Asynchronous Message-Passing and Inter-Application Communication Software for Process Improvement in Complex Systems

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ABSTRACT

Complex systems nowadays are usually supported by previously developed or inherited application systems, which have been developed on the basis of business functions standard model. Such application systems cover particular business fields, however, since they have been developed in an independent and uncoordinated way, there are modest possibilities of interacted automated data exchange because of heterogeneous data. Because of increasing data exchange needs, enforcement of development and upgrade of programmatic procedures is required. In this connection it is necessary to find ways and means to integrate all existing application systems in given circumstances and render possible exchange and usage of all needed data in a reliable and consistent way. The problem can be solved in different ways. Asynchronous message-passing and inter-application communication software appliance imply commencement of automated data exchange among existing organizations application systems, providing for full scale control and management of mutually exchangeable data, internally as well as externally. In this connection contributing model of the running application systems integrated by means of Message-Oriented Middleware (MOM) of the complex system has been created.

Keywords: Application, Database, Information System, Integration, Message-Oriented Middleware (MOM), Process Improvement

1. INTRODUCTION

With complex business systems and their accompanying information systems, which support the implementation of their business functions, there is a need for constant mutual data exchange. In this case automated processes of one information system produce data that are used by another information system or several of them. Here, complex system is referred to as any system featuring a large number of interacting components (agents, processes,
etc.) whose aggregate activity is nonlinear (not derivable from the summations of the activity of individual components) and typically exhibits hierarchical self-organization due to certain (selective) circumstances. This definition applies to systems from a wide array of scientific disciplines. Indeed, the sciences of complexity are necessarily based on interdisciplinary research (Rocha, 2010). Generation, usage and maintenance of procedures which support processes and operations of data exchange present an additional effort for information staff and an additional expense for the organization. This is so due to the constant need for data exchange, in circumstances of frequent changes in the inner and outer environment of the complex system.

This kind of data exchange slows down other business processes in the system as well – those depend on data which need exchange, because this procedure cannot be executed in real time. The dimension of this problem is more related to organizational domain than to the technical; in solving it we must take into account the restriction which is obvious in the fact that within every information system, alongside the allowed (and desirable) business process reengineering in the complex system, the data structure of the master data system should be maintained.

In the case examined and elaborated by the author, databases can physically be centralized or distributed, but from the point of view of business functions and processes they are logically separated and the object-related communication is conducted through the existing and specifically created programmatic procedures for efficient database updates. There are no common database tables, and the data, when transferred from one system into another, change their format and structure - they are being processed through new group of specific procedures according to the system they have entered, keeping their information content. Different information systems programmatic solutions are also independent of each other and support the work of independent databases as parts of these systems. There is a networking infrastructure which enables the interconnection between information systems and work for users of all information systems. It also provides information assurance.

The need for integration of information systems exists because part of the data created by one system processes (output values) is used for processing within one or more other systems (input values). The basic integration condition of the information system must be releasable: with information systems which are complex and distributive in organization, as well as in those which are organized centrally, managing the data of the complex system must be centralized, i.e. master data management (MDM) must be achieved.

Technical interoperability is relative to the norms and standards used for the interconnection of computer systems and services. It includes open interfaces, network and security services, middleware, integration presentation and data exchange.

Semantic interoperability is relative to data meaning. Thanks to this level exchanged data have the same meaning at the starting point and destination, pieces of information originating from various information resources are linked in a meaningful way.

Process interoperability is relative to business goals, business process modeling and cooperation achievement between different units whose structure and work mode are not necessarily congruous. To fulfill system user needs and to reinstall available and simple user services it is necessary to establish process interoperability.

The objective of the research is to provide information systems interoperability by the means of message-oriented middleware.

This paper is structured as follows. Section 1 and 2 discuss the necessity to integrate information systems of the organization; the concept of solution model is given as well. