University of Applied Sciences Northwestern Switzerland
School of Business

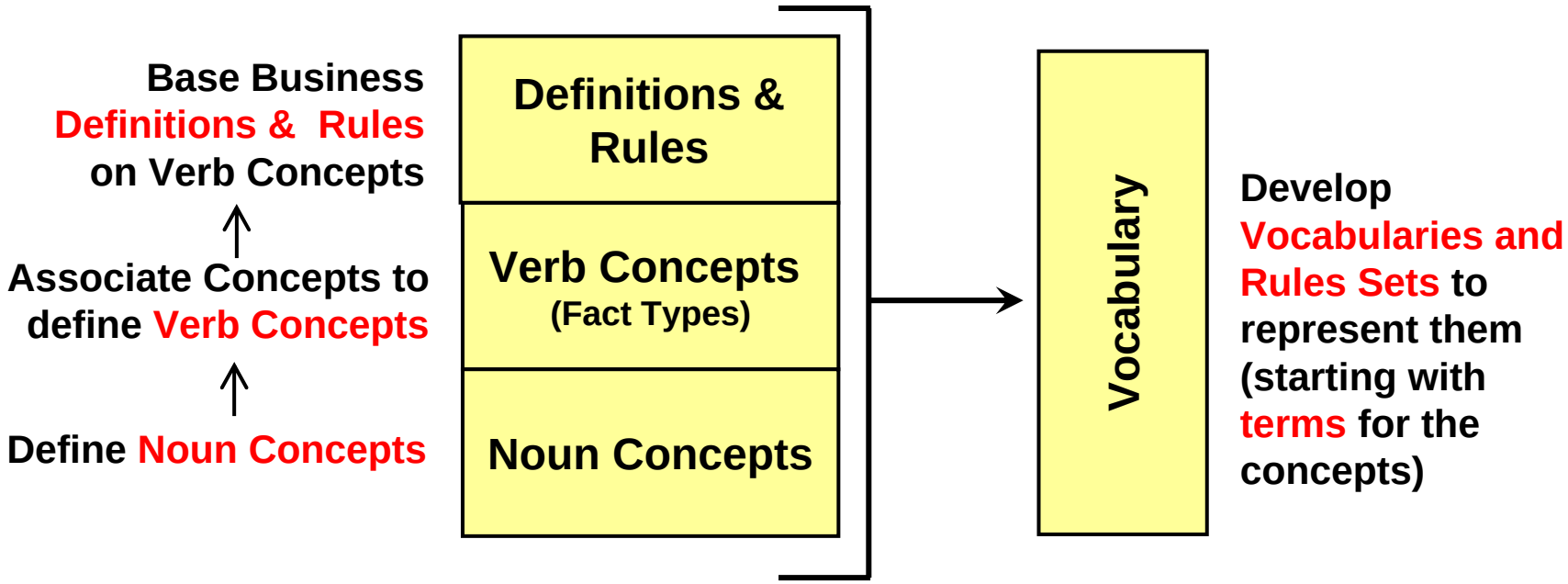
# SBVR – Semantics for Business Vocabulary and Business Rules

http://www.omg.org/spec/SBVR/1.0

# 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 not a Language Standard

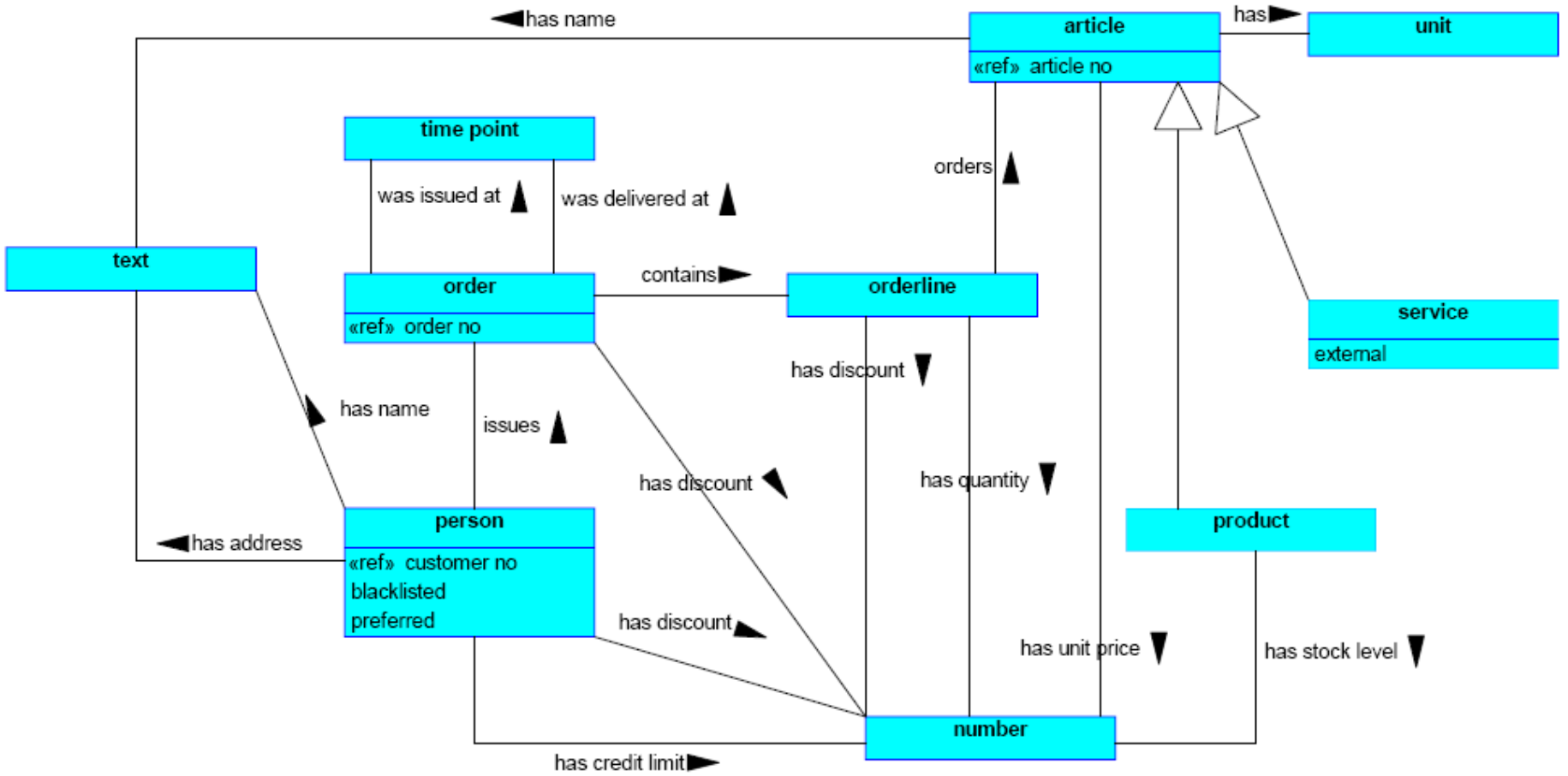
- SBVR is a vocabulary
  - consisting of interrelated sub-vocabularies
- The SBVR vocabulary permits to capture the semantics of those kinds of sentences commonly used to express business rules
- SBVR represents the semantics as facts, i.e.
  - it consists of terms and facts about semantic formulation of meaning
- SBVR-compliant tools capture the meaning of business vocabularies and rules

