Business Rules

Business Rules - Definitions

A Business Rule is a directive, intended to influence or guide business behavior, in support of Business Policy that has been formulated in response to an Opportunity, Threat, Strength, or Weakness.

(www.**brportal**.org)

A business rule is a statement that defines or constrains some aspect of the business. It is intended to assert business structure or to control or influence the behavior of the business.

(www.**businessrulesgroup**.org)

Business rules may be

- defined as business definitions for business use (to represent policies, practices and procedures), or
- defined as executable business rule statements for use in some ruledriven system, or
- both.

(http://www.**omg**.org/attachments/pdf/PaulHarmonBParticle.pdf)

Business Rules Manifesto
Article 1. Primary Requirements, Not Secondary

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

1.2. Rules are essential for, and a discrete part of, business models and technology models.

Why Business Rules

Some frequently mentioned reasons for Business Rules:

- Motivation: Rational Enterprises
  - Enterprises should be able to say why the act in a particular way
  - Motivated rules are derived from policies and support the achievement of goals and objectives
- Agility
  - Customers ask for individual, "customized" products
  - Flexible reaction on market needs causes changes in business
  - Changes in business often demand flexible adaptation of IT systems
  - Business RUles can make the dependencies of solutions explicit
- Compliance
  - More and more enterprises have to ensure that they observe the laws and regulations
  - Business Rules represent the compliance requirements

The Importance of Rules

- Often, business rules are not accessible or even unknown
- When rules are unaccessible or unknown, people (including business developers) make assumptions that might be incorrect of inconsistent which leads to behaviour that is
  - not effectively focused on common objectives
  - not capable of easy changes and adaptibility
- Such assumptions lead to behaviour that is not effectively focused on common objectives,

(von Halle 2002, p. 4)

Four Principles of the Business Rules Approach

The business needs systems in which rules are …

… *separated* from other components so that everybody knows *that* they exist

… *externalized* so everybody knows *what* the rules are

… *tracable* to their origins and their implementation so everybody knows *where* they come from

… deliberately *positioned for change* so everybody knows *how to improve* them

(von Halle 2002, p. 4)

Business Rules Manifesto
Article 2. Separate From Processes, Not Contained In Them

2.1. Rules are explicit constraints on behavior and/or provide support to behavior.

2.2. Rules are not process and not procedure. They should not be contained in either of these.

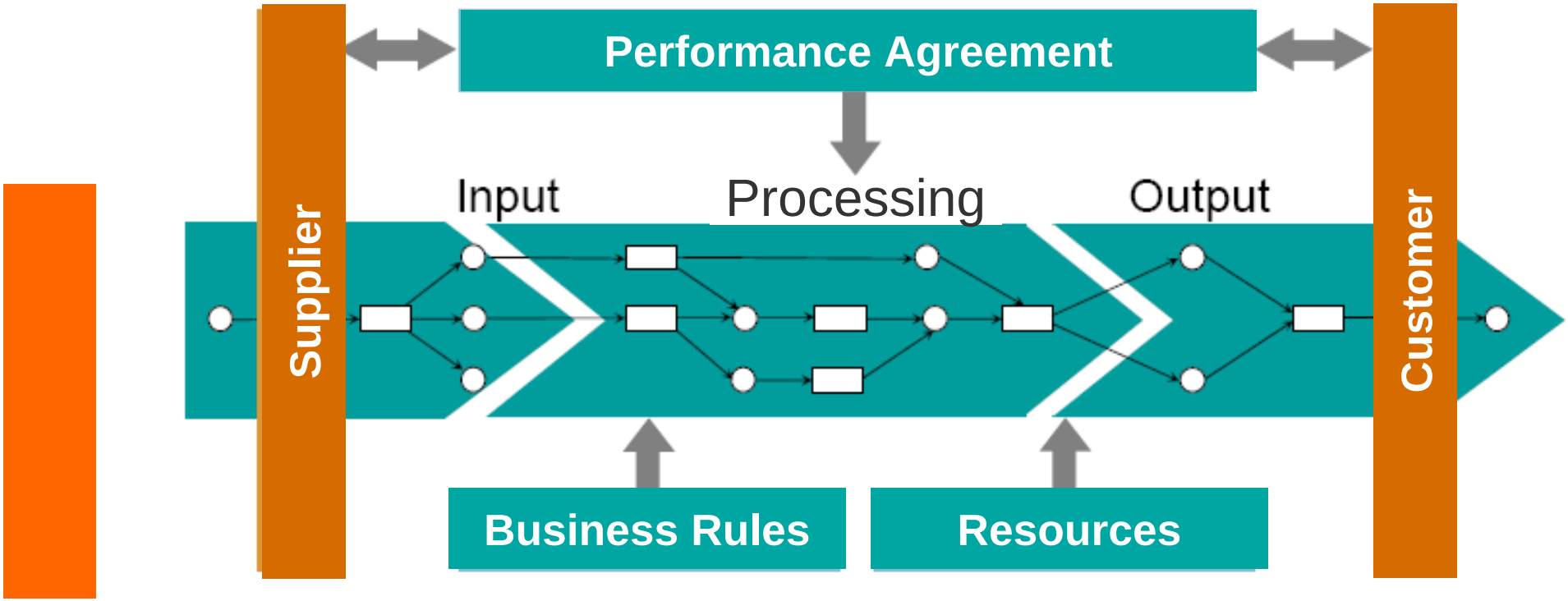
2.3. Rules apply across processes and procedures. There should be one cohesive body of rules, enforced consistently across all relevant areas of business activity.

Business Rules Characteristics

- Business Rules define conditions that must hold true in specific situations
- Business Rules are not descriptions of process or processing
- Rather, they define
  - the conditions under which a process is carried out or
  - the new conditions that will exist after the process has been completed
- Business Rules define what must be the case rather than how it comes to be.

(Morgan 2002, p. 59)

Business Rules and Processes



Source: Rainer Endl (2004): Regelbasierte Entwicklung betrieblicher Informationssysteme, EUL-Verlag, S. 16
siehe auch:
R. Endl: Modellierung von Geschäftsprozessen. http://www.brportal.org/German/vertInformationen/Regelbasierte_Prozessmodellierung.pdf

Business Rules Manifesto
Article 3. Deliberate Knowledge, Not A By-Product

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

3.2. Terms express business concepts; facts make assertions about these concepts; rules constrain and support these facts.

3.3. Rules must be explicit. No rule is ever assumed about any concept or fact.

3.4. Rules are basic to what the business knows about itself -- that is, to basic business knowledge.

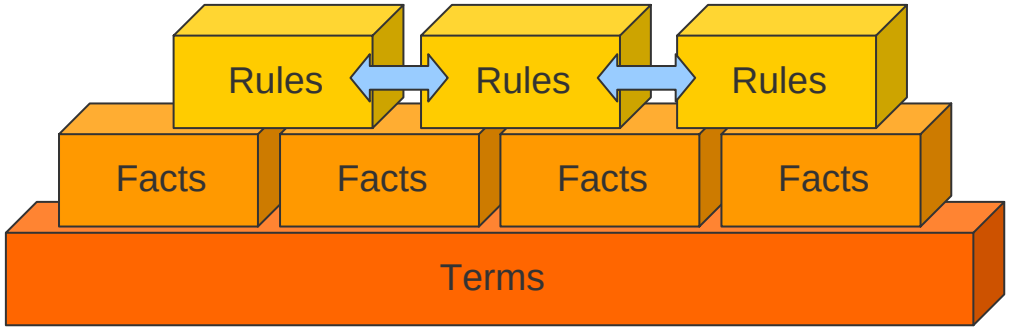
3.5. Rules need to be nurtured, protected, and managed.

