

Business Rules Management In Distributed Information System - Risk Analysis

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Abstract - In order to remain competitive an enterprise needs a flexible business process, which can adapt to frequent changes that occur in the market, regulations or internal goals. The essence of adaptability of business process is applying and effective management of business rules. Large enterprises distributed information systems are used within operational and strategic processes. Complexity of distributed information systems structure and functionality brings risks of application business rules in common practice. The purpose of this paper is to present theoretical foundation as well as some software solutions for distributed business rules management, and a critical overview of risks of those systems.

I. INTRODUCTION

Business processes are changing according to market and regulatory impact, and therefore should be flexible and accurate according to those impacts. Changes should be adequate to required rules and needed performance measurements, but also should be done in appropriate time period. IT sector of an enterprise should provide flexible software support to effective and efficient business process at operational and strategical levels. Much research has been made in theoretical and experimental surveys about impact of IT to business processes performances. The conclusions are similar, and one of them is that impact of IT usage on organizational performance rests on the application of sophisticated IT tools in enterprise business processes. ([1])

Information system lifecycle depends on the lifecycle of an enterprise. The essence of information system development is model of an enterprise business domain – business process and business objects that are involved in those processes. Business design describes how that business works – the processes that it performs; the organizational structure of the people and finances within that business; the business' near-term and long-term goals and objectives; the economic and market influences that affect how that business achieves its goals; the rules and policies that condition how the business operates. By deriving the information system design from the business design you can more easily drive changes into the information system at the rate and pace of change in the business design. Furthermore, the information system can be used as a catalyst for change in the business design – the information system can be used to monitor the state of the business; it can report on how well the business is doing in meeting its goals; and can be used to suggest

changes in the business design to improve its efficiency at achieving those goals.[2]

The critical part of business process modeling is formalization of business rules and its involvement in business processes which impacts software support to those processes. Business rules are statements that reflect policies, procedures, or other constraints on ways to satisfy the customers, make good use of resources, or conform to laws or industry regulations applications. Specification of business rules as well as enforcement and distribution of business rules in distributed environments are very important part of business rules management.[3]

The objectives of this paper are literature survey in the field of business rules, distributed information systems and risk analysis, as well as presentation of software support to business process management and its role in distributed information systems. Risk analysis of using business process management systems within distributed information system is contribution of this paper.

II. BUSINESS RULES

The basic research interest and results in the field of business rules come from several research and technology communities [4]:

- Artificial Intelligence community - knowledge based systems, inference engine, predicate logic, automated reasoning systems, expert systems [5]
- Databases research community – deductive databases, active databases (triggers, stored procedures), extensions of ERM (entity relationship model) for presenting events, actions and conditions
- Object oriented community – OCL (object constraint language) with UML, Z- formal language for specification, Active middleware
- Business rules projects – whole business rules lifecycle - discovery, analysis, modeling, classification, articulation, formalization and documentation, resulted in methodology, tools and technologies based on Business rules repository and Business rules engines
- Internet and e-Commerce - B2B communication and interoperability of heterogenic environments

[3], XML as a widely recognized technology, Web services, SOA, ontology, Semantic Web [6]

- Business rules engines technology and commercial software – some software companies focus on development of business rules engines as standalone software support that could be integrated in information systems of enterprises. The most popular commercial software are: QuickRules (<http://www.yasutech.com>), VisualRules (<http://www.visual-rules.de>), Jboss Rules (<http://www.jboss.com>). JBoss Rules and QuickRules are in the class of EXPERT SYSTEMS, and Visual Rules belongs to ACTIVE SYSTEMS. [7]

“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.

From the business perspective, it pertains to any of the constraints that apply to the behavior of people in the enterprise. From the business perspective some of issue categories pertaining to the behavior of people in an organization include: capturing the rules that involve the use of human judgment, looking at the components of systems that are related to soft rules and seeing how they come together to support business rationale, showing workflows, processes etc. in terms of their relationships to business rules, the process of acquiring, maintaining and enforcing rules, other systems of classification such as mandates, policies, guidelines and corporate culture, industry rules and corporate rules, determining when rules are ineffective etc.