# SBVR Structured English Notation

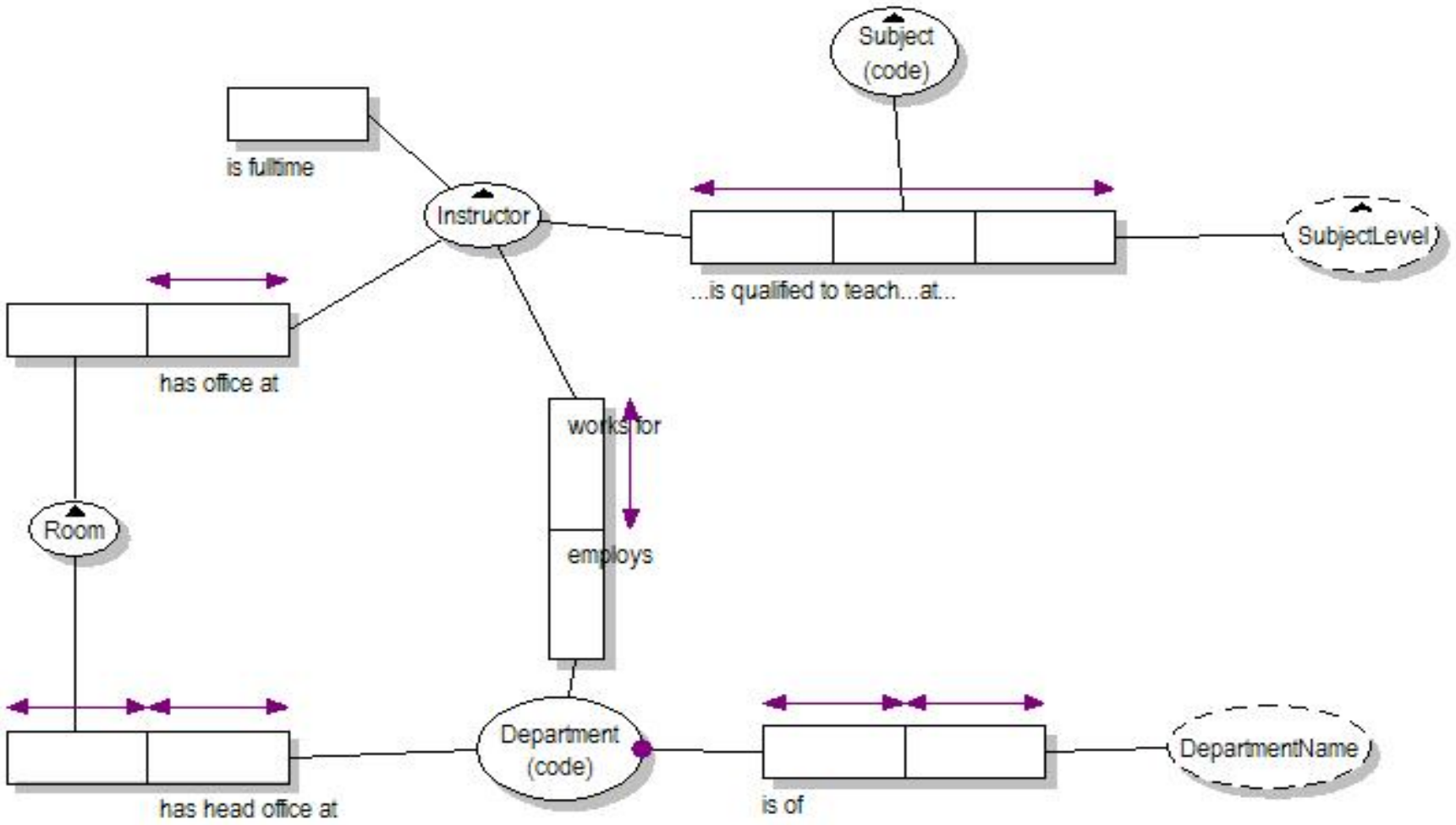
There are four font styles with formal meaning:

| | |
|---|---|
| term | The 'term' font is used for a designation for a noun concept (other than an individual concept), e.g. rental car, branch |
| Name | The 'name' font is used for a designation of an individual concept — a name. Names tend to be proper nouns, e.g. California, 25 |
| *verb* | The 'verb' font is used for designations for verb concepts — usually a verb, preposition or combination thereof. Such a designation is defined in the context of a form of expression, e.g. local area *owns* rental car, rental *has* pick-up branch |
| keyword | The 'keyword' font is used for linguistic symbols used to construct statements – the words that can be combined with other designations to form statements and definitions, e.g., 'each' and 'it is required that'. |
| | Quotation marks are also in the 'keyword' font. Single quotation marks are used (among other purposes) to mention a concept – to refer to the concept itself rather than to the things it denotes. In this case, a quoted designation or form of expression is preceded by the word 'concept' or by a term for a kind of concept, e.g. the concept 'walk-in rental' *is* a category *of* the concept 'rental'. |

# UML Notation for SBVR

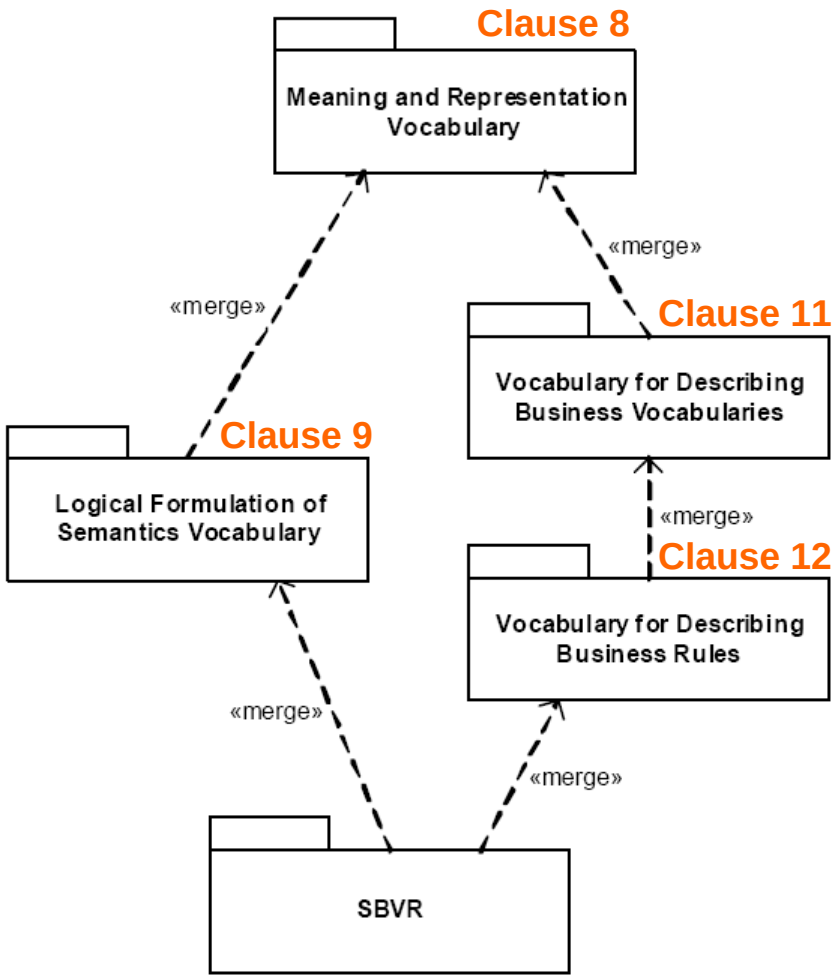


# SBVR Model in ORM (fragment)




(Chapin et al 2008)