All starts with terms and facts

„The work that results in successful business rule discovery, analysis, modeling, and implementation all starts with term and fact identification and term-fact modeling.

[…] business terms are words and phrases that have meaning to business people in the context where those terms are used.

Facts are combinations of business terms that describe what business people know about their business.“



Oscar Chappel: Term–Fact Model

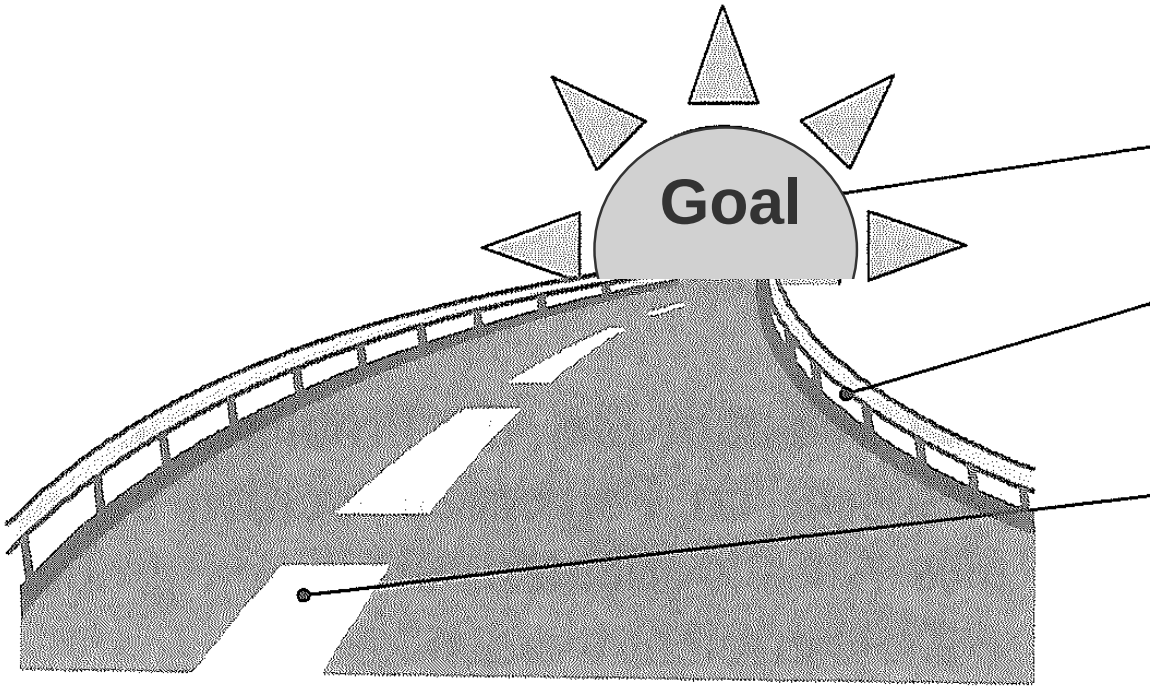
Quelle: Oscar Chappel: Term–Fact Modeling, the Key to Successful Rule-Based Systems.
URL: http://www.brcommunity.com/b250.php

Categories of Business Rules

A common classification distinguishes 3 categories of rules

- Inference Rules
  - Rules deriving new information from existing information
- Constraints
  - Rules making assertions that have to be true, they reject any event that would cause a violation to occur
- Process Rules
  - Rules enabling, enforcing or preventing actions

Business Rules show the Way

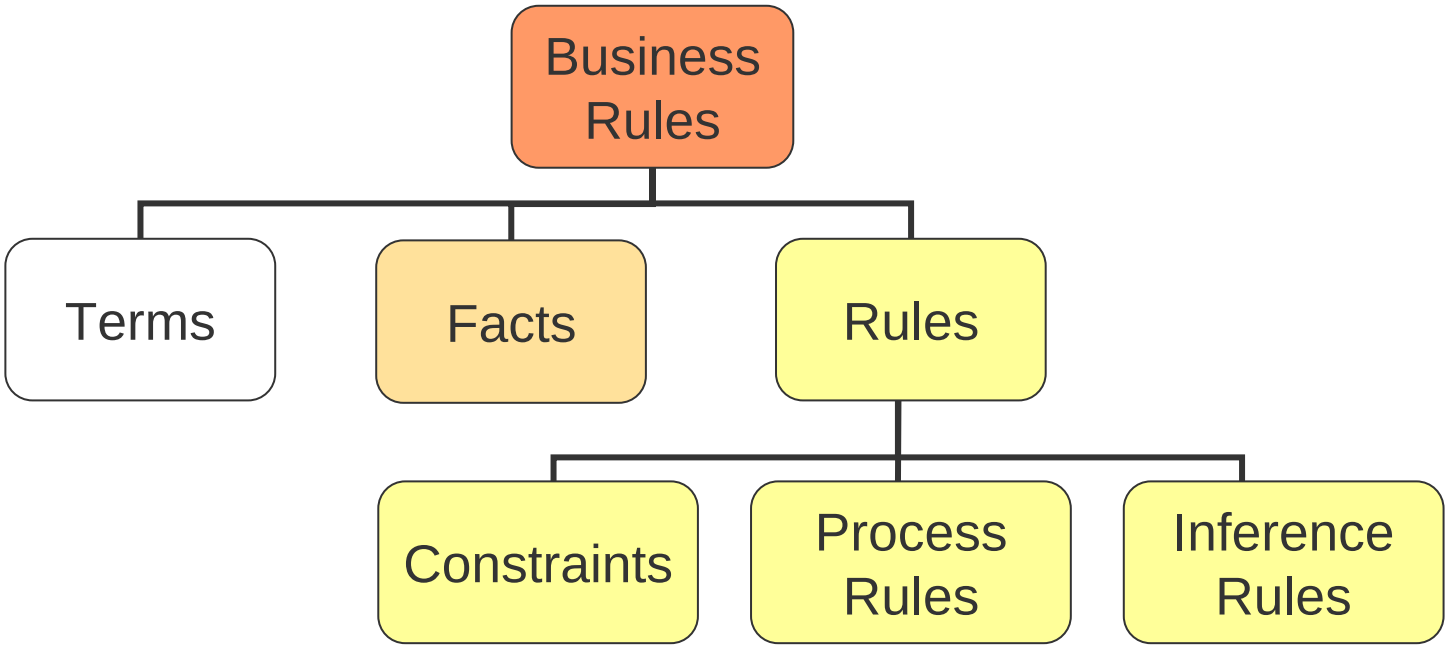


adapted from (Schacher and Grässle 2006, p. 18)

Examples of Business Rules for EU-Rent

1. A Car whose odometer reading is greater than (next service mileage – 200) must be scheduled for service.
2. Each Car purchased must match the standard specification of its Car Model.
3. A customer must present a valid driver's license in order to rent a EU-Rent vehicle.
4. Every driver on a rental must be over 21 years old.
5. The Car assigned to a Rental must be: at the time of assignment, of the available Cars in the requested Car Group, the one with the lowest mileage.

