# The Experience of Implementation and Application of GERAM International Standard for IT Reengineering in Russia

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**Abstract**

The notion of workflow is practically unknown in Russia, while in the world the Workflow Management Coalition exists since 1993. Nevertheless, usual approaches for creating accounting, economical and automation solutions are usually suffering from the great number of problems. This is especially true for large information system such as those based on SAP R/3, BAAN IV, because they are resistant for changes, and thus in a lot of cases business processes turn out to be "locked" in the code.

Our team was the first in Russia to use ISO 15704 standard, which is also known as GERAM, for IT reengineering in an industrial setting. We found out that this approach could be used effectively, even though it requires solid knowledge in the areas of workflow and business processes. We believe that application of GERAM methodology could be especially beneficial for Russian companies, because most of them are in dire need of information reengineering.

## 1. Introduction

1. The enterprises interaction on the real time scale is typical for the modern economy, when market needs are continuously changing, new technologies and products are appearing but competition amongst producers is global. New market trends, economy globalization and forming of great economic blocks such as European Alliance, NAFTA, MERCOSUL require from the companies the accomplishment of the business administration international rules, new forms of organizations and standard quality observance of the product. Under these circumstances the enterprise strategies must adapt quickly to the new conditions of business administration and to be supported by technological facilities for realization of their business-processes reengineering. The following generation of production systems will be more oriented to the reduction of the product production (development) cycle, expenses and quality increasing. Such enterprises must satisfy the following main requirements:

- Integration of enterprises. The separate and complex production enterprises must integrate with suppliers, partners and clients in dynamically built networks of

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information transfer for the realization of global concentration and flexible market reaction;

Distributed organization. The efficient integration of enterprise is possible on the base of distributed organization, ensuring the interaction at a rate of technological systems of efficient management;

- Heterogeneous environment. The production systems must be provided with facilities for joint functioning co-ordination of heterogeneous program and technical ensuring both in the internal environment and at the interaction with the external world;
- Open dynamic structure. The enterprises must have a possibility to dynamically integrate the new subsystems to the acting systems without stop and regeneration of working surround;
- Co-ordination and cooperative work. The production enterprises must have a possibility to efficiently co-ordinate their own production programs in accordance with market requirements, suppliers and business-partners possibilities;
- People and information systems integration. The consumers (people) through the information systems get the information about the condition of all types of activity at the enterprise and they have an influence on the different parameters of running business processes. The flexibility of access and the modification possibility of information systems components are the necessary conditions for realization of efficient integration;
- Flexibility. The enterprises must continuously develop their own production strategies for the expansion of their sales markets and, thereby, to reconstruct flexible the technological, resort and information environment under new economic conditions;
- Knowledge concentration. It is necessary for the successful operation in dynamically changing market environment of enterprise to hold a repository of knowledge on their organizing building, structure and composition of business-processes and resources, information environment. The enterprises will be able to produce dynamic reengineering of their own production strategies using given information and corresponding tools;
- Product, interfaces, protocols and processes standardization. The efficient integration, co-operation and dynamic reorganization can be accomplished materially when using only the international standards and united conceptual foundation.

2. The enterprises will use information systems with the adaptive architecture, based on modules reusing, which ensure business-processes flexible support for successful functioning in dynamically changing market conditions. The future enterprises must be network, flexible and they must take advantages of the following technologies:

- The international communication systems, ensuring connection to the clients, suppliers and partners enterprises;

- The standards for enterprise models description, ways of their integration, business-rules, agents, specifications and information protocols;
- The workflow controlling systems, supporting co-ordination of all enterprise activities;
- The designed imitating surrounding, supporting evolution of the product and production equipment and optimization of production processes;
- The general infrastructure based on open architecture, for enterprise integration, general service realization through network and business-supporting applications.

3. The main problems of reengineering are enterprise models building and its interaction with all other business participants, performance of these models in the simulation environment in order to work out the necessary technical decisions. The application problems of existing tools for distributed systems modeling of business conduct are concluded in following:

- Modeling paradigms and user languages. The tools must model events, processes and individual works, facilities and information objects;
- Monolithic models, i.e. majority of tools deal with the single model and simple set of business-rules. It makes them poorly available for the enterprise modeling, where the behavior of business-essences depends on external and internal events, resources, conduct of the agents and coordinating mechanisms;
- The tools do not support simultaneous modeling of information and controlling flows;
- Modeling environment and imitating one have a different set of constructors, specific syntax and semantics;
- Enterprise models sizes and difficulties. The enterprise models can have a great amount of the modeling components and relationships between them. The simulation modeling of such enterprises is not supported by existing facilities;
- Multilevel models structure. Some models components have hierarchical structure. For example, the domain-processes consist of the business-processes, which in turn consist of separate works;
- Existing facilities transform such hierarchy to the flat single model;
- Network models structure reflecting the interaction of suppliers, producers and clients. Classical simulation facilities reduce a network organization of business with separate thread to the one linear process.

Analyzing given existing tools limitations, we see, it is necessary to develop a new set (family) of facilities, having multilevel distributed architecture and ability to reconstruct their own configuration and modeling rules quickly to provide processes of designing and reengineering of networks. In this report we have tried to formulate the main principles of modern information systems building.

## 2. International Standards Applications for All Stages of Enterprise Life Cycle

In our opinion, it is necessary to follow at least the following standards for modeling and specifications:

- ISO 14258 – Concepts and Rules for Enterprise Models;
- ISO 15704 – requirements for Enterprise reference architectures and methodologies;
- ISO 10314 – Shop floor -production model;
- CEN ENU 4003 – CIM – systems – architecture framework for modeling;
- CEN ENU 12204 – Constructs for enterprise modeling;
- ISO/IEC 15288 -System life-cycle Processes;
- IEEI – Standard Upper Ontology.

