

The background image shows a city street scene. On the left, there is a tall, white, multi-tiered church tower with a dark dome and a cross on top. To the right of the tower are several multi-story buildings with classical architectural features like columns and pediments. A blue banner with the word 'metasite' in white is visible in the lower left foreground. The sky is overcast with grey clouds.

metasite

On Business Rules

www.metasite.net

Agenda

- Motivation
- Why it is important for us
- Current state of our confidence – survey results
- Summary of current status of my research
- (Very) Short history of business rules
- MDE, MDA, MOF, SBVR
- SBVR specification
- SBVR Structured English

Motivation

- Was using BR-like statements before, but rarely called them by that name
- Have done little research of the topic before, although the topic is very interesting and important

Why is it important for us

- Business rules are part of our business analysis methodology
- Usage is left at the discretion of the business analysts

BR Survey

Do you agree with following statements:

1. I always know how to write a BR:

1 (Strongly disagree) – 10 (strongly agree)

2. I always know where in specification to put my BR:

1 (Strongly disagree) – 10 (strongly agree)

3. I rarely have situations when I have to explain my BRs to stakeholders (dev, qa, customer)

1 (Strongly disagree) – 10 (strongly agree)

4. We should be not wasting our time discussing BR topic

1 (Strongly disagree) – 10 (strongly agree)

BR Survey Results

Question	Average	Min	Max
1. I always know how to write a BR	7.8	7.0	9.0
2. I always know where in specification to put my BR	9.0	7.0	10.0
3. I rarely have situations when I have to explain my BRs to stakeholders	6.0	4.0	8.0
4. We should be not wasting our time discussing BR topic	2.8	1.0	4.0

Current state of BR usage

- There is some guidance, e.g. usage and formatting of Entities, Classifiers and Definitions.
- But mostly BA is on it's own to decide how to articulate business rules statements.

Are we happy with it?

- I think we have some room for improvement

Room for improvement

- “Business rules on business rules” would help us
 - Maintain consistency in our practice using business rules
 - Improve interchangeability of BA in projects (is there a such need?)
 - Communicate better with stakeholders
 - Improve our professional image in the company (it's good already, I think, but only sky is the limit)

My goal

- To come up with the draft of the document (2BR) by the end of the June
- Condition – approval of BA CL, Metasite BA community and TL.

Current status of my research

- ~20 articles on the topic, SVBR specification, Websites, whitepapers
- Vision about direction of the research
- Overall progress estimate – 30%

Problems of Natural Language

Nelken et al. on the problems in the analysis of natural language with regard to logic. Amongst other points they mention the following:

- Ambiguity and imprecision, e.g.:
 - Mismanagement of synonyms and homonyms
 - Conjunctors and disjunctors may be interpreted in several ways, changing the semantics of a sentence.
 - Use of plural to denote sets of entities without stating the exact properties of the sets (e.g., borders, duplicates, etc.)
- Links between sentences, e.g., mismanagement of the use of pronouns
- The temporal structure of specifications
 - Specifications are usually written in a generic present tense or future tense. This makes reasoning difficult for the intended temporal behavior.
 - Quantifications over events
- NELKEN, R., AND FRANCEZ, N. Automatic translation of natural language system specifications into temporal logic. In *Computer Aided Verification*, R. Alur and T. Henzinger, Eds., vol. 1102 of *Lecture Notes in Computer Science*. Springer Berlin / Heidelberg, 1996, pp. 360–371

Short history of Business Rules

- There is a history already (started in 1980's)
- Many names
- Business Rules Group (<http://www.businessrulesgroup.org/>)
 - Business Rules Manifesto (<http://www.businessrulesgroup.org/brmanifesto.htm>)
- ... other names as life and BR researches continue
- OMG and it's SBVR
- ... life continues bringing other names
 - KTU: Butleris, Nemuraitė, Skersys, Garšva, Kapočius, Danikauskas, Mickevičiūtė, Tutkutė, Butkienė,...

Business Rules Group

"Rules are a first-class citizen of the requirements world."

"Rules build on facts, and facts build on concepts as expressed by terms."

- **Primary Requirements, Not Secondary.** Rules are essential for, and a discrete part of, business models and technology models.
- **Separate From Processes, Not Contained In Them.** Rules apply across processes and procedures. There should be one cohesive body of rules, enforced consistently across all relevant areas of business activity.
- **Deliberate Knowledge, Not A By-Product.** Rules build on facts, and facts build on concepts as expressed by terms. Terms express business concepts; facts make assertions about these concepts; rules constrain and support these facts. Rules are basic to what the business knows about itself -- that is, to basic business knowledge. Rules need to be nurtured, protected and managed.
- **Declarative, Not Procedural.** Rules should be expressed declaratively in natural-language sentences for the business audience. A rule is distinct from any enforcement defined for it. A rule and its enforcement are separate concerns.
- **Well-Formed Expression, Not Ad Hoc.** Business rules should be expressed in such a way that they can be validated for correctness by business people. Business rules should be expressed in such a way that they can be verified against each other for consistency.
- **For the Sake of the Business, Not Technology.** Rules are about business practice and guidance; therefore, rules are motivated by business goals and objectives and are shaped by various influences. The cost of rule enforcement must be balanced against business risks, and against business opportunities that might otherwise be lost.
- **Of, By and For Business People, Not IT People.** Rules should arise from knowledgeable business people.
- **Managing Business Logic, Not Hardware/Software Platforms.** Rules, and the ability to change them effectively, are fundamental to improving business adaptability.

OMG – Object Management Group

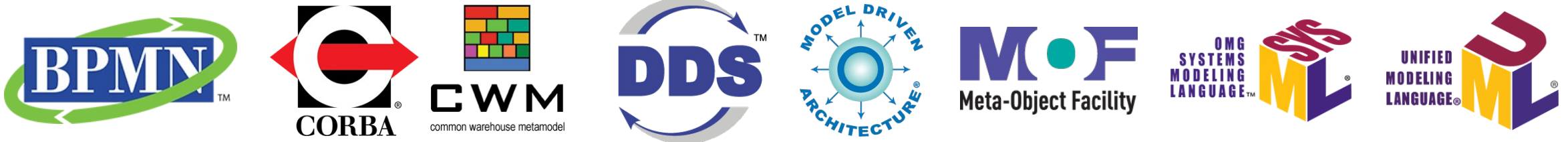


■ ABOUT OMG

- The Object Management Group® ([OMG®](https://www.omg.org)) is an international, open membership, not-for-profit **technology standards** consortium, founded in 1989.

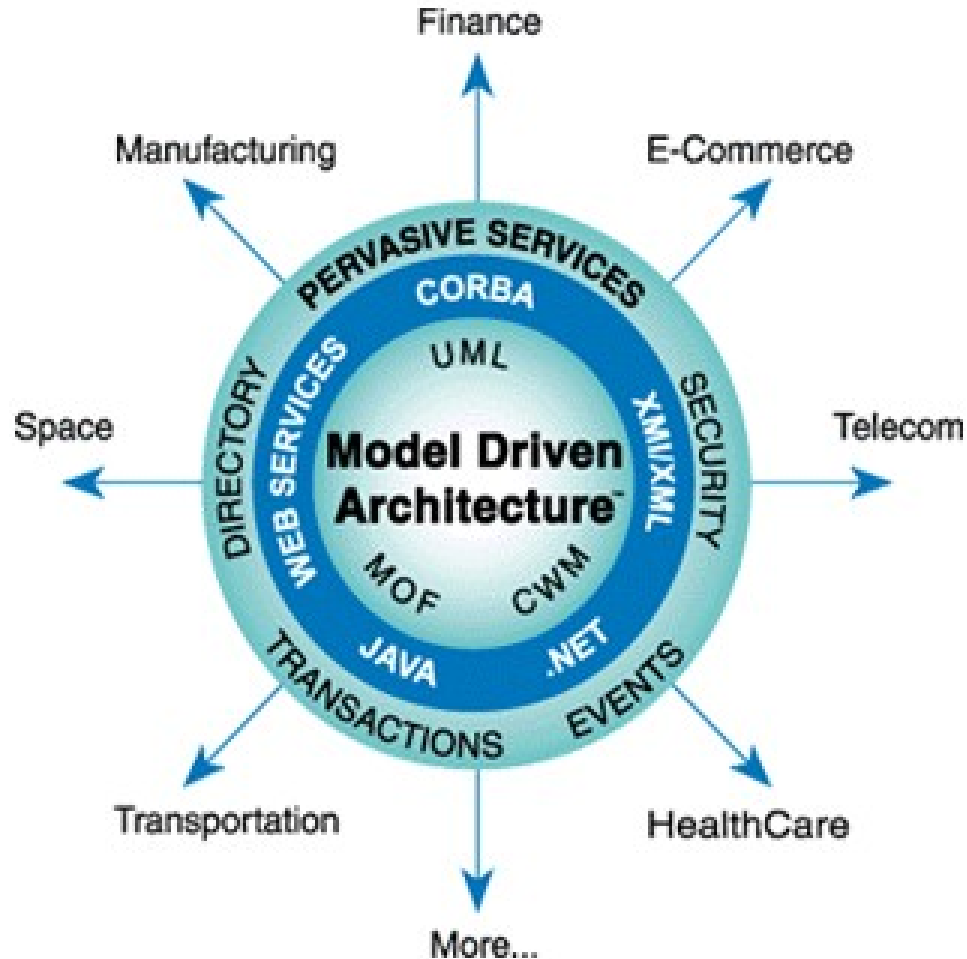
■ MISSION STATEMENT

- The mission of the Object Management Group (OMG) is to develop technology standards that provide real-world value for thousands of vertical industries. OMG is dedicated to bringing together its international membership of end-users, vendors, government agencies, universities and research institutions to develop and revise these standards as technologies change throughout the years.



