Semantics of Business Vocabulary and Business Rules (SBVR)

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Agenda

- Introduction to SBVR
- SBVR and Information System Modeling
- Overview of SBVR
- SBVR Architecture
- Context for Meaning
- Business Vocabulary (vs. Business Rules)
- Integration by Vocabulary Adoption
- Business Rules: Building on Business Vocabulary
- Formal Logics
- What Next?

Introduction to SBVR

- Semantics of Business Vocabulary and Business Rules (SBVR)
- A metamodel for developing semantic models of business vocabularies and business rules
  - Developed in response to OMG RFP “Business Semantics of Business Rules”
  - Team drawn from 17 organizations in 7 countries
- Adopted by OMG in September 2005
- Scheduled for finalization as an OMG specification in September 2006
- Available for comment and issues at

  www.omg.org/docs/dtc/06-03-02.pdf

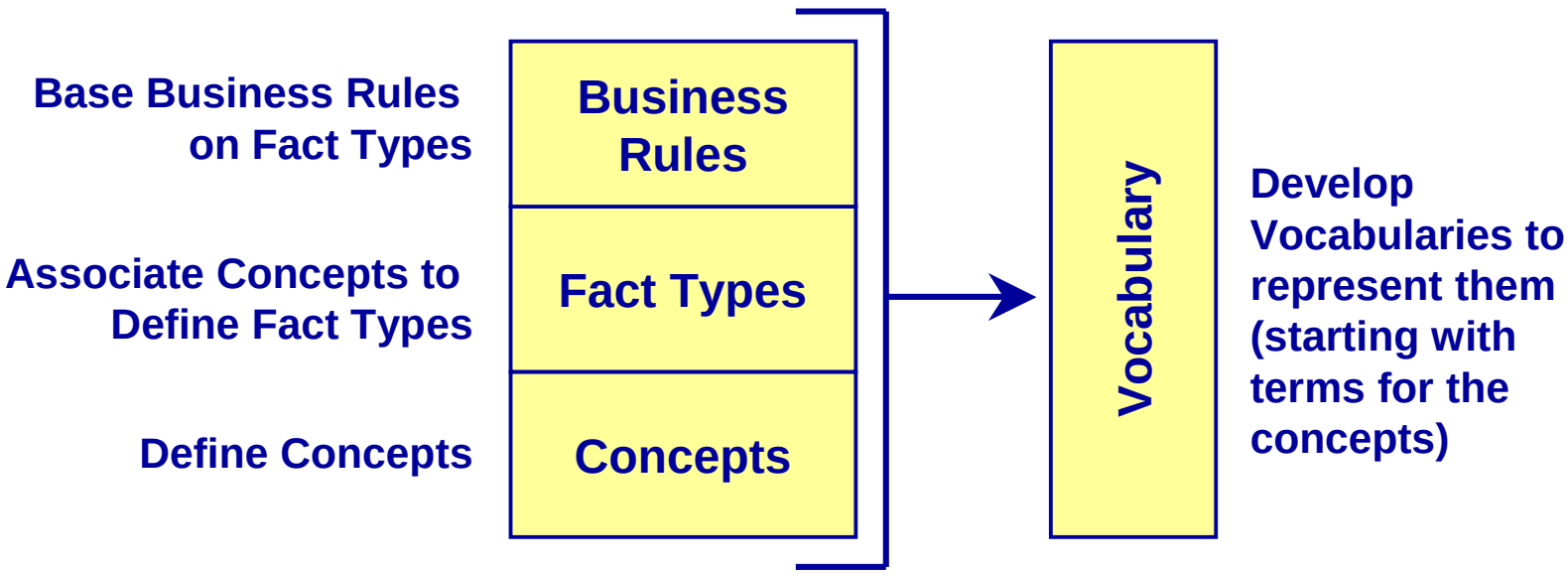
EU-Rent Case Study

- EU-Rent is a (fictitious) car rental company, used to provide coherent examples in SBVR, and in this tutorial
- The business requirements are fairly simple:
  - EU-Rent operates in several countries; in each country it has local areas containing branches
  - EU-Rent rents cars to customers from branches; one-way rentals are allowed
  - Rentals may be booked in advance or “walk-in”
  - Cars are owned by local areas and stored at branches
  - Each car is of a given model; car models are grouped into car groups; all the cars in a car group have the same rental tariff
  - Cars are serviced at 5,000 mile intervals
  - EU-Rent notes “bad experiences” with drivers (police action, unpaid parking fines, cars damaged or not returned to EU-Rent branches, etc) and may bar drivers who cause them.

What will SBVR do?

SBVR realizes the 'Business Rules Mantra':

"Rules are built on Facts. Facts are built on Terms."



… to describe businesses, not the IT systems that serve them

… in language understandable by business people

Preview: making a business rule

Start with a fact type, e.g.

rental *has* driver

Add a modal operator (from a limited set: “it is obligatory”, “it is necessary” …), e.g.

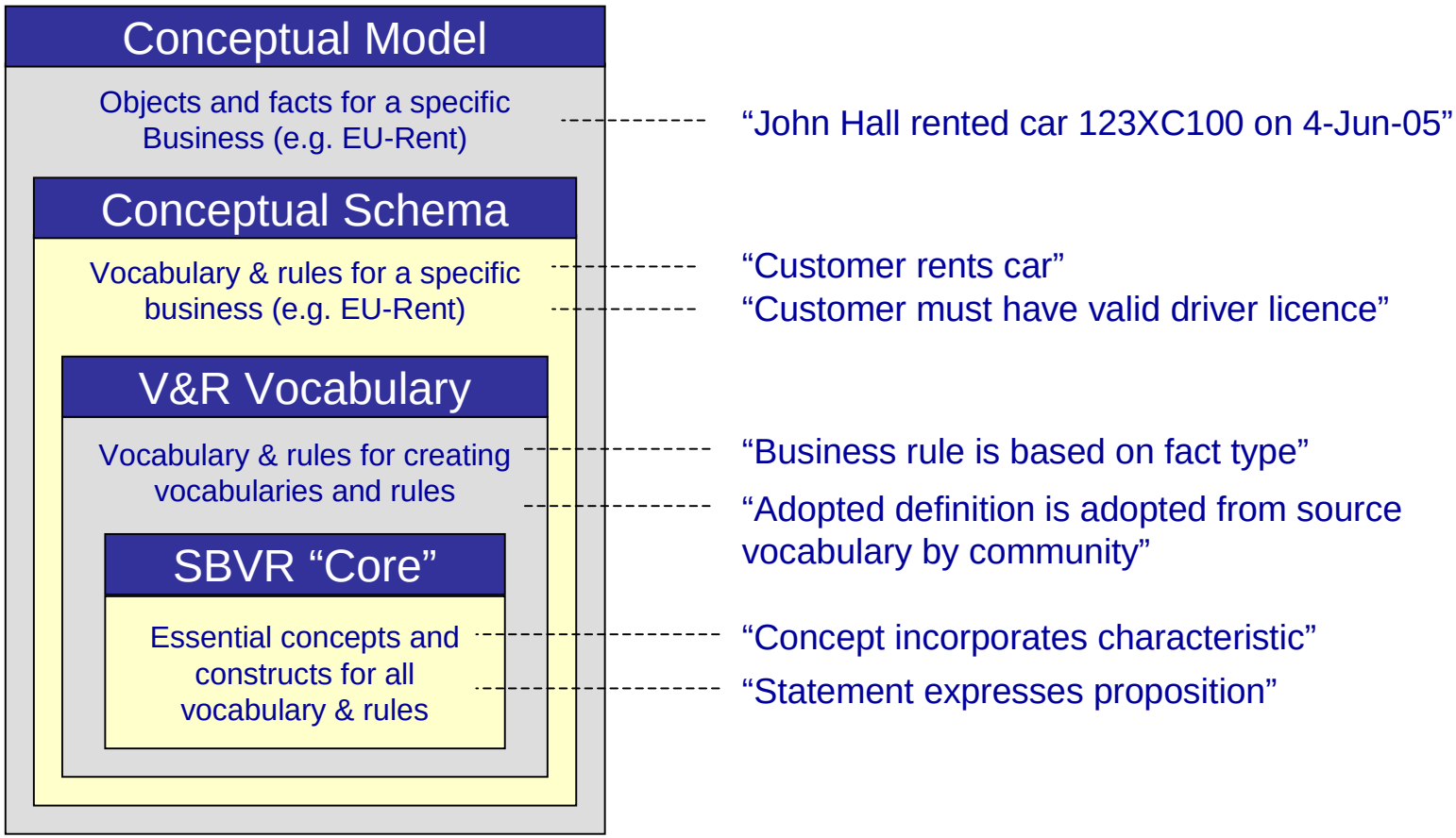
it is obligatory that rental *has* driver

Quantify and qualify:

- Add quantifiers to roles in the fact type (“each”, “at least one”, “no more than N”, …)
  - it is obligatory that each rental *has* at least one driver
  - it is obligatory that each rental *has* no more than 4 drivers
- Use additional fact types as qualifiers (“the location *of* the return branch *of* the rental …”)
- Add conditions based on fact types (“if a rental return *is* more than 4 hours *late* …”)

What's in an SBVR Model?

Simplified View



What does SBVR deliver?

If your company were modelled using SBVR, what would you get?

Perspective 1

- SBVR built-in Vocabularies
- For your enterprise
  - Business Vocabulary
  - Business Rules
  - Fact instance data? (wasn't designed for this, but it would work)

Perspective 2

- For all content:
  - Definitions
  - Fact Model
  - Structural rules and projections
- For your enterprise
  - Operative business rules

Why operative business rules only at enterprise level?

- Operative business rules govern what people do.
- For SBVR itself they will be written in methodologies for using SBVR, and built into:
  - tools that support SVBR
  - training material and user manuals
  - project management and quality assurance guidance
- They could be included in the interchanged model, if you wanted to send methodology along with the content – but someone would first have to define the methodology using SBVR, and that requires more than just rules.
- It's possible it could happen when an SBVR vocabulary for processes has been developed.

What could you do with the model?

With suitable tools:

- Send it to other parts of your company, or to close partners
- Store it in your repository, as guidance for your business and:
  - Manage it over time, as your business vocabulary and rules change
  - Validate and verify its content
  - Use it as a basis for creating consistent, focused guidance for different groups of people in your company, business partners, customers, suppliers …
- Use it as input (with suitable tool support for transformation) to your IT specifications:
  - Business applications
  - Workflow

Wait for other aspects of business modelling to be realised in SBVR tools

What would the model look like?

- MOF/XMI compliant XML
- SBVR Structured English
- Graphical Model:
  - UML
  - ORM
  - Other?

XML (fragment)

<is-obligation-claim obligation-claim=”oc”/>
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<quantification-introduces-variable quantification=”eq1” variable=”v2”/>
<variable-has-type variable=”v1” type=”bdt”/>
<quantification-scopes-over-logical-formulation quantification=”eq1” logical-formulation=”eq2”/>
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<atomic-formulation-has-role-binding atomic-formulation=”af” role-binding=”rb2”/>
<role-binding-is-of-fact-type-role role-binding=”rb2” fact-type-role=”ftr2”/>
<esbr:thing xmi:id=”oc”/> <esbr:thing xmi:id=”n”/> <esbr:thing xmi:id=”eq1”/>
<esbr:thing xmi:id=”v1”/> <esbr:thing xmi:id=”bdt”/> <esbr:thing xmi:id=”eq2”/>
<esbr:thing xmi:id=”v2”/> <esbr:thing xmi:id=”rt”/> <esbr:thing xmi:id=”af”/>
<esbr:thing xmi:id=”ft”/> <esbr:thing xmi:id=”rb1”/> <esbr:thing xmi:id=”rb2”/>
<esbr:thing xmi:id=”ftr1”/> <esbr:thing xmi:id=”ftr2”/>

Fragment of Model in SBVR Structured English

current contact details

Concept Type: role

Definition: contact details of a rental that *have been confirmed by* the renter *of* the rental

rental

contract *with* renter *specifying use of a car of* car group *for* rental period and rental movement

optional extra

Definition: Item that may be added to a rental at extra charge if the renter so chooses

Example: One-way rental, fuel pre-payment, additional insurances, fittings (child seats, satellite navigation system, ski rack)

Source: CRISG [“optional extra”]

rental actual return date/ time

Concept Type: role

Definition: date/time when the rented car *of* a rental *is returned to* EU-Rent

rental *requests* car model

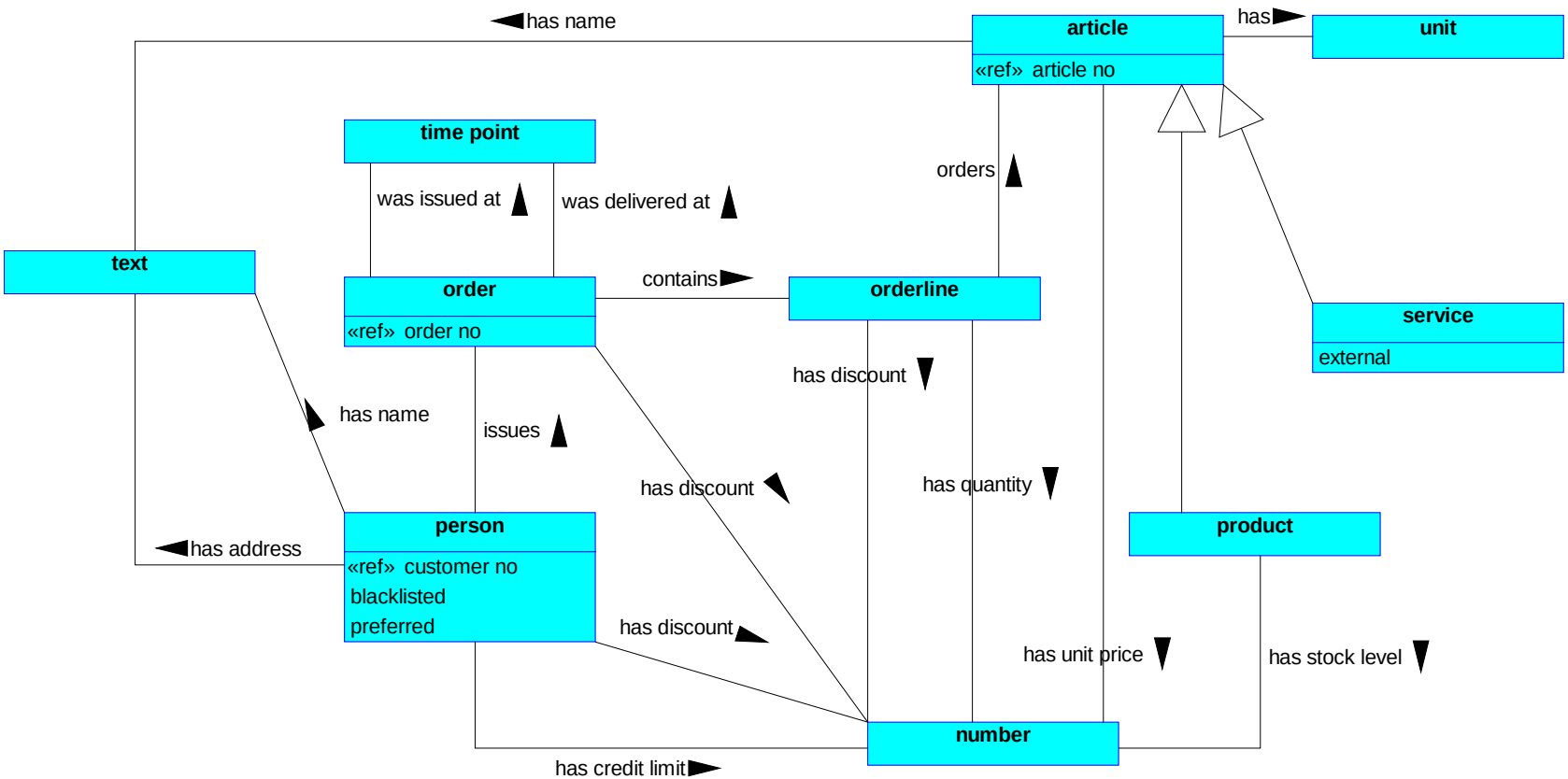
Synonymous Form: car model *is requested for* rental

Necessity: Each rental *requests* at most one car model.

