Defining Business Vocabulary

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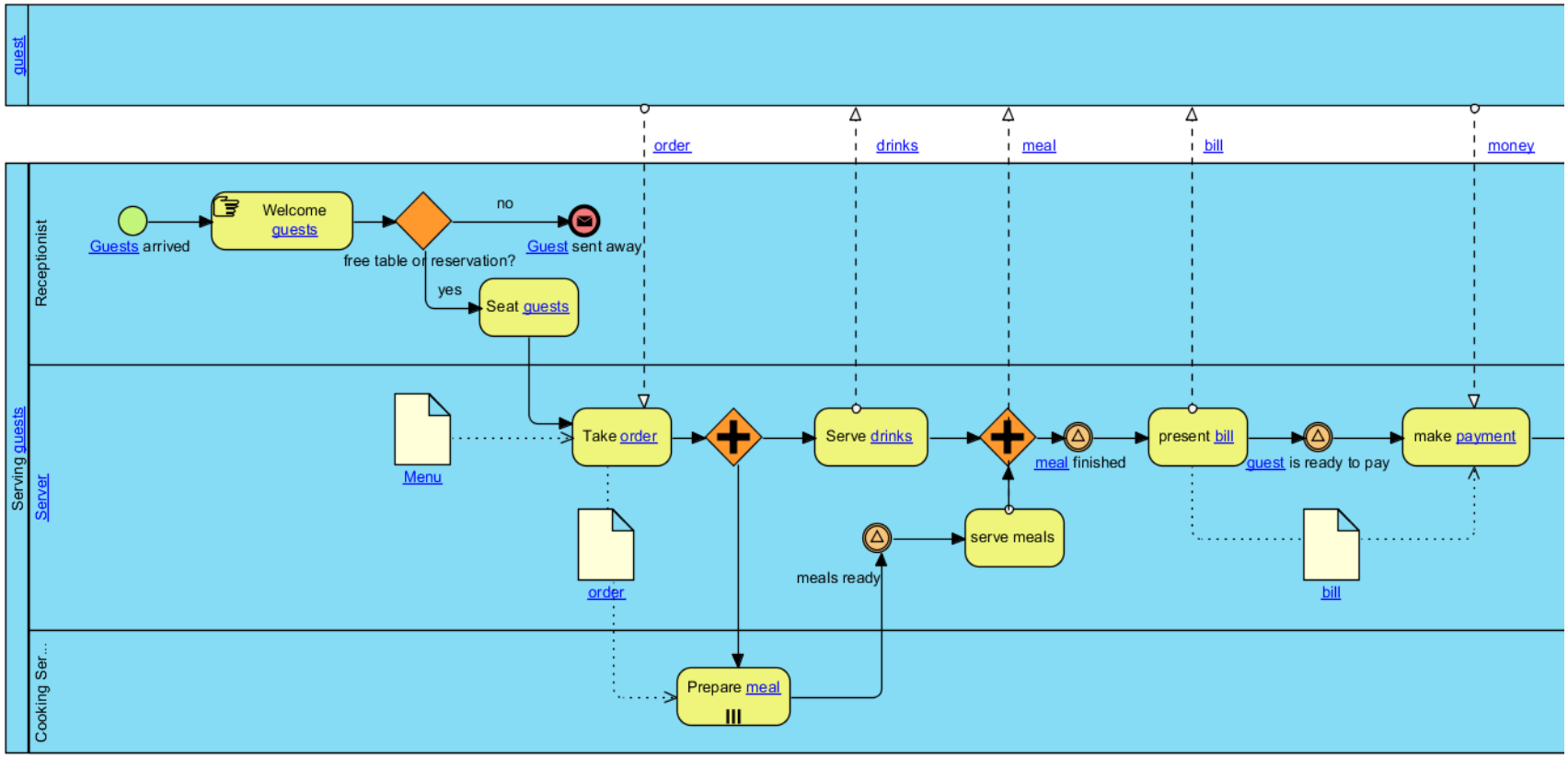
Models should use defined Terms

- Using terms defined in a vocabulary increases model quality:
  - Meaning of terms is known
  - Naming across models is consistent

