

Business Rules make Business more flexible

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Abstract

The Business Rules approach is an advanced technology more and more applied in business applications in order to create more flexible solutions. Business Rules are used to describe the business policies of an enterprise such as pricing models, tariff plans or even workflows. Business Rules decrease the costs of changes and shorten the time of their introduction. Moreover Business Rules formalize important and / or critical regulations in a language, managers or other non computer scientists can easily understand.

The paper gives an introduction into the Business Rules approach, its basics, applications, and benefits. In the second part a survey of Business Rules systems will be given, including commercial systems as well as open-source software. Outlining the principles and benefits of Business Rule can make managers become aware of the chances of this new technology. The market survey supports a decision for a certain business rule system.

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1. Introduction

The market, whether national or global, changes rapidly. New models for pay scales or tariffs have to be developed and implemented almost every month. Telephone companies, utility providers, transportation companies as well as other companies use a tremendous variety of rules and guidelines to fix their pricing for their services. Pricing is more and more customized and almost personal. Tariff plans have to be adapted frequently in order to meet customer requirements. Companies are forced to do so in order to keep their customers aboard and to survive on the market.

On the other hand completely new models for pay scales require serious changes in the software for invoices or accounting. But the process of implementing new features into a software system is time consuming. New regulations cause a new software development process starting with an appropriate requirement specification, followed by a design of the new features and end up in additional programming. Afterwards time consuming testing of the software is necessary before the new version can be released. Thus a new pricing model not fitting into the defined possibilities of the software can launch a time consuming and expensive process.

The technology of Business Rules claims that required costs and time for an introduction of new pricing models will decrease dramatically. This is done by a declarative description of pay scales, tariffs or the business policy in total. A Business Rule represents a piece of knowledge about e.g. pricing in a declarative way. Sets of Business Rules are then managed by a called Business Rules Engine. The rules engine processes the rules and at the end a certain price is calculated or certain actions will be performed. A change of pricing models require only a change in the Business Rules. The software itself, here the rules engine, remains unchanged. Thus a change in the business policy can be implemented much faster than before.

Business Rules or rule-based knowledge representations in general can even be managed by non-computer experts. In general Business Rule can be developed by the business policy expert himself. Even though it may be sometimes too difficult at least a consultant is able to come up with a rule description for the desired pay scales or tariff. A redesign of the software can definitely be avoided in any case. No further programming is required which shortens the introduction process of a new policy enormously.

Business Rules not only speed up the introduction of a new policy. A Business Rule can serve as documentation as well. Since rules can be understood quite easily by non-computer experts, they function as a definition or documentation of a policy as well as its implementation. Thus, there is no gap between both parts: implementation and documentation. An up to date documentation becomes more and more important nowadays, because the number of different pricing models used at one and the same moment increases.

In the paper we give an introduction into the concept of knowledge representation using Business Rules. Some applications of Business Rules will be listed and the benefits of the Business Rules technology will be discussed afterwards in detail. The Business Rules Manifesto published by the Business Rules Group gives a good overview as well as a guideline for using the technology. In the paper we present a market survey of Business Rules Management Systems as well. Based on a set of criteria worked out in cooperation with a local provider of standard software, eight Business Rules Management Systems have been analyzed. The survey gives an overview of Business Rules Engines in general and may help to come up with a decision on a suitable system that fits a company's purposes.

2. Business Rules

2.1 Basics

The Business Rules concept is a new approach based on a well-known concept of artificial intelligence. Rule-based knowledge representation has been used in expert systems since the 70ies. Representing knowledge based on rules goes back to the development of mathematical logic and was first used by the German mathematician and philosopher Gottlob Frege¹ in his *Begriffsschrift* (1879). He based the mathematical logic on the concepts of implication (if-then), negation, and an all-quantification of variables.

¹ Gottlob Frege (*1848 in Wismar — † 1925 in Bad Kleinen) was a German mathematician and philosopher who developed first-order mathematical logic, gave a first precise definition of a number, and made contributions to the linguistic philosophy. He worked at the University of Jena, Germany.

The concept of implications or if-then-statements became quite famous in computer science and later on, the basis of logic programming and rule-based knowledge representation. A rule consists of a set of premises and a set of conclusions:

IF premises	THEN conclusions.
IF situation	THEN action.
IF condition	THEN result.

