See ‘language’.
**business vocabulary**

Definition: *vocabulary* that is under business jurisdiction

**vocabulary is used to express body of shared meanings**

Definition: the *vocabulary* includes designations and fact type forms of the concepts in the body of shared meanings
References

- Chapin, Donald; Hall, John; Nijssen, Sjir; Piprani, Baba (2008): SBVR Tutorial. Open Forum 2008
Exercise: Definition

- Give definitions for the following concepts:
  - weekday
  - working day
  - weekend

- Are the definitions intensional or extensional?