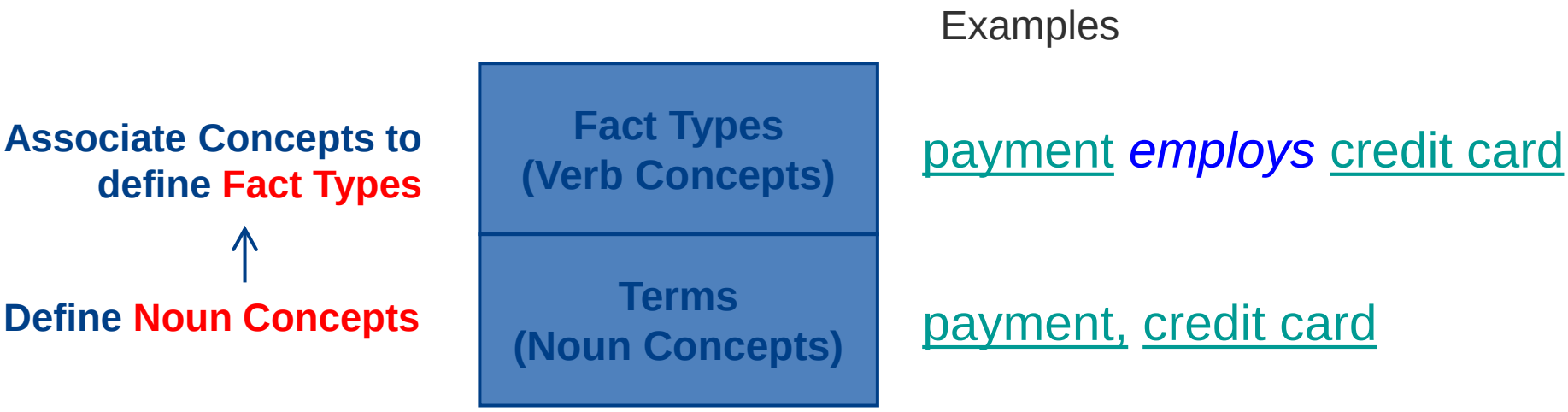


SBVR - Semantics for Busines Vocabulary and Business Rules

- The Semantics of Business Vocabulary and Business Rules (SBVR) is a standard of OMG
- It is intended to be the basis for formal and detailed natural language description of a business
  - vocabularies
  - business facts
  - business rules

Vocabulary

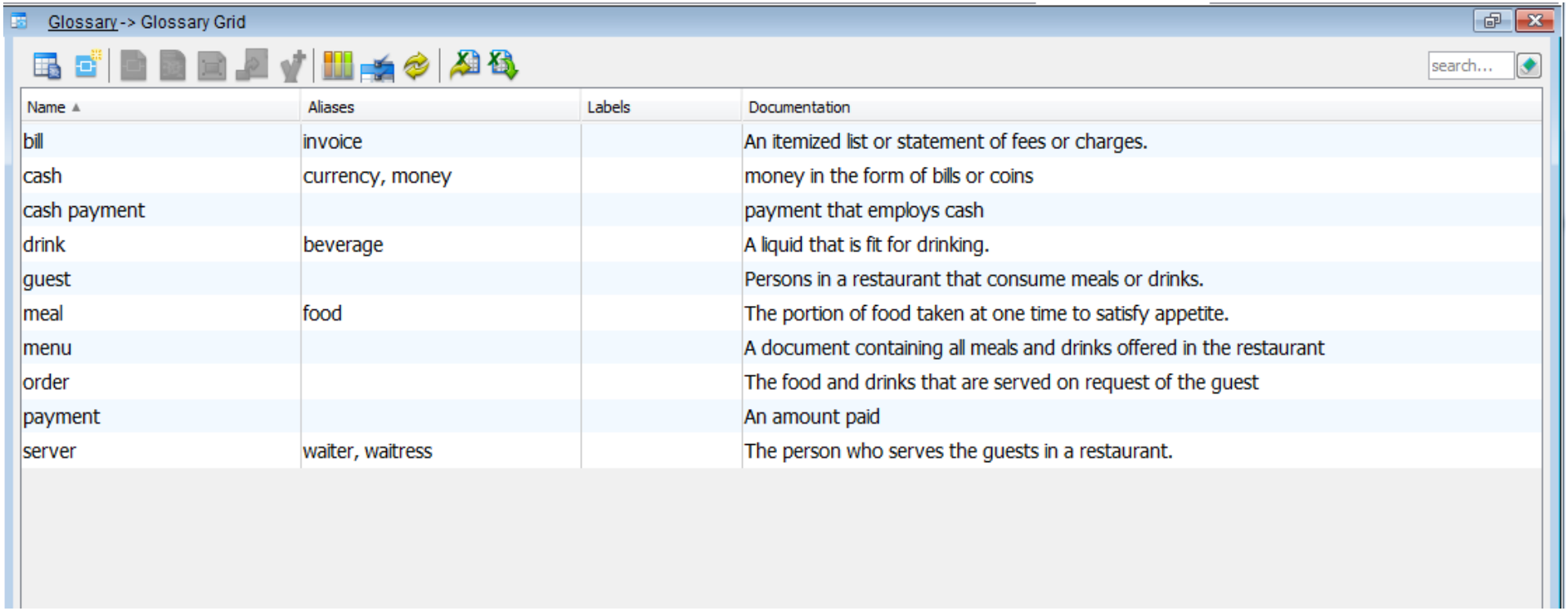
- The vocabulary consists of the terms that are used to name model elements and to phrase rules.
- The vocabulary consists of - Terms (noun concepts)
  - Fact types (verb concepts)