# Conformance




- For conforming software, the SBVR specification defines four compliance points.
- A software tool that conforms to to any of these compliance points shall support all of the concepts specified in the corresponding clauses
- There are too additional conformances specified by requirements defined in clause 10
  - Restricted Higher Order Logic
  - First Order Logic

# How to read the SBVR Specification

- This specification describes a vocabulary, or actually a set of vocabularies, using terminological entries.
- Each entry includes a definition, along with other specifications such as notes and examples. Often, the entries include rules (necessities) about the particular item being defined.
- 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 |

- The sequencing of the clauses in this specification reflects the inherent logical order of the subject matter itself. Later clauses build semantically on the earlier ones. The initial clauses are therefore rather 'deep' in terms of SBVR's grounding in formal logics and linguistics.
- This overall form of presentation is rather difficult to approach. Figures help illustrate the structure of the vocabulary.
- The following slides contain a small subset of the SBVR vocabulary

# Clause 8: Meaning and Representation Vocabulary

Clause 8 defines the basic concepts for defining meaning and representation.

**Expression** – things used to communicate (e.g., sounds, text, diagrams, gestures), but apart from their meaning — one expression can have many meanings.

**Representation** – the connection between expression and a meaning. Each representation ties one expression to one meaning.

**Meaning** – what is meant by a word (a concept) or by a statement (a proposition) – how we think about things.

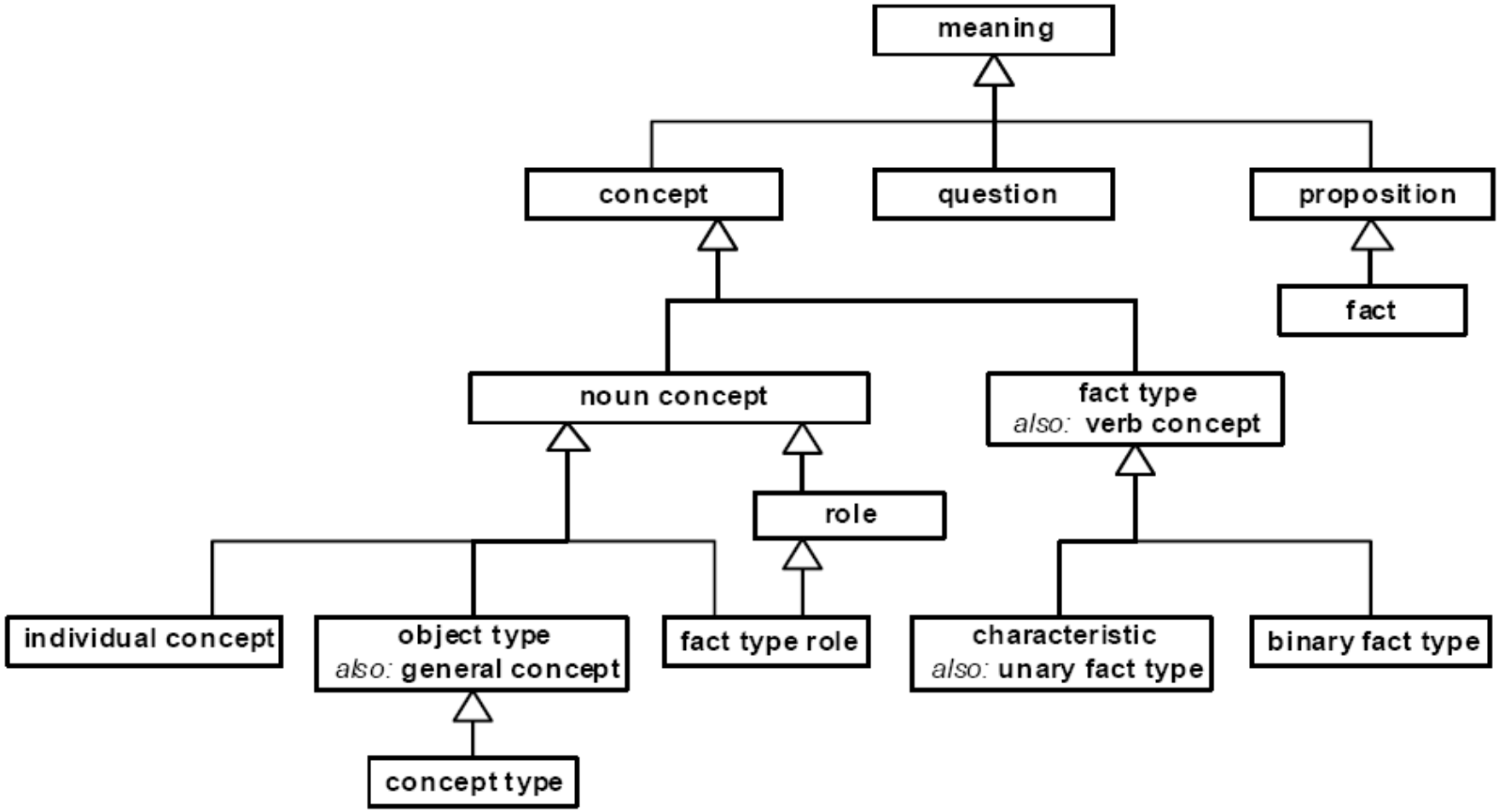
**Extension** – the things to which meanings refer, which can be anything (even expressions, representations, and meanings when they are the subjects of our discourse).

**Reference** schemes – ways people use information about something to identify it. For example, a city in the United States is identified by a name combined with the state, which is identified by its name or by a two-letter state code.

# Examples for Extension, Meaning, Representation and Expression

| Extension | Meaning | Representation | Expression |
|---|---|---|---|
| The actual drivers of motor vehicles | Concept 'driver' — how we think of drivers, what characterizes them | Designation of the concept 'driver' by the signifier "driver" | The character sequence "driver" |
| | | Definition of the concept 'driver' as "operator of a motor vehicle" | The character sequence "operator of a motor vehicle" |
| The actual City of Los Angeles, California – a real place | Individual concept 'Los Angeles' — how we think of that city, what distinguishes it from other places | 'Los Angeles' as a designation for the individual concept of 'Los Angeles' | The character sequence "Los Angeles" |
| For each car that is out of service, its actually being out of service | Characteristic applicable to a car, what is meant by a car being out of service | Fact type form 'car is out of service' as a template for the characteristic with 'car' being a placeholder | The text "car is out of service" |
| The actual state of affairs of it being obligatory in the EU-Rent business that it not rent to a barred driver | Proposition — the meaning of the statement "EU-Rent must not rent to a barred driver" | The statement, "EU-Rent must not rent to a barred driver," having the proposition as its meaning | The character sequence "EU-Rent must not rent to a barred driver" |

# Meaning


meaning
concept
question
proposition
fact
noun concept
fact type
also: verb concept
role
individual concept
object type
also: general concept
fact type role
characteristic
also: unary fact type
binary fact type
concept type