Although the syntax of rules is always the same we can have different interpretations. In a pure sense of logic if the premises hold, i.e. they are true, then draw some conclusions which then will be true as well. From a behaviour or process point of view we can perform some action if a certain situation is reached. And in a mathematical sense a result may depend on certain conditions. The different interpretations show the various possibilities for applying rules. If the premises (situation, condition) are notated in a formal way then knowledge can be processed by the computer and new conclusions (results or actions) can be calculated. The calculation is based on the modus ponens and other reasoning and inference techniques like resolution using unification.

2.2 Applications

We start with an introductory example and some real world applications will be listed afterwards. Business Rules are most often applied in order to define pay scales or other customer-related regulations. In the example below the type of billing is fixed according to a customer classification. It is important that the used premises can be either verified by an access to a database, in a user dialogue or it can be calculated using some other rules.

1. IF X is customer THEN send bill.
2. IF not X is customer THEN cash on delivery.
3. IF X is a good customer THEN allow discount.
4. IF annual business volume of X > 1,000 THEN X is a good customer.

The premise of rule 3 whether a customer is a good customer and therefore receives a discount is concluded by another rule, rule 4. Rule 4 can be verified by a database query. Business Rules Management Systems support the non-computer expert by providing a graphical or a natural language interface for the development of rules.

Such rules can be used to define several aspects in a company. So far we have focused on the pricing models and billing regulations. Business rules can be used to check or validate data especially data provided by user dialogues as well. Moreover Business rules can be applied to define workflows in a real declarative and understandable way.

Real world applications are reported in various fields. Financial services companies use Business Rules in loan and credit decisions, in pension calculation, or in a rating of the Basel II-compliance. Travel agencies find tours for their customers. Even Production planning is done using Business Rules. You may find very up-to-date and good surveys of applications on the web-pages of the providers of Business Rule Engines².

² Listed links have been last visited on the 23rd of April in 2007.

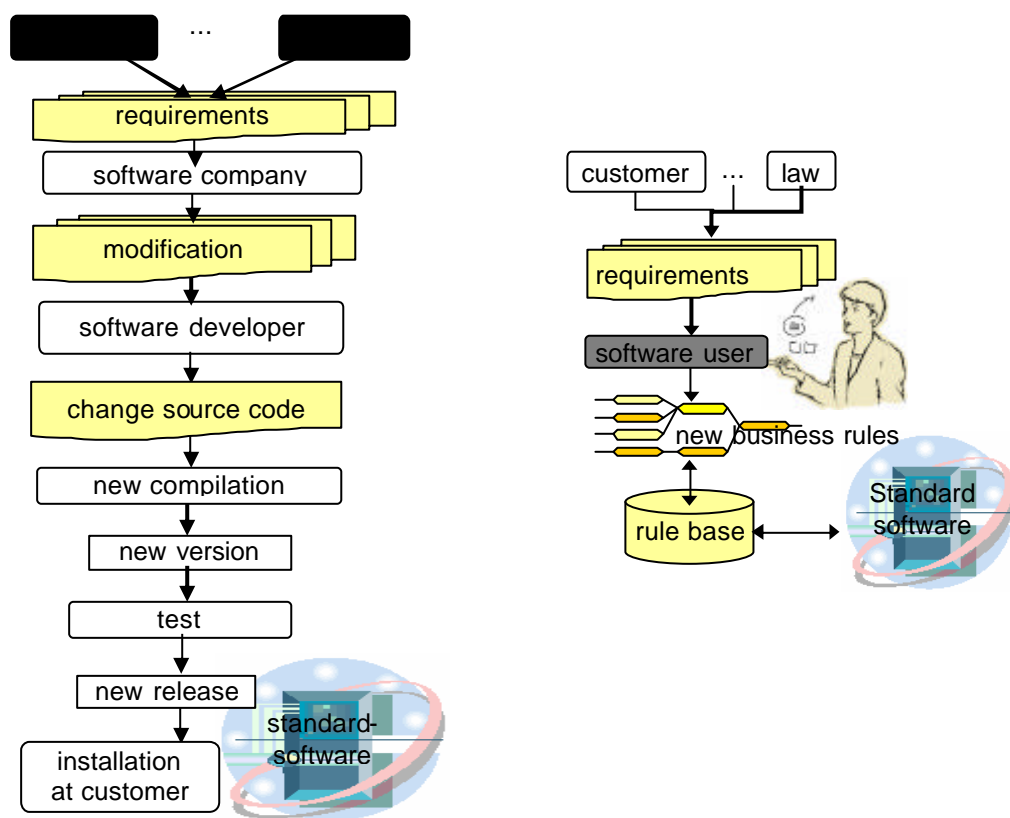
- ILOG: www.ilog.com/products/jrules/customers.cfm
- FairIsaac: www.fairisaac.com/Fairisaac/Solutions/Enterprise+Decision+Management/Business+rules/
- VisualRules: www.visual-rules.de/063_customers/successstories.html
- YasuTech: www.yasutech.com/downloads/casestudies/index.htm

Moreover all the companies give at least one tiny example in order to give an introduction into the concept. A quite common example handles the pricing of a car rental company.