- Business terms are words and phrases that have meaning to business people
- Facts are combinations of business terms that describe what business people know about their business.“

Glossary

- A glossary is a collection of noun concepts and their defininitions.
- Example: Glossary in Visual Paradigm



Name	Aliases	Labels	Documentation
bill	invoice		An itemized list or statement of fees or charges.
cash	currency, money		money in the form of bills or coins
cash payment			payment that employs cash
drink	beverage		A liquid that is fit for drinking.
guest			Persons in a restaurant that consume meals or drinks.
meal	food		The portion of food taken at one time to satisfy appetite.
menu			A document containing all meals and drinks offered in the restaurant
order			The food and drinks that are served on request of the guest
payment			An amount paid
server	waiter, waitress		The person who serves the guests in a restaurant.

Noun Concepts - Examples

- A glossary contains definitions of terms that are used to name model elements and to phrase rules.
- Definition of a Noun concept

> ***cash payment***
> *Definition:* ***payment*** *that employs* ***cash***

  - ♦ A cash payment is a specialisation; any payment that employs cash is a cash payment

- Two noun concept definitions from a dictionnary

> ***payment***
> *Definition: an amount paid*
>
> ***cash***
> *Definition: money in the form of bills or coins; currency*
> — American Heritage Dictionary of the English Language, Fourth Edition

Intensional and Extensional Definitions

- In general there are two types of definitions
  - **intensional definition**: a definition which describes the intension of a concept by stating the superordinate concept and the delimination characteristics
  - **extensional definition**: a description of a concept by enumerating all of ist subordinate concepts
- Example: An intensional and an extensional definition of the restaurants of Cora Group

Cora restaurant

Definition: restaurant which belongs to Cora Group

Definition: one of restaurants **Nola**, **Portia**, **Viola**, **Zona** and **Adelina**