Planned standards:

- Universal Enterprise Modeling Language (UEML);
- Process Specification Language (PSL);
- Extensible Business Reporting Language (XBRL).

Standards for designing and integrations:

- ISO 10303 – Standard for Exchange of Product Model Data;
- ISO DIS 14750 – specification language IDL;
- ISO/IEC 10746 – Open Distributed Processing;
- ISO 8879 – Standard Generalized Markup Language;
- IGES – ANSIY14.26M – Initial Graphics Exchange Specification;
- ISO 9735 (EDIFACT) -Electronic Data Interchange for Administration, Commerce and Transport;
- ISO 18876 – Integration of Industrial Data for Exchange, Access, Sharing;
- GENCR 1831 – Systems Architecture Enterprise Model Execution and Integration Services.

## 3. GERAM Methodologies Transformation for Integrating Technology Building

At present there are six main methodologies for developing models of an enterprise, reflecting different aspects of its activity (functions, facilities, organization, information objects). They are: GERAM, ARIS, CIMOSA, GRAI/GIM, IEM and PERA.

GERAM methodology synthesizes main components such as CIMOSA, GRAI/GIM, PERA and consists of the following main components:

- Review Architecture;
- Methodologies;
- Languages;
- General and private models;
- Tools;
- General program modules;
- Detailed models.

The association of these components to the technological chain for the enterprise information system development is a necessary condition for the successful solving of enterprises reengineering problems.

The integrated technology review architecture consists of main CASE facilities required for enterprise information system development or reengineering which reflects general, private and detailed data domain models. The cardinal principle of CASE facilities building is based on the generation of program components on the base of meta-models of goals, scenarios, business-rules, roles and business-processes. The CASE facilities association to the technological system depends on realized project goals and provided with corresponding workflow facilities.

## 4. The Instrumental and Applied Facilities Component Building

### 4.1. Architecture

The component built business-system architecture consists of four levels: data, business-rules, business-processes, and client applications. The developed component models (COM, CORBA, EJB) can be used on each level. The processes and data components must have different interfaces for heterogeneous surrounding realization to be dynamically reused and (to be) retargeted.

### 4.2. Technologies

The component technology must ensure the performing of the following functions:

- Transaction processing;

- Object request brokers;
- Message brokers;
- Configurable security.

The given functions realization ensures components independence from programming languages and used platforms, dynamic connection of components in a real-time, virtual execution of the program module, business-exhibits adaptation to the new rules of the business administration and independent designing, implementation and testing.

### 4.3. Tools

It is possible to divide tools for the components development and implementation into five groups: (1) modeling facilities (support components and interfaces modeling), (2) construct facilities (intended for separate components designing and testing), (3) repository (ensures components keeping), (4) interconnecting facilities (support components visual specification and interconnection in some executing environment), and (5) integration facilities (ensure heterogeneous platforms integration).

***Modeling facilities*** – ensure an enterprise model development in the manner of component-built scenarios, business-rules, roles, business processes with the interface specification and interaction protocols.

***Construct facilities*** – ensure components program generation on the specified models base:

- Interfaces generation for component models;
- Tests generation on model specifications base;
- Automatic certification of applied processes;
- The interfaces with the available program environment creation.

***Interconnecting facilities*** – produce separate components assembling on two levels:

- Business-semantic – components assembling is accomplished in accordance with specified concrete proposition business-logic;
- Technological – components assembling is accomplished in accordance with the product development or provided service technological cycle.

***Integrations facilities*** – ensure different technologies integration through used platforms and component applications integration with ERP systems.

## 5. Multiagent Realization of Instrumental and Applied Facilities Interaction Mechanisms

The dominant feature of the information system reengineering is a new business-processes multichoice construction and efficient network organizations modeling. One of the ways to solve these problems is a multiagent infrastructure building, ensuring the instrumental

environment adaptation and information enterprise system to the changing conditions of business administration. Agents are characterized by the following characteristics:

- Adaptability – an ability to be educated and to be self-improved in the process of using;
- Autonomy – direct and self-organize behavior;
- Behavior in the community – an ability to work with other agents for general purposes realization;
- Ability to make a conclusion – a possibility to work on abstract problem specifications;
- Communications at knowledge level – an ability to interact with other agents on the natural language communication;
- Mobility – a possibility to move from one platform to another;
- Reactivity – the system quick reaction due to an ability to recognize a sense and semantics.

Multiagent systems are used for solving both as technological problems (such as modeling, imitation and specification) and as problems of applied nature (planning, management, checking and integration). General components of such systems are:

- Agent architecture – reflects a agents content as essence capable to the perception, action and discourse;
- Agent system architecture – expresses agents ability to iterations and interaction;
- Tools – ensure agent construction (for instance, systems Voyager, Eaglets, Odyssey);
- Infrastructure – adjusts communications between agents.

The following aspects characterize agents' infrastructure:

- Ontologies – define concepts schemes and their relationships (KIF) description;
- Communication protocols – describe communications languages;
- Communication infrastructure – specifies channels for agent communications;
- Iterative protocols – describe agreements for agents' iterations.

Multiagent system under the domain presentation of data domain includes several types of agents, ensuring interaction inwardly domain and between them.

Multiagent infrastructure practically is a semantic information system shell, reflecting the business administration rules and its participants interaction.