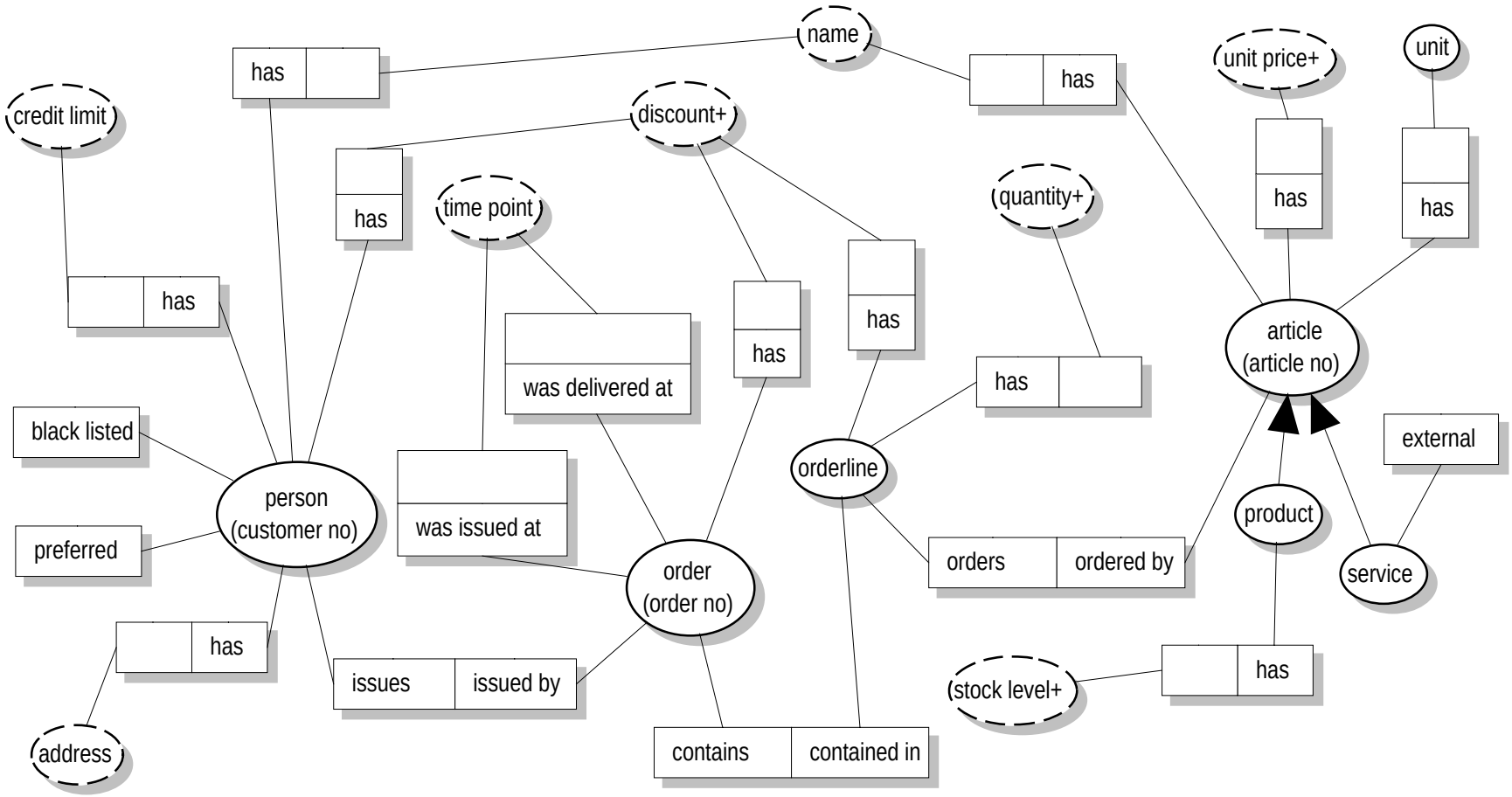
Possibility: The car model *requested for* a rental *changes before* the actual pick-up date/time *of* the rental.

Necessity: No car model *requested for* a rental *changes after* the actual pick-up date/time *of* the rental

Fragment of Model in UML



Fragment of Model in ORM



Fragment of Model in RuleSpeak™

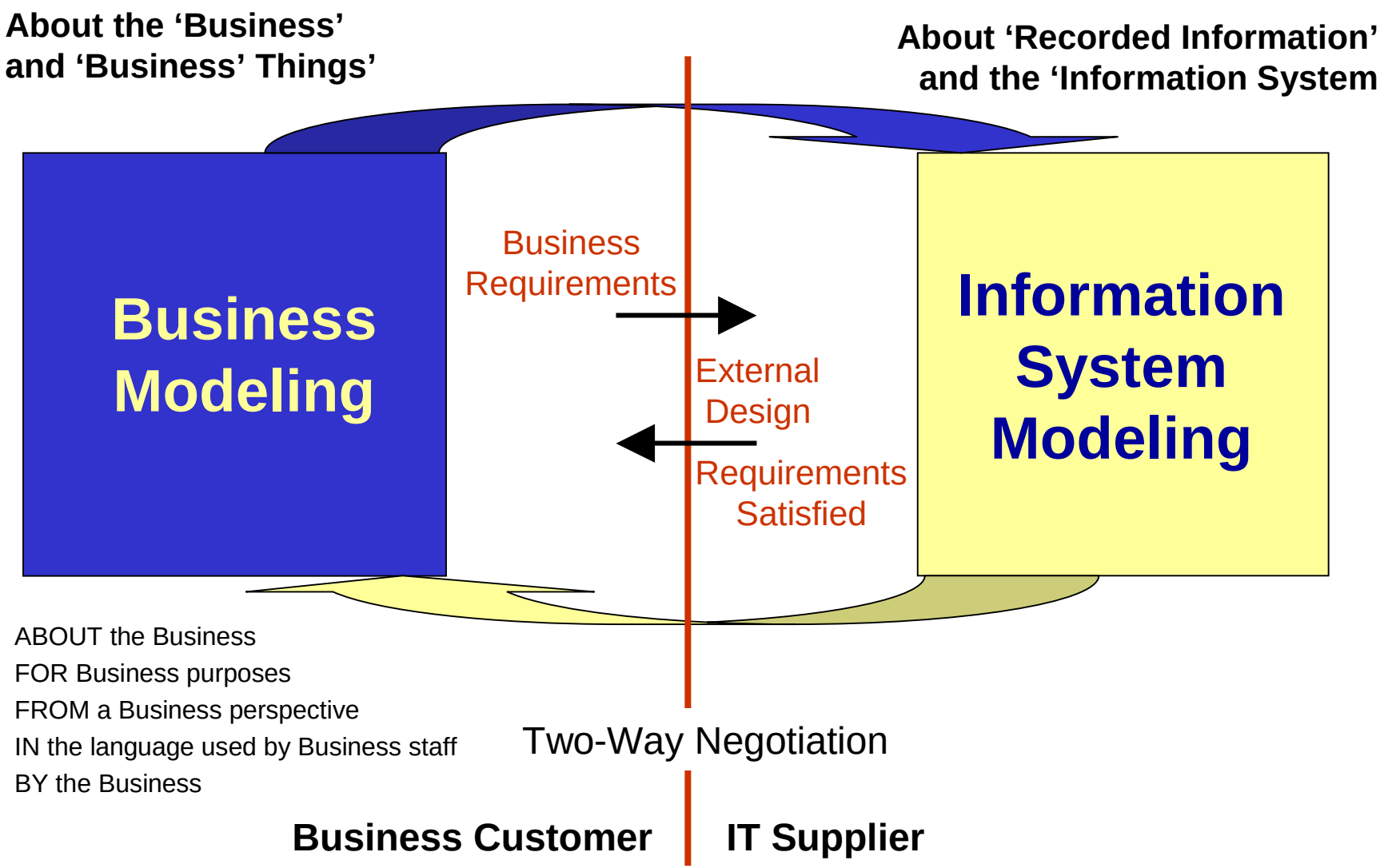
- A rental may be open only if an estimated rental charge is provisionally charged to the credit card of the renter of the rental.
- The rental charge of a rental is always calculated in the business currency of the rental.
- The rental charge of a rental must be converted to the currency of a price conversion requested by the renter of the rental.
  - Note: RuleSpeak does not recommend the "If ...then..." syntax for operative business rules.
    - Principles of the Business Rule Approach, pp. 114, 126, 255 256, 288, 297.
- A cash rental always honors its lowest rental price.

Semantics of Business Vocabulary and Business Rules (SBVR)

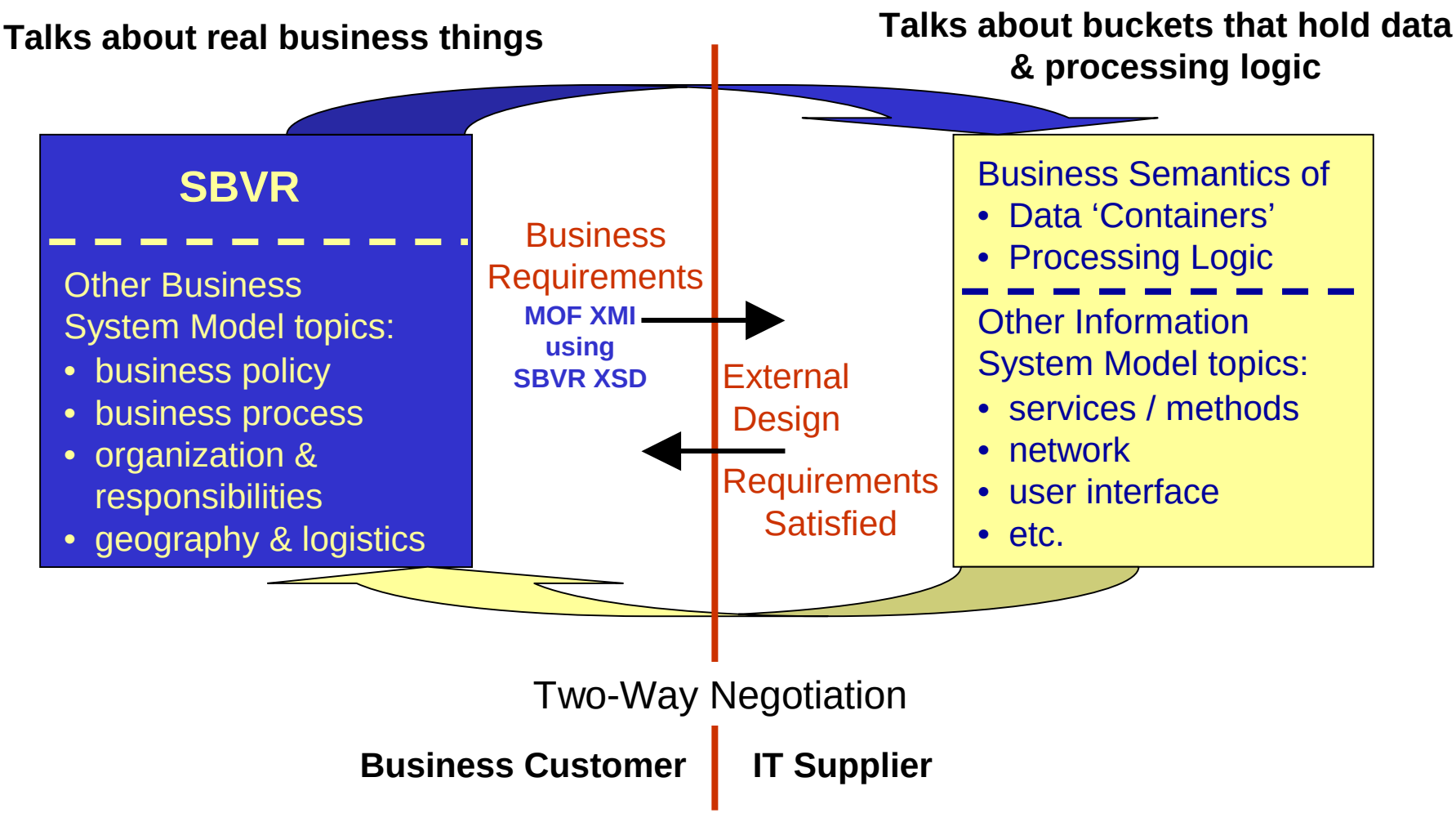
SBVR ←→ Information System Modeling

How Business Modeling Relates to Information System Modeling

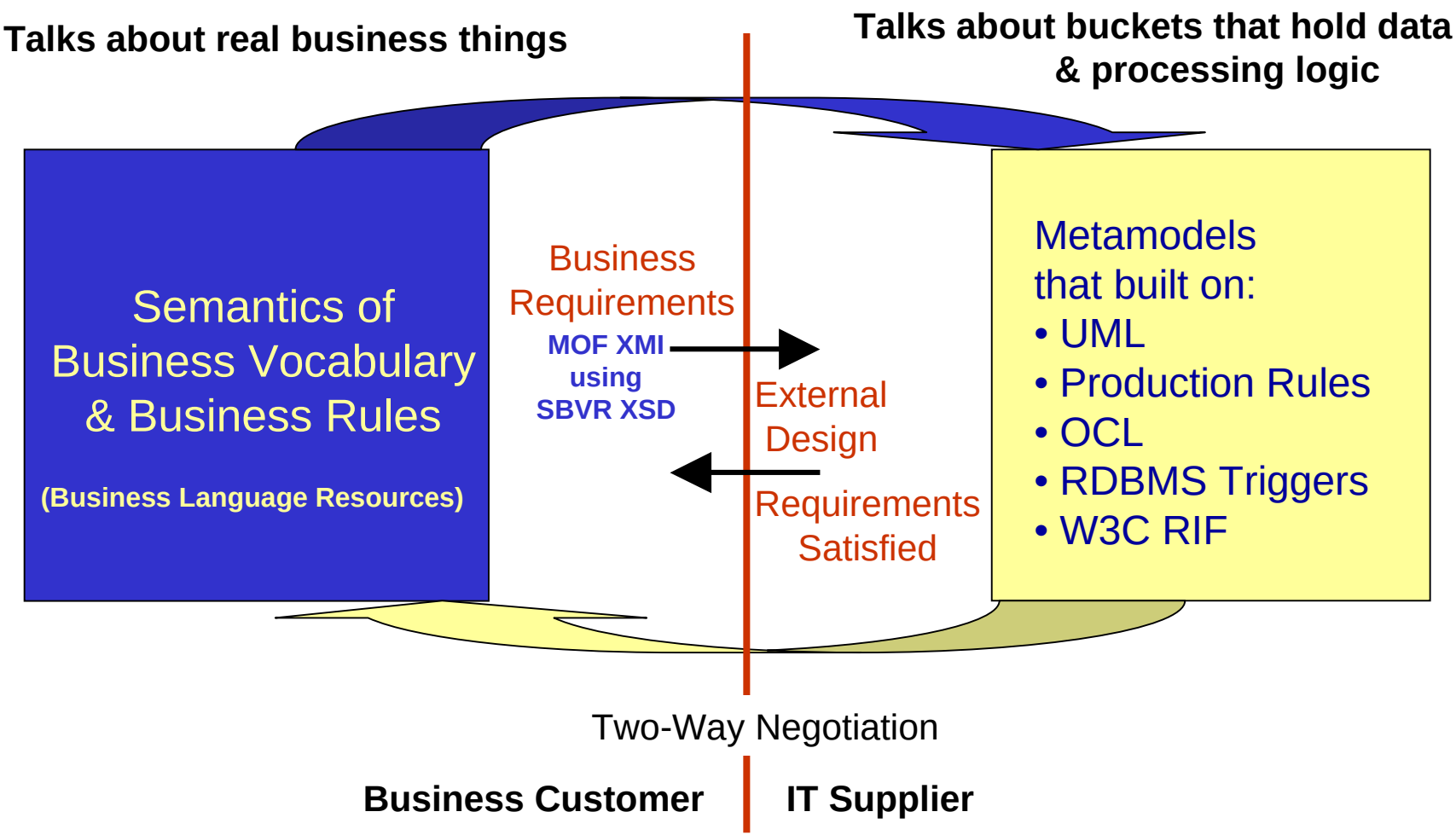
Model Systems



SBVR and IT Architecture Working Together



Rules Standards & Business and Information System Modeling



Semantics of Business Vocabulary and Business Rules (SBVR)

Overview of SBVR

SBVR Business Vocabulary+Rules: What does it Contain?