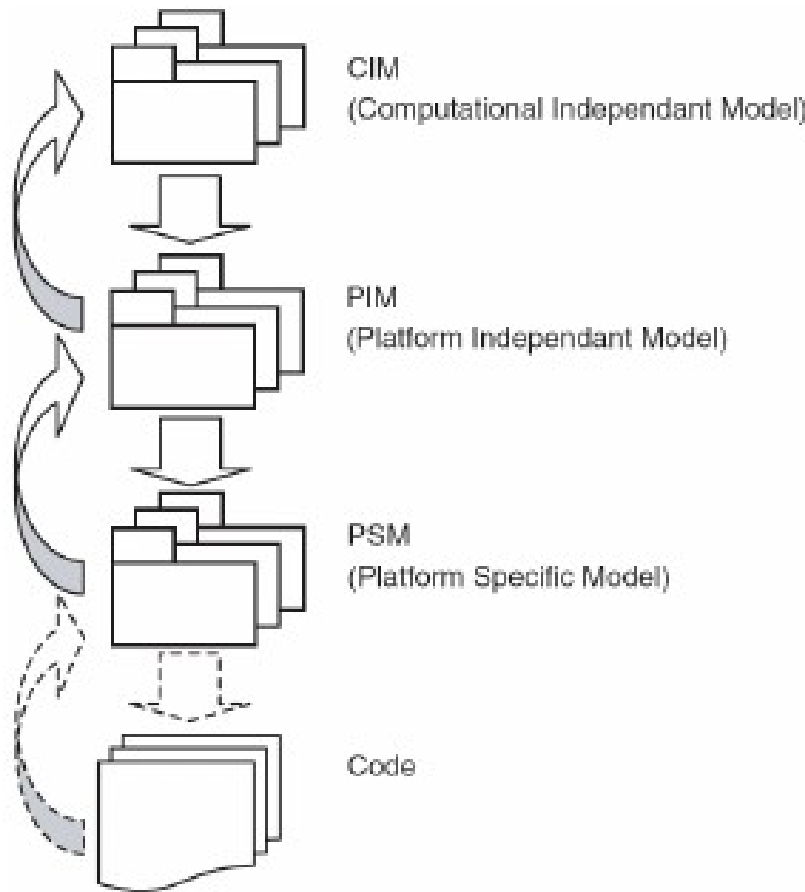
MDA – Model Driven Architecture

Implementation of MDE (Model Driven Engineering)



- Model Driven Architecture® (MDA®) is an approach to software design, development and implementation spearheaded by the OMG.
- MDA provides guidelines for structuring software specifications that are expressed as models.

MDA layers



■ CIM – Computational Independent Model

MDA-wise Business Rules are here

■ PIM – Platform Independent Model

■ PSM – Platform Specific Model

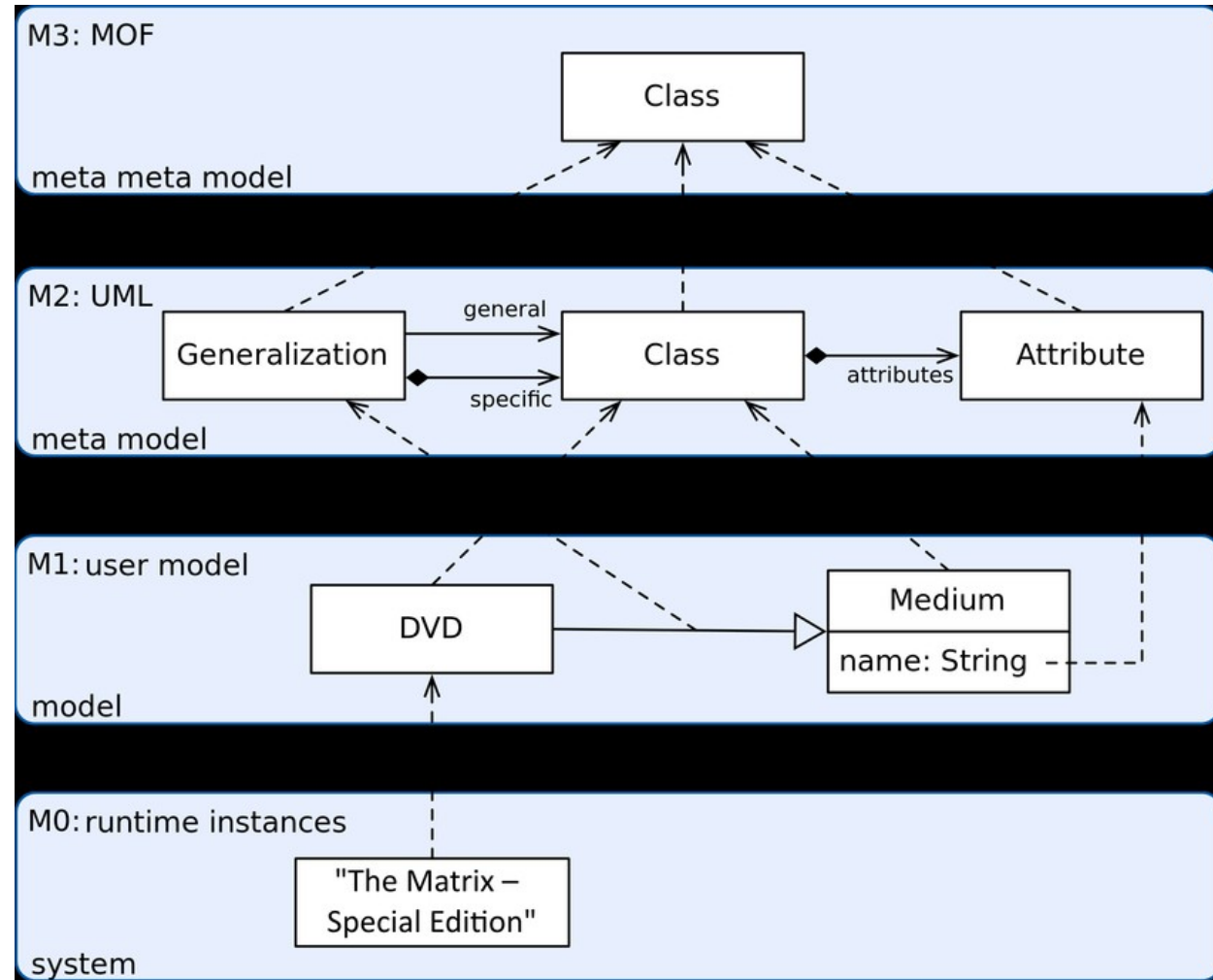
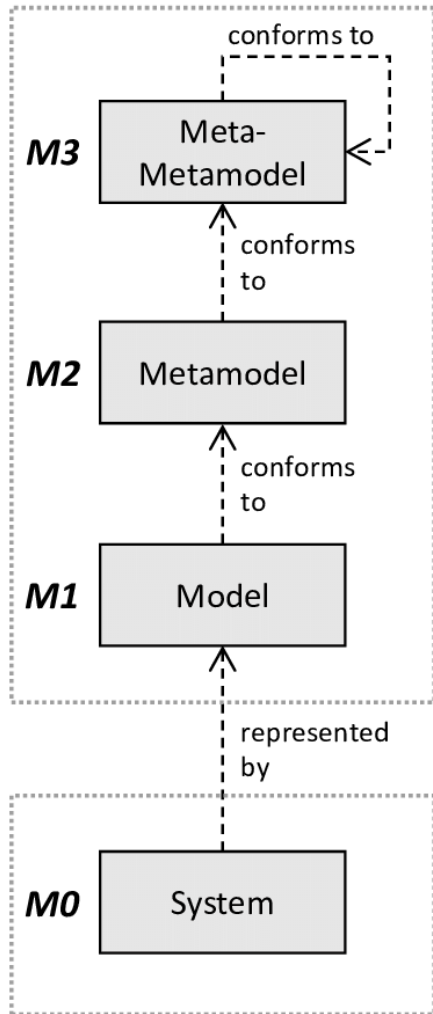
■ Code

MOF – Meta-Object Facility



- The MetaObject Facility Specification™ (MOF™) is the foundation of OMG's industry-standard environment where models can be exported from one application, imported into another, transported across a network, stored in a repository and then retrieved, rendered into different formats (including XMI™, OMG's XML-based standard format for model transmission and storage), transformed, and used to generate application code.