2.3 Benefits

As mentioned in the introduction part the Business Rules approach has several benefits. A great benefit can be attained in the case that a completely new pricing model has to be introduced within a short amount of time in order to be competitive on the market. We compare here the traditional procedure for an extension of a software system and the Business Rules approach. Figure 1 shows that the Business Rules approach is handled by the user of standard software itself and no change of the source code is necessary. Thus a company can introduce for instance a new pricing idea quite fast.

Figure 1: Process of extending software according to new customer requirements: On the left side the conventional procedure. The Business Rules approach on the right is much shorter.



Another benefit comes from the readability of Business Rules. The rules themselves can serve as documentation as well. First, all the regulations can be laid out by rules and

secondly, the rules document these regulations quite nicely. Gaps between the software behaviour and the documentation are avoided. Once a company has started to work with Business Rules it can go on and define as many regulations, contracts, business policy, workflows as possible. Following this approach a very flexible acting company can be developed. The company has a faster reactive time to the market. The rule-based approach opens the door towards more flexibility in products, pricing and services. More customized products and services can be offered. The readability of Business Rules provides greater visibility to regulatory bodies and easier change processes. See Sinur, J. (2002).

2.4. Business Rules Manifesto

The Business Rule Group³ has developed a list of demands and guidelines for the application of Business Rules. We will here report a few important parts of the manifesto:

1. Rules are a first-class citizen of the requirements world.
2. Rules are essential for, and a discrete part of, business models, system models, and implementation models.
3. Rules are not process and not procedure. They should not be embedded in either of these.
4. Rules build on facts, and facts build on concepts as expressed by terms.
5. Terms express business concepts; facts make assertions about these concepts; rules constrain and support these facts.
6. Rules must be explicit. No rule is ever assumed about any concept or fact unless a rule has been specified explicitly.
7. Rules are basic to what the business knows about itself – that is, to basic business knowledge. Rules need to be nurtured, protected, and managed.
8. Rules are about business practice and guidance; therefore, rules are motivated by business goals and objectives and are shaped by various influences.
9. Rules should be expressed declaratively for the business audience, in natural-language sentences.

The manifesto contains many more points but the first rules for rules give already good advice for the application of the Business Rule technology in a company.

3. Business Rule Systems

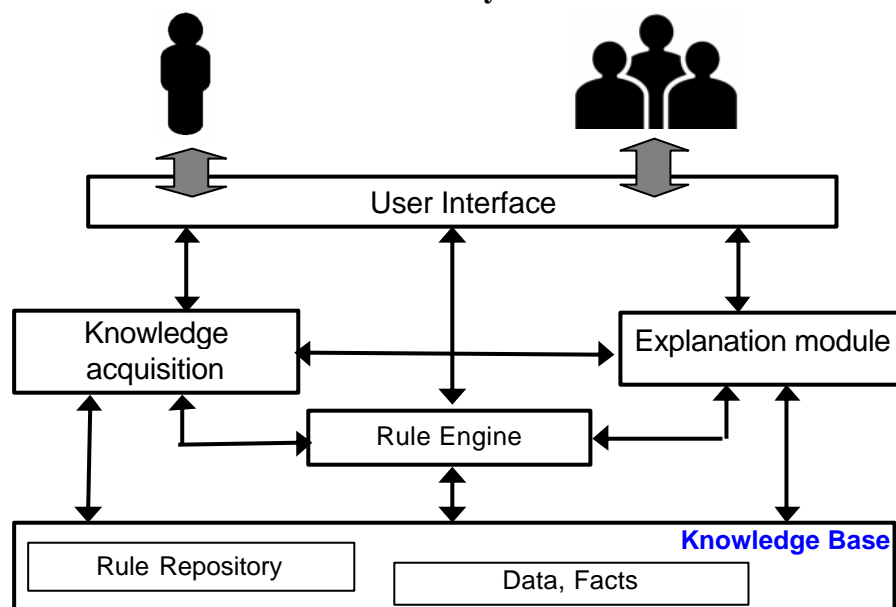
The architecture of a Business Rules Management System (BRMS) follows in principle the one of an expert system. Two different users interact with a rule system. First, the knowledge engineer keeps the knowledge of the system up-to-date. He or she adds new rules, delete rules of no further relevance and check the rule sets. Checking the rule sets is quite important: the set of rules should not contain rules which lead to contradictory results. Whereas in rule-based systems in general, ambiguity is part of a solution finding process, we are not interested for instance in ambiguous pricing for a certain service.