Model Systems

SBVR Business Vocabulary+Rules

=

Business Glossary

(Noun Concepts, Definitions & Primary Terms)

(+)

Taxonomy

(General/Specific + Whole/Part Hierarchical Relationships)

+

Thesaurus

(Synonyms, Acronyms, Abbreviations, etc. + Multilingual)
(Instances of Concepts e.g. Business Events & Business Entities)
(Verb Concepts {Business Facts; Relations among Concepts})

+

Ontology

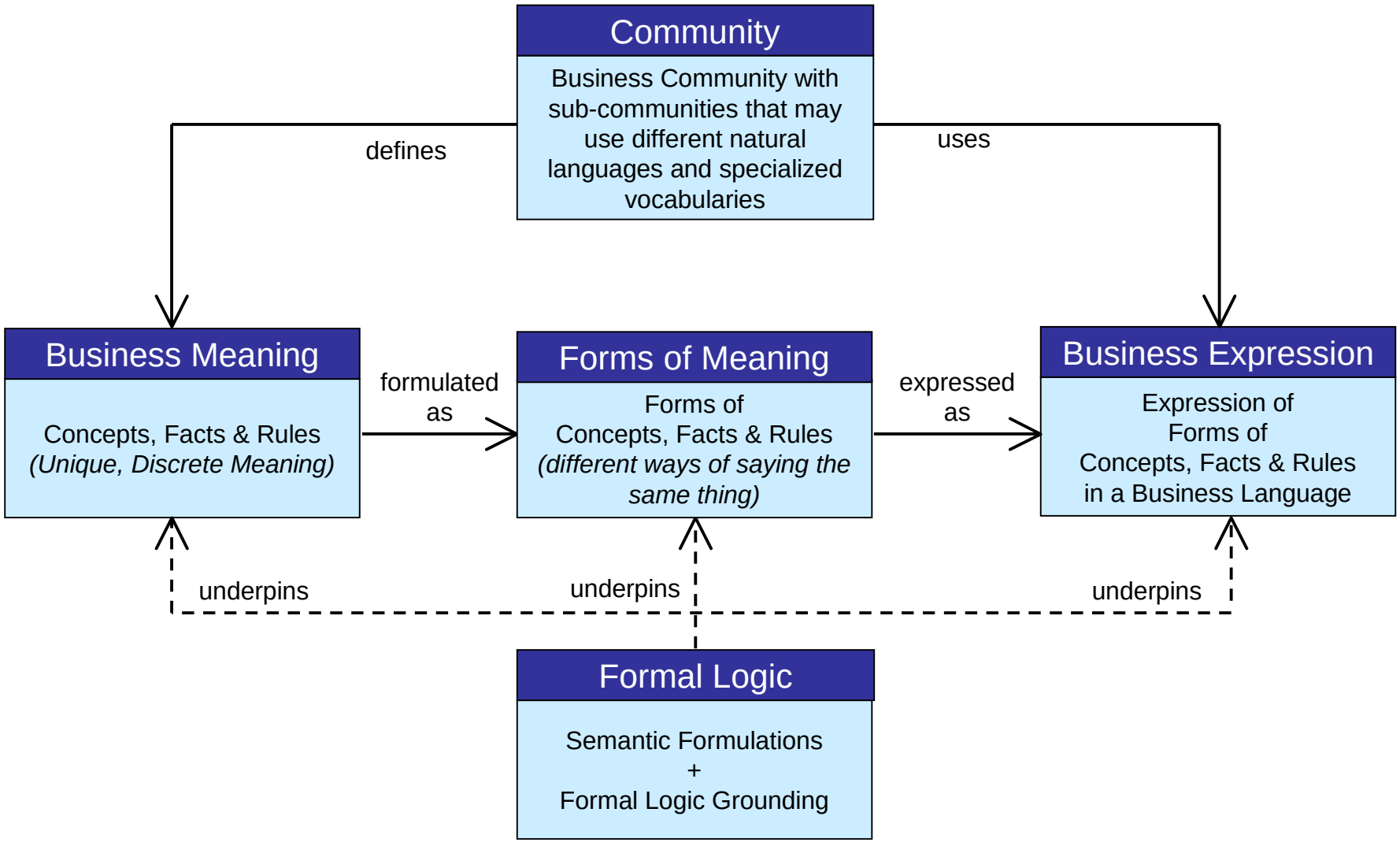
(Relations among Instances of Concepts)
(Structural Business Rules)
(Definitions, Relationships & Rules specified in formal logic)

+

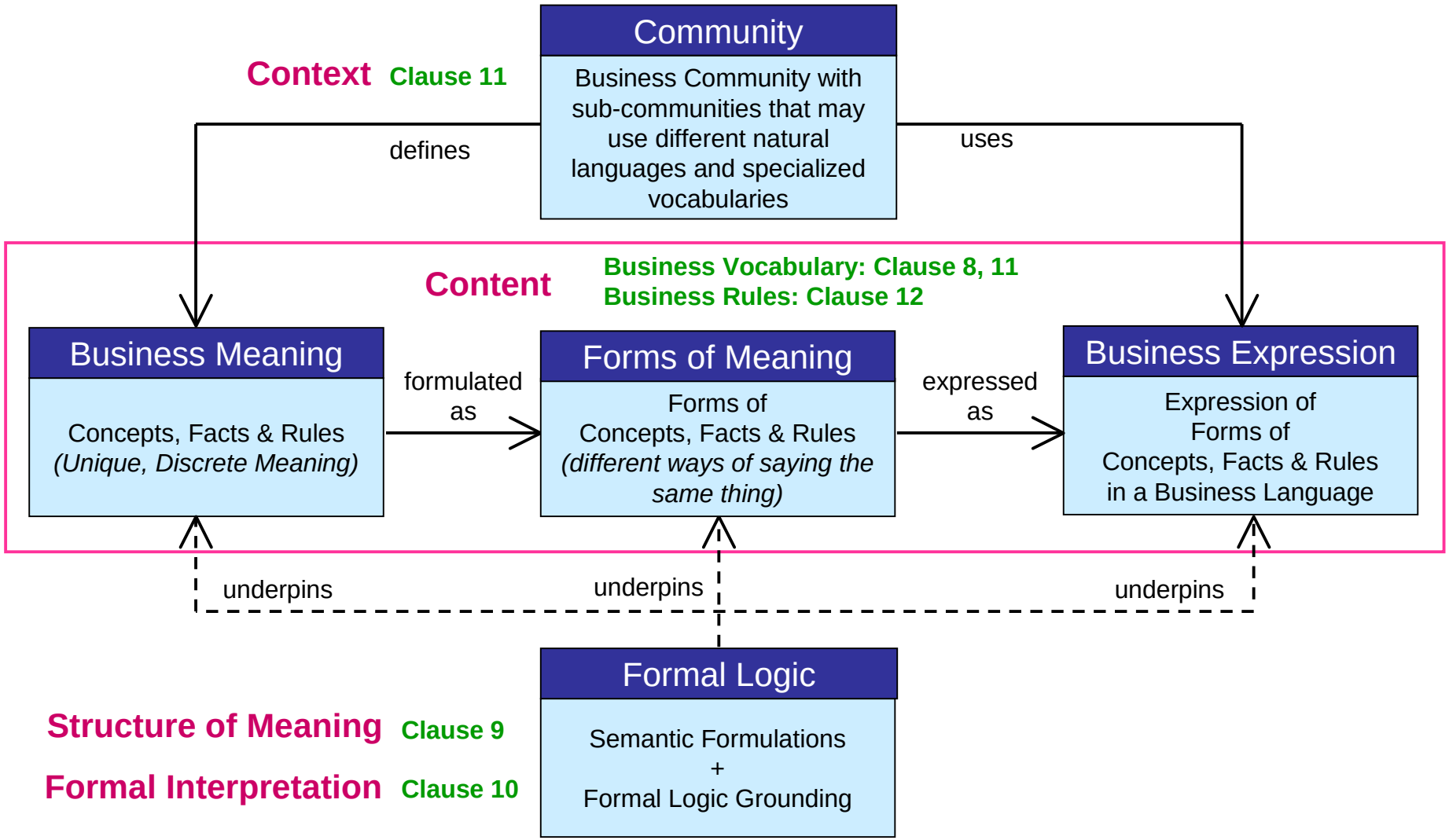
Operative Business Rules

(Rules Governing Business Actions)

Overview of SBVR



Context, Content and Logical Formality



SBVR Audiences

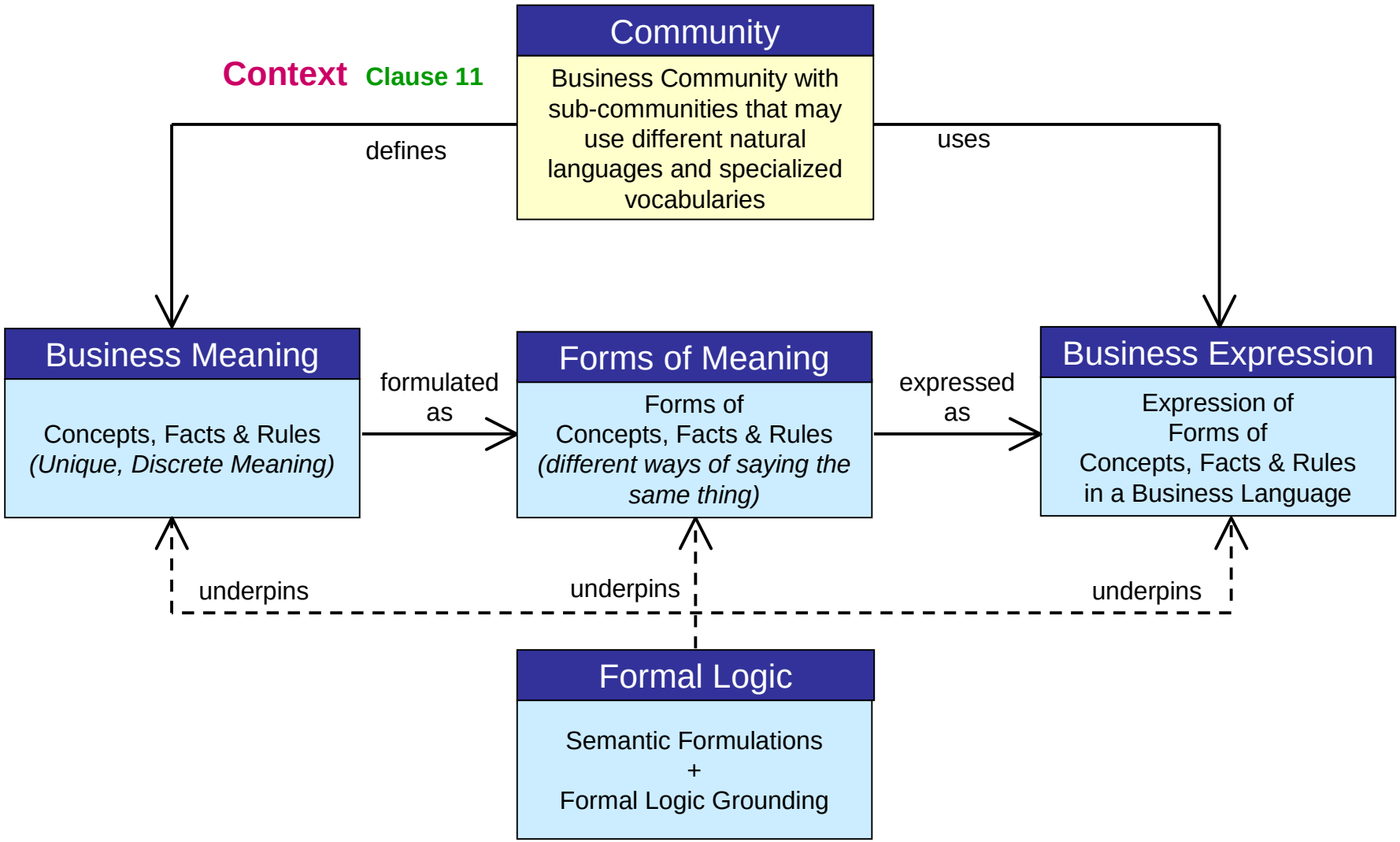
Audience	Role
Business people in general	Create the business content (e.g. EU-Rent) in a BV+R
BV+R integrators/ administrators	Integrate and quality assure the business content in a BV+R
Information system designers	Design information systems that talk and work according to the business content in a BV+R
BV+R business tool designers	Design BV+R tools for business people to use to define, store and manage business content
Infrastructure designers for BV+R business tools	Design tools to support interchange of business content in a BV+R among business communities within and between organizations
Linguists, semanticists and logicians	Provide the semantic and logical foundation for all BV+R

BV+R: "SBVR Business Vocabulary + Rules"

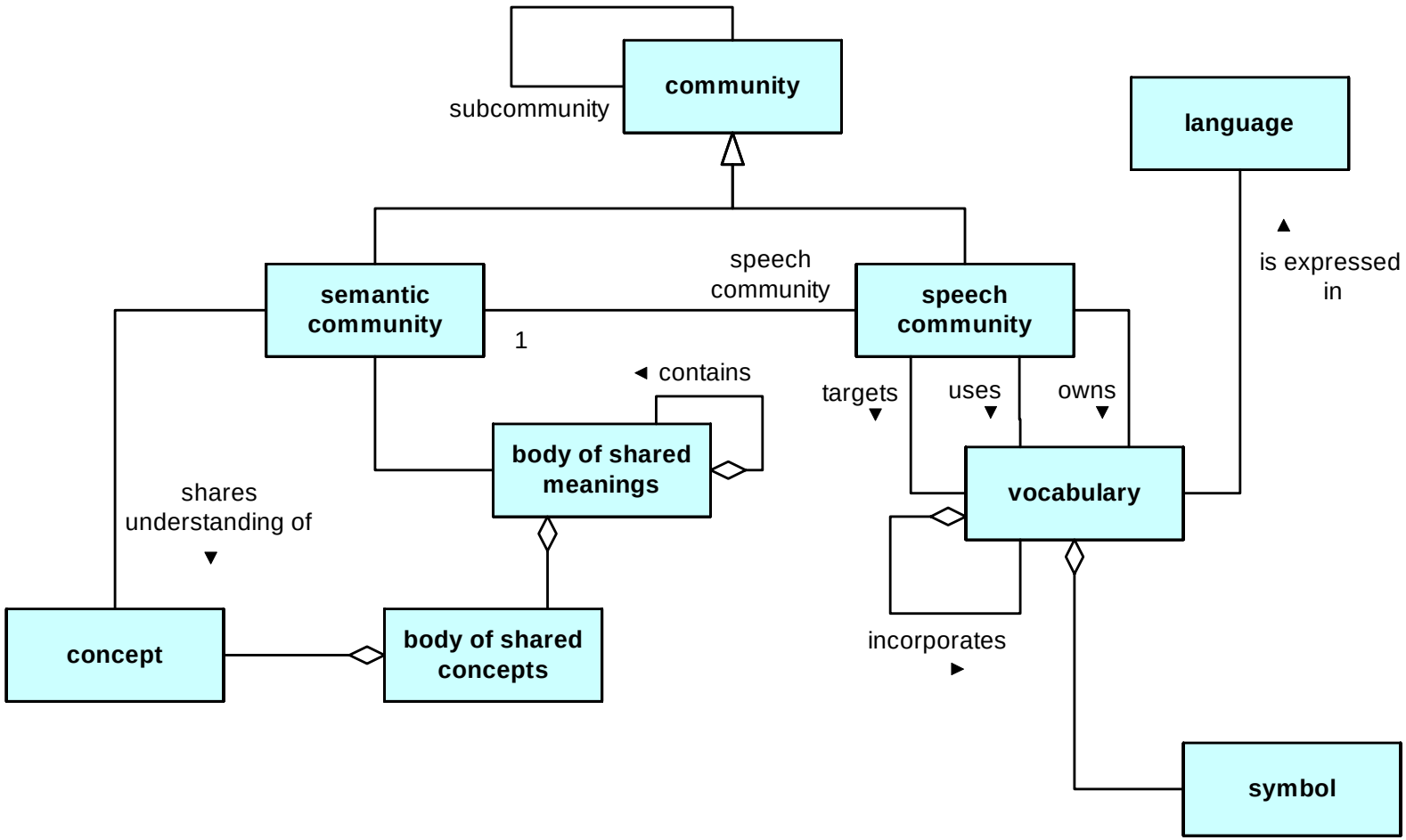
Semantics of Business Vocabulary and Business Rules (SBVR)