Rule Classification



Enforcement Levels of Business Rules

- Consider the following two rules:
  - A customer *must* be assigned to an agent if the customer has placed an order
  - A customer *should* be assigned to an agent if the customer has placed an order
- The first rules is a constraint, the second one is a guideline
- Guidelines influence behaviour rather than control it
  - A constraints that is violated means "Error"
  - A guideline that is violated means "Warning"
- The rules have the same form and are applied in the same situation but the enforcement level is different

Business Rules Manifesto
Article 4. Declarative, Not Procedural

4.1. Rules should be expressed declaratively in natural-language sentences for the business audience.

4.2. If something cannot be expressed, then it is not a rule.

4.3. A set of statements is declarative only if the set has no implicit sequencing.

4.4. Any statements of rules that require constructs other than terms and facts imply assumptions about a system implementation.

4.5. A rule is distinct from any enforcement defined for it. A rule and its enforcement are separate concerns.

4.6. Rules should be defined independently of responsibility for the who, where, when, or how of their enforcement.

4.7. Exceptions to rules are expressed by other rules.

What should a Rule say?

- Business Rules should be concerned only withh the conditions that must apply in a defined state
- In particular, a business Rule should define what should be the case and should **not** prescribe
  - *Who* invokes the rule
    - This is usually described in a use case or a process description
  - *When* the rule is executed
    - This is usually described in a business event, use case or a process description
  - *Where* the rule executes
    - This will be defined in the design
  - *How* the rule is implemented
    - This will be defined in the design

Business Rules Manifesto
Article 5. Well-Formed Expression, Not Ad Hoc

5.1. Business rules should be expressed in such a way that they can be validated for correctness by business people.

5.2. Business rules should be expressed in such a way that they can be verified against each other for consistency.

5.3. Formal logics, such as predicate logic, are fundamental to well-formed expression of rules in business terms, as well as to the technologies that implement business rules.

Clarity of Business Rules

- Business Rule statements must be in a form that the business owner can immediately accept them as valid or reject as invalid.
- Thus, Business Rules are a series of simple statements about the business with the following characteristics:

  Atomic: can't be broken down any further without losing information

  Unambiguous: have only one, obvious, interpretation

  Compact: typically, a single sort of sentence

  Consistent: together, they provide a unified and coherent description

  Compatible: use the same terms as the rest of the business model

(Morgan 2002, p. 61)

Levels of Expression

- For expressing rules there is a trade-off between acessibility of business meaning and desirable automation
- Rules can be expressed on various levels:

  Informal: natural language statements within a limited range of patters, e.g.

  > A credit account customer must be at least 18 years old

  Technical: Combining structured data references, operators and constraint natural language, e.g.

  ```
  CreditAccout
    self.customer.age >= 18
  ```

  Formal: statements conforming a more closely defined syntax with particular mathematical properties, e.g.

  ```
  {X, Y, (customer X) (creditAccount Y) (holder X,Y)
    ==> (ge (age X) 18)
  ```

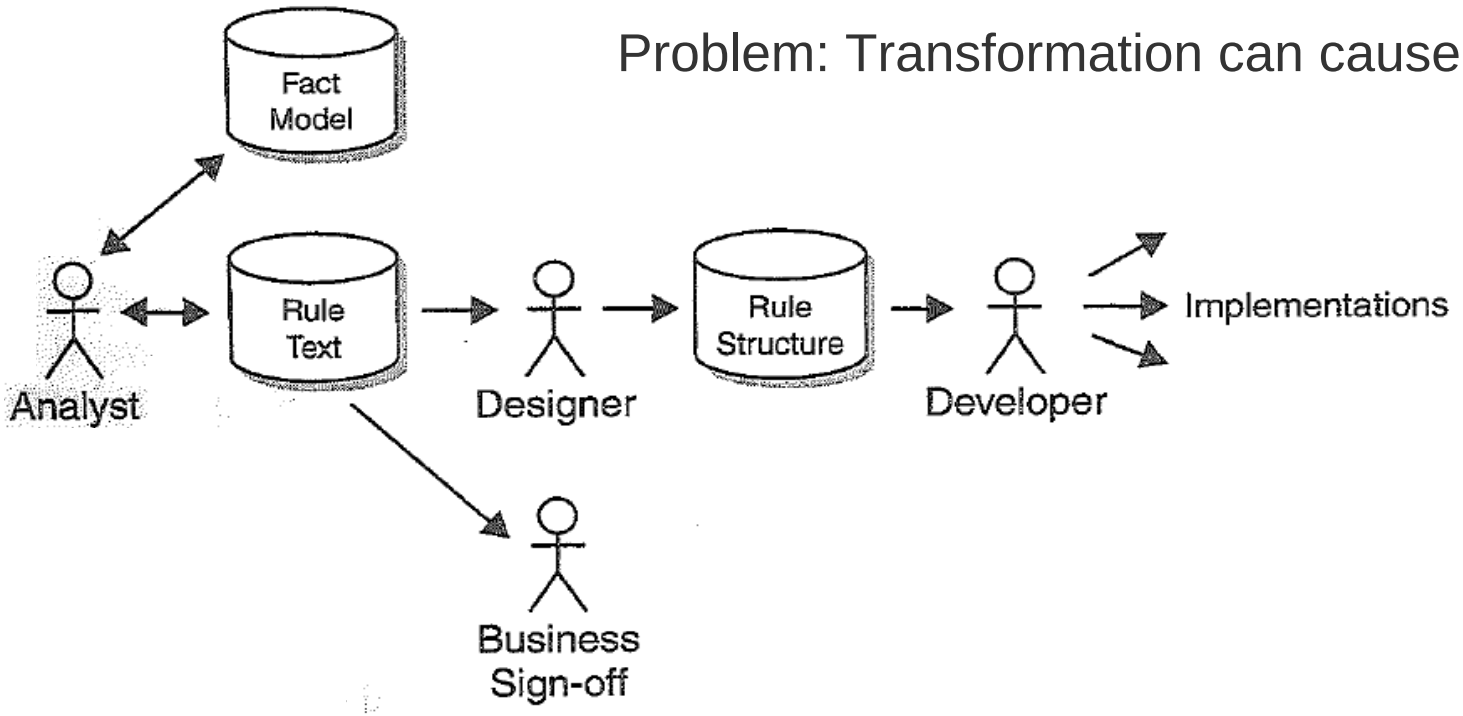
(Morgan 2002, p. 63)

From textual Rules to Formal Structures: Low Technology Rule Definition

Current generation of tools for rule definitions

- Business Analyst defines rules on information level (→ easy to read)
- Translation to formal structures is a human task, too