# 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

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**

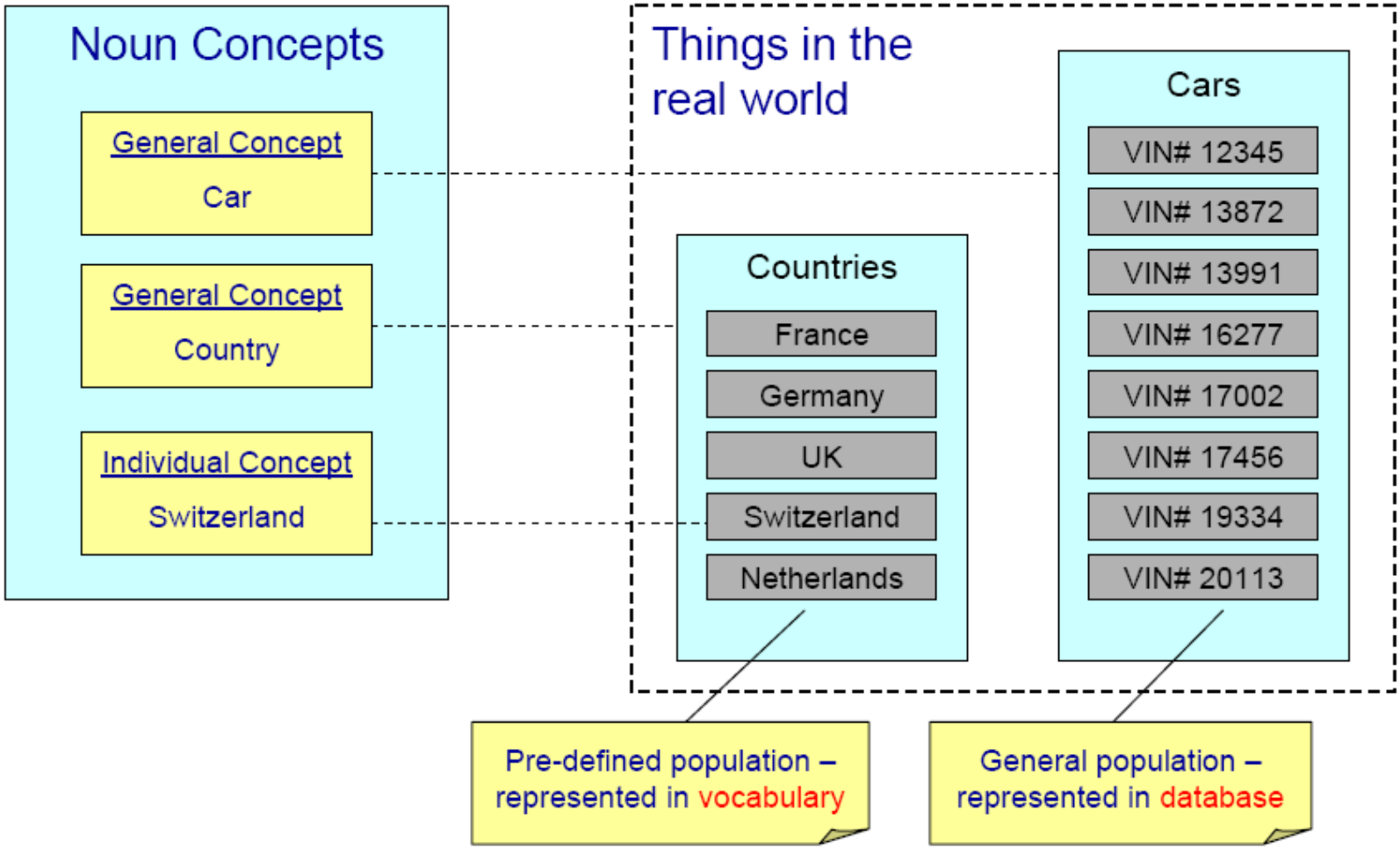
| | |
|---|---|
| Concept Type: | individual concept |
| General Concept: | country |
| Synonym: | CH |

# Verb Concepts – Examples

- Verb concepts
  - 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'
- Can objectify a verb concept and use it as a noun concept

(Chapin et al 2008)

# Noun Concepts: General and Individual




(Chapin & Hall 2006)

# 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**

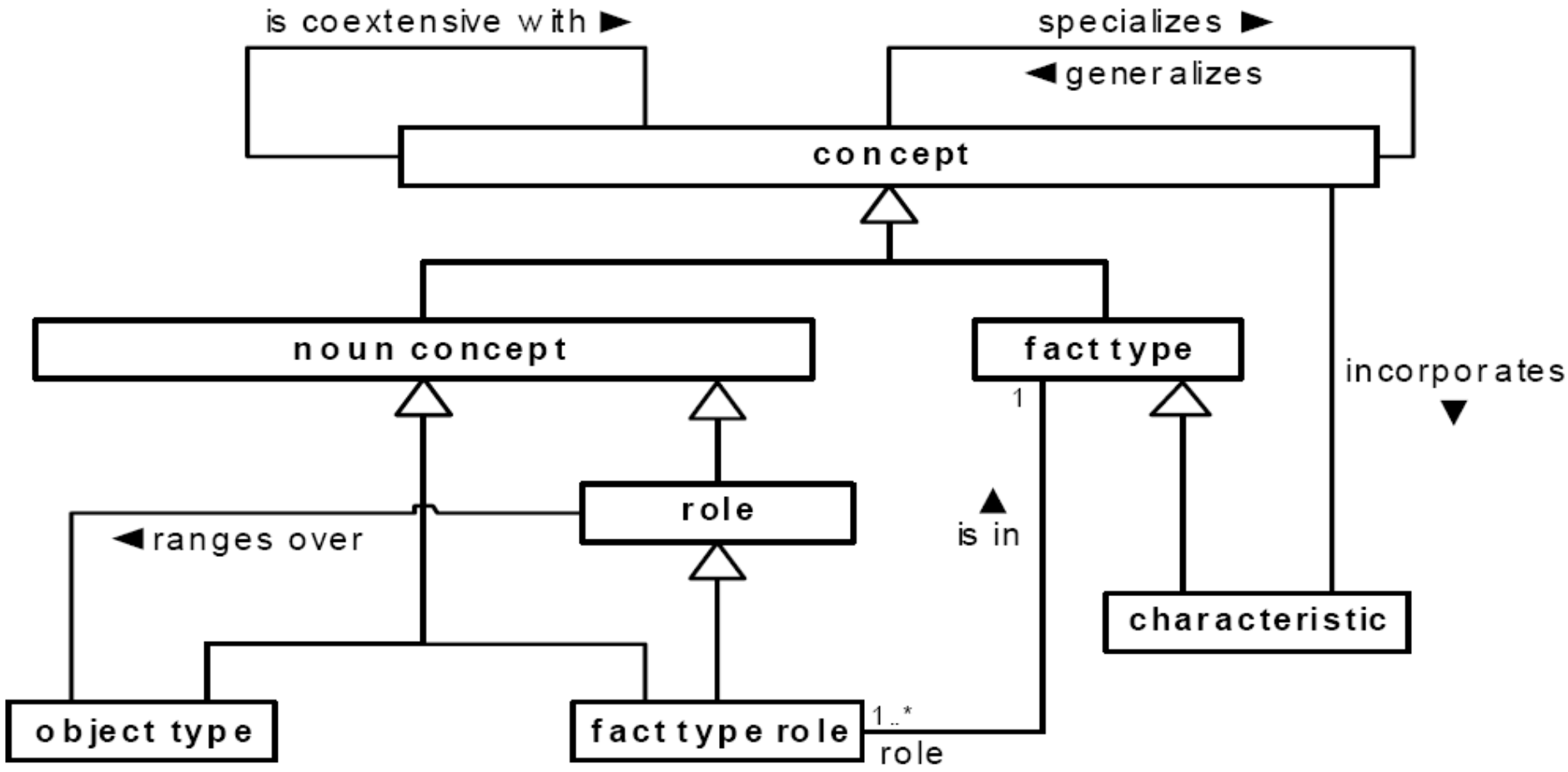
| | |
|---|---|
| Source: | ISO 1087-1 (English) (3.2.2) ['individual concept'] |
| Definition: | concept that corresponds to only one object [thing] |
| General Concept: | noun concept |
| Concept Type: | concept type |
| Necessity: | No individual concept *is* an object type. |
| Necessity: | No individual 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 |