Context for Meaning

Business Context: Community



Communities and Vocabularies



Semantic Community

Semantic Community

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

- A semantic community defines the scope of an SBVR Business Vocabulary+Rules:
  - 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 Business Vocabulary+Rules, e.g. EU-Rent.
- You will often have to consider other semantic communities that do or could share some of the vocabulary, e.g. the car rental industry, national trade associations, EU-Rent 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, a internal service
  - Community of Practice, e.g. project managers, operational excellence champions, departmental budget managers
- Two scopes for Semantic Communities:
  - Internal to an organization
  - Among parts of different organizations

Speech Community

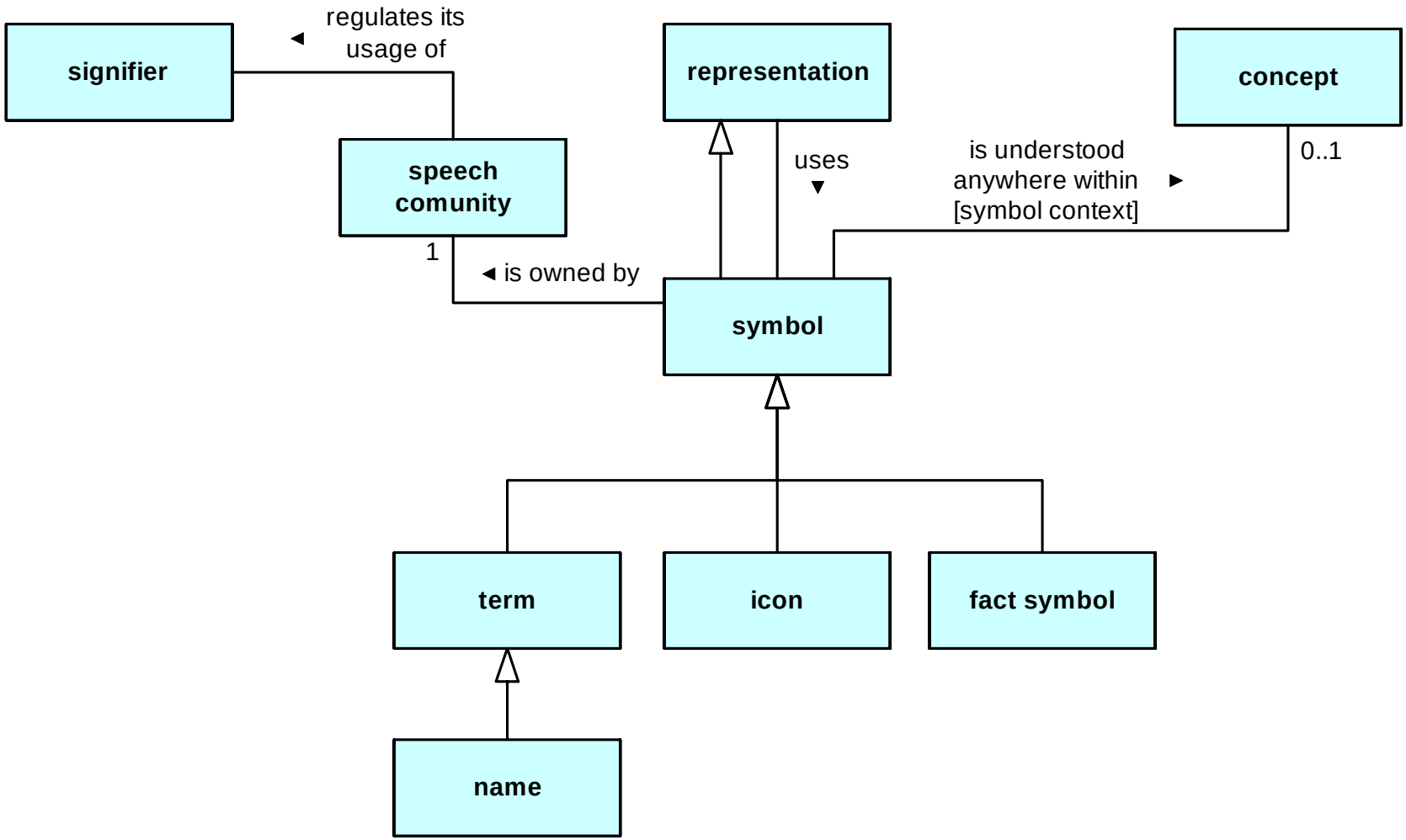
Speech Community

Definition	community whose unifying characteristic is the vocabulary that it uses
Example	The EU-Rent German Community shares the German-based vocabulary of symbols used in EU-Rent's business. The symbols include German words for EU-Rent's concepts plus symbols adopted from other languages
Note	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
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.

Symbolization



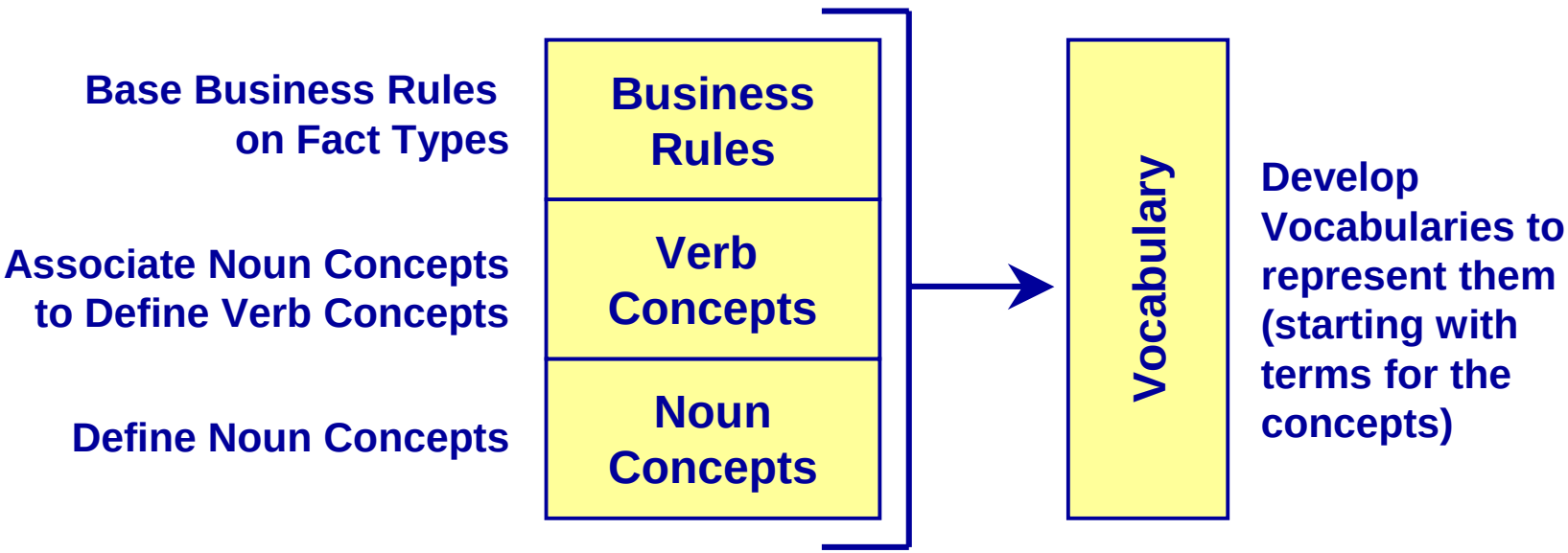
Semantics of Business Vocabulary and Business Rules (SBVR)

SBVR Architecture
1: How Rules are Built

How Are Business Rules Built?

SBVR supports realization of the 'Business Rules Mantra':

"Rules are built on Facts. Facts are built on Terms."



… to describe businesses, not the IT systems that serve them

… in language understandable by business people

How Are Business Rules Built?

SBVR supports realization of the 'Business Rules Mantra':

"Rules are built on Facts. Facts are built on Terms."

Base

Associate to Define

Define

The Mantra is memorable, but is a great simplification.

In SBVR:

- **Meaning is separate from expression.**
- **Fact Types (Verb Concepts) are built on Noun Concepts.**
- **Noun Concepts are represented by Terms.**
- **Fact Types are represented by Fact Symbols (verb phrases)**

… to describe businesses, not the IT systems that serve them

… in language understandable by business people

Business Rule

A rental may *be open* only if an estimated rental charge *is provisionally charged to* the credit card *of* the renter *of* the rental.

Business Rules are built on Verb Concepts

Unary verb concept (fact type): Rental *is open*

Supporting Verb Concepts	rental *has* estimated rental charge estimated rental price *is provisionally charged to* credit card renter *has* credit card rental *has* renter
Related Factual Connections	'*being open*' *is a characteristic of* the concept 'rental'

Verb Concepts are built on Noun Concepts

rental

Definition: contract with renter specifying use of a car of a car group for a rental period and a rental movement

Dictionary Basis: contract for use of a rental car by a renter for an agreed period under the rental company's terms and conditions for rental. [CRISG]

credit card

Dictionary Basis: MWU, 1: a small card (as one issued by hotels, restaurants, stores, or petroleum companies) authorizing the person or company named or its agent to charge goods or services

estimated rental charge

Definition: rental charge estimated at start of rental

renter

Source: CRISG ["renter"]

Concept Type: role

Definition: person contractually responsible for a rental

Synonym: customer (car rental responsibility)

Synonym: primary driver

Semantics of Business Vocabulary and Business Rules (SBVR)

SBVR Architecture
2: Meaning vs. Form vs. Expression

Separating Meaning, Form & Expression

SBVR Business Vocabulary+Rules

Business Vocabulary

Noun Concepts

Verb Concepts

Business Rules

Separating Meaning, Form & Expression

Body of Shared Meanings (informally “SBVR Business Vocabulary+Rules”)

Body of Shared Concepts (informally “Business Vocabulary”)

Unique, Discrete
Vocabulary
(Noun & Verb Concepts)
Meaning

Business Rules

Unique, Discrete
Rule
Meaning

Single Discrete Meanings

- Provides to focus for shared understanding of meanings by a community regardless of:
  - Language
  - Grammar syntax or graphic notation
  - Terms (character strings, icons, etc used to refer to meanings)
  - Form in which the meaning is stated
- Enables each discrete meaning to be recorded non-redundantly e.g.
  - C=A+B, A=C-B and B=C-A are all entered once as a single discrete meaning
- Enables all statements of meaning to be tied directly or indirectly back to a single discrete meaning
- Supports semantic integration

Separating Meaning, Form & Expression

Body of Shared Meanings (informally “SBVR Business Vocabulary+Rules”)

Body of Shared Concepts (informally “Business Vocabulary”)

Unique, Discrete *Vocabulary (Noun & Verb Concepts)* **Meaning**

Unique, Discrete *Vocabulary (Noun & Verb Concepts)* **Form(s)** for each Discrete *Vocabulary* Meaning

Business Rules

Unique, Discrete *Rule* **Meaning**

Unique, Discrete *Rule* **Form(s)** for each Discrete *Rule* Meaning

Single Discrete Meaning ←→ ‘Forms of Meaning’

- C=A+B, A=C-B and B=C-A are each a different ***form*** of the same single discrete meaning
- What ‘Forms of Meaning’ add to a Single Discrete Meaning
  - Different ***ways to say the same thing*** independent of:
    - Natural Language used
    - Notation, graphics or syntax used
    - A particular speech community’s vocabulary
- What a Single Discrete Meaning adds to multiple ‘Forms of Meaning’
  - Ability to know that different ‘Forms of Meaning’ mean the same thing
  - Ability to automatically translate from one ‘Form of Meaning’ to another

Separating Meaning, Form & Expression

Body of Shared Meanings (informally “SBVR Business Vocabulary+Rules”)

Body of Shared Concepts (informally “Business Vocabulary”)

Unique, Discrete *Vocabulary (Noun & Verb Concepts)* **Meaning**	Unique, Discrete *Vocabulary (Noun & Verb Concepts)* **Form(s)** for each Discrete *Vocabulary* Meaning	Language/Notation & Community-specific **Expression(s)** for each Discrete **Vocabulary** Form

Business Rules

Unique, Discrete *Rule* **Meaning**	Unique, Discrete *Rule* **Form(s)** for each Discrete *Rule* Meaning	Language/Notation & Community-specific **Expression(s)** for each Discrete **Rule** Form

‘Form of Meaning’ ←→ Expressions in a Language / Notation

Model Systems

- Example language and optional notation combinations:
  - English
  - French
  - English + SBVR Structured English
  - ORM + English
- What ‘Expressions in a Language/Notation’ add to a ‘Form of Meaning’
  - The particular terms and names used by a given Speech Community
  - A natural or artificial language used by the Speech Community
  - A graphics notation
- What a ‘Form of Meaning’ adds to multiple ‘Expressions in a Language/Notation’
  - Ability to know that different ‘Expressions in a Language/Notation’ have the same ‘Form of Meaning’ (and through ‘Form of Meaning’ the same of different discrete meanings)
  - Ability to automatically translate from one ‘Expressions in a Language/Notation’ to another using
    - a common ‘Form of Meaning’ or
    - the ability to also translate between different forms of meaning.

Semantics of Business Vocabulary and Business Rules (SBVR)

SBVR Architecture
3: Propositional Content + Performatives

Propositional Content + Performative

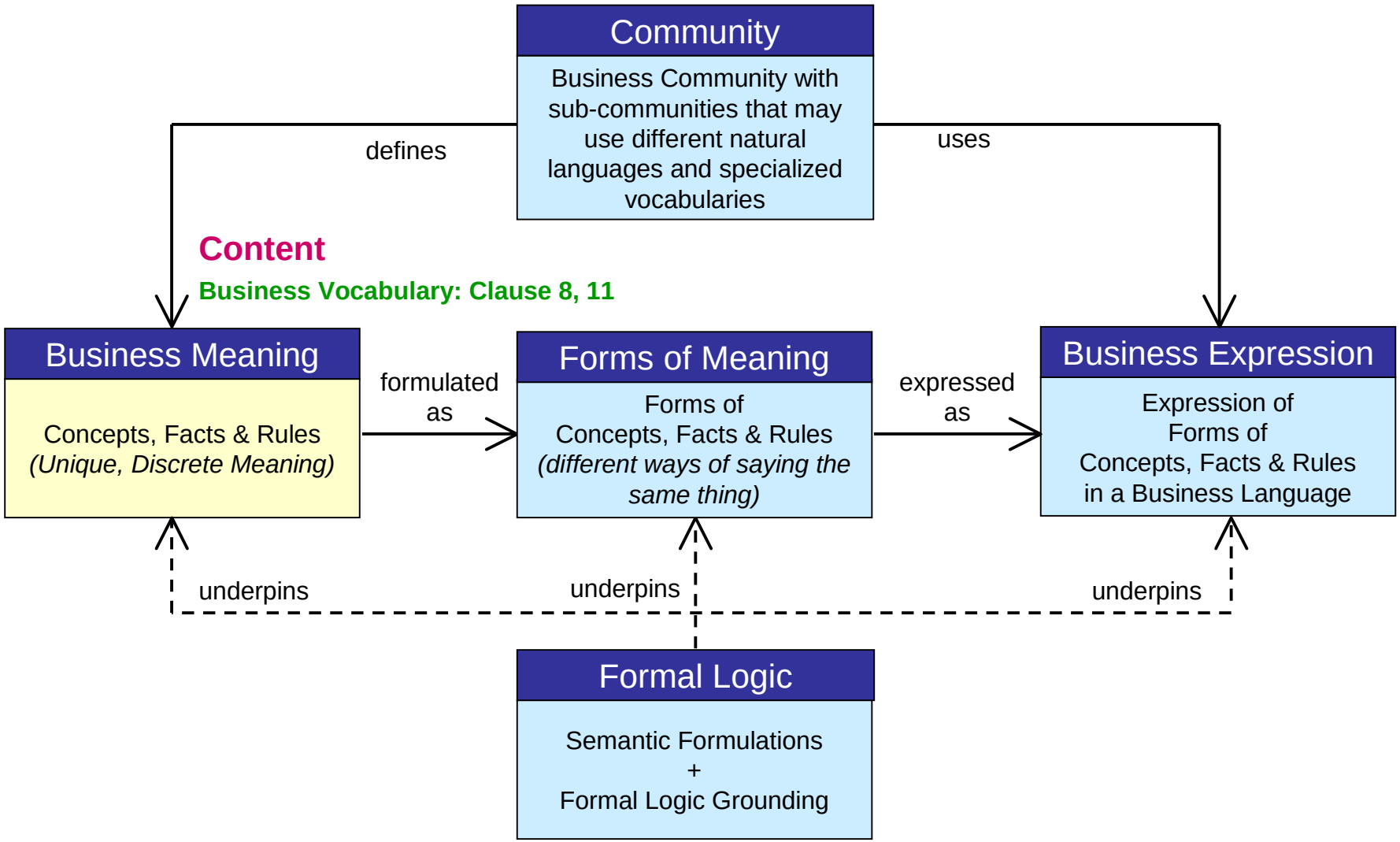
- Propositional Content:
  - a mental picture of a possible state of the world that is expressed in some communication (for example, expressible by arranging certain words: car at location)
  - is INDEPENDENT of how you use it!
    - Statement: car at location – The car is at the location.
    - Command: car at location – Let the car be at the location!
    - Question: car at location – Is the car at the location?
    - Stipulation: car at location – The car must be at the location.
- Example SBVR Propositional Content:
  - customer *wants* kind of car
- SBVR supports these kinds of Performatives
  - Assertion *(Statement)*
    - (It is taken to be true that) customer *wants* kind of car

      NOTE: The 'it is taken to be true that' is implied from the formal logic grounding of SBVR
  - Stipulation *(Rule)*
    - It is obligatory that customer *wants* kind of car if the customer *places* an order
  - Question
    - What kind of car the customer *wants* ? … from within the rule:
      - An agent must *ask* each new customer what kind of car the customer *wants*.