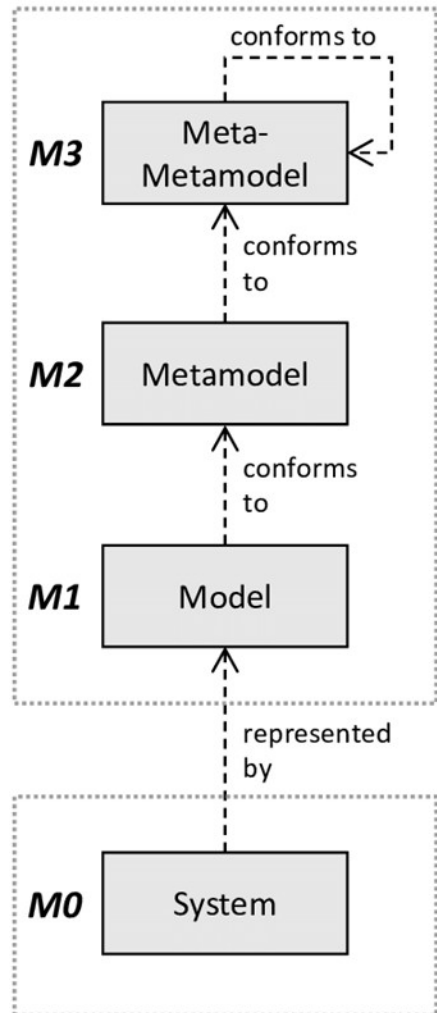
MOF



SBVR - Semantics of Business Vocabulary and Business Rules

- The Semantics of Business Vocabulary and Business Rules (SBVR) is an **MOF based metamodel** standardized by the OMG. SBVR enables giving **business rules** and **domain concepts** a precise semantics based on the SBVR meta model and, at the same time, making business rules/vocabulary libraries exchangeable by providing an XMI based data format.
- OMG Document Number: formal/2019-10-02 [SMSC/19-10-02]
Release Date: October 2019
Standard document URL: <https://www.omg.org/spec/SBVR/1.5/PDF>

SBVR place in MOF



SBVR specification is MOF metamodel

BPMN – SBVR integration

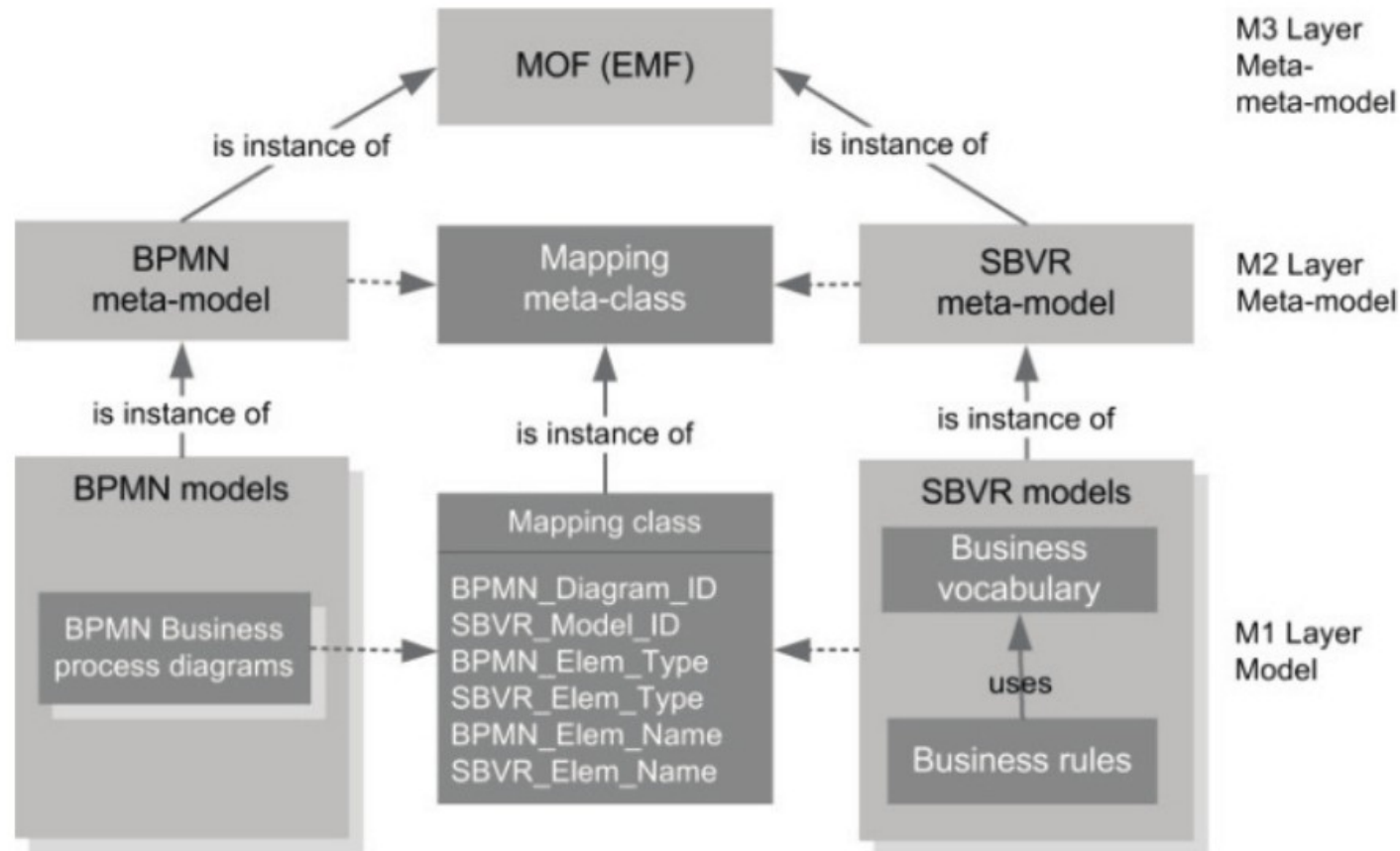


Figure 2. The principle of BPMN-SBVR integration in OMG's Model Driven Architecture

SBVR Applicability

- The SBVR specification is applicable to the domain of business vocabularies and business rules of all kinds of business activities in all kinds of organizations. It provides an unambiguous, meaning-centric, multilingual, and semantically rich capability for defining meanings of the language used by people in an industry, profession, discipline, field of study, or organization.

SBVR Aplicability

This specification is conceptualized optimally for business people rather than automated processing. It is designed to be used for business purposes, independent of information systems designs to serve these business purposes:

- Unambiguous definition of the meaning of business concepts and business rules, consistently across all the terms, names and other representations used to express them, and across the natural languages in which those representations are expressed, so that they are not easily misunderstood either by “ordinary business people” or by lawyers.
- Expression of the meanings of concepts and business rules in the wordings used by business people, who may belong to different communities, so that each expression wording is uniquely associated with one meaning in a given context.
- Transformation of the meanings of concepts and business rules as expressed by humans into forms that are suitable to be processed by tools, and vice versa.
- Interpretation of the meanings of concepts and business rules in order to discover inconsistencies and gaps within an SBVR Content Model (see 2.4) using logic-based techniques.
- Application of the meanings of concepts and business rules to real-world business situations in order to enable reproducible decisions and to identify conformant and non-conformant business behavior.
- Exchange of the meanings of concepts and business rules between humans and tools as well as between tools without losing information about the essence of those meanings.