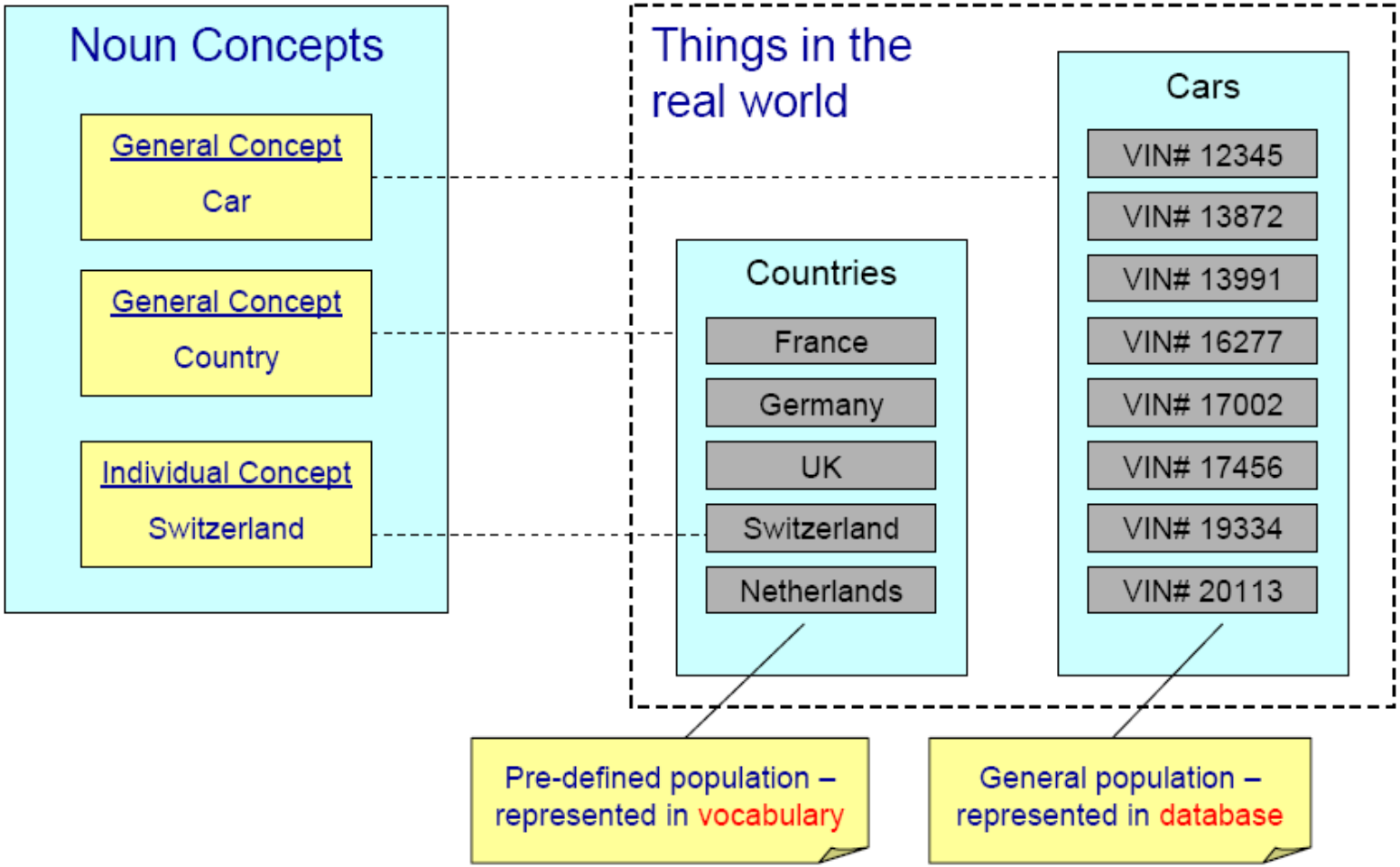
Noun Concepts and Structural Rules

- A noun concept can be detailed with a structural rule
- Structural Rules cannot be violated and thus can be used as definitions
- Example: The following rule can be regarded as a definition of the noun concept „separated party“: A separated party must be seated at two or more tables, otherwise it is not a separated party

Parties 1: It is necessary that a separated party is seated at two or more tables

Noun Concepts: General and Individual

Individual concepts represent things in the real world
General concepts represent classes (= sets of elements)



(Chapin & Hall 2006)

General and Individual Noun Concepts

Examples:

- The '**general concept**' that denotes the set of cities in which Cora Group has restaurants

operating cities

Definition: **cities** in which **Cora Group** has restaurants
Concept Type: **general concept**

- The '**individual concept**' that denotes the city Washington D.C.

Washington D.C.

Concept Type: **individual concept**
Definition: The capital city of the **USA**
General Concept: **city**

Fact Types

- A Fact Type is the meaning of a verb phrase that involves one or more noun concepts
- Fact types characterize, how noun concepts may be related.
- Example:
  - The following fact type says that the noun concept payment and the noun concept personal check can be related via the verb *employs*

    payment *employs* personal check
- Fact types can be visualized as fact-type diagrams

Multiple Fact Types

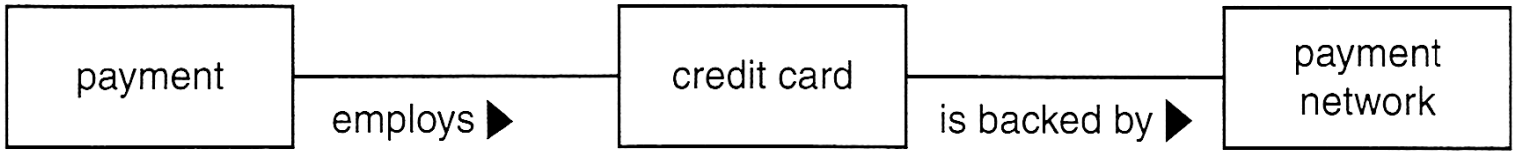
- A business rule can be build on more than one fact type
- Example:
  - The rule VISA Only is build on two fact types