Semantics of Business Vocabulary and Business Rules (SBVR)

Business Vocabulary
(vs. Business Rules)

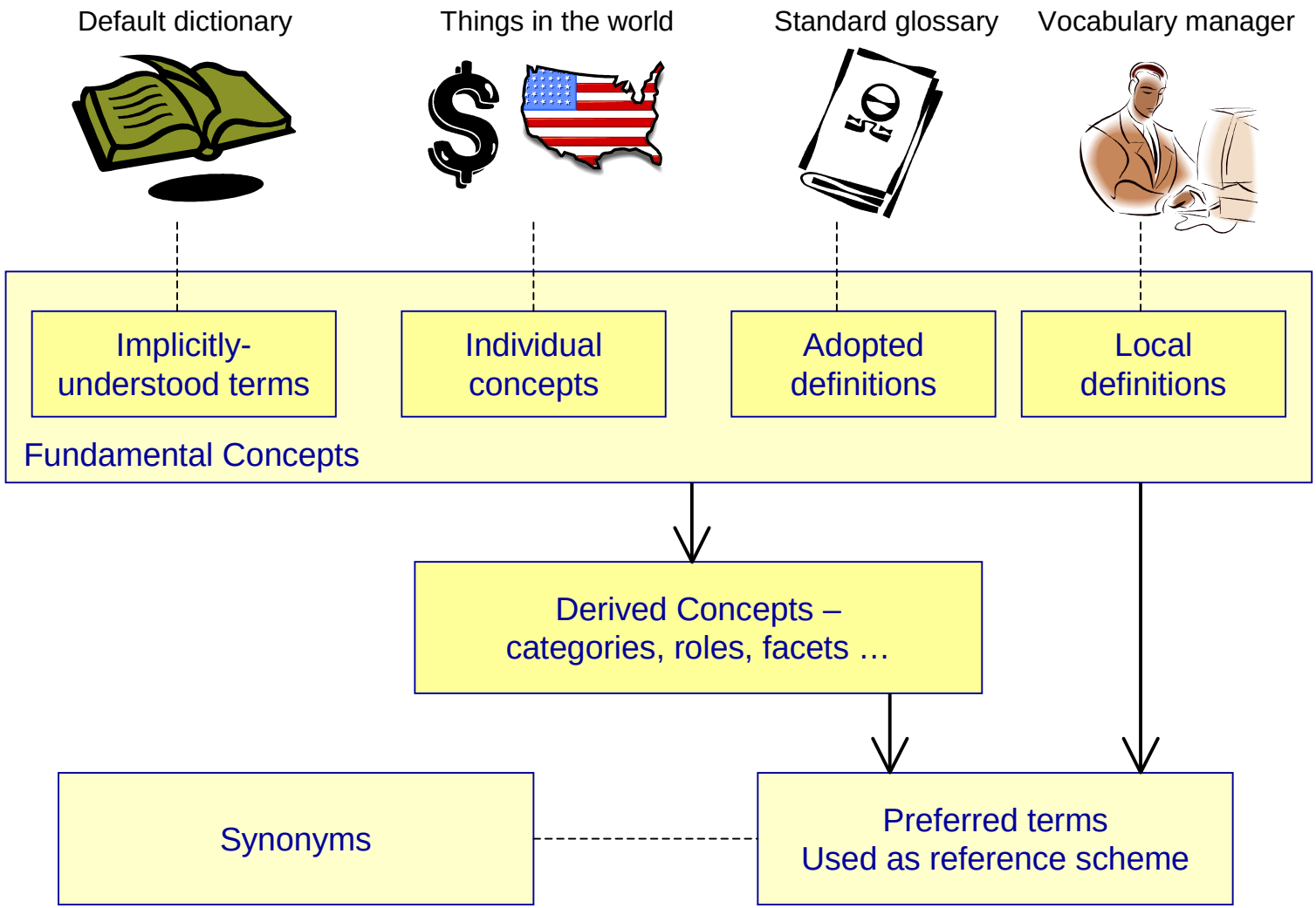
Business Vocabulary: Business Meaning of Concepts



Noun Concepts (Discrete Meaning) --
(represented by Terms, Names & Definitions)

- The ‘noun concept’ that denotes the set of cars EU Rent has for renting to customers:
  - DEFINITION:
    - **vehicle owned by EU-Rent and rented to its customers**
  - TERM:
    - **rental car**
    - **car**
- The ‘noun concept’ that denotes all the specific agreements EU Rent makes with customers to rent cars:
  - DEFINITION:
    - **contract with renter specifying use of a car of a car group for a rental period and a car movement**
  - TERM:
    - **rental**

Noun Concepts



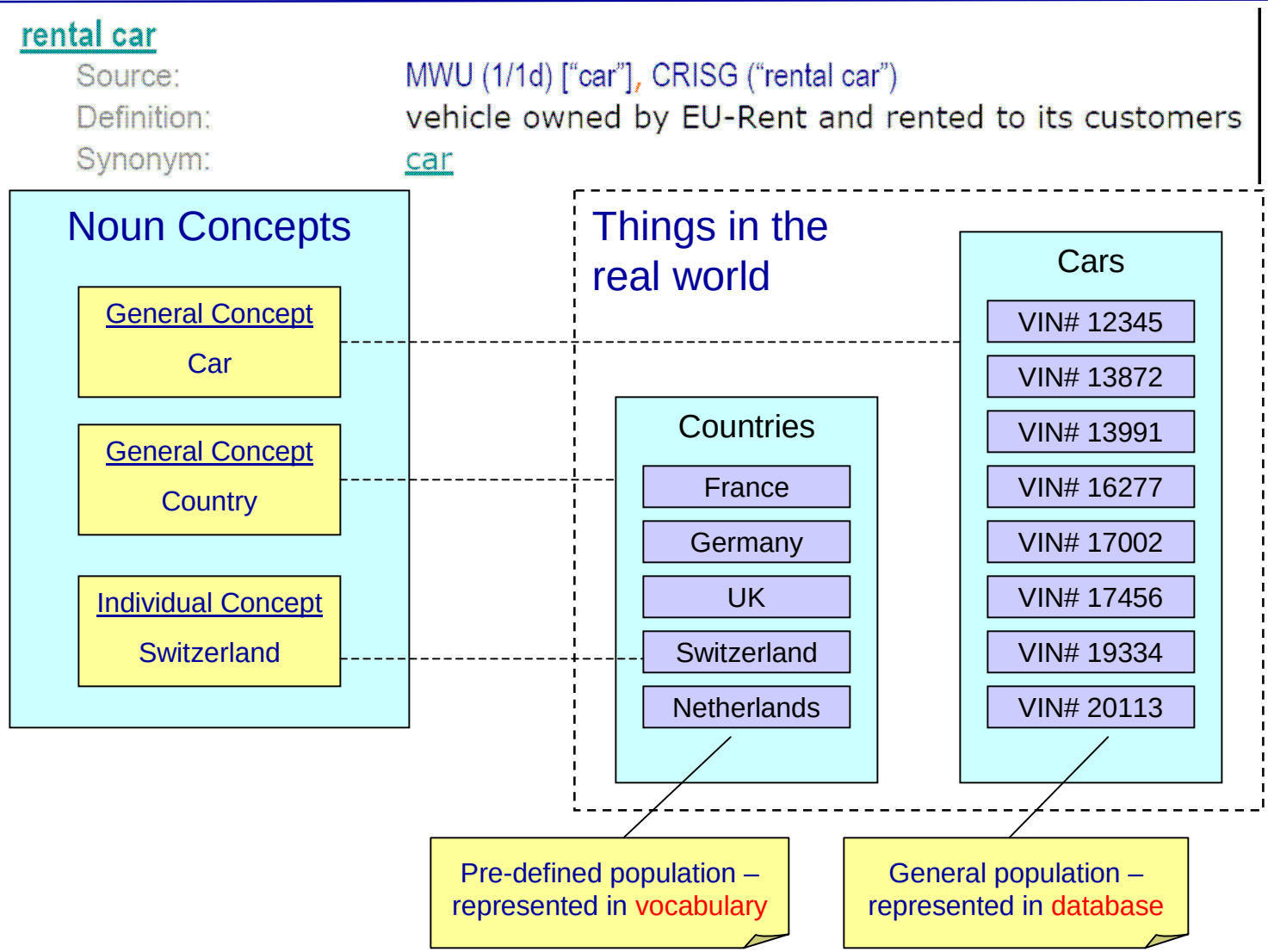
Forms of Noun Concept Definition

- Intensional (based on ISO 1087):
  - More general concept
  - Delimiting characteristics to define category within more general concept
    - E.g. additional driver: “qualified driver who is not the renter of a rental and who is permitted to drive the rented car of the rental ”
- Extensional (based on ISO 1087):
  - List of concepts (not necessarily individual concepts)
    - E.g. European operating country: EU member state or Norway or Switzerland
- Individual concept (based on ISO 1087):
  - Is named
  - May not need any additional definition
    - E.g. Switzerland, US Dollar, IRS, Ford Motor Company
- Adopted definition
  - Reference to source
    - E.g. rule: Oxford Dictionary of English (ODE), ‘rule’ [1]

Noun Concepts in practice

- Choose a default dictionary (SBVR uses MWU and ODE)
  - If a formally-identified term does not have an explicit definition, it is taken to be “everyday language, implicitly understood”
  - If vocabulary users are in doubt, they should use the default dictionary to find a definition
  - Use implicitly-understood terms as much as possible
- Make pragmatic decisions about individual concepts, e.g. “90 days” vs “maximum rental duration”
- Create “predefined populations” (extensional definitions) where needed, e.g. business currency: US Dollar or Euro or Swiss Franc
- Adopt from standard glossaries as much as possible
- Minimise the number of locally defined concepts:
  - Reduces maintenance
  - Increases ease of use

Noun Concept (Discrete Meaning -- ISO 1087-1)



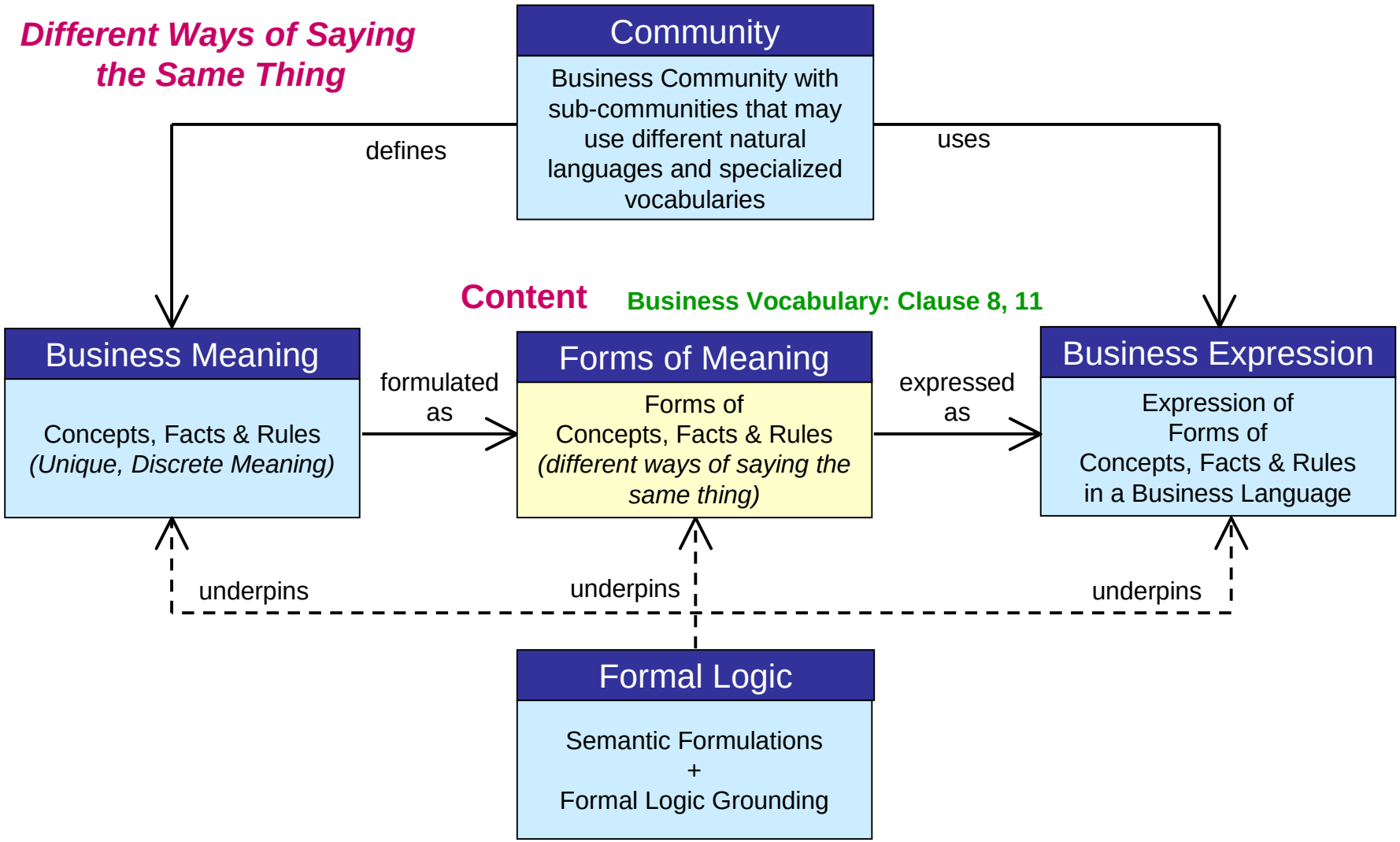
Verb Concepts

- AKA “fact types”, “associations”
- Represented by “Fact Symbols” (verb phrases)
- Verbs are taken to have no meaning except in fact types (“manager *runs* company”, “horse *runs* race”) – definitions are for entire verb concepts, not for verbs in isolation
- Trade off simple synonyms against simplicity of verb concepts,
  - e.g. if currency in which rental is charged is used in lots of verb concepts, consider defining “currency *of* rental” as a synonym for “currency *of* operating country *of* EU-Rent site that *is base for* pick-up branch *of* rental”

Verb Concepts (Discrete Meaning)

Supporting Verb Concepts	rental has estimated rental charge estimated rental price is provisionally charged to credit card renter has credit card rental has renter
Related Factual Connections	'being open' is a characteristic of the concept 'rental'

Business Vocabulary: Forms of Meaning



Multiple Definition Forms for One Noun Concept (Discrete Meaning)

- The Definition of one Concept
  - E.g. 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 structured in many ‘Forms of Meaning’:

  – Intensional Form
    - E.g. sales tax rate for a rental: sales tax rate at the pick-up branch of the rental on the drop-off date of the rental.
  – Extensional Form
    - E.g. 1%, 2.5%, 4%, 7%

- The meaning of a concept is structured (formulated) into a ‘Form of Meaning’ by using a Semantic Formulation
  – One Semantic Formulation for each Form of Meaning

    (see section explaining Semantic Formulations)