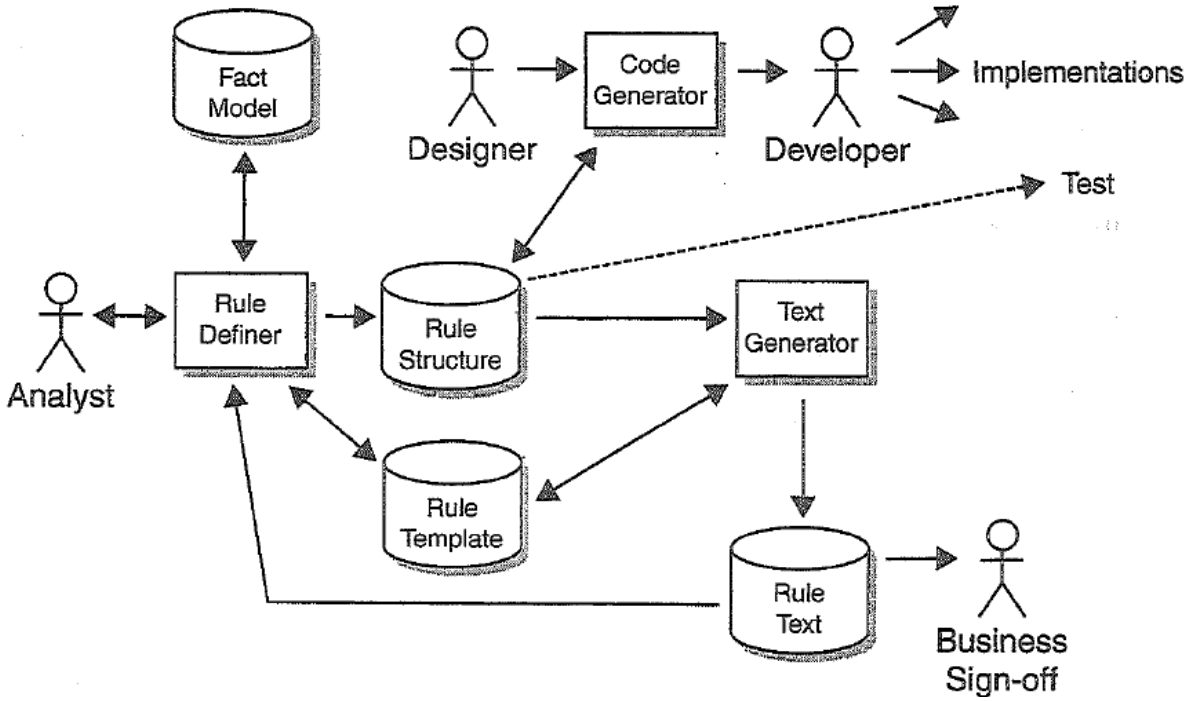
Problem: Transformation can cause errors



(Morgan 2002, p. 64)

From textual Rules to Formal Structures: Controlled Rule Definition

- Controlled rule definition shows a way to assure the consistency of colloquial and formal rule representation
  - Business Analyst defines rules using predefined structural units
  - Code can be generated from the structured representation
- The ultimate goal would be to generate code fully automatically.



(Morgan 2002, p. 64f)

Rule Patterns

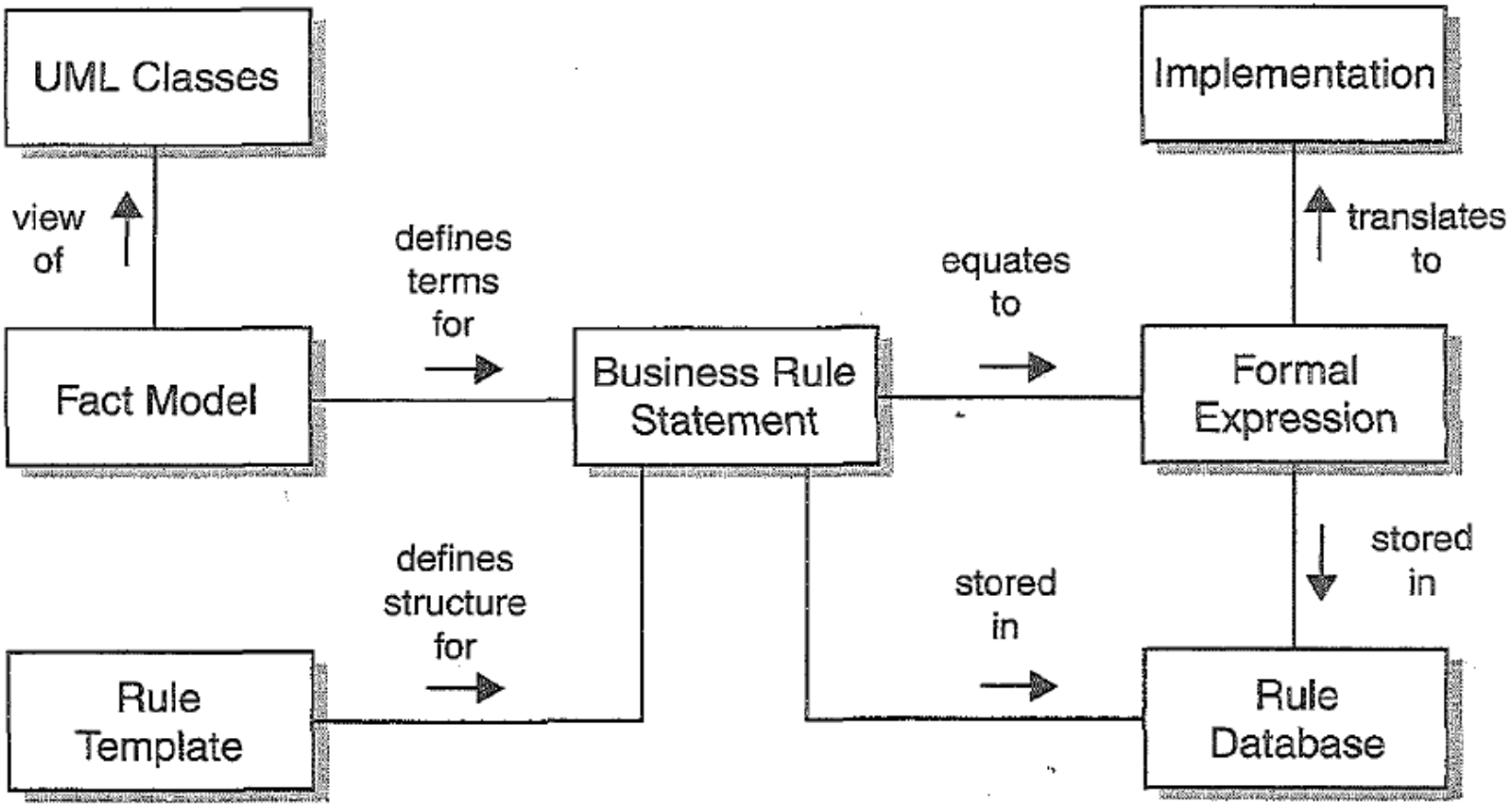
- The most convenient way of creating rule statements is to select an appropriate pattern selected from a short list of available patterns.
- In addition to conforming to an appropriate pattern, the rule also has to make reference to other model elements, principally business objects and their attributes. This is done through a fact model.
- In the following, a set of possible patterns is discussed that are variants of one basic form:

  `<subject> must <constraint>`

- These patterns are only suggestions. The should exemply the style of rule definitions. Variants or additional patterns might make sense in particular applications.

(Morgan 2002, p. 66f)

Rule Statements and their Relationships



(Morgan 2002, p. 67)

Rule Pattern 1: Basic Constraint

- Establish a constraint on a subject

  <det> <subject> (must | should) [not] <characteristic>
  [(if | unless) <fact>].

  <det> <subject> may (<characteristic> only if <fact>) |
  (not <characteristic>).

- Examples:

  R302 An urgent order must not be accepted if the order value is less than $30.

  R303 An account may be closed only if the current balance is zero.

Rule Pattern 2: List Constraint

- Establish a constraint on a subject when the characteristic is one of more items from a list

  <det> <subject> (must | should) [not | <characteristic> (if | unless) at least <m> [and not more than <n>] of the following is true: <fact-list>.