From the information system perspective, it pertains to the facts which are recorded as data and constraints on changes to the values of those facts. That is, the concern is what data may or may not be recorded in the information system. A business rule from information system perspective expresses specific constraints on the creation, updating, and removal of persistent data in an information system. The business rules described here control whether or not such data may be created or changed and the implications when this occurs.” [8]

The complete definition and basic features of business rules are described in “Business Rules Manifesto – the principles of rule independence”, by Business Rules Group in 2003. Some of the main characteristics are:

- Rules are the most important part of requirements, business models and technology models of an information system. Rules are a vital business asset. Rules are about business practice and guidance and are motivated by business goals and objectives. Rules should arise from knowledgeable business people – they describe part of the knowledge of a business process.
- Terms express business concepts, facts make assertions about these concepts and rules constrain and support these facts. Rules are explicit constraints on behavior and / or provide support to behavior. They are not process or a procedure and should not be contained in them.

Rules apply across processes and procedures. Rules define the boundary between acceptable and unacceptable business activity. Rule violation should be handled with business activities.

- Rules should be expressed declaratively in natural language sentences for the business audience. Rules should be declarative, not procedural – they should consist only of terms that describe concepts from the problem domain and facts that are included in constraints applied in business domain over the facts.
- Rules should be expressed in the way that they can be validated for correctness by business people, verified against each other for consistency. Formal logics, such as predicate logic, are fundamental to well-formed expression of rules in business terms.
- Rules need to be nurtured, protected and managed. There should be cohesive and consistent body of rules that are enforced across all relevant areas of business activity. A rule is distinct from any enforcement defined for it, i.e. rules should be defined independently of responsibility of who, where, when and how of their enforcement. Business people should have tools available to help them formulate, validate and manage rules, to verify them against each other for consistency.
- Application of business rules is adapted to continuous change in business rules and software that runs those rules should support continuous change in business rules. Executing rules directly from a rules engine is a better implementation strategy than transcribing the rules into some procedural form. A business rule system should always be able to explain the reasoning by which it arrives at conclusions or takes action. Business rules should be organized and stored in such a way that they can be readily redeployed to new technology platform. Rules and the ability to change them effectively are fundamental to improving business adaptability. [9]

III. ENTERPRISE BUSINESS RULES ARCHITECTURE

Enterprise architecture [2] is essentially the integration of business and technical architecture using a comprehensive methodology and shared repository.

Business architecture is comprised of: business strategy, security, business rules, enterprise decision management, business object model and/or data model, metadata, business process including workflow, orchestration and choreography, information architecture, application architecture, analysis and project management tools, business to technical alignment, organizational structure, performance management.

Technical architecture, including data and security architectures, consists of: infrastructure (network, operating systems, enterprise service buses etc), database, data-warehouse, programs, messages, design,

development and deployment tools and environments, integration tools and guidelines, standardization.

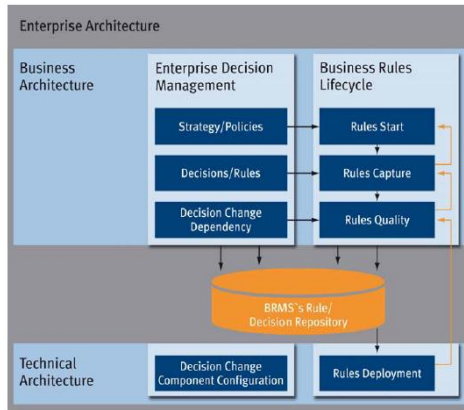


Figure 1. Enterprise architecture [1]

According to Enterprise Knowledge Development approach [4], an enterprise business rules architecture is structured through five sub-models:

- Business vision model: Describes an overall strategy of the business, focusing on goal structure and problems that must be solved in order to achieve those goals.
- Business process model: Describes the processes that are set to achieve the enterprise goals. The business process model describes how the enterprise processes interact, and clarifies the processes inputs and outputs.
- Business rule model: Describes and maintains explicitly formulated business rules as well as some of the rules that are implicit in other models.
- Business actors and resource model: Focuses on the structures of resources and their relationships with actors, processes, goals and other components of the enterprise model.
- Business concepts model: Establishes a common vocabulary for all the concepts that comprise the business environment (e.g. products, services, information resources, etc.). It helps to avoid misunderstandings and different interpretations of terms used in the business.