Definitions

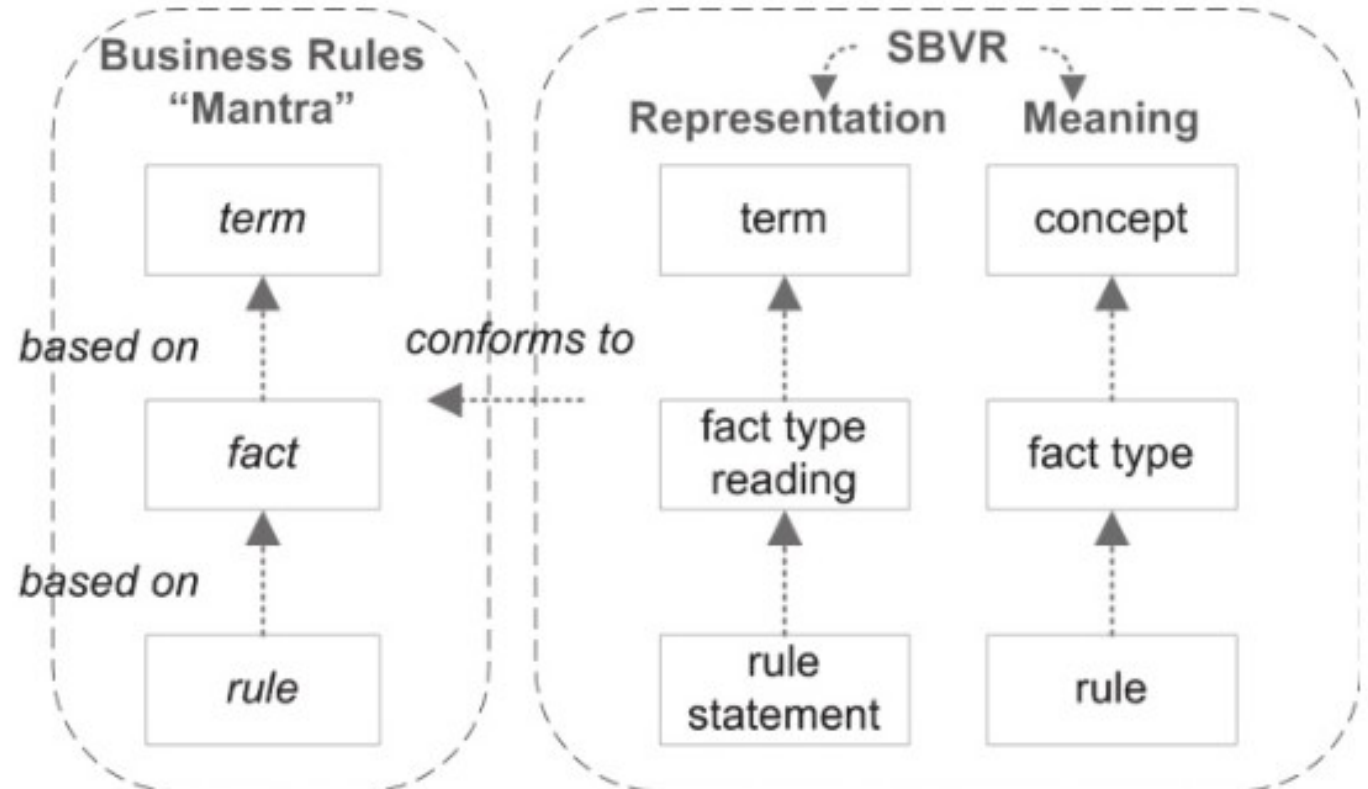
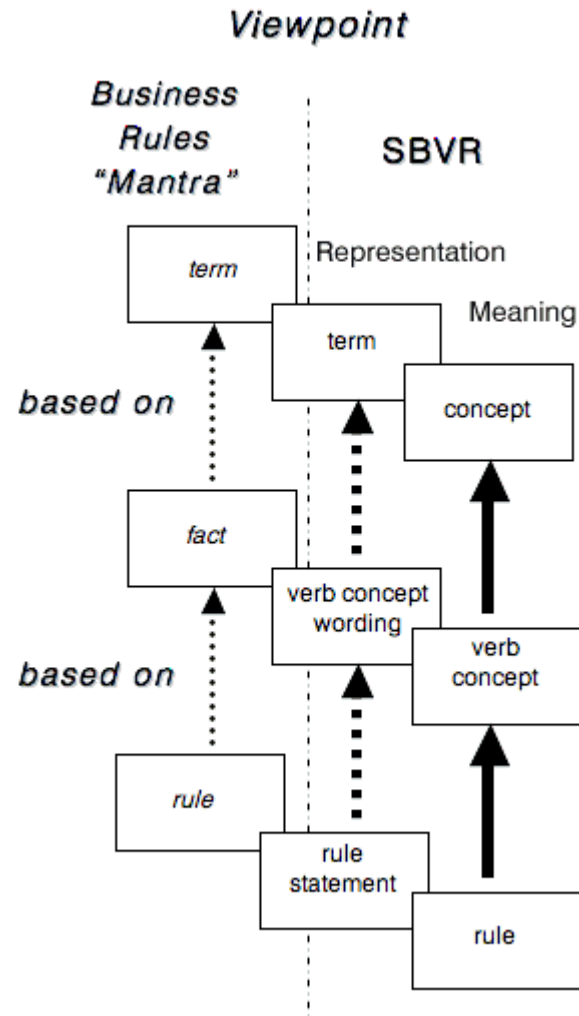
Business Vocabulary