# Role

**role** FL

| | |
|---|---|
| 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. |

# Relations between Concepts



# Examples of Relations

**concept$_1$ *specializes* concept$_2$** FL

Definition: the concept$_1$ incorporates each characteristic that is incorporated by the concept$_2$ plus at least one differentiator

Synonymous Form: concept$_2$ *generalizes* concept$_1$

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

**concept$_1$ *is coextensive with* concept$_2$**

Definition: the extension *of* the concept$_1$ *is* always the extension *of* the concept$_2$

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** FL

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**

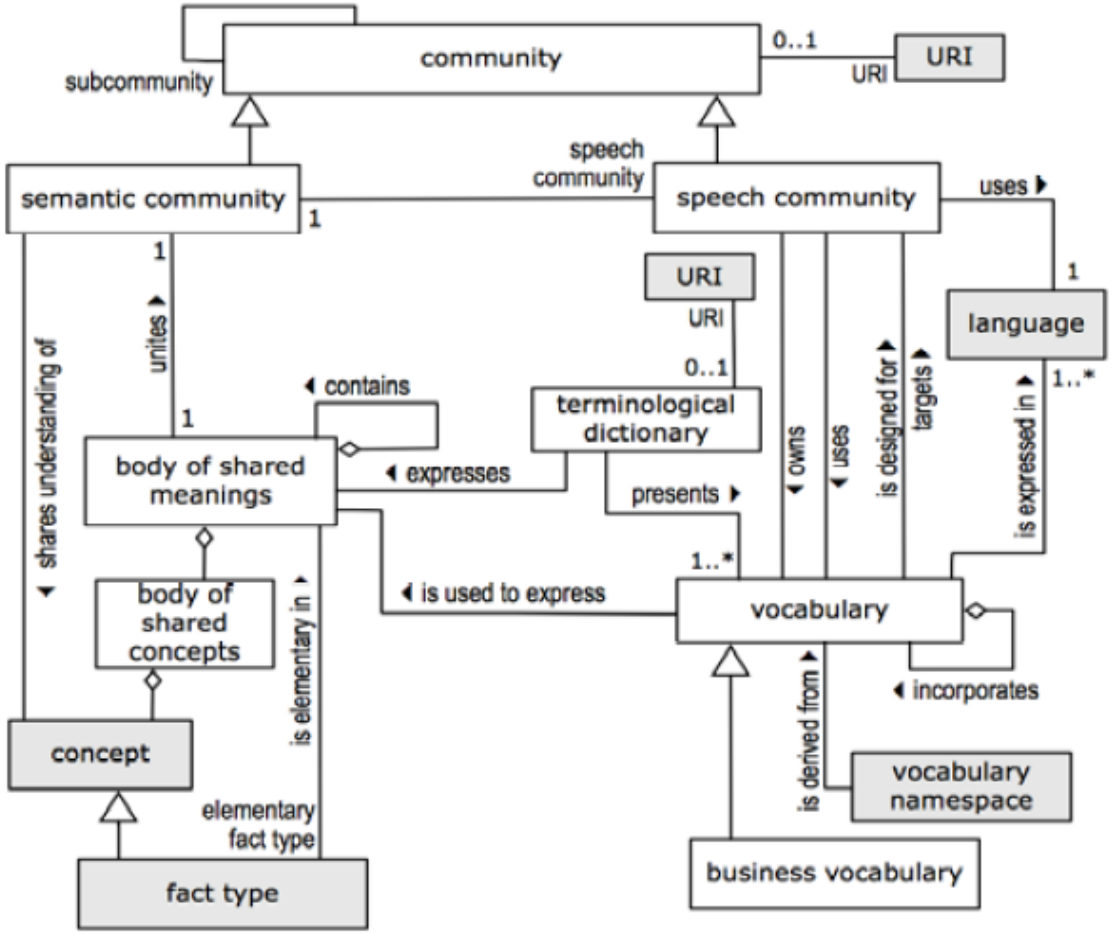
Definition: each characteristic that *is incorporated by* the object type *is incorporated by* the role

Example: The role 'company' of the fact type 'company employs person' ranges over the object type 'company'.

# 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 |

NODE = The New Oxford Dictionary of English.

# Semantic Community

**semantic 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. |

- 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
- Usually, the most important semantic community is the organization for which you are building the SBVR Body of Shared Meanings, e.g. EU-Fly.
  - You will often have to consider other semantic communities that do or could share some of the vocabulary, e.g. the airline industry, national trade associations, EU-Fly customers
- When you define rules, you do it from the perspective of the owning semantic community
- Two kinds of Semantic Communities in business:
  - Collaborative Community, e.g. a department, cross-function programme team
  - Community of Practice, e.g. project managers, operational excellence champions, departmental budget managers

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

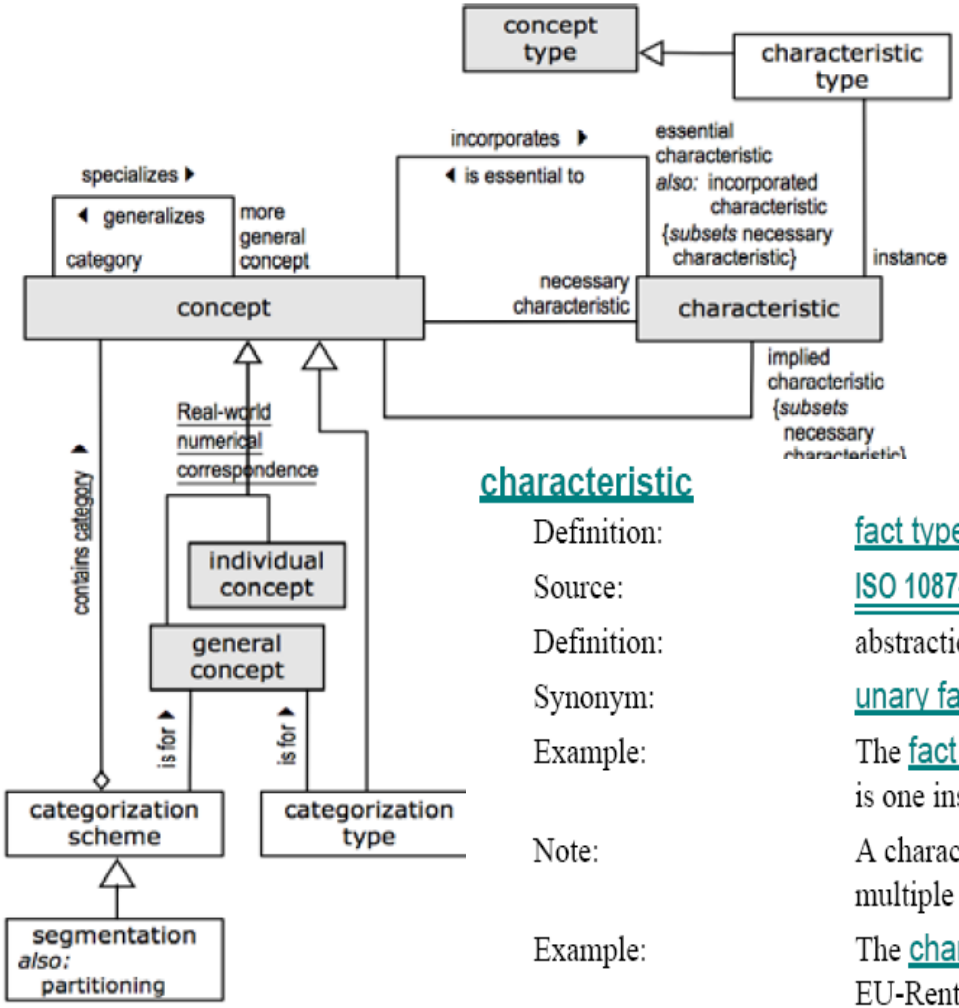
**vocabulary *is designed for* speech community**