Multiple Verb Concept Forms for One Verb Concept (Discrete Meaning)

- **One Verb Concept (e.g. Associative Verb Concept)**
  - **E.g. Drivers licenses have expiration dates**

can be put together in many forms:

- **Sentential Forms**

  driver's license expires on date *(semantics in verb)*

  driver's license has expiration date *(semantics in role name)*

- **Noun Forms**

  driver's license expiring on date

  driver's license having expiration date

- **Multiple orderings**
  - **Sentential Form**

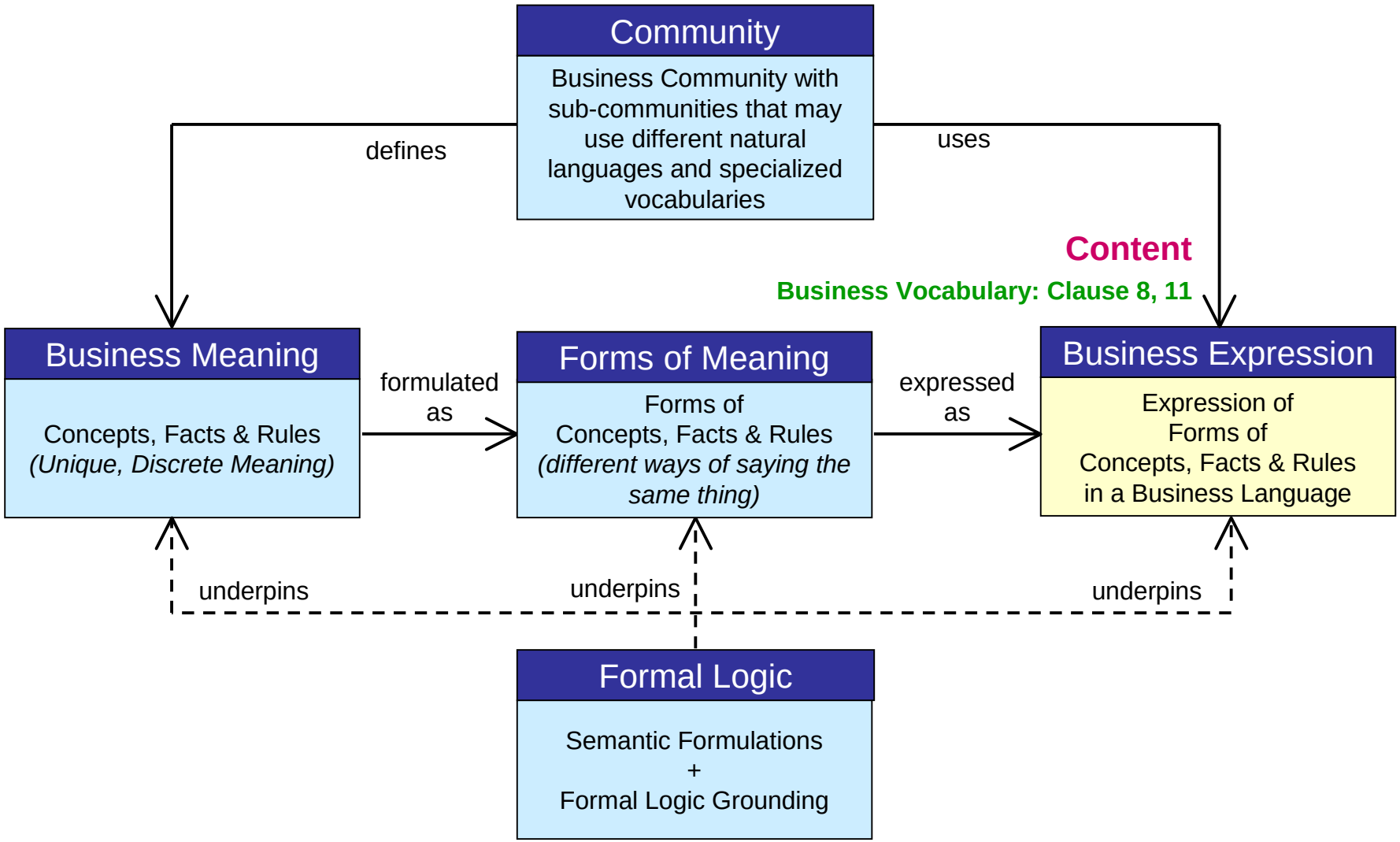
    driver's license expires on date *(active)*

    date is expiration of driver's license *(passive)*
  - **Noun Form**

    expiration date of driver's license

    driver's license having expiration date

Business Vocabulary: Business Expression



Multiple Definition Statements Expressing One Definition Form

Model Systems

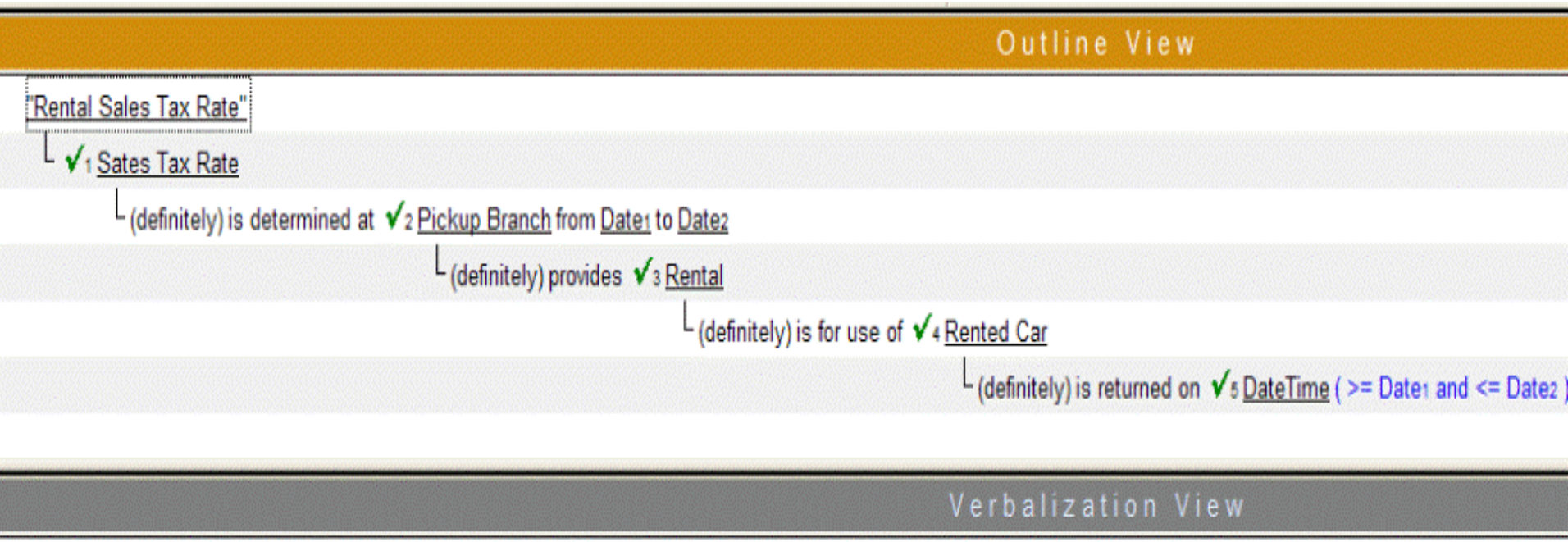
- One Definition Form (e.g. Intensional)
  - The sales tax rate for a rental is the sales tax rate at the pick-up branch of the rental on the drop-off date of the rental.

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.**
- Expressed in ORM ("ActiveQuery" notation)
  - (see next slide)

Expressed in ORM ("ActiveQuery" notation)

Model Systems

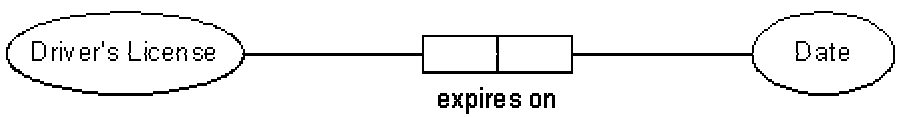


Multiple Fact Symbols Expressing One Verb Concept Form

- One Verb Concept Form (e.g. Sentential Form)
  - driver's license expires on date

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

  - Expressed in English
    - driver's license expires on date
  - Expressed in French
    - le permis de conducteur expire la date
  - Expressed in SBVR Structured English
    - **driver's license** *expires on* **date**
  - Expressed in ORM ("Object Role Modeling" notation)



SBVR Structured English Notation

SBVR Structured English is defined using styled fonts in MS Word.

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. Ford, San Jose
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'.

Semantics of Business Vocabulary and Business Rules (SBVR)

Integration
by Vocabulary Adoption

Owned & Adopted Concepts

- Adoption is important:
  - Reduces work in maintaining business vocabulary
  - Supports communication with organizations that have interests in common
  - Creates consistency across vocabularies
- Concepts are adopted two ways:
  - By reference – via an adopted vocabulary, e.g. rental, rental car (*from 'Car Rental Industry Standard Glossary'*)
  - By name – Individual concept, e.g. Switzerland
- Adoption by reference is about adopting definitions:
  - The terms from the source are used as a reference scheme for the adopted definitions.
  - They do not have to be adopted as terms in the SBVR vocabulary (although in practice they usually are)
- When a vocabulary that has been adopted by others is revised,
  - all the "users" of the vocabulary have to be considered –
  - this is a good thing!

SBVR provides strong support for adoption

Vocabulary Adoption

- EU-Rent English Vocabulary - built using SBVR - contains:
  - The symbols EU-Rent has assigned as term and fact symbols, and has assumed responsibility for maintaining; e.g.
    - bad experience: damage to car or moving traffic offence or unauthorized late return or car not returned to EU-Rent or …
    - barred driver: driver who *has* at least three bad experiences *on* rentals
  - Adopted vocabularies:
    - Car Rental Industry Standard Glossary [fictitious]
      - Note: the EU-Rent German speech community has adopted equivalent "Glossar für Autovermietunggeschäft" [also fictitious] – consistency issue to be managed
    - ISO Dictionary of International Symbols – adopted across all languages [does not exist yet]
    - Merriam-Webster Unabridged Dictionary – default vocabulary for English

Synonyms and Homonyms

- Required for local ease of use
- Especially important when dealing with closely-involved semantic communities, e.g.
  - After merger/acquisition
  - Working with outsourcers and value chain partners
- Noun concepts are referenced by preferred terms
  - Business can require that ‘official’ communications use preferred terms
  - In practice, is impossible to enforce preferred terms for all business discourse
- Synonyms reference preferred terms
- Homonyms need a disambiguating context, e.g.
  - Customer (car rental)
  - Customer (car sales)

Semantics of Business Vocabulary and Business Rules (SBVR)

Business Rules:
Building on Business Vocabulary

Business Rules

- (Surprisingly) small part of SBVR
  - Business Vocabulary is much bigger (and reusable for other aspects of business modelling)
- Operational Business Rules
  - Govern what the business does
    - "It is obligatory that …"
    - "It is permitted that …" (and its negation, "It is forbidden that …")
  - Intended for people:
    - Actionable, but not necessarily automatable
    - Can be broken
    - Need enforcement
- Structural Business Rules
  - true by definition
    - "It is necessary that …"
    - "It is possible that …" (and its negation, "It is impossible that …")

Enforcement

- Operative business rules can be broken, and need to be enforced. This requires a regime:
  - To detect breaches
  - To take remedial action, if required
  - To impose penalties, if required
- Enforcement action is outside SBVR's scope. It will be resolved in integration with other OMG business modelling specifications
- SBVR does include enforcement level – how strictly the rule will be enforced. This is quite independent of what the enforcement action is. Examples are:
  - Strictly enforced: no escape from the consequences
  - Pre-authorized exceptions permitted
  - Consequences if exceptions are not logged and justified

Sample Language of Business Rules

Quantification

each	universal quantification
some	existential quantification
at least *n*	at-least-n quantification

Logical Operations

it is not the case that *p*	logical negation
p and *q*	conjunction
p or *q*	disjunction

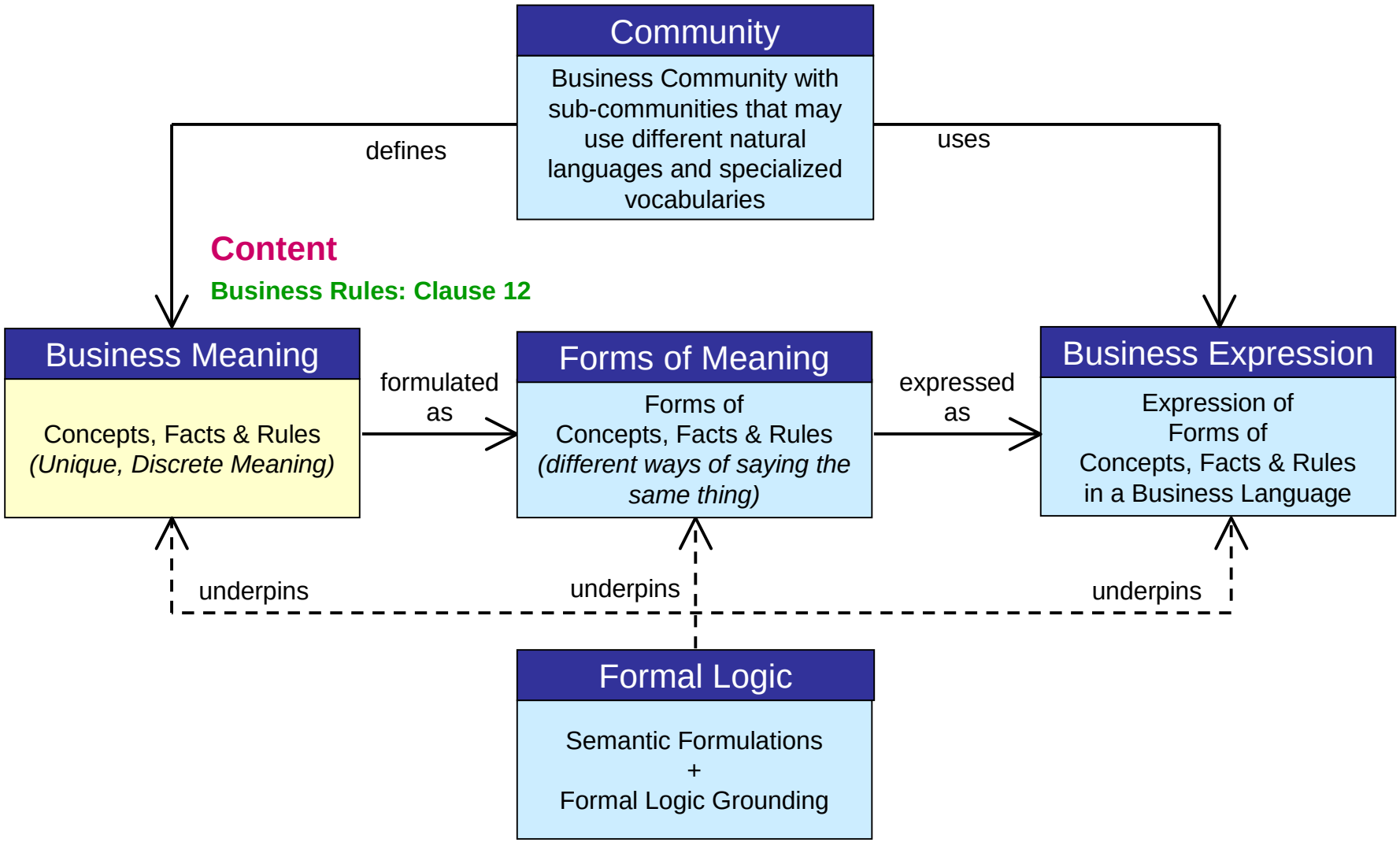
Modal Operations

it is obligatory that *p*	obligation claim
it is prohibited that *p*	obligation claim embedding a logical negation
it is necessary that *p*	necessity claim

Other Keywords

the	who
a, an	is of
another	what
a given	that

Business Rules: Business Meaning of Rules



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.

Supporting Verb Concepts

The structural business rule:

> it is necessary that the rental charge *of* each rental *is calculated in* the business currency *of* the rental.

… is based on the verb concept

> rental charge *is calculated in* business currency

But it needs two supporting verb concepts (also defined in the EU-Rent Business Vocabulary)

> rental *has* rental charge

> rental *has* business currency

Additional factual connections

The operative business rule

> it is obligatory that the rented car *of* each assigned rental *is stored at* the pick-up branch *of* the rental.