vocabulary that is under business jurisdiction

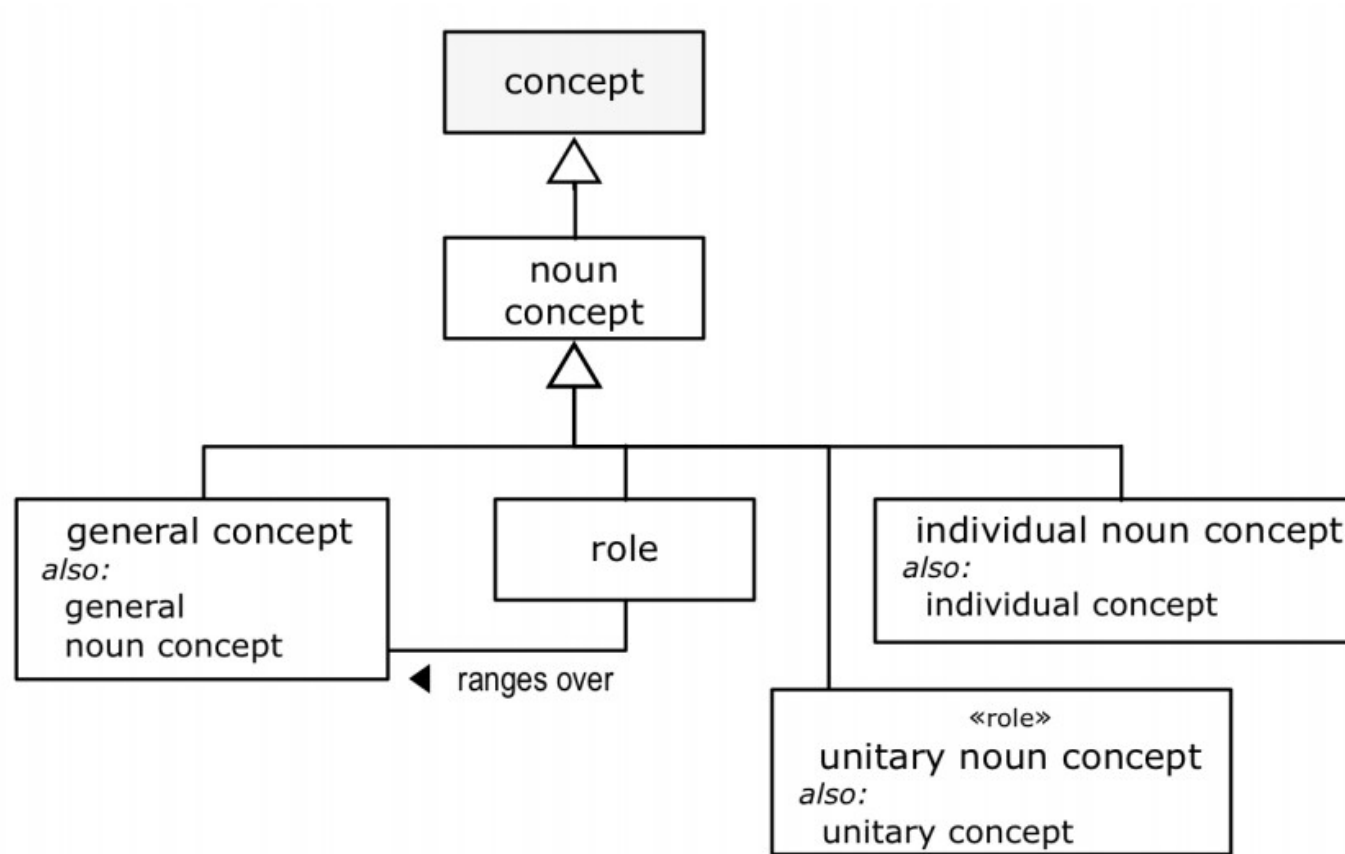
Business Rule

rule that is under business jurisdiction

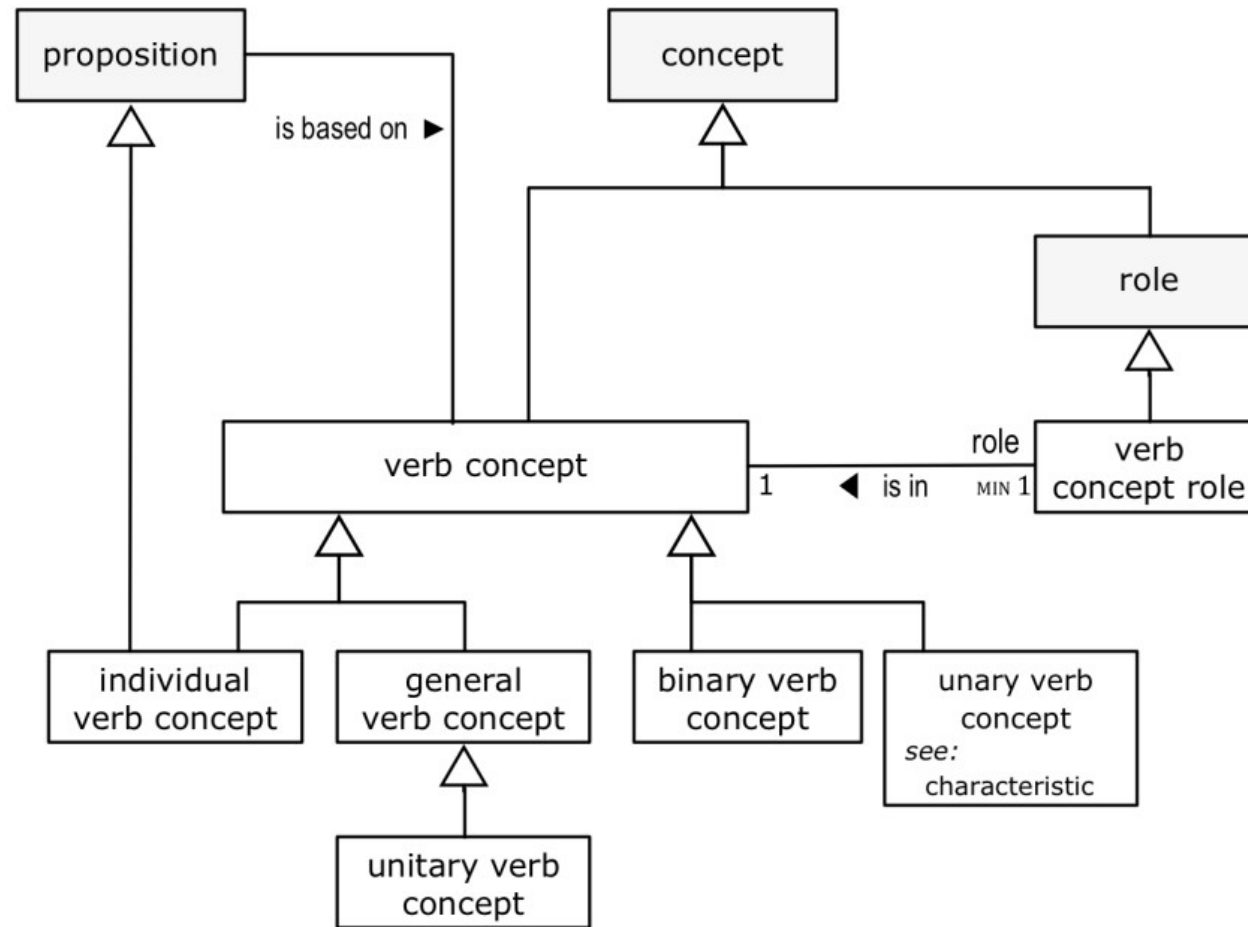
BR Mantra – SBVR



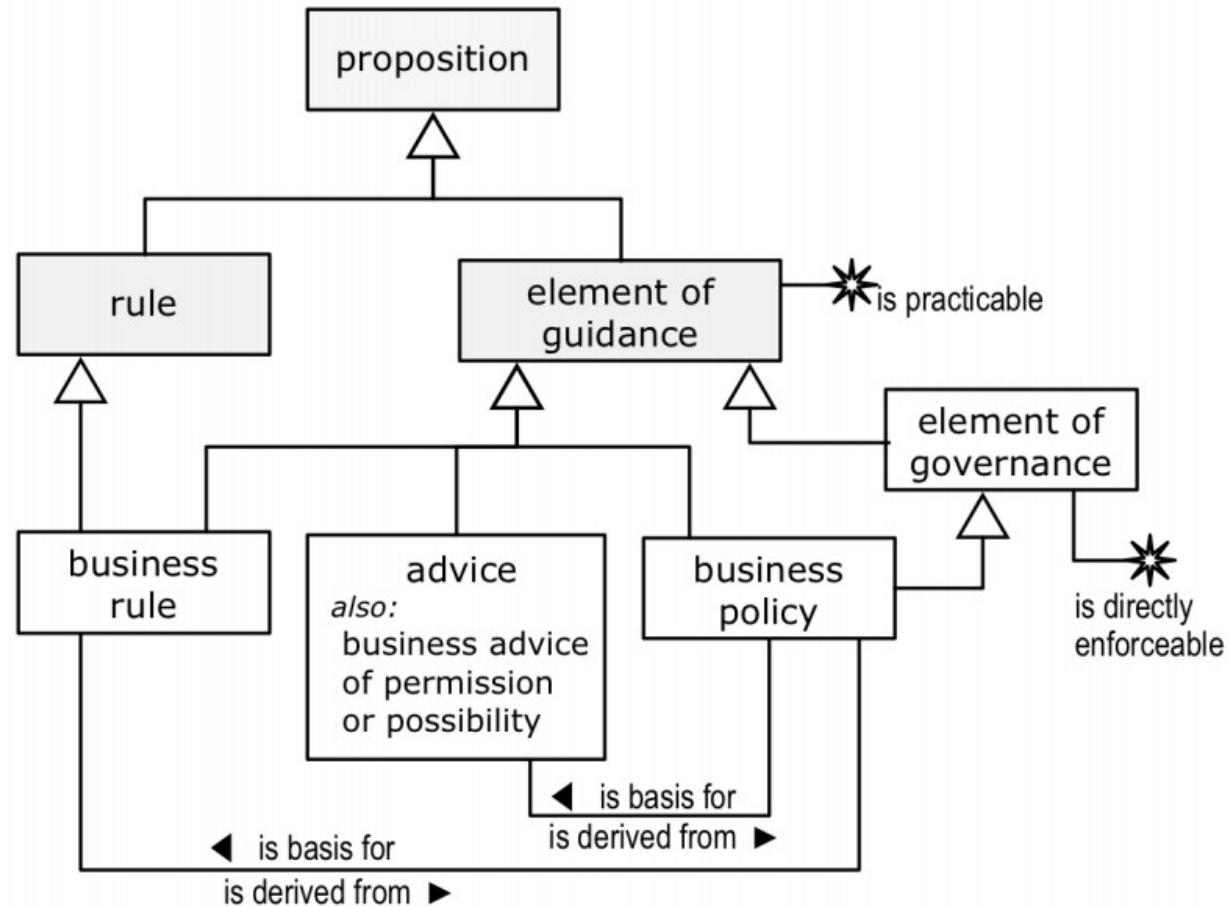
Noun Concept



Verb Concept



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Business Rule

Definition:

General Concept:

Note:

rule that *is practicable* and that *is under* business jurisdiction
element of guidance

A rule's being under business jurisdiction means that it is under the jurisdiction of an authority that can opt to change or discard the rule at its own discretion. Laws of physics may be relevant to a company; legislation and regulations may be imposed on it; external standards and best practices (other than business rules) may be relied upon. These things are not business rules from the company's perspective, since it does not have the standing to change them. The company will decide how to react to laws and regulations, and will create or adopt business rules to ensure compliance with the laws and regulations. Similarly, it will create or adopt business rules to ensure that standards or best practices (other than business rules) are implemented as intended.

Fundamental Principles for Elements of Guidance

■ The Severability Principle

The meaning of an element of guidance may be expressed separately from any other element of guidance; nonetheless, a body of shared guidance that includes the element of guidance will be evaluated as if all the elements of guidance had been expressed jointly and all had to hold true.

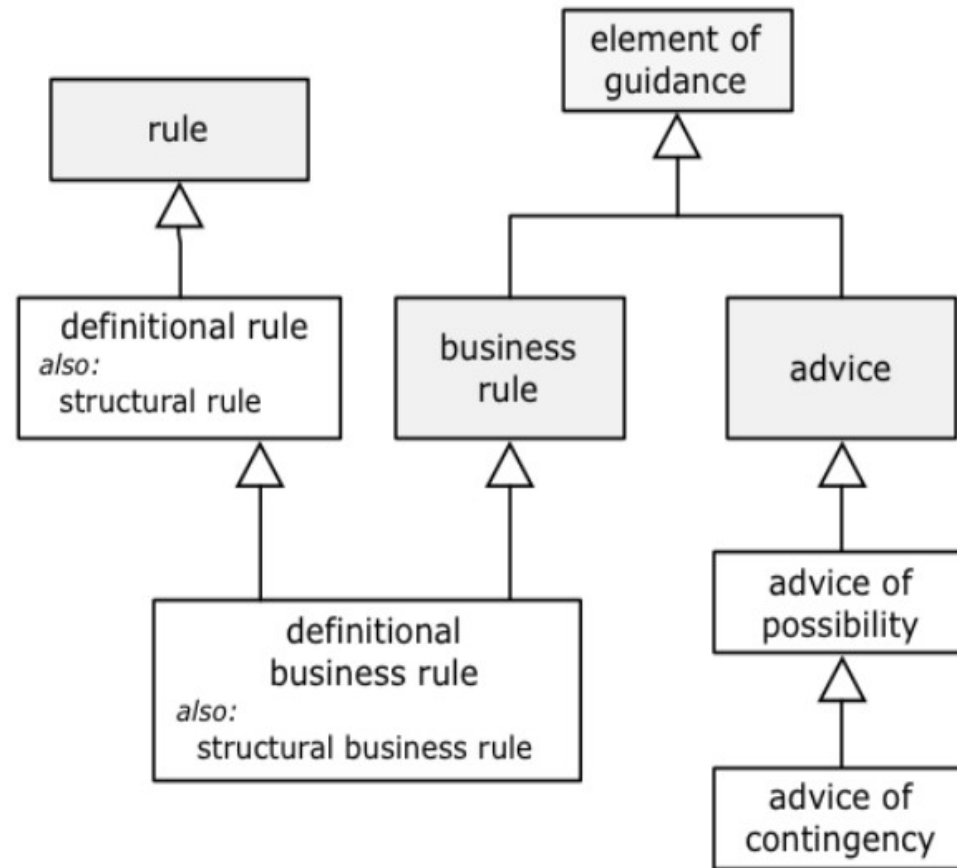
■ The Accommodation Principle

An element of guidance whose meaning conflicts with some other element(s) of guidance must be taken that way; if no conflict is intended, the element(s) of guidance must be expressed in such a way as to avoid the conflict.

■ The Wholeness Principle

An element of guidance means only exactly what it says, so it must say everything it means.

Definitional Elements of Guidance



Definitional Rules

definitional rule

Definition:

rule that *necessitates* a given state of affairs

Synonym:

structural rule

Example:

Newton's first law of motion is a "rule of nature" - i.e., not under business jurisdiction. This definitional rule is commonly expressed as:

A body at rest will stay at rest unless acted on by an outside force.

Example:

EU-Rent requires that a rental is for one car group (economy, compact, full-size, etc.).

This definitional business rule can be expressed as:

It is necessary that each rental *has* exactly one car group.

Alternatively:

Each rental always *has* exactly one car group.