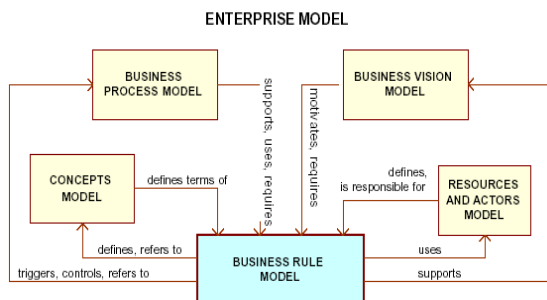


Figure 2. Enterprise model with business rules submodels [4]

IV. DISTRIBUTED INFORMATION SYSTEM

Distributed information system is collection of joined independent computer systems acting like a single coherent system [10]. Data processing in distributed database systems can be executed on all servers participating in this system. Information systems that support distributed data processing in the distributed database environment are Distributed Information Systems (DIS) [11]. Basic reason for starting DIS development is to provide better support for user requirements from organizations that are situated in wider geographical area. Comparing to the centralized IS (Information System), DIS offers more availability and better performance. Basic advantage of distributed databases is its architecture, which is suitable for modern decentralized organization of complex systems [11]. Each part of these systems has high level of local autonomy and requirement for local data storage. The unification of the system is achieved through collaboration of different parts of the system [12]. Concept of DIS is created as an answer to problems that often appear in phase of development and usage of integrated information systems with centralized database. Those problems may be very long development process, high expenses, management support, hard modifications in real time etc. DIS consists of subsystems that are feasible to develop and use independently, with previously designed communication interfaces. Decentralized database system enable high level of security and easier data control, better performances in data processing, better adaptability to local needs because equipment and database is physically closer to the users. DIS advantages are: higher fidelity and availability, better system performance and easier system maintenance and upgrade [12]. Disadvantages are that these systems eliminate duplication of data in file maintaining process, complicated coordination of processes and additional data exchange increasing network traffic [13]. Basic characteristics of DIS are [14]: resource sharing, openness, concurrency, scalability, fault tolerance, local autonomy of nodes, absence of a central node [12] and transparency.

According to the technological base of distributed database implementation there are homogenous and heterogeneous systems. Homogenous systems are based on the same DBMS type. Heterogeneous systems (multi-database systems) require portability and interoperability of DBMS of different types in a single functional unit, need integration of various data sources in a single unit developed in different technologies. There are several technology approaches for data integration. One of them is data warehousing, as a basis for OLAP (On Line Analytical processing). Data warehouse collects data from various physical sources [12]. Copying, extraction and correction, transformation, loading and updating of data create data collection. Software components, which integrate various source data, are called middleware application. The query is at first forwarded to the middleware application, after that the query is forwarded to the wrapper application for the appropriate data source in order to get the requested answer. Modern DIS are based on n-tier client-server architecture [12]; platforms for e-business are based on web technology that enables dynamic answers to user requests and ability to execute

tasks on client (Java applet, Java Script, ActiveX) or server side (Java Server Pages, Microsoft Active Server Pages, Java Servlet). XML gives opportunity for interoperability of heterogeneous data especially if they are used within middleware in web service applications.

V. BUSINESS RULES IN DISTRIBUTED INFORMATION SYSTEMS

To implement synergistic achievement between the business and IT domains we need to employ a number of capabilities:

- a formalism and language for capturing the business design;
- a methodology for translating the business design into a set of information system artifacts to implement that design;
- an infrastructure for hosting those implementation artifacts that is as flexible as the business itself needs to be to changes in its marketplace;
- a place for retaining the correlation between the business design and the information system that can be used to identify and fix failures in executing on the goals and constraints of the business design;
- a means by which we can manage the system to ensure those goals are met. [3]

The process of business rules implementation within a distributed information system could be modelled through steps, that deal with business rules (BR) as follows:

1. creation and definition – regulatory bodies /enterprise management create business rules
2. formulation – BR should be written (in a text form)
3. formalization – BR should be formalized to be more precise (predicate calculus, fuzzy rules...)
4. coding – BR should be coded for transfer (XML format or other)
5. transfer – via Internet or intranet (FTP transfer or other)
6. decoding - transformation of XML document to structured text or database items with formalized form of business rules – predicate calculus form, or fuzzy form of business rules
7. archive – archive of texts with business rules in file or database form
8. application – connection between software that supports business process and business rules that are in BR archive, so business rules can be enforced during software operation mode
9. check the application – comparing business rules requirements with data that are collected during software usage within some time frame (operational period)

10. application report – reporting about enforcement of business rules in using/reporting period, by examination on database where data should be stored according to business rules constraints
11. evaluation - measurement if business rules applications give appropriate business process performance measurements results, should business rules be changed to adopt to the acceptable level of business performance.

VI. XML FOR BUSINESS RULES EXCHANGE

The actual standard in data/rules exchange is XML format. Communication between two business systems in a distributed information system is based on special XML format of business rule. XML formatted business rule presents a media for exchanging business rules among business systems. At the business system we have several modules:

- Enterprise organizational system database
- Business rules API for application in appropriate software support of information system
- Rule repository for rule storage
- Rule monitor as a software engine for checking if the data in a database is adequate to business rules from a repository, i.e. it is for enforcing business rules to be applied by checking the consistency of data with business rules
- Business rules generator – for presenting business rules in XML format
- Business rules parser – for getting the essence of XML format of business rule so it could be stored in BR repository and applied accordingly.