VISA Only: It is permitted that a payment employ a credit card only if the credit card is backed by VISA™.

payment *employs* credit card

credit card *is backed by* payment network

  - Multiple Fact Types can be combined into one diagram

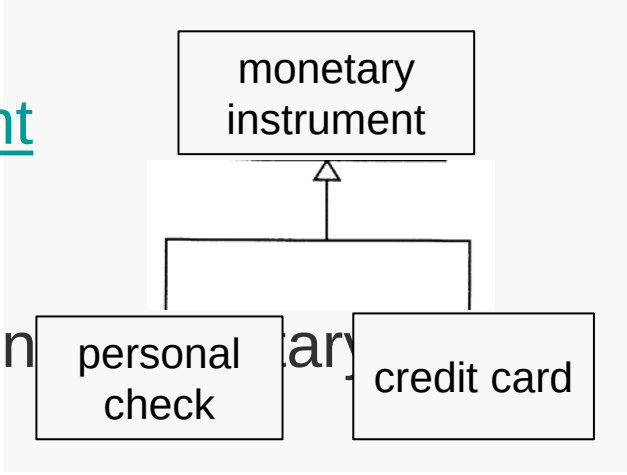


Generalization and Specialization

- The relation *specializes* is a predefined fact type in SBVR to define a generalisation hierarchy.
- It either relates two general concept which is equivalent to the generalization in UML (meaning subclass of)

  credit card *specializes* monetary instrument

  "Each credit card is a monetary instrument"
  or: "each element of credit card is also an element of monetary instrument"



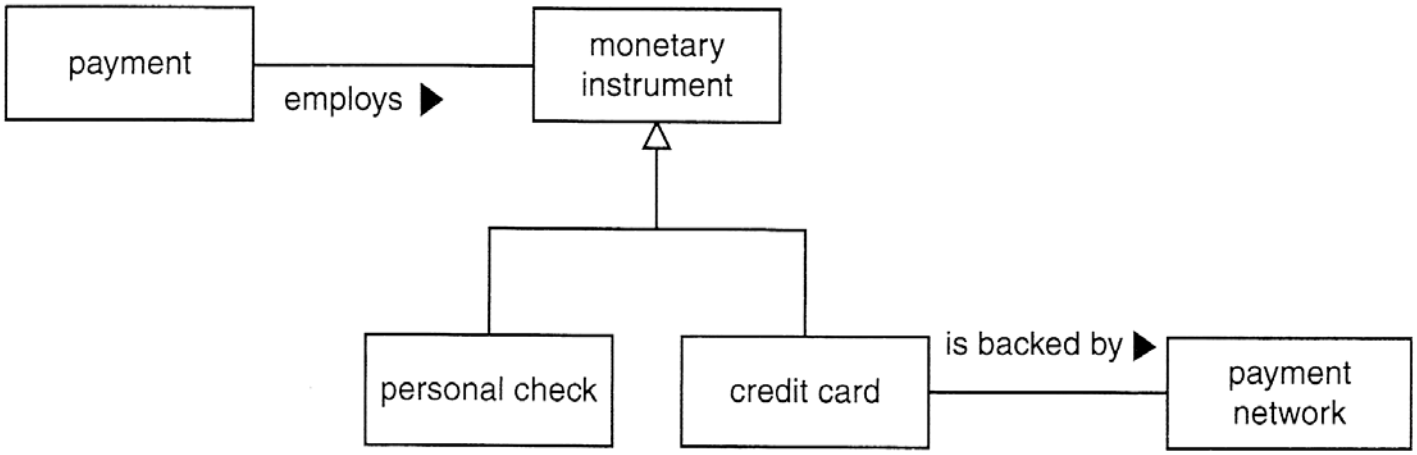
  or it relates an individual and a general concept