Definitional Advices

advice of possibility

Definition:

advice that acknowledges as possible a given state of affairs

Note:

Every definitional rule implies an advice of possibility. Consider the definitional rule expressed as:

Each rental always has exactly one car group

This definitional rule implies an advice of possibility that can be expressed as:

It is possible that a rental has exactly one car group.

Alternatively:

A rental can have exactly one car group

There is no practical reason, however, to express the advice of possibility implied by a definitional rule explicitly. In such cases, best practice generally favors keeping the number of elements of guidance to be managed to a minimum.

Example:

(In a bank) The element of guidance that “It is possible that an account balance is negative.”

Definition:

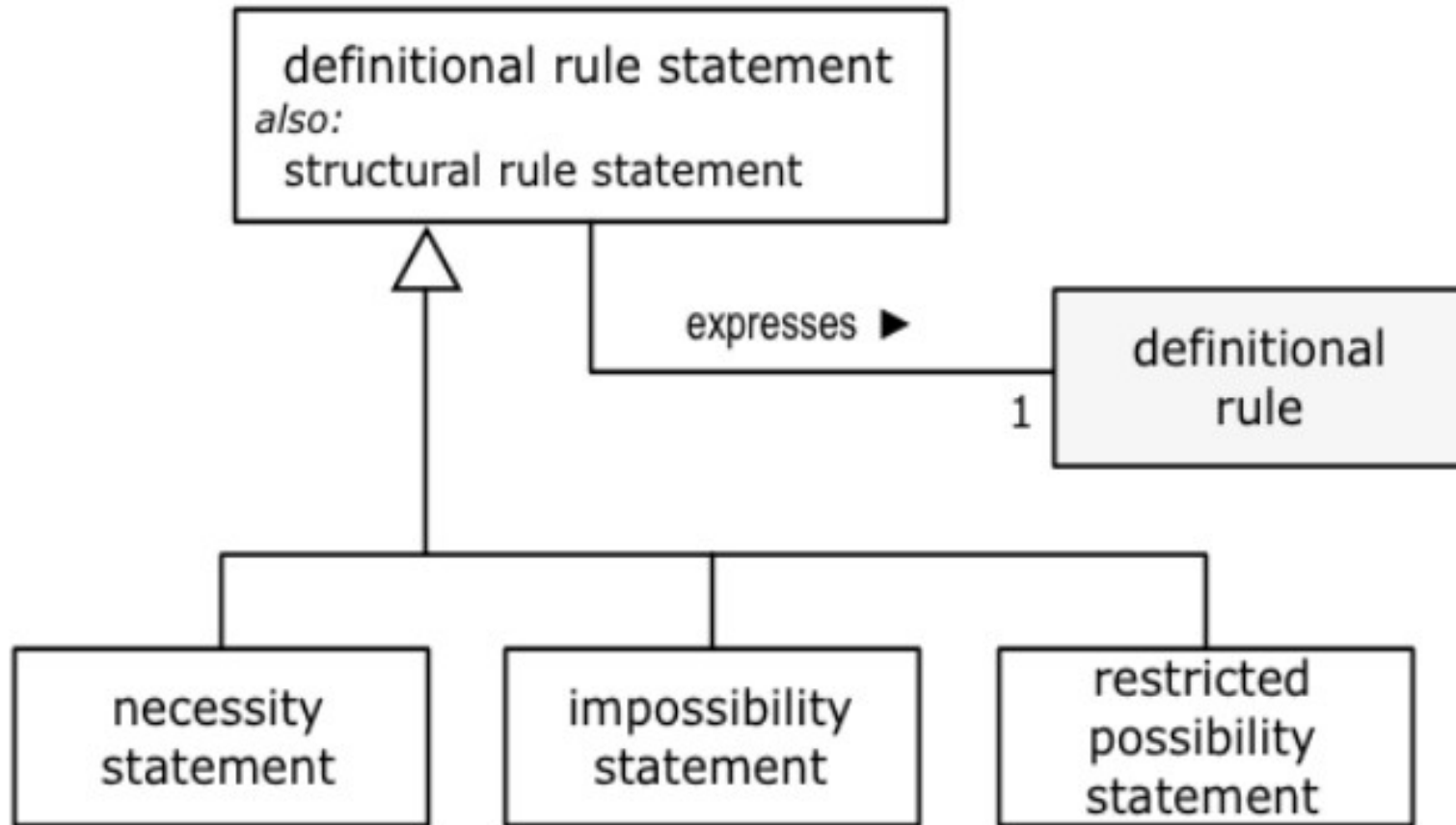
No advice of possibility is an advice of permission.

Definitional Advices

advice of contingency

Definition:	advice of possibility that does not necessitate a given state of affairs
Note:	The purpose of an advice of contingency is to preempt application of definitional “rules” that might be assumed to exist, but are not actually included in the body of shared guidance of the authority. Often, the reason for this assumption in a business is that other, similar businesses have such rules. Typically, the reason for providing such explicit advice is that people in the business have mistakenly applied the non-existent rule in the past.
Example:	(In EU-Rent) Advising that it is not necessary for a qualified driver to be over 21. This might be expressed in various ways, for example as: “It is neither necessary nor impossible that the age of a qualified driver is at least 21,” or “It is possible (but not necessary) that a qualified driver be under 21.”

Statements of Definitional Rules



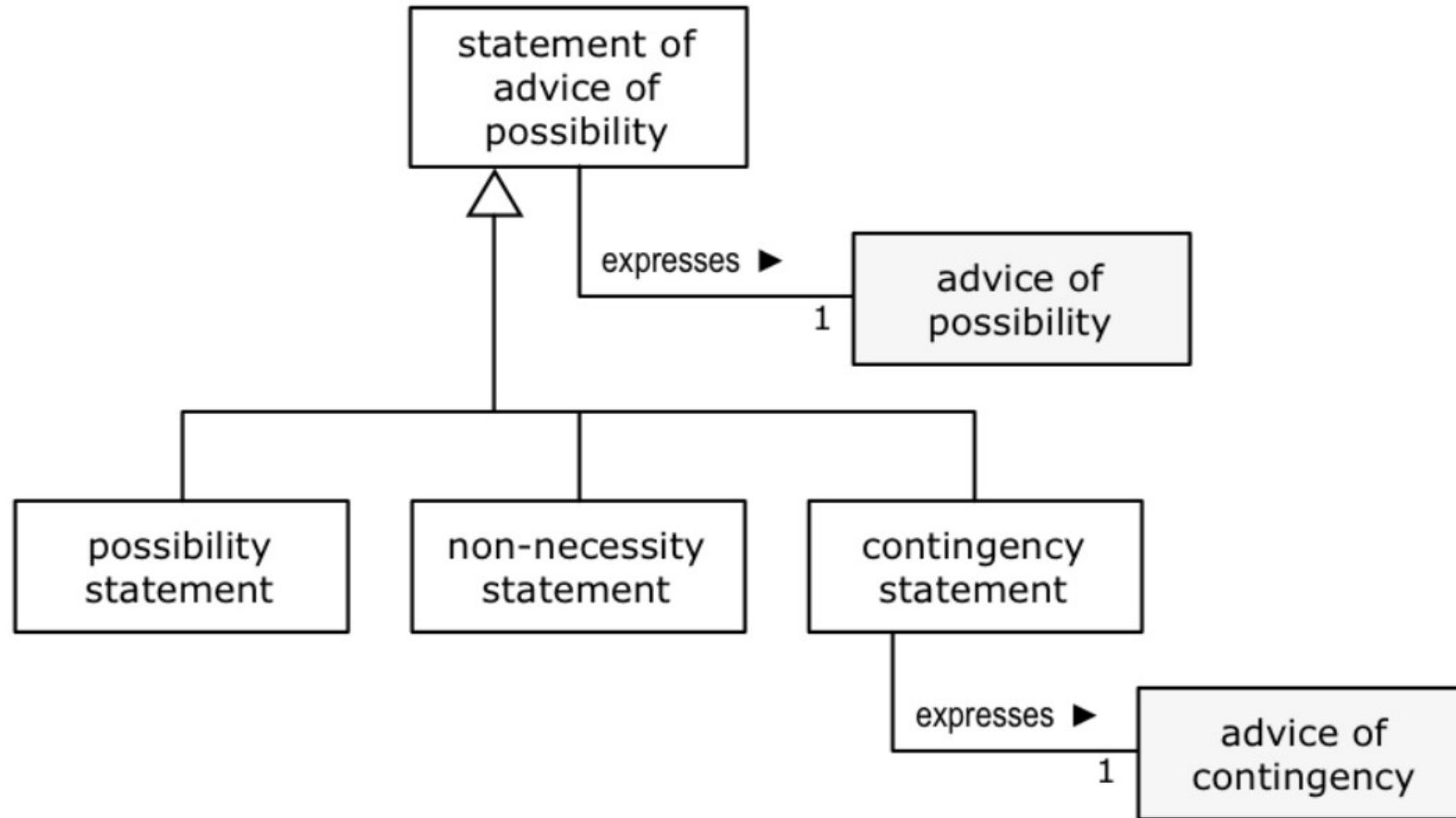
Statements of Definitional Rules

definitional rule statement

Definition:	rule statement that expresses a definitional rule
Synonym:	structural rule statement
Note:	One definitional 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.”