| | |
|---|---|
| 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'. |

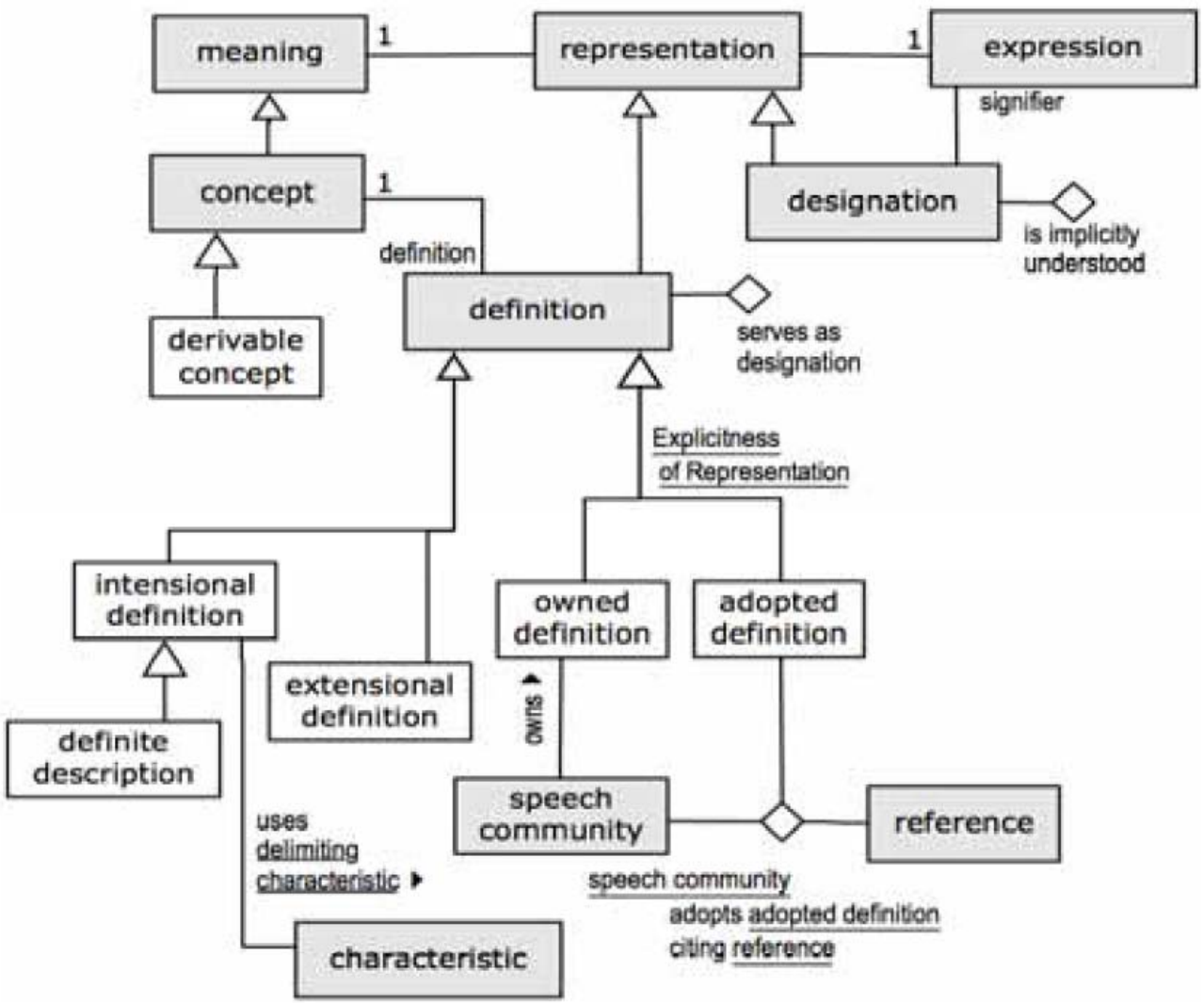
# Concept and Characteristic




**characteristic** FL

| | |
|---|---|
| Definition: | fact type that *has* exactly one role |
| Source: | ISO 1087-1 (English) (3.2.4) ['characteristic'] |
| Definition: | abstraction of a property of an object [thing] or of a set of objects |
| Synonym: | unary fact type |
| Example: | The fact type 'shipment is late' whose instances are actualities of shipments being late. There is one instance of the fact type for each shipment that is late. |
| Note: | A characteristic always has exactly one role, but it can be defined using fact types having multiple roles. |
| Example: | The characteristic 'driver is of age' with this definition: "the age of the driver is at least the EU-Rent Minimum Driving Age." The semantic formulation of this definition appears in the introduction to Clause 9 - Logical Formulation of Semantics Vocabulary. |