³ See www.businessrulesgroup.org

Business Rule Management Systems offer some rule checking tool in order to find contradictions in the rule sets. The knowledge expert can be the business expert who directly interacts with the system. The other user applies the system when interacting with customers. The system may be used as well by other system for instance to automatically perform buy orders or transactions via internet.

A Business Rules Management System provides several tools for managing rules and rule sets: A textual as well as a graphical rule editor is part of the user interface. Rules, especially their premises or their conclusions, as well act on data. In general the data can be stored and managed in databases that support the ODBC interface like Oracle, MySQL or Access. Many systems use an application server to get a clear separation between presentation (user interface), business logic and the data management. A Business Rules Management System normally supports several application servers. Other tools provide rule testing and checking or version management.

Figure 2: Architecture of a Business Rules System



3.1 Evaluation Criteria

Any evaluation requires some criteria the evaluation can be based on. In order to evaluate the different software solutions for Business Rules, we applied two groups of criteria: application-independent criteria which can be applied on any software; and application-specific criteria matching the special requirements for managing Business Rules. The application-independent criteria are:

- Correctness
A software is said to be *correct* if the implementation and the documentation match the user's problem definition.
- Flexibility
A software is *flexible* if it can be used under different conditions. Flexibility includes the use on different operating systems as well as the adaptation to personal user requirements.

- Usability
Usability includes the readability of all software descriptions like the user interface or the documentation. Readability from the programmer's point of view covers the specification and the source code as well.
- Stability
A software is called *stable* if it reacts sensible in exceptional or erroneous situations. It includes the software reaction on typing errors as well as reaction on hardware errors or e.g. a power failure.
- Efficiency
Efficiency is seen with respect to time and space. We value the reaction time of a system as well as the amount of space in memory and on a hard disk.

Obviously in our case application-dependent criteria focus on the management of Business Rules. We see the following criteria:

- Rule representation
Here we look at the structure of a rule, its possible components as well as its notation. A natural language notation should be offered in order to make the rules readable for non-computer experts.
- Rule processing
In order to come to new conclusions rules have to be applied. Application includes the selection of applicable rules. If more than one rule is involved in a conclusion process the chaining of rules is important. The provided techniques are valued.
- Development tools
Tools we look at include possibilities for rule editing, like a textual or a graphical editor. Moreover, tools for code checking and validation of the rule set are required.
- Database
The integration of a data base into the rule management is valued. Whereas it is obvious that data and facts are stored in a data base it is recommended that the rules themselves are handled in a database as well.
- Deployment of rules
Necessary processes to adapt a rule set to a certain environment are seen as the deployment of rules. It includes possibilities for a version management or a recovery of former situations or states.

Table 1: Scale and interpretations used in the evaluation







Value	Interpretation A	Interpretation B	Interpretation C
	Exists:	Fits...	
0	No	... not	Inadequate
1	Partly	... partly	Sufficient
2	Yes	... yes	Satisfying
3	Yes – partly good	... partly good	Good
4	Yes – mostly good	... mostly good	Very good
5	Yes – always good	... perfect	Excellent

Besides the criteria we need a scale in order to measure the quality of a system according to a certain criterion. We applied a scale from 0 to 5. Depending on a criterion we used a different interpretation for the values, see Table 1.

3.2 Systems

At the beginning we searched for companies who offer Business Rules Management Systems. A first survey was found in Endl (2004). Afterwards we tried to get more information about the systems. Most of the companies provide at least an evaluation version. But that was not a K.O. criterion. We ended up with the systems listed in Table 2. It includes five commercial products and two open-source systems. The complete list of products includes five commercial products and two open source systems, as shown in Table 2.