… is based on the verb concept

> rental car *is stored at* branch

It needs support from these additional factual connections:

- the concept ‘rented car’ *is a* role *of* the concept ‘rental car’
- the concept ‘assigned rental’ *is* a category *of* the concept ‘rental’
- the concept ‘pick-up branch’ *is* a role *of* the concept ‘branch’

Supporting factual connections are based on characteristics, roles and categories.

Adding Conditions

The operative business rule:

It is obligatory that the rental *incurs* a location penalty charge.

… is based on the verb concept

rental *incurs* location penalty charge

The added condition:

if the drop-off location *of* a rental *is* not the EU-Rent site *of* the return branch *of* the rental.

... uses these supporting verb concepts

rental *has* drop-off location

rental *has* return branch

branch *is located at* EU-Rent site

$thing_1$ *is* $thing_2$

... to produce this conditioned rule:

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

Trade-off with Vocabulary

The business rule:

> it is necessary that the rental charge of each rental *is calculated in* the business currency *of* the rental.

… was defined simply, and supported by the verb concept

> rental *has* business currency

This was possible only because this verb concept had been defined in the EU-Rent Business Vocabulary.

Strictly, it is redundant. The business rule could have been defined as:

> it is necessary that the rental charge *of* each rental *is calculated in* the national currency *of* the operating country *of* the operating company that *contains* the local area that *contains* the pick-up branch *of* the rental.

Getting the right trade-off in the enterprise Business Vocabulary is important in having manageable and understandable vocabulary and rules.

Rules based in time

(1) The operative business rule

It is obligatory that the fuel level *of* the rented car of each rental *is* full *at* the actual start date/time *of* the rental .

… is supported by the verb concept

rental car *has* fuel level (synonymous form: fuel level *is of* rental car)

Its point in time is supported by the verb concept

state of affairs *occurs at* date/time

(2) The operative business rule

It is obligatory that each driver *of* each rental *is qualified after* the booking date/time of the rental and *before* the actual return date/time of the rental.

… is supported by the verb concept

rental *has* driver (synonymous form: driver *is of* rental)

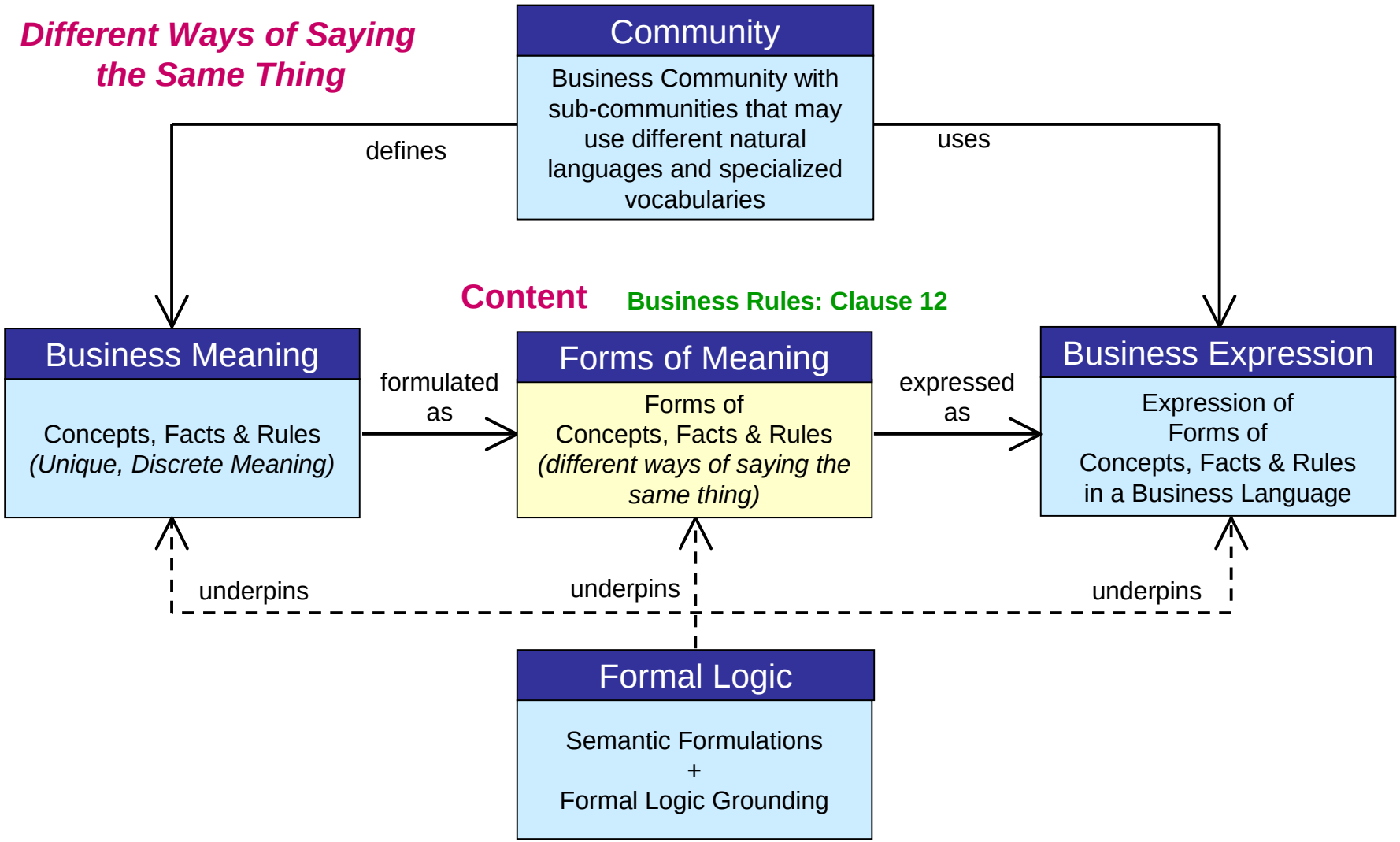
The duration of its effect is supported by the verb concepts

state of affairs *occurs after* date/time

state of affairs *occurs before* date/time

date/time$_1$ *is before* date/itme$_2$

Business Rules: Forms of Meaning



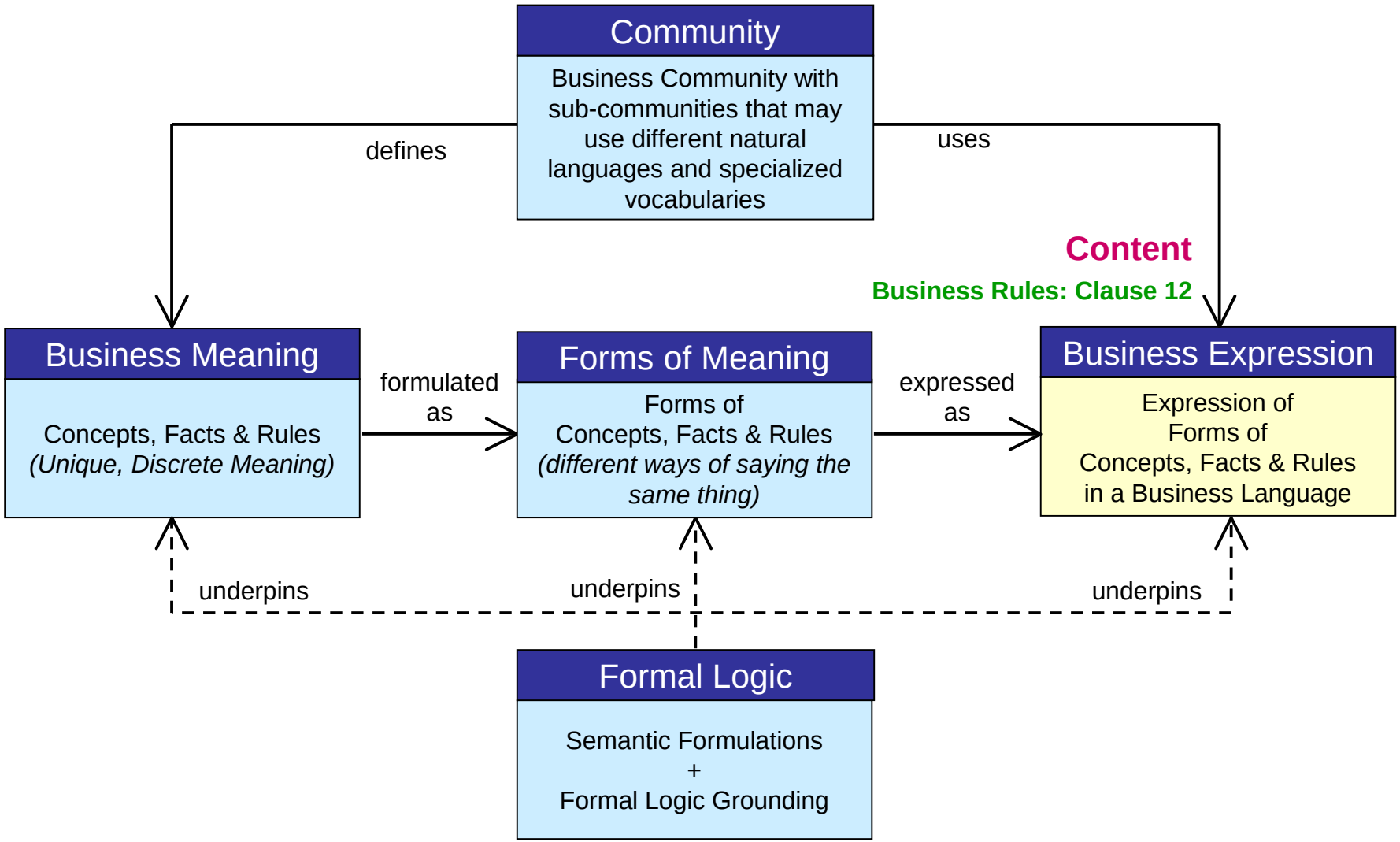
Multiple Rule Forms for One Rule (Discrete Meaning)

- One Rule Meaning (e.g. Obligation)
  - Don't rent a car to a drunk!

  can be put together in many forms:
  - Obligatory Forms
    - It is obligatory that an intoxicated person is not accepted for a walk-in rental
    - An intoxicated person should not be accepted for a walk-in rental
  - Prohibitive Forms
    - It is prohibited that an intoxicated person is accepted for a walk-in rental
    - No intoxicated person may be accepted for a walk-in rental
  - Conditional Permissive Form
    - A person may be accepted for a walk-in rental only if that person is not intoxicated
- The meaning of a rule is structured (formulated) into a 'Form of Meaning' by using a Semantic Formulation
  - One Semantic Formulation for each Form of Meaning

    (see section explaining Semantic Formulations)

Business Rules: Business Expression



Multiple Rule Statements Expressing One Rule Form

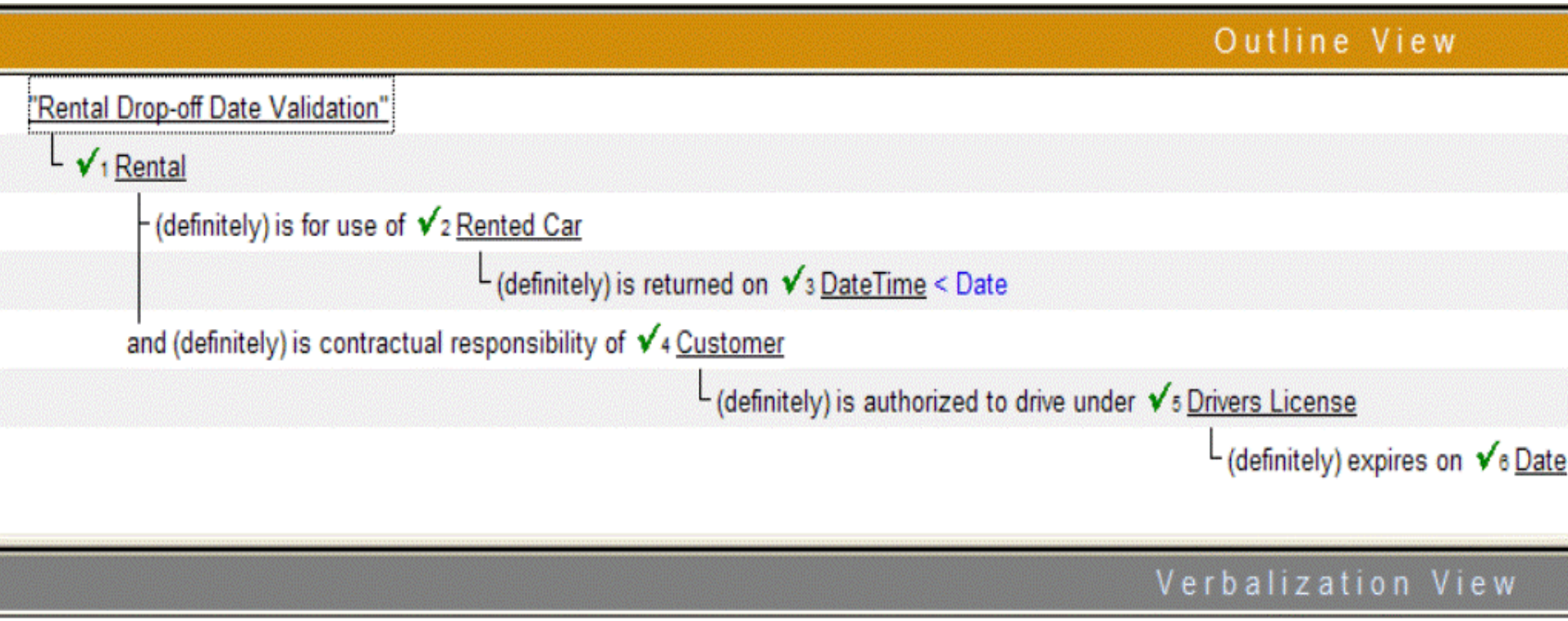
- One Rule Form (e.g. Obligatory Form)
  - It is required that the drop-off date of a rental precedes the expiration date on the driver's license of the customer reserving the rental.