  Washington D.C. *specializes* city

- The fact type *generalizes* is the inverse relation

Fact Type Diagrams

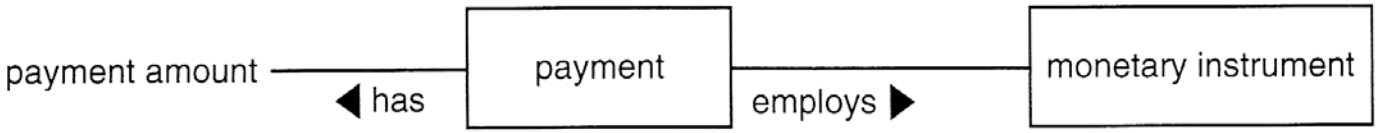
- The following fact type diagram contains fact types for several rules
- It consists of noun concepts, verbs and a specialisation



- Note the correspondence of fact type diagrams to UML class diagrams:
  - ♦ noun concepts correspond to classes
  - ♦ verbs correspond to associations

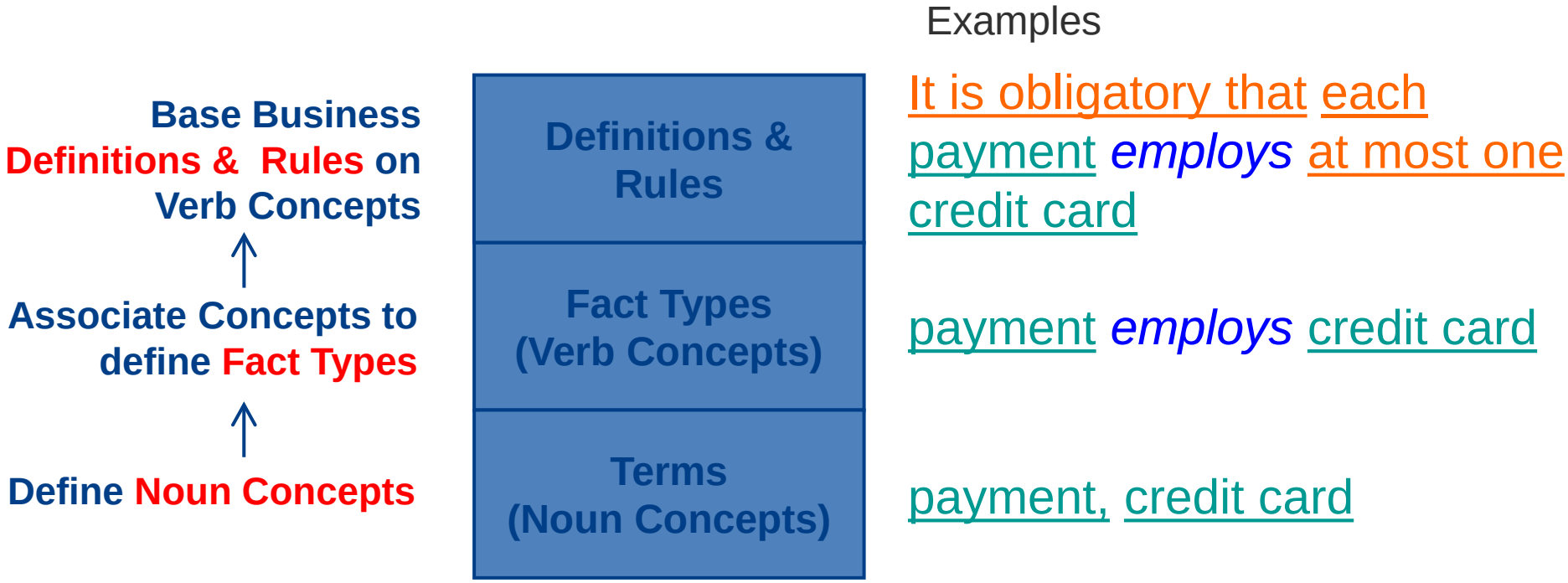
Fact Type Properties

- A property is a fact type, whose value is not a noun concept but a number or a string (e.g. a name)
- Example: The value of a payment amount is a number.



- It could be a convention, to use a specifc verb „has“ to indicate properties and to distinguish them from other fact types.
- Properties correspond to attributes:

Rules are built on Facts, Facts are built on Terms



- Business terms are words and phrases that have meaning to business people in the context where those terms are used.
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(Chapin et al. 2008)

Defining a Business Rule

- Start with a fact type, e.g.

  payment *employs* credit card

- Apply an obligation or necessity to it, e.g.

  it is obligatory that payment *employs* credit card.