Table 2: Systems included in the evaluation

System	Company	Web page
Blaze Advisor		www.fairisaac.com/Fairisaac/Solutions/
ILOG JRules		www.ilog.de
JBossRules		labs.jboss.com/portal/jbossrules
Mandarax		www.mandarax.org , mandarax.sourceforge.net
Oracle-Rules		www.oracle.com/appserver/rules.html
QuickRules		www.yasutech.com/
Visual Rules		www.visual-rules.de

3.3 Survey

All the systems share some common features. Obviously they all offer some possibilities to create, manipulate, and process Business Rules. Moreover all the systems are based on Java and therefore can be used on several platforms including various Windows and Linux/Unix systems. The systems support an access to many common database systems

such as Oracle, mySQL or MS-Access. Rule execution is based mostly on the so called RETE algorithm. The RETE algorithm is an efficient algorithm for the selection and execution of rules using forward reasoning. It reduces the number of rules to be processed based on pattern matching algorithms and dates back to the mid seventies. Mandarax supports only backward reasoning based on PROLOG algorithms. Both kinds of reasoning strategies have their advantages and disadvantages, depending on the number of attributes to be used and their variability.

Blaze Advisor has a big number of applications in the areas of insurance, telecommunication, health care, public services, or in the production of branded articles. Fair Isaac as the provider of Blaze Advisor claims that its rule execution algorithm, called RETE III, is about 300% faster than those of the competitors. There is no limit in the number of rules, applications using up to 100,000 rules are reported. Rules can be developed in table-like style, as a tree structure or in an English-like language.

ILOG offers an English-like representation of rules as well. ILOG runs on the JBoss application server. Rule can be edited using Eclipse, which is a commonly used integrated development environment for various programming languages including the Java programming language. ILOG is used by various banks and is used for instance in a travel company as well.

Table 3: Evaluation of Business Rules Management Systems

Criteria	Software	Blaze Advisor	ILOG JRules	JBOSS Rules	Mandarax	Oracle Rules	QuickRules	Visual Rules
Application independent								
Licensing / costs		0	2	5	5	2	1	?
Runtime environment		5	5	5	5	4	5	3
Performance		5	5	4	4	4	4	3
Resources		3	5	4	4	4	5	?
Usability		4	3	4	3	4	4	4
Compatibility		0	4	2	2	2	2	0
Application dependent								
Rule representation		4	4	3	3	4	4	4
Rule processing		4	4	4	5	4	4	4
Facts handling		5	5	5	4	5	5	1
Development support		3	5	3	3	3	3	4
Deployment of rules		5	4	2	3	3	4	3
Security		5	5	2	1	3	4	?
Sum:		43	51	43	42	42	45	20

JBoss Rules is an open-source Business Rules engine. It is based on the JBoss Application server. Based on the Drools Rules Language a Domain Specific Language allows a natural language like handling. JBoss Rules has minimal systems requirements.

Mandarax is not a fully developed Business Rules Management System. It is an open-source Java class library for implementing rule-based systems. A semi-graphical editor for rule development and testing called Oryx is available.

Oracle Business Rules consist of three components, the rule engine, the rule repository and the rule author. The rule author component offers an English-like presentation of rules. Rules are stored in the rule repository, which manages different rule versions as well.

QuickRules is offered by YasuTechnology from India and has customers worldwide including finance, government, healthcare, insurance, telecom, or logistics. Besides the rule engine and the rule builder, an analyse tool is available and a user access via a web editor is possible.

Visual Rules is offered by Innovations Softwaretechnologie GmbH, Germany. It provides graphical modelling of Business Rules. Visual Rules is used in banks, telecommunication companies, traders, or public services.

4. Conclusion

The survey has shown that the technology of Business Rules is well developed. In contrast to the single solutions of expert systems in the mid eighties Business Rules systems are nowadays widely used in various fields.

The result of our investigation is shown in Table 3. It might give the impression that the Visual Rules system lies a bit behind. If we keep in mind that criteria could not be valued the distance is not that much. For licensing and costs we only award a 5 to both open-source products. In general all systems got good evaluations in almost all criteria. The Business Rules technology is still missing a standard notation for the rules which could make an exchange of rules possible, i.e. the exchange of knowledge. Although there are ongoing efforts to establish RuleML as a standard, it is not widely accepted yet.

Business Rules is a powerful technology for representing a business policy. It opens the chance to react fast on changes in the market. For example, new pricing strategies can be implemented without a time consuming re-programming of a sales software. The knowledge expressed by rules can be easily understood by non-computer experts. Business experts therefore are able to handle Business Rules directly and therefore make changes even faster.

Business Rules Management Systems, which are available on the market, are well developed and ready for use. As the Innovations Softwaretechnologie GmbH expresses it: Let the Business Rules rule your Business.

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