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

  - Expressed in English
    - The drop-off date of a rental must precede the expiration date on the driver's license of the customer reserving the rental.
  - Expressed in French
    - La date de retour d'une location de voiture doit précéder la date d'échéance sur le permis de conducteur du client réservant la location de voiture.
  - Expressed in Structured English
    - **It is obligatory that the drop-off date *of* each rental *precedes* the expiration date *on* the driver's license *of* the customer who *reserves* the rental.**
  - Expressed in RuleSpeak
    - **The drop-off date *of* a rental must *precede* the expiration date *on* the driver's license *of* the customer who *reserves* the rental.**
  - Expressed in ORM ("ActiveQuery" notation)
    - (see next slide)

Expressed in ORM ("ActiveQuery" notation)

Model Systems

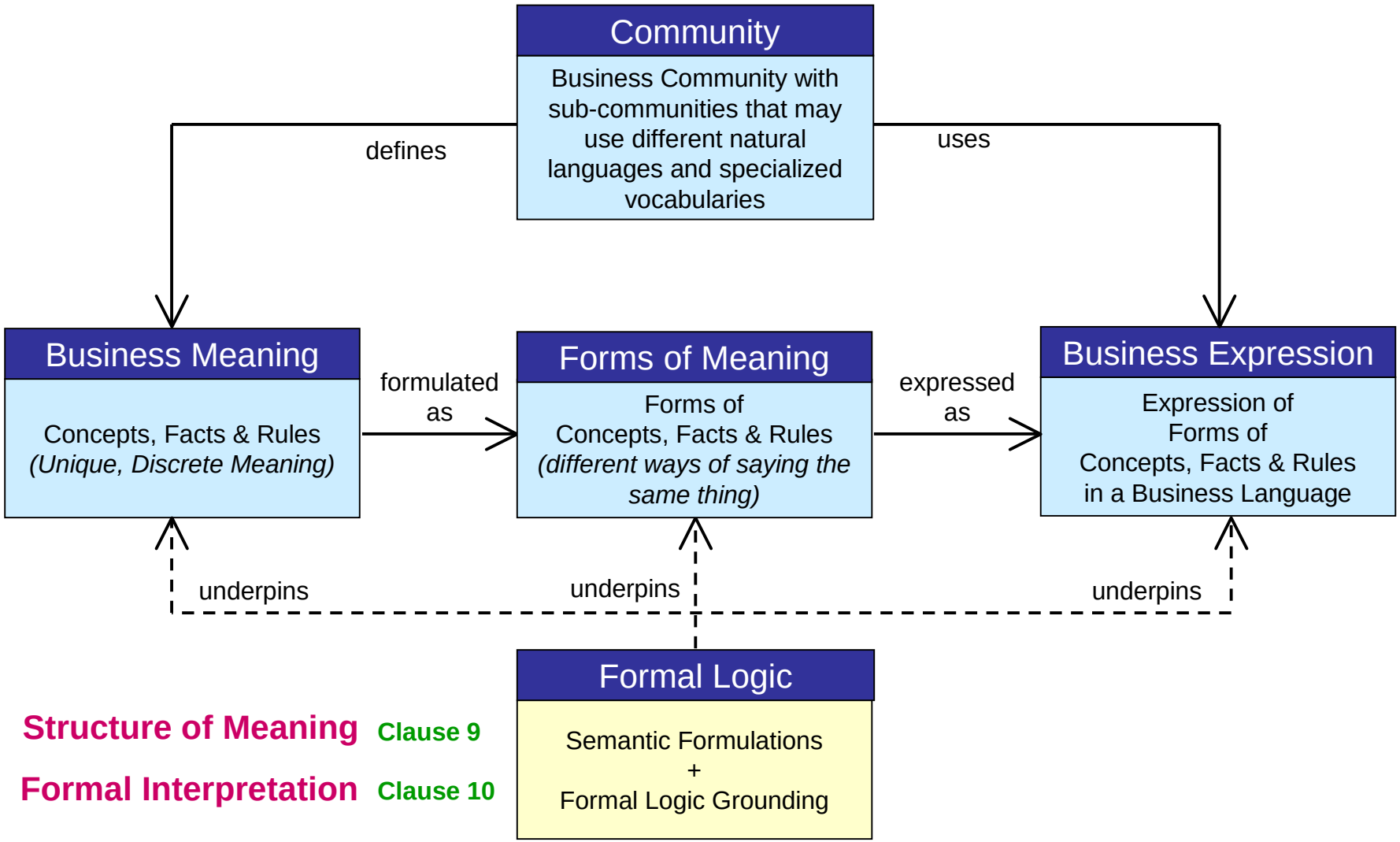


Semantics of Business Vocabulary and Business Rules (SBVR)

Semantic Formulation

Meaning Structured and Interpreted within a Formal Logic Theory

Model Systems



Structure of Meaning Clause 9

Formal Interpretation Clause 10

From Business Rule Statement to XML

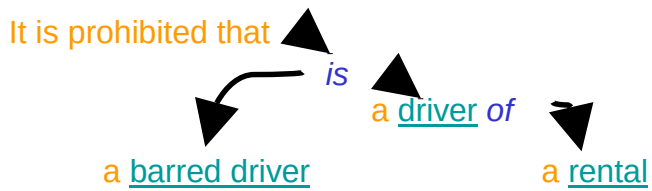
1. Start with a business rule statement.

   It is prohibited that a barred driver is a driver of a rental.

2. Identify symbols in vocabulary.

   It is prohibited that a barred driver *is* a driver *of* a rental.

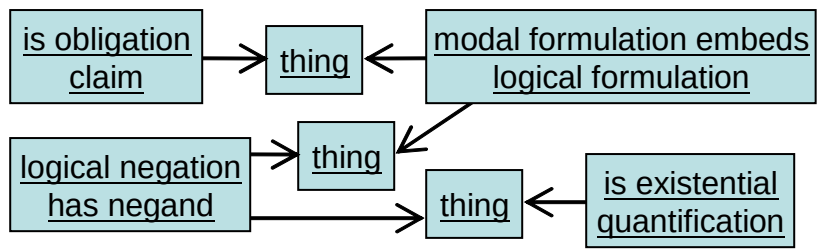
3. Parse according to language rules.



4. Restate as facts of logical formulation.

   An obligation claim *embeds* a logical negation….

5. Represent facts of logical formulation as objects.



6. Write objects as XML.

   <is-obligation-claim …/>

Logical Formulation of Semantics

- Provides a vocabulary to describe the formal semantic structures of business discourse.
  - Not for discussing business
  - For discussing the semantic structures underlying business communications of concepts, facts and rules.
- A typical business person:
  - does not talk about quantifications – but expresses quantifications in almost every statement he makes
  - doesn't talk about conjuncts, disjuncts, negands, antecedents and consequents - but these are all part of the formulation of his thinking.
- Logical formulation of Semantics is about explicitly using these conceptual devices (that people use unconsciously all the time) to capture the semantics of their discourse.

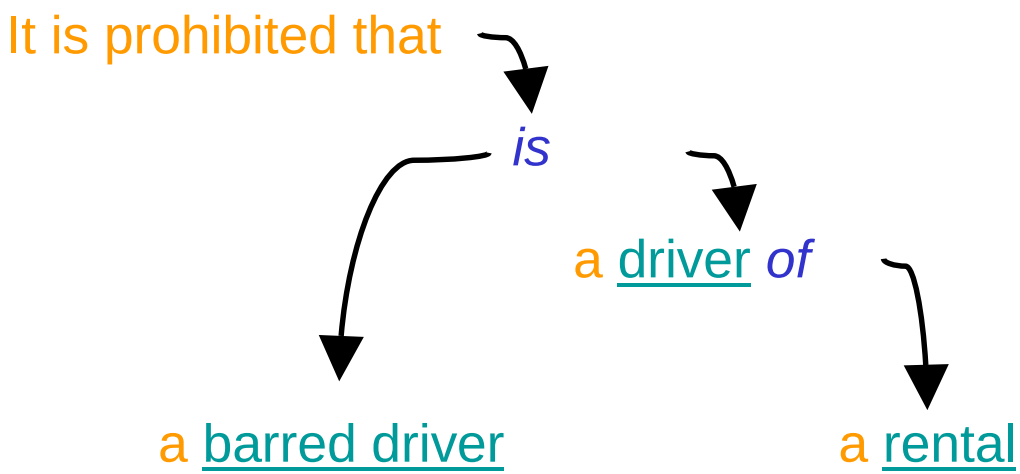
This is new – one of the unique features of SBVR

What is a Semantic Formulation?

- What it's NOT:
  - A ***language*** for stating business rules
  - A ***language*** for stating constraints
  - About software design
  - Intended for use by business people in general
  - Intended to parse free-form natural language
- What it is
  - Language for talking about meanings of concepts and rules
    - regardless of the languages or notations used to state them
  - A way of ***structuring*** the ***meaning*** of:
    - Definitions
    - Rules that govern the operation of an organization
    - Questions (Queries)
  - ***Optimized for people and natural language*** – not for machine processing
  - Interpretable in formal logics: first order and restricted higher order
  - Recursive
- Scope: Whatever business people mean by the vocabularies they use and the rules they make

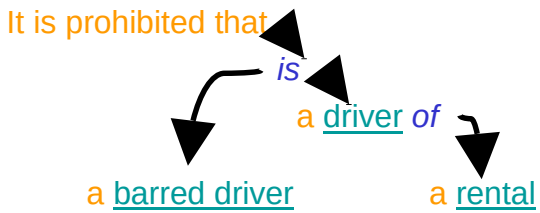
Business Rule – Parsed

It is prohibited that a barred driver *is* a driver *of* a rental.



Logical Formulation

It is prohibited that a barred driver *is* a driver *of* a rental.



obligation claim
. *embeds* a logical formulation that *is* a logical negation
. . *has* a negand that *is* an existential quantification
. . . *introduces* a variable
. . . . *has* the type barred driver
. . . *scopes over* an existential quantification
. . . . *introduces* a variable
. . . . . *has* the type rental
. . . . *scopes over* an atomic formulation
. . . . . *is based on* the verb concept: 'rental has driver'
. . . . . *has* a role binding
. . . . . *is of* the fact type role that *is* 'rental' of 'rental *has* driver'
. . . . . *binds to* the variable that *has* the type rental
. . . . . *has* a role binding
. . . . . *is of* a fact type role that *is* 'driver' of 'rental *has* driver'
. . . . . *binds to* the variable that *has* the type barred driver

XML (for Logical Formulation)

<is-obligation-claim obligation-claim=”oc”/>
<modal-formulation-embeds-logical-formulation modal-formulation=”oc” logical-formulation=”n”/>
<logical-negation-has-negand logical-negation=”n” negand=”eq1”/>
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<atomic-formulation-has-role-binding atomic-formulation=”af” role-binding=”rb2”/>
<role-binding-is-of-fact-type-role role-binding=”rb2” fact-type-role=”ftr2”/>
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<esbr:thing xmi:id=”v1”/> <esbr:thing xmi:id=”bdt”/> <esbr:thing xmi:id=”eq2”/>
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<esbr:thing xmi:id=”ft”/> <esbr:thing xmi:id=”rb1”/> <esbr:thing xmi:id=”rb2”/>
<esbr:thing xmi:id=”ftr1”/> <esbr:thing xmi:id=”ftr2”/>

Semantics of Business Vocabulary and Business Rules (SBVR)

Formal Logic Grounding

Formal Logic Basis of SBVR

- Oriented to logicians' perspective
- Documented in an Appendix to the submission, as the "Authoritative Source"
- Aligned with "Common Logic" – draft standard 24707, currently being fast-tracked by ISO
- Validated with Pat Hayes, consultant to ISO on Common Logic

Formal Logic

- Underpins Body of Shared Meanings and Semantic Formulation
- Required:
  - To ensure formal basis for automated processing in repositories and for interchange
  - For alignment with other OMG specifications
- Typed predicate logic:
  - First order
  - Restricted higher order
- Modal Operators – needed for business rules:
  - Alethic: “It is necessary that …”, “It is possible that …”
  - Deontic: “It is obligatory that ….”, “It is permitted that …”
- Grounded in Common Logic (draft ISO standard 24707)
  - Needed to allow “irregular expressions” to handle modal operators

Modality

SBVR needs two kinds of modality in order to create business rules:

- **Alethic**, for Structural Business Rules with two operators:
  - "It is necessary that …"
  - "It is possible that …" (and its negation, "It is impossible that …")

  They are used in the sense of 'logically necessary' and 'logically possible/impossible'

  Alethic operators, when introduced into verb concepts, define "Structural" Business Rules.

  Structural business rules are always true, by definition.
- **Deontic**, for Operative Business Rules with two operators:
  - "It is obligatory that …"
  - "It is permitted that …" (and its negation, "It is forbidden that …")

  Deontic operators, when introduced into verb concepts, define "Operative" Business Rules, rules that govern activity in the business.

  Operative business rules can be broken, and require enforcement

These operators are the only elements of modal logic included in SBVR
Full (and possibly controversial) modal logics are not necessary

Semantics of Business Vocabulary and Business Rules (SBVR)

What Next?

SBVR Progress

- Submission to OMG:
  - Accepted September 2005
  - Available for comment until July 24 2006

    www.omg.org/docs/dtc/06-03-02.pdf
  - Finalization scheduled September 2006
- Release as OMG specification
- Industry and vendor take-up (has already started):
  - Tools: repository and interchange
  - Best practice and methodology
- OMG vertical task forces and Special Interest Groups (financial, health care, telco …) develop BV+R for their industries

OMG SBVR-related activity

- Business Motivation Model:
  - Accepted September 2005 for consideration as existing standard to be adopted
- Completion of related OMG specifications: BPDM, OSM, PRR, BRM:
- Alignment across OMG business-oriented specs:
  - Interfaces
  - Common vocabulary
  - Business Architecture emerges
- Transforms to MDA CIM and PIM
- Submission of RFP responses in SVBR? (Has been done for OSM)
- Interest from Regularity Compliance SIG

Reusing “Business Vocabulary”

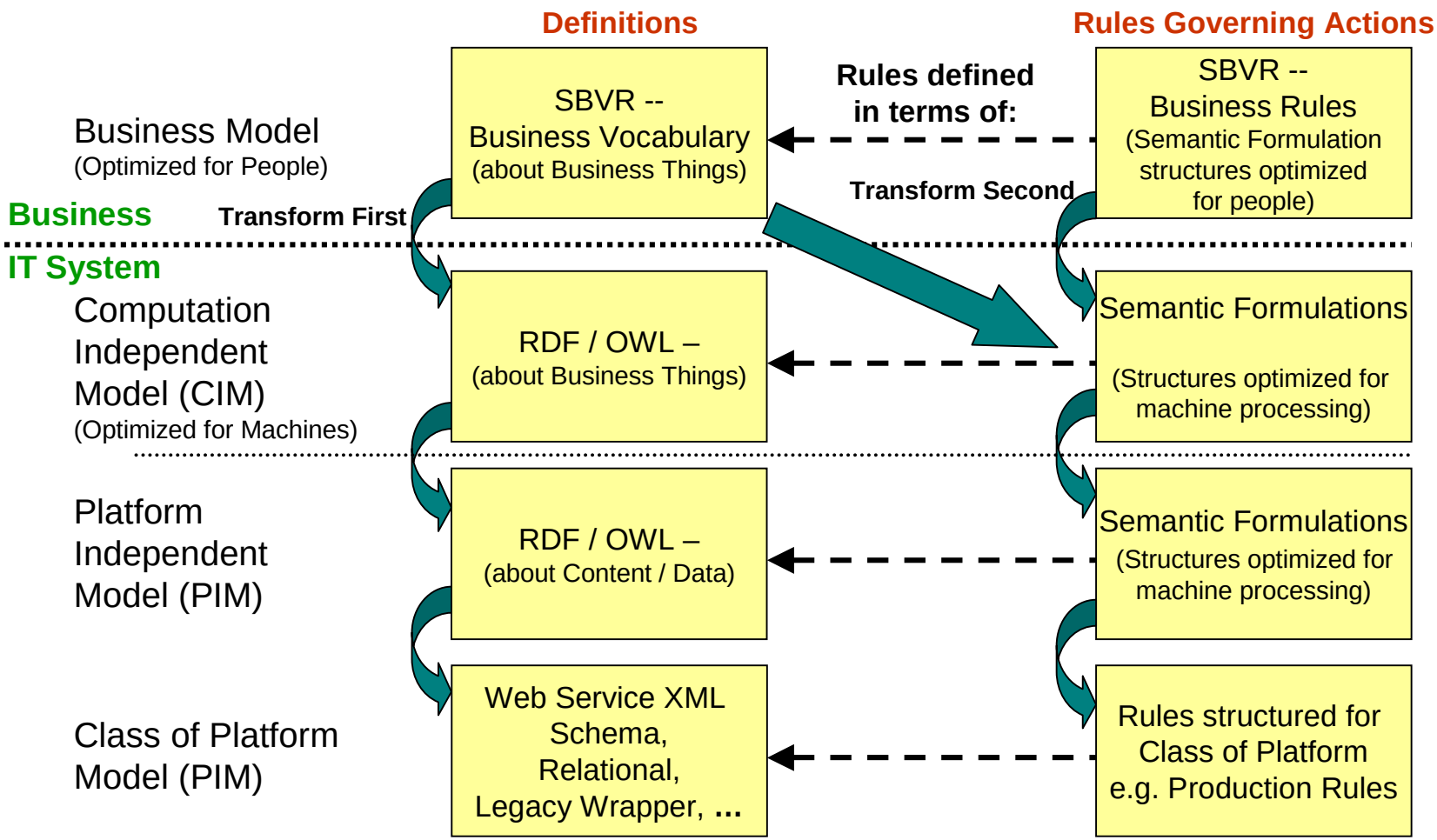
- Take SBVR specification, excluding “Business Vocabulary for Business Rules”
- Use it to define vocabularies for other aspects of business modelling, e.g.
  - “Business Vocabulary for Business Process”
  - “Business Vocabulary for Organization Structure” (already done in OMG RFP submission)

  These are examples of SBVR’s self-extensibility
- Then have consistency for vocabulary definition – and for MOF/XMI-compliant interchange
- When creating a business model for a specific business, use the same vocabulary for all aspects

World Wide Web Consortium

- See rules as a major part of Semantic Web and Web services
- Has established Rule Interchange Format (RIF) Working Group
  - http://www.w3.org/2005/rules/wg
  - Chartered in 2005 for 2 years
  - First draft document (Use Cases) made publicly available in March 2006
  - SBVR is one of the major inputs: ongoing liaison with OMG (also for ODM and PRR)

SBVR mapping: MDA & Semantic Web Architecture



Thank you

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… and the S-beaver