Statements of Definitional Advices

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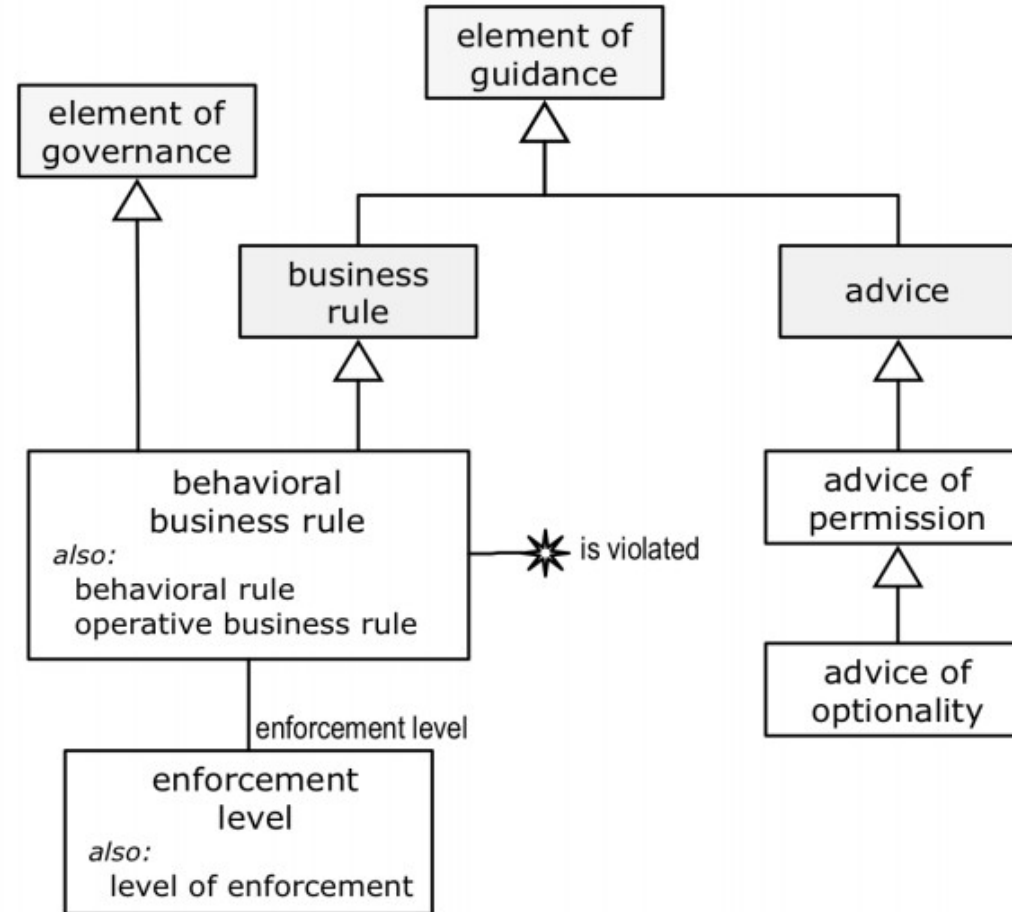


Statements of Definitional Advices

statement of advice of possibility

Definition:	advice statement that expresses an advice of possibility
Example:	“The notification date/time of a bad experience that occurs during a rental can be after the actual return date/time of the rental.”
Necessity:	No statement of advice of possibility is a statement of advice of permission.
Note:	One advice of possibility can be expressed as various equivalent kinds of statements by introducing or removing negation. The following are examples of the same advice, expressed in two forms.
Example:	[as a possibility statement] “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.”
Example:	[as a non-necessity statement] “It is not necessary that the notification date/time of a bad experience that occurs during a rental be on or before the actual return date/time of the rental.”

Behavioral Elements of Guidance



Behavioral Rules

behavioral business rule

Definition:

Example:

business rule that *obligates* a given state of affairs

It is obligatory that each open rental *is guaranteed by* a credit card that *is held by* the renter who *is responsible for* the rental

Alternatively:

Each open rental *must be guaranteed by* a credit card that *is held by* the renter who *is responsible for* the rental

Definition:

Dictionary Basis:

element of governance that *is directly enforceable*

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']

Behavioral Advices

advice of permission

Definition:

advice that *permits* a given state of affairs

Note:

Every behavioral business rule implies an advice of permission. Consider the behavioral business rule expressed as:

Each open rental must be guaranteed by a credit card that is held by the renter who is responsible for the rental.

This behavioral business rule implies an advice of permission that can be expressed as:

It is permitted that an open rental be guaranteed by a credit card that is held by the renter who is responsible for the rental.

Behavioral Advices

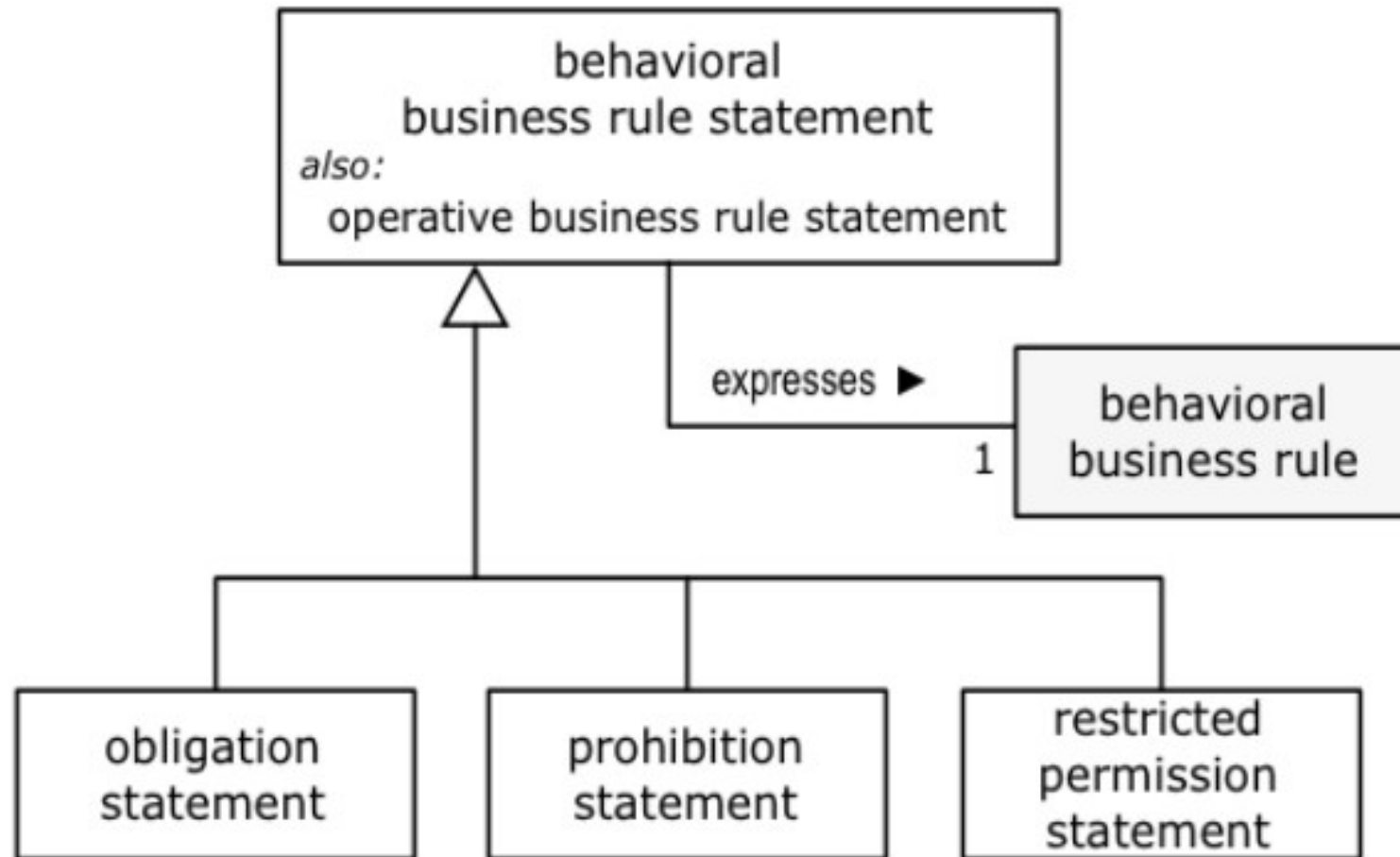
advice of optionality

Definition: advice of permission *that does not obligate a given* state of affairs

Note: The purpose of an advice of optionality is to preempt application of behavioral "rules" that might be assumed to exist, but are not actually included in the body of shared guidance of the authority. Often, the reason for this assumption in a business is that other, similar businesses have such rules. Typically, the reason for providing such explicit advice is that people in the business have mistakenly applied the non-existent rule in the past.

Example: (In EU-Rent) Advising that it is not obligatory that a renter show picture identification at the time of a rental pick-up. This might be expressed in various ways, for example as: “It is neither obligatory nor prohibited that at rental pick-up time the renter shows picture identification,” or “It is not obligatory (but permitted) that a renter shows picture id in order to pick up his car.”

Statements of Behavioral Rules



Statements of Behavioral Rules

behavioral business rule statement

Definition:	rule statement that expresses a behavioral business rule
Synonym:	operative business rule statement
Necessity:	No behavioral business rule statement is a definitional rule statement.
Note:	One behavioral 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.”