  <det> <subject> (may <characteristic> only if) | (may not <characteristic> if) at least <m> [and not more than <n>] of the following is true: <fact-list>

- Example:

  R304 A next-day order must not be accepted if at least one of the following is true:
  - Order is received after 15:00, Monday through Friday,
  - Order is received anytime on Saturday or Sunday,
  - Order is received between 15 December and 5 January,
  - Postal inhibition is in place.

Rule Pattern: Inference

- Establish a definition of a term in a fact model constraint on a subject when the characteristic is one of more items from a list

  if (<fact> | and <fact>) then <characteristic>.

- Example:

  R404 If total of bill is greater than $1000 and customer standing is gold then discount is 20%

Rule Pattern: Computation

- Establish a definition of a term in a fact model constraint on a subject when the characteristic is one of more items from a list

  <det> <result> is defined as <algorithm>.

  <det> <result> = <algorithm>.

- Example:

  R304 Total sale value is defined as total item value plus sales

  R309 Pi = 4 * arctan(1)

Rule Pattern: Enumeration

- Establish the range of values that can legitimately be taken by a term in the fact model.

  <det> <result> must be chosen from the following [open I closed] enumeration: <enum-list>.

- Example:

  R304 Customer standing must be chosen from the following closed enumeration:
  -Gold,
  -Silver,
  -Bronze.

Alternative Patterns for Rules (1)

Terms

Term	IS DEFINED AS	Definition
building		a usually roofed and walled structure built for permanent use
document		an official paper the administration needs to perform an action

Facts

Term	(IS A | <verb>)	Term
a garage	IS A	building
a building	has	an address

Alternative Patterns for Rules (2)

Mandatory Constraints

Subject	Predicate (MUST (NOT) HAVE, MUST (NOT) BE)	Characteristic
a resident	MUST	provide a lease contract or contract of purchase for her place of residence
a decision	MUST BE	in list application decision ('application approved', 'application denied', 'decision postponed')

Guidelines

Subject	Predicate (SHOULD (NOT) HAVE, SHOULD (NOT) BE)	Characteristic
a confirmation	SHOULD BE	sent within 5 days

Inference Rules

IF	Term	Condition	THEN	Consequence
	a building	is older than 100 years		it is an ancient building

Action-enabling Rules

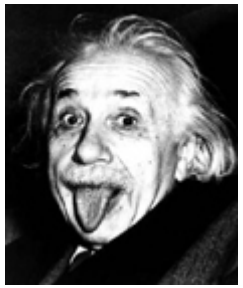
IF	Term	Condition	DO	Action
	a building	Is closer than 50 m to a natural water		environmental compatibility must be approved

Tips on Rule Construction

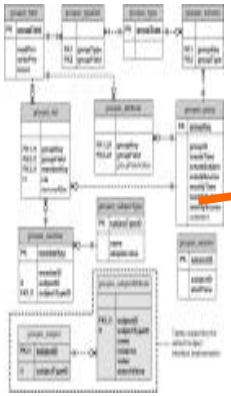
- Some common problems in rule construction can be avoided following some general recommendations.
- Examples:
  - Use a fact model so that rules can be related to other arts of the business model
  - Split complex rules into several simple rules if possible
  - Whenever possible avoid using plurals as terms of rules
  - Avoid ambiguous states
  - …
- More tips with detailed descriptions can be found in (Morgan 2002, pp. 79-90).

Information Sources: Where do the Rules come from?

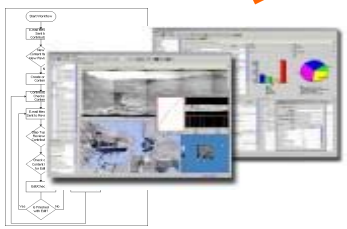
Documentation



tacit know-how



Business records
(data models)



Automation systems
(program code)

„making rules explicit“

Business Rules Manifesto
Article 6. *Rule-Based Architecture, Not Indirect Implementation*

6.1. A business rules application is intentionally built to accommodate continuous change in business rules. The platform on which the application runs should support such continuous change.

6.2. Executing rules directly -- for example in a rules engine -- is a better implementation strategy than transcribing the rules into some procedural form.

6.3. A business rule system must always be able to explain the reasoning by which it arrives at conclusions or takes action.

6.4. Rules are based on truth values. How a rule's truth value is determined or maintained is hidden from users.

6.5. The relationship between events and rules is generally many-to-many.

Business Rules Manifesto
Article 7. *Rule-Guided Processes, Not Exception-Based Programming*

7.1. Rules define the boundary between acceptable and unacceptable business activity.

7.2. Rules often require special or selective handling of detected violations. Such rule violation activity is activity like any other activity.

7.3. To ensure maximum consistency and reusability, the handling of unacceptable business activity should be separable from the handling of acceptable business activity.

Business Rules Manifesto
Article 8. *For the Sake of the Business, Not Technology*

8.1. Rules are about business practice and guidance; therefore, rules are motivated by business goals and objectives and are shaped by various influences.

8.2. Rules always cost the business something.

8.3. The cost of rule enforcement must be balanced against business risks, and against business opportunities that might otherwise be lost.

8.4. 'More rules' is not better. Usually fewer 'good rules' is better.

8.5. An effective system can be based on a small number of rules. Additional, more discriminating rules can be subsequently added, so that over time the system becomes smarter.

Business Rules Manifesto
Article 9. *Of, By, and For Business People, Not IT People*

9.1. Rules should arise from knowledgeable business people.

9.2. Business people should have tools available to help them formulate, validate, and manage rules.

9.3. Business people should have tools available to help them verify business rules against each other for consistency.

Business Rules Manifesto
Article 10. *Managing Business Logic, Not Hardware/Software Platforms*

10.1. Business rules are a vital business asset.

10.2. In the long run, rules are more important to the business than hardware/software platforms.

10.3. Business rules should be organized and stored in such a way that they can be readily redeployed to new hardware/software platforms.

10.4. Rules, and the ability to change them effectively, are fundamental to improving business adaptability.

Finding Rules

Approaches for finding rules:

- Static analysis
  - best approach when relevant documentation is available
  - careful checking of source documents for potential ruels
- Interactive sessions
  - bring together analysts and business specialists in *structured interviews* or *analysis workshops*
  - applicable where business knowledge is not readily available in a documented form
- Automated rule discovery
  - find rules through machine analysis (*data mining, code analysis*)
  - provided that suitable source data can be made available

for more details see (Morgan 2002, pp. 110-121)

Rule Indicators: How can we find rules?

There are some indications that business rules might be available, e.g.