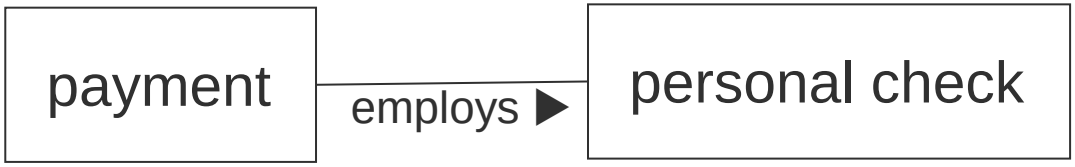
- Add qualifications, quantifications and conditions, if necessary, e.g.

  It is obligatory that each payment *employs* at most one credit card

The rules are phrased using SBVR Structured English Notation

Fact Types and Rules

The same fact type can be used in many rules



Potential Rule	Interpretation
It is obligatory that a payment employ a personal check.	For that odd restaurant that requires all payments be made in personal checks.
It is permitted that a payment employ a personal check only if the personal check is drawn on a local back.	A personal check is acceptable if another condition holds: the check is local.
It is obligatory that a customer be photographed if the customer makes a payment and the payment employs a personal check.	For the careful restaurant that wants to collect forensic evidence from customers who might bounce checks.

Defining a Business Rule

This procedure is applied also for complex rules with more than one fact type

- Start with the fact types, e.g.

  payment *employs* credit card

  credit card *is backed by* payment network

  VISA *specializes* payment network

- Apply modality keyword, e.g.

  It is permitted that payment *employs* credit card,
  credit card *is backed by* payment network

- Add qualifications, quantifications, conditions, and instantiate, etc.

  It is permitted that a payment *employs* a credit card only if the
  credit card *is backed by* VISA

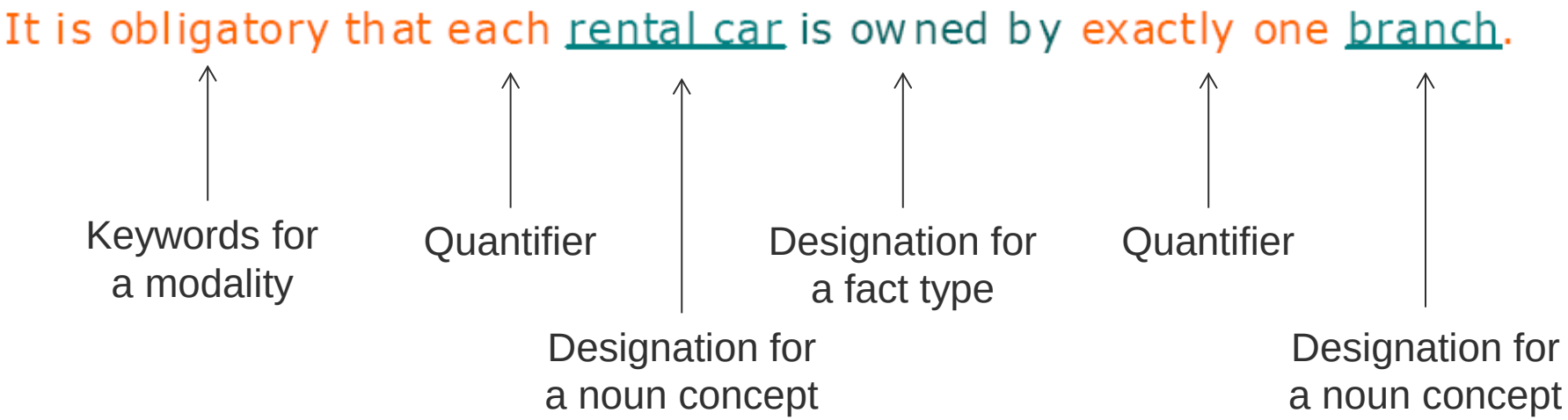
SBVR – Structured English Notation

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'.

SBVR Structured English – An Example



(Chapin & Hall 2006)

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- 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

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. 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 fact type, 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 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.

Exercise: Definitions

- Give definitions for the following concepts:
  - weekday
  - working day
  - weekend
- Are the definitions intensional or extensional?