# 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)

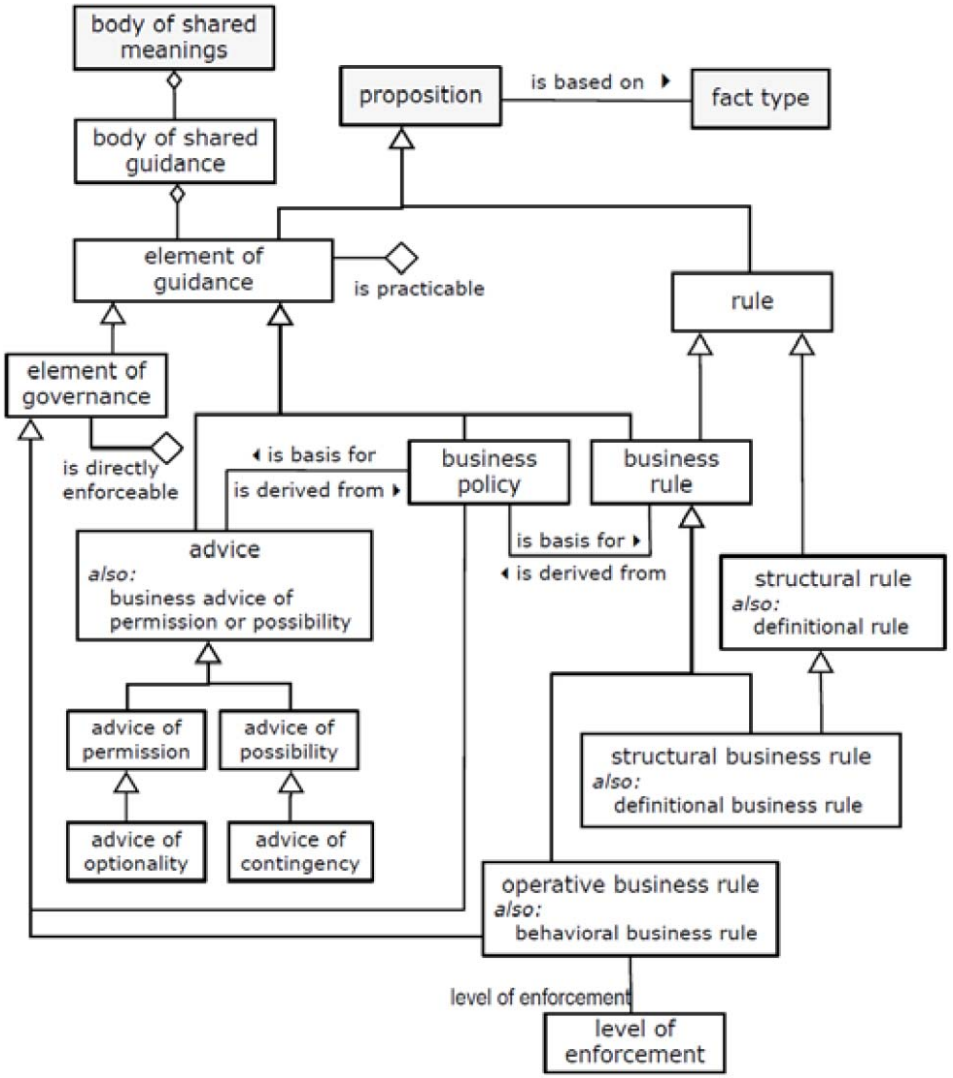
- The sales tax rate for a rental is the sales tax rate at the pick-up branch of the rental on the drop-off date of the rental.

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
- Business Vocabulary is much bigger (and reusable for other aspects of business modelling)
- Intended for people:
  - Can be broken
  - Need enforcement
- Actionable, but not necessarily automatable

# 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

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 …")

(Chapin & Hall 2006)

# Kinds of Business Rules

**structural rule**

| | |
|---|---|
| Definition: | rule that is a claim of necessity. |
| Synonym: | definitional rule |

**structural business rule**

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

**operative business rule**

| | |
|---|---|
| Definition: | business rule that is a claim of obligation |
| Definition: | 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 |

# Defining a Business Rule

Underlying verb concept (in SBVR's Vocabulary for Business Rules):

element of guidance *is based on* verb concept

We know that (also in SBVR's Vocabulary for Business Rules):

element of guidance *introduces* an obligation or necessity

business rule *is a category of* element of guidance

So, in the SBVR Business Vocabulary+Rules for a specific business (e.g. EU-Rent)

- Start with a verb concept, 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 each rental *has* at most 4 drivers.

(Chapin & Hall 2006)

# 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**

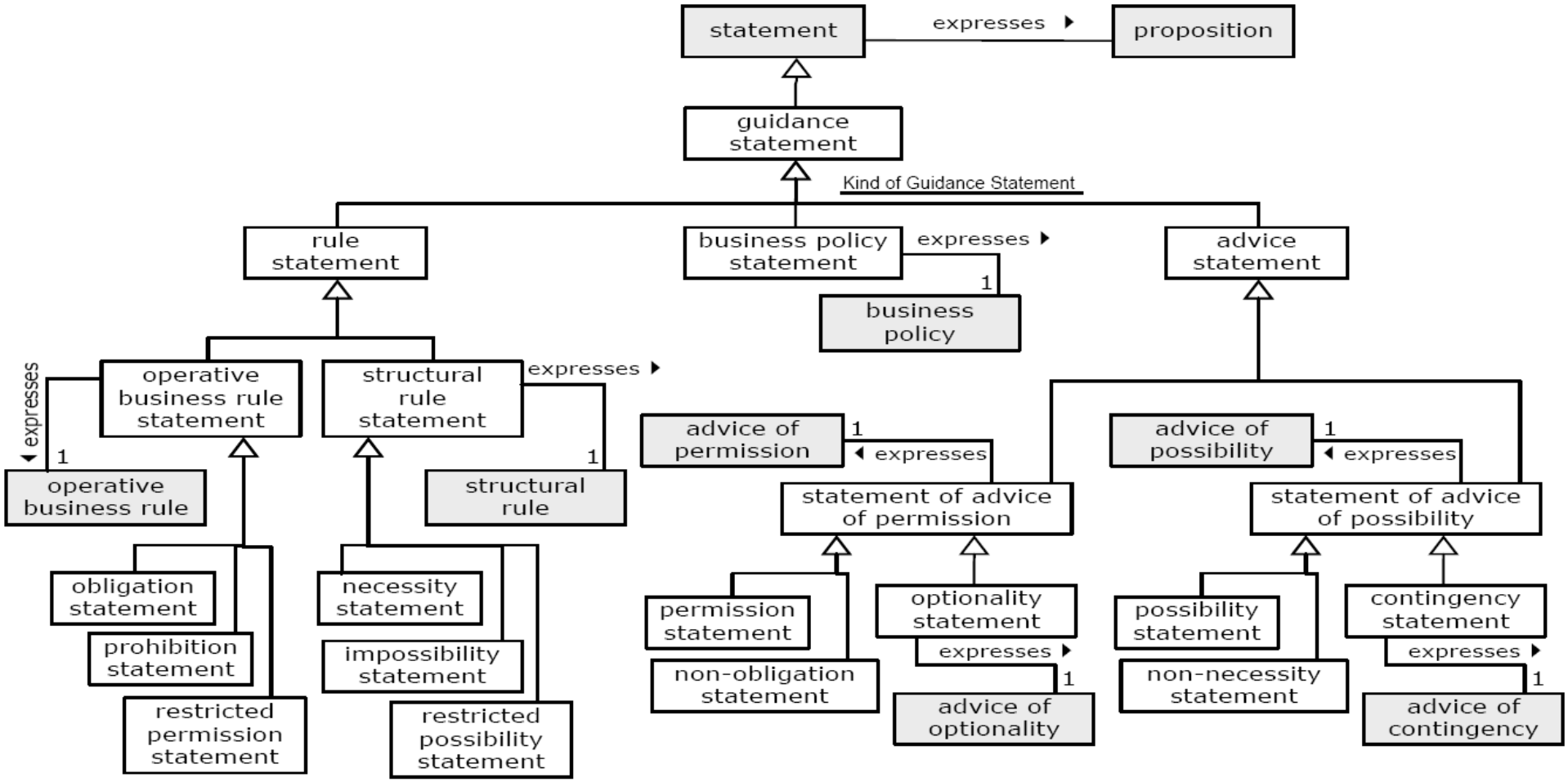
- SBVR does not prescribe any enforcement levels. It only gives examples (the ones also mentioned in BMM):

  strict, deferred, pre-authorized, post-justified, override, guidelins

# Statements of Guidance

- Clause 12.2 provides a normative vocabulary for the kinds of guidance statements that business people assert.
- These kinds of guidance statements are general with respect to any particular language.
- It does not standardize any particular rule language
- The categories presented in this subclause are intended for business people.
  - deeper logical analysis is provided in clause 10 of the SBVR specification (see later)