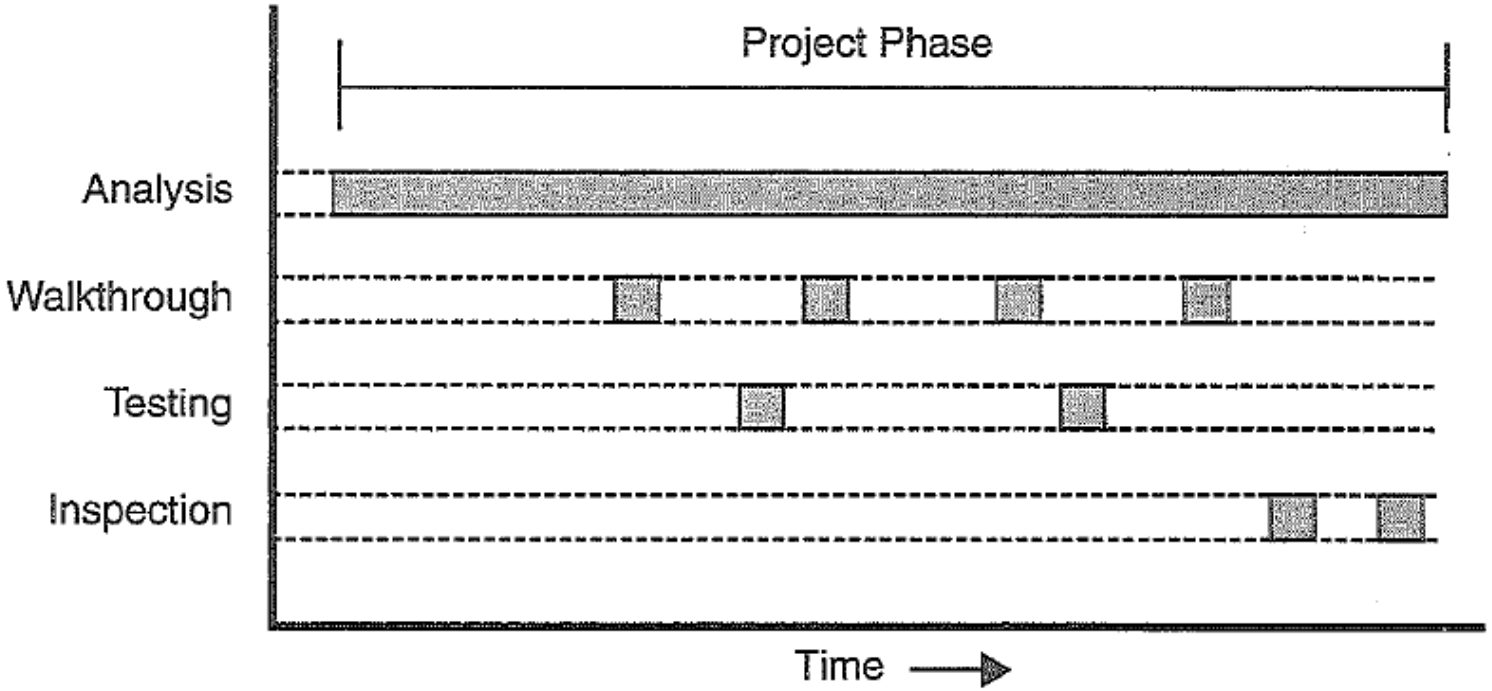
- **Entities with multiple states**
  - If an entity can have multiple states, then there usually are rules indicating conditions for these states
  - Example: a loan application might be submitted, pending or approved
- **Specialisations or subclasses**
  - It is common that rules deal with differences among categories
  - Example: An insurance can be specialized to health, life or car insurance
- **Conditions linked to time**
  - Some business conditions are relevant only at a particular point in time or during a particular time span
    - Examples: calender-related date, definition of business hours
- **Activities related to particular circumstances or events**
  - Some rule may be required to characterize the event accurately
  - Examples: When an event happens or defined conditions exist

for more indicators see (Morgan 2002, pp. 106-109)

Controlling Rule Quality

- Quality control mechanisms that can be applied during rule development
- **Walkthroughs**: Workshop-style review sessions
  - as soon as enough rules are defined to support a business scenario
- **Inspections**: more formal type of review
  - involving representatives from many business areas
  - used mostly at major milestones
- **Testing**: ensure a clear understanding of complex rule sets
  - understand the logic of whole sets of rules
  - applying a series of specific test cases to a trial implementation of the rule set

Typical Assessment Activity Pattern



(Morgan 2002, p. 133)

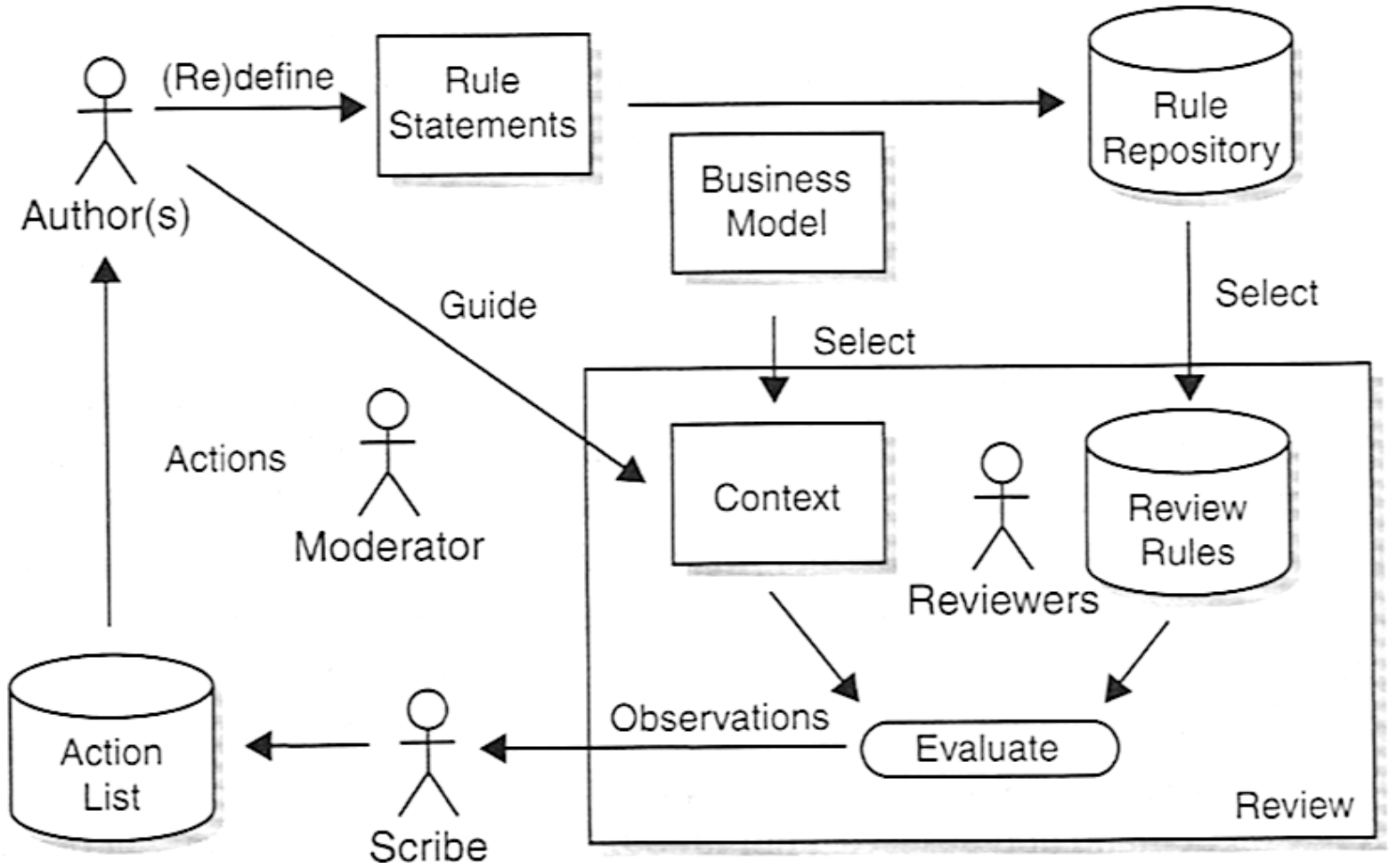
Reviewing Rules: What to look for

- Look for problems of rules, e.g. rules that are
  - malformed: rules that don't conform to standards or preferred rule patterns
  - incomplete: a situation is not properly covered by the rules
  - inconsistent: leading to ambiguous results with different rules
  - redundant: serve no business purpose of are covered by another rule
  - use terms not properly rooted in the supporting fact model