Statements of Behavioral Rules

obligation statement

Definition:	behavioral business rule statement that is worded as the state of affairs <i>being obligated</i>
Note:	Contrast this with a behavioral business rule statement worded as the state of affairs being prohibited.
Necessity:	No obligation statement <i>is</i> a prohibition statement.
Necessity:	No obligation statement <i>is</i> a restricted permission statement.
Example:	“It is obligatory that a rental incurs a location penalty charge if the drop-off location of the rental is not the EU-Rent site of the return branch of the rental.”

Statements of Behavioral Rules

prohibition statement

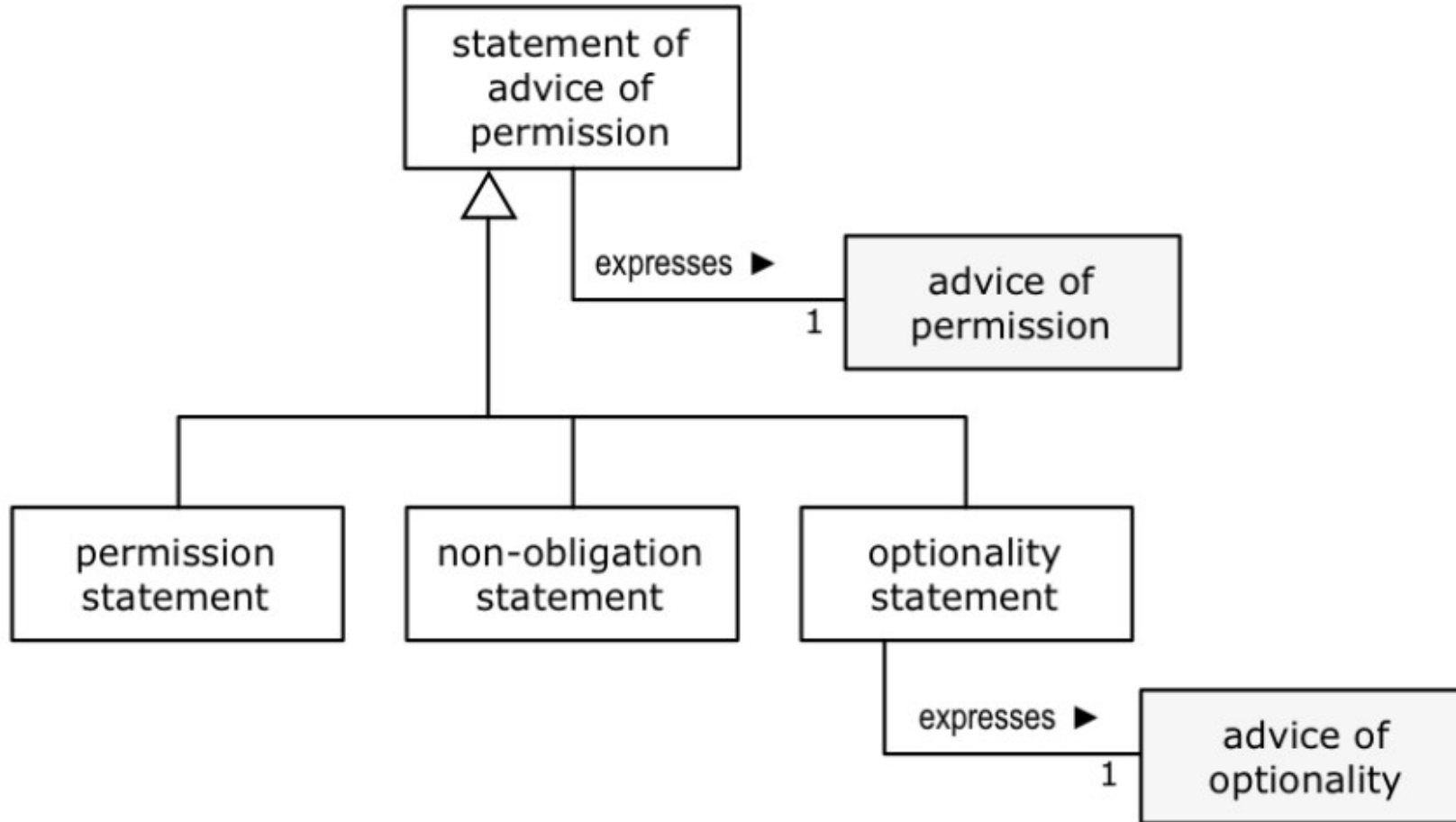
Definition:	behavioral business rule statement that is worded as the state of affairs <i>being prohibited</i>
Note:	Contrast this with a behavioral business rule statement worded as the state of affairs being obligated.
Necessity:	
Example:	No prohibition statement <i>is</i> a restricted permission statement.
Example:	“It is prohibited that the duration of a rental be more than 90 rental days.” “The duration of a rental must not be more than 90 rental days.”

Statements of Behavioral Rules

restricted permission statement

Definition:	behavioral business rule statement that is worded as the state of affairs <i>being permitted</i> only if a given condition is met
Example:	“It is permitted that a rental is open only if an estimated rental charge is provisionally charged to the credit card of the renter of the rental.”
Example:	“A rental may be open only if an estimated rental charge is provisionally charged to the credit card of the renter of the rental.”
Note:	A restricted permission statement should not be confused with a statement of advice of permission. The latter should never contain ‘only’, which is always interpreted as eliminating or diminishing a degree of freedom (i.e., indicating the presence of a rule). This inclusion of ‘only’ is the key characteristic of restricted permission statements

Statements of Behavioral Advices



Statements of Behavioral Advices

statement of advice of permission

Definition:	advice statement that expresses an advice of permission
Note:	One advice of permission can be expressed as various equivalent kinds of statements by introducing or removing negation. The following are examples of the same advice, expressed in alternative forms.
Example:	[as a permission statement] “It is permitted that the drop-off branch of a rental is not the return branch of the rental.”
Example:	[as a non-obligation statement] “It is not obligatory that the drop-off branch of a rental be the return branch of the rental.”
Example:	[as a non-obligation statement] “The drop-off branch of a rental need not be the return branch of the rental.”

Statements of Behavioral Advices

permission statement

Definition:	statement of advice of permission that is worded as the state of affairs <i>being permitted</i>
Note:	Contrast this with a statement of advice of permission worded as the state of affairs being not obligated.
Necessity:	No permission statement <i>is</i> a non-obligation statement.
Example:	“It is permitted that the drop-off branch of a rental is not the return branch of the rental.”
Example:	“The drop-off branch of a rental need not be the return branch of the rental.”

Statements of Behavioral Advices

non-obligation statement

Definition:	statement of advice of permission that is worded as the state of affairs not being obligated
Note:	Contrast this with a statement of advice of permission worded as the state of affairs being permitted.
Example:	“It is not obligatory that the drop-off branch of a rental be the return branch of the rental.”
Example:	“The drop-off branch of a rental need not be the return branch of the rental.”

Statements of Behavioral Advices

optionality statement

Definition:	statement of advice of permission <i>that expresses an</i> advice of optionality
Note:	An <i>optionality statement</i> may take various forms, each expressing the meaning of the same <i>advice of optionality</i> , as illustrated by the following examples.
Example:	“It is neither prohibited nor obligatory that the renter shows photo identification at the pick-up time of a rental.”
Example:	“It is permitted but not obligatory that the renter shows picture identification at the pick-up time of the rental.”

Rule (Modelling) Languages

- SBVR Structured English
 - OMG specification
- The RuleSpeak™ (<http://www.rulespeak.com/en/>)
 - By Business Rule Solutions, LLC

SBVR Structured English

- Business Vocabularies
- Business Rules

4 font styles

- term – for a designation for a noun concept
- Name – for a designation of an individual noun concept
- *verb* – for a designation for verb concepts
- keyword – for linguistic symbols used to construct statements

Quantification

each	<u>universal quantification</u>
some	<u>existential quantification</u>
at least one	<u>existential quantification</u>
at least n	<u>at-least-n quantification</u>
at most one	<u>at-most-one quantification</u>
at most n	<u>at-most-n quantification</u>
exactly one	<u>exactly-one quantification</u>
exactly n	<u>exactly-n quantification</u>
at least n and at most m	<u>numeric range quantification</u>
more than one	<u>at-least-n quantification</u> with $n = 2$
no	<u>logical negation</u> whose <u>logical operand</u> is an <u>existential quantification</u>

Logical operations

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

Modal operations

it is obligatory that p	<u>obligation formulation</u>	... must ...	<u>obligation formulation</u>
it is prohibited that p	<u>obligation formulation</u> embedding a <u>logical negation</u>	... must not ...	<u>obligation formulation</u> embedding a <u>logical negation</u>
it is necessary that p	<u>necessity formulation</u>	... need not ...	the negation of <u>obligation formulation</u> (i.e., non-obligation)
it is impossible that p	<u>necessity formulation</u> embedding a <u>logical negation</u>	... always ...	<u>necessity formulation</u>
it is possible that p	<u>possibility formulation</u>	... never ...	<u>necessity formulation</u> embedding a <u>logical negation</u>
it is permitted that p	<u>permissibility formulation</u>	... can ...	<u>possibility formulation</u>
		... may ...	<u>permissibility formulation</u>

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

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.
 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’).
 2. when after a designation for a noun concept and before a designation for a verb concept, this is used to introduce a restriction on things denoted by the previous designation based on facts about them.
 3. when followed by a propositional statement, this is used to introduce a nominalization of the proposition or an objectification, depending on whether the expected result is a proposition or a state of affairs. See A.2.5.
- 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 A.2.5 below.