XML document has specific format for business rules with the structure as following tags/sections: Business_rules tag, Rule name, Rule version, Business action name, Start date, Retire date, Precedence, Success Action, Success Rule Name, Failure Action, Failure Rule name, Language (C), Database type (Oracle PLSQL), Digital signature. It is clear that it is important changes of rules are followed by versions, start date and retire date; business rules require business actions on successful accomplishment and on failure, and recognition of business rules responsible entity/person is provided by digital signature.

VII. RISK ANALYSIS OF BUSINESS RULES MANAGEMENT IN DISTRIBUTED INFORMATION SYSTEM

According to elements of risk analysis for IT sector [15], here we will present elements of risk analysis for distributed information systems and application of business rules management in distributed IT/IS environment.

System characterization

- results: distributed information system of an enterprise with decentralized databases and data processing, that has implemented module for

business rules acquisition, storage and application, as well as distribution to other client-server nodes...

- processes: development of distributed information system, business process, business rules management lifecycle, business rules distribution and application

Threat identification

- threat sources: - internal (results, process), external (users, other enterprises, viruses...)
- results: complexity of distributed information system, integration of business rules management system with legacy systems and client-server applications that are developed according to business process needs, formalization of business rules (fuzzy rules/predicate logic rules)
- process: IT process vs. Business process (parallelism of processes), accurate application of business rules

Vulnerability identification

- system environment vulnerabilities: technology changes and development, diversity of operational environments, computer viruses, unauthorized attempts to access the system...

Control analysis

- technology control: integration of heterogeneous operational systems, centralization of business rules dissemination
- organizational control: business organization and strict role / responsibility determination

Likelihood determination

- First priority and likelihood of threat: internal factors (business organization and technology)
- Second priority and likelihood of threat: external factors (technology development, virus, unauthorized access...)

Impact analysis

- Loss of Integrity – application of constraints to data entry according to business rules is needed to be enforced at each node of distributed information system. If any node don't use the same business rules, data integration from all nodes could be influenced and put on threat.
- Loss of Availability – business rules constraints include limited usage and functionality, and application of business rules could make the threat of loss of system functionality and operational effectiveness.
- Loss of Confidentiality - protection of information from unauthorized disclosure is needed because of need for centralized or controlled access to distribution of business rules to distributed nodes of distributed information system of an enterprise.

If unauthorized access is under threat, functionality and confidence in proper business process software support is under risk.

Risk determination – the most important risk elements threat/vulnerabilities are:

- Complexity of distributed information system development and integration of business rules management module
- Organizational distributed / centralized roles / responsibilities
- External threats – unauthorized access, technology development...

Control recommendations

- Strong internal organizational role/responsibility determination
- The importance of IT sector and its integration to top management strategy plans
- Enterprise application integration tools and technologies, as well as reliable technology for integration of remote databases and operational systems in distributed environment
- User friendly tools for business rules management within all steps from business rules determination to business rules application evaluation.

VIII. CONCLUSION

Enterprise is changing in the dynamic environment. IT support is crucial for rapid adaptation to those changes and for enabling continual function of every business process. Business rules have the key role in the business process to be supported by software solutions. Separation of business rules from program code and database design and active components enable handling business rules by business staff, not by IT or other supporting staff at an enterprise.

Business rules management software support consists of software for rule capturing, formalization, distribution, application, enforcement, reporting and evaluation. In large companies that consist of many nodes of distributed information system, it is very important that business rules management module integrates within the functionality of existing client-server applications that support business processes.

Risk threat in distributed information systems is itself a challenge for IT sector of large companies, since the main feature if those systems are decentralization of database and data processing. Business rules that are distributed via special XML formatted documents give another vulnerability to the whole system, since business rules should all be applied at each node of distributed system at the same time and should not make constraints be limits to functionality of existing software practice.

Therefore risk management needs concrete activities that are planned controls for threats not to harm functionality and reaching an enterprises mission during everyday data processing. These activities are included in

business design through strong organizational role/responsibility determination, integrative technology for enterprise application integration and distributed information systems of heterogeneous operating systems integration, key role of IT sector together with management sector of an enterprise, user friendly tools for business rules management from business rules capturing to evaluation of its application during operational and strategic processes of an enterprise.

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