Rule Context

- An individual rule might be relevant in several contexts
- The context defines not only which rules are in scope but also the viewpoint from which you should be reviewing them.
- The context(s) must be agreed before the review is planned
- When a rule is marked as reviewed in the repository, also the context(s) within which the review took place is recorded
- It's also very convenient to apply a version number to each group of rules

General Structure of a Review



(Morgan 2002, p. 135)

Quality Controls

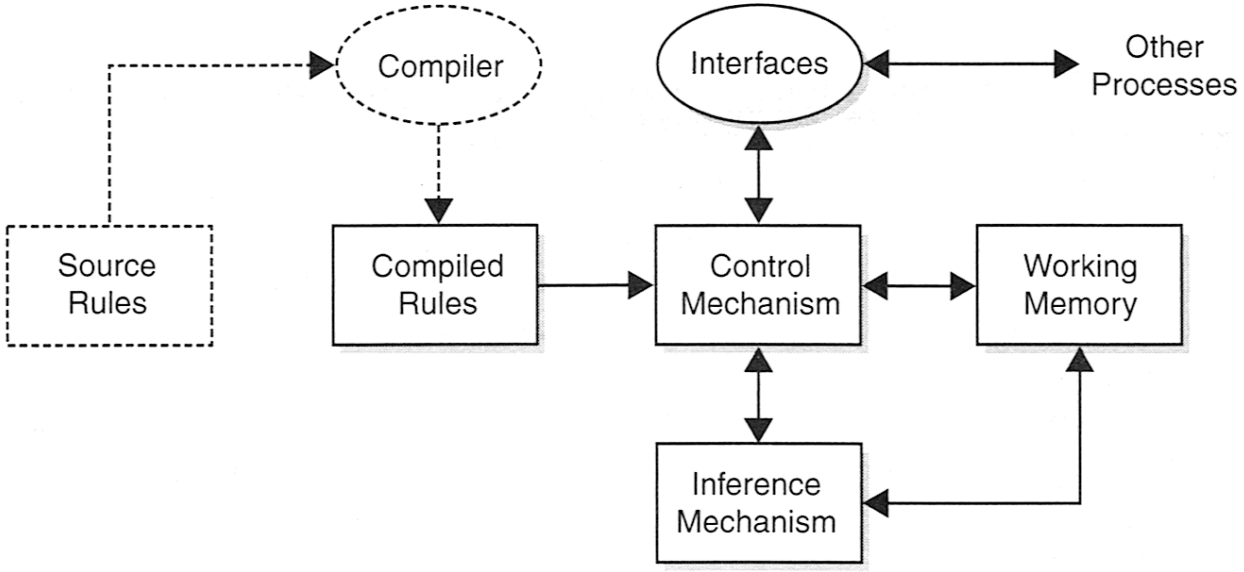
Feature	Reviews		Testing
	Walkthroughs	Inspections	
What's examined?	Rule population, possibly incomplete	Complete rule population	Rule set
When used?	As often as practical, starting as soon as a reasonable body of rules is assembled	Toward the end of a project phase, before a rule population is released	When a sufficiently complex rule set is defined or changed
What's checked?	Rule clarity and business relevance	Rule clarity and business relevance, along with consistency of rule population	Logic of rule set
Focus defined by	Selected business scenarios	Business scope of rule population	Facts constrained by rule set
Purpose of meeting	Work though rules and raise actions	Work through pre-prepared comments and consolidate into actions	Work through test results and raise actions
Results on file	Observations and actions from each walkthrough, checked as completed	Observations and actions from each inspection, checked as completed	Test harness; test data; test results; any resulting actions, checked as completed

(Morgan 2002, p. 167)

Realizing Business Rules

- After creating business rules and check them for consistency, at the end, rules have to be operationalized
- There are various approaches to operationalize rules, e.g.
  - rule engines are specialized programs designed to execute rules
  - Program code: to identify a program statement as implementing a rule, one should encapsulate the rule or rule set in a function call
  - databases: business rules could implement integrity contraints, stored procedures, or triggers
  - workflow systems: in a workflow rules are mostly associated with branching points
- Art. 6 of the buiness rules manifesto says that executing rules directly -- for example in a rules engine -- is a better implementation strategy than transcribing the rules into some procedural form, criteria like run-time performance may lead to different implementation approaches

Components of a Business Rules Engine



- Source rules are defined offline using an appropriate rule language
- They are compiled into an efficient internal representation
- The working memory contains the facts and the derived facts
- The inference mechanism applies rules at runtime deriving new facts and storing them in the working memory
  - It implements an inference rule (cf. predicate logic)
- The control mechanism determines which rules to apply in which order

(Morgan 2002, p. 208)

Business Rules Technology

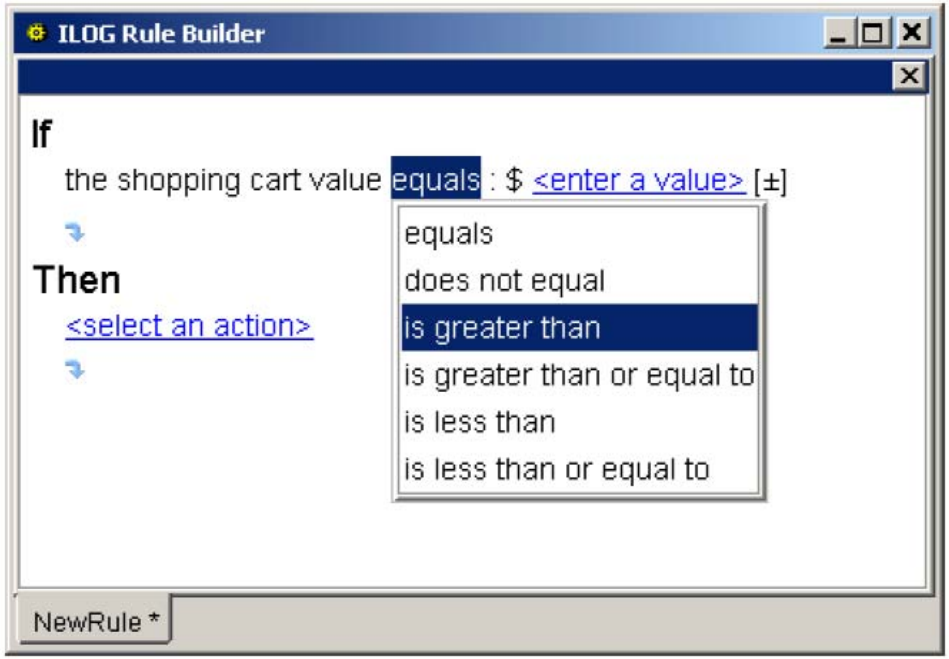
There are different types of Business Rules technology