# Statements of Guidance



# 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.

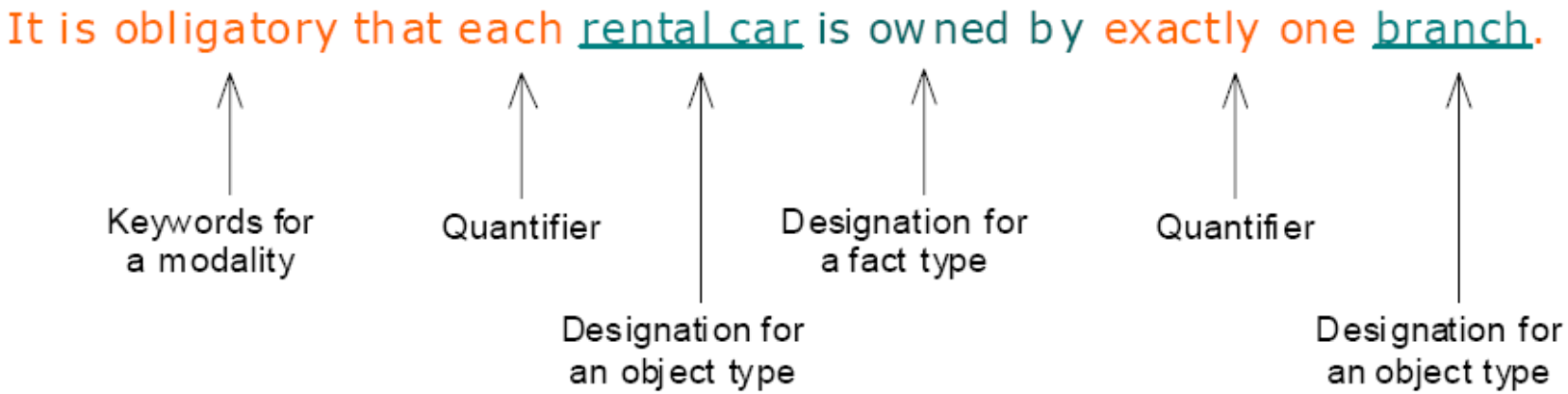
Note: One operative business rule can be expressed as various equivalent kinds of statements by introducing or removing negation. The following are examples of the same rule, expressed in three forms.

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."

# SBVR Structured English – An Example




(Chapin & Hall 2006)

# SBVR Structured English- Quantification

| | |
|---|---|
| each | universal quantification |
| some | existential quantification |
| at least one | existential quantification |
| at least $n$ | at-least-n quantification |
| at most one | at-most-one quantification |
| at most $n$ | at-most-n quantification |
| exactly one | exactly-one quantification |
| exactly $n$ | exactly-n quantification |
| at least $n$ and at most $m$ | numeric range quantification |
| more than one | at-least-n quantification with $n = 2$ |

# SBVR Structured English – Logical Operations

| | |
|---|---|
| it is not the case that $p$ | logical negation |
| $p$ and $q$ | conjunction |
| $p$ or $q$ | disjunction |
| $p$ or $q$ but not both | exclusive disjunction |
| if $p$ then $q$ | implication |
| $q$ if $p$ | implication |
| $p$ if and only if $q$ | equivalence (see exception explained under Modal Operations below) |
| not both $p$ and $q$ | nand formulation |
| neither $p$ nor $q$ | nor formulation |
| $p$ whether or not $q$ | whether-or-not formulation |

# SBVR Structured English – Modal Operations

| | |
|---|---|
| it is obligatory that *p* | obligation formulation |
| it is prohibited that *p* | obligation formulation embedding a logical negation |
| it is necessary that *p* | necessity formulation |
| it is impossible that *p* | necessity formulation embedding a logical negation |
| it is possible that *p* | possibility formulation |
| it is permitted that *p* | permissibility formulation |

The following key words are used within expressions having a verb to form verb complexes that add a modal operation.

| | |
|---|---|
| … must … | obligation formulation |
| … must not … | obligation formulation embedding a logical negation |
| … always … | necessity formulation |
| … never … | necessity formulation embedding a logical negation |
| … may … | permissibility formulation |

# SBVR Structured English – Modal Operations

The key word phrase "only if" is used in combination with some of the key words and phrases shown above to invert a modality.

| | | |
|---|---|---|
| … may … only if *p* | is equivalent to | … must not … if not *p* |
| it is permitted that *q* only if *p* | is equivalent to | it is obligatory that not *q* if not *p* |
| it is possible that *q* only if *p* | is equivalent to | it is necessary that not *q* if not *p* |

For example, the following two statements have the same meaning.

A car may be rented only if the car is available.

A car must not be rented if the car is not available.

The key word "only" can also be used before a preposition in combination with "may" to invert a modality. The noun phrase after the preposition is then understood as a negated restriction as shown in these two equivalent statements:

A car may be rented only to a licensed driver.

A car must not be rented to a person that is not a licensed driver.

Because of the use of "only" in stating modal operations, the pattern "*p* if and only if *q*" for equivalence is not used if *p* involves a modal operation.

# SBVR Structured English – Other Keywords

| | |
|---|---|
| the | 1. used with a designation to make a pronominal reference to a previous use of the same designation. This is formally a binding to a variable of a quantification.<br>2. introduction of a name of an individual thing or of a definite description |
| a, an | universal or existential quantification, depending on context based on English rules |
| another | (used with a term that has been previously used in the same statement) existential quantification plus a condition that the referent thing is not the same thing as the referent of the previous use of the term |
| a given | universal quantification pushed outside of a logical formulation where 'a given' is used such that it represents one thing at a time – this is used to avoid ambiguity where the 'a' by itself could otherwise be interpreted as an existential quantification. Within a definition, 'a given' introduces an auxiliary variable into the closed projection that formalizes the definition. |
| that | 1. when preceding a designation for a noun concept, this is a binding to a variable (as with 'the')<br>2. when after a designation for a noun concept and before a designation for a fact type, this is used to introduce a restriction on things denoted by the previous designation based on facts about them<br>3. when followed by a propositional statement, this used to introduce nominalization of the proposition or objectification, depending on whether the expected result is a proposition or an actuality. See C.1.5. |
| who | the same as the second use of 'that' but used for a person |
| *is of* | The common preposition "*of*" is used as a shorthand for "that *is of*." For any sentential form that takes the general form of '<placeholder 1> *has* <placeholder 2>' there is an implicit reversed form of '<placeholder 2> *is of* <placeholder 1>' that has the same meaning. |
| what | used to introduce a variable in a projection as well as indicate that a projection is being formulated to be considered by a question or answer nominalization. See C.1.5 below. |

# References


- OMG (2008): Semantics of Business Vocabulary and Business Rules (SBVR), v1.0, URL: http://www.omg.org/spec/SBVR/1.0 (17.10.2008)
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