- **Business Rules Management System (BRMS):** a software system used to define, deploy, execute, monitor and maintain business rules. It includes
  - A repository, allowing business rules to be stored
  - A runtime environment, allowing applications to invoke business rules and execute them using a business rules engine
  - Maintenance tools, allowing both technical developers and business experts to define and manage business rules, e.g. supporting simulation, testing, quality checking
- **Business Rules Discovery:** Automatically finding rules (e.g. in form of decision trees, decision tables) by using data mining techniques
- **Business Rules Engine:** execute business rules in a runtime environment

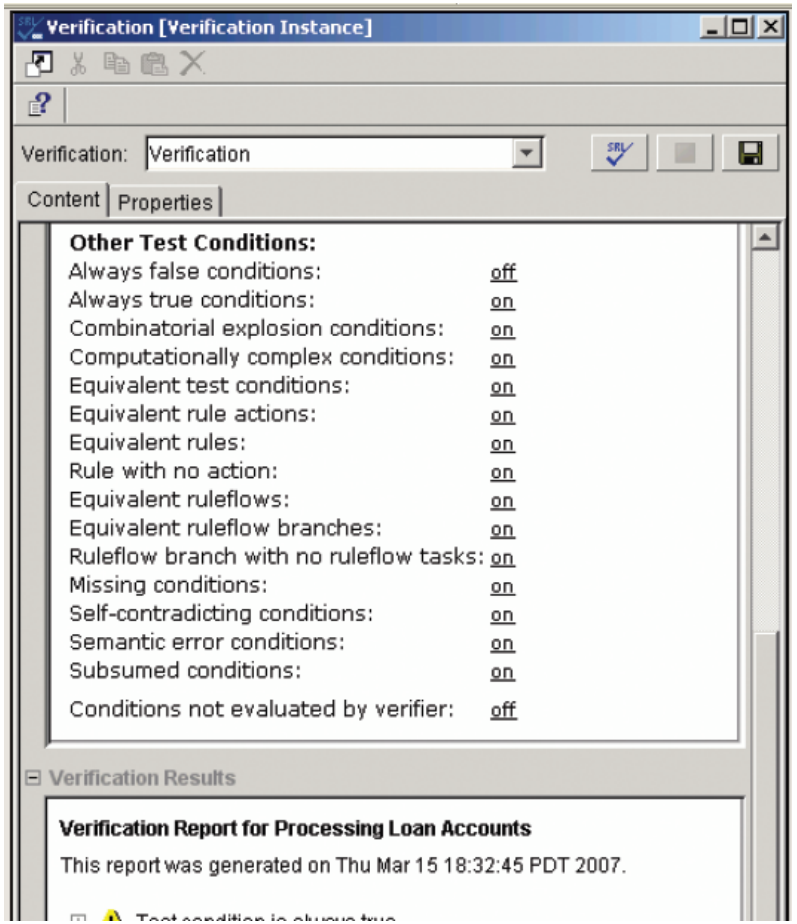
Business Rules Management Systems

- Many Business Rules Management Systems have evolved from rule engines to support the whole rule life-cycle.
  - definition
  - storage
  - execution
  - maintenance
- This is why most of the rule languages in BRMS are proprietary
- Vendors attach importance to user interfaces for easy rule development, e.g. graphical representations or decision tables
- However, there are some upcoming standards, e.g.
  - Production Rule Representation (by OMG)
  - RuleML (an XML-based markup language for rules)

Business Rules Management Systems

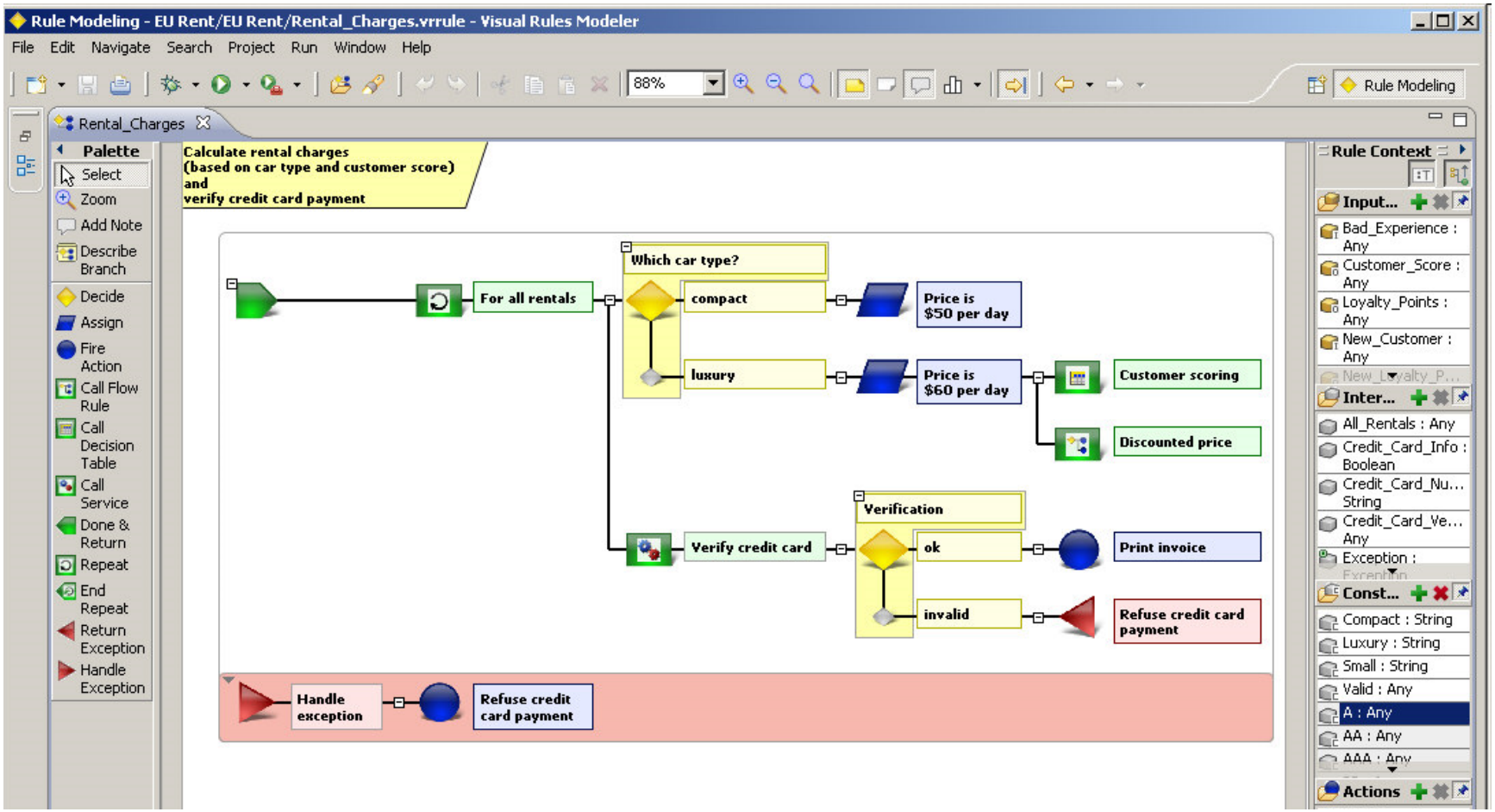


Editing JRules in the ILOG Rule Builder
http://www.ilog.com/



Rule verification in BlazeAdvisor (FairIsaac)
http://www.fairisaac.com

The Visual Rules Editor



Innovations Software Technology Corp. http://www.visual-rules.com/
For screencasts on Visual Rules see http://www.visual-rules.com/screencasts-demos-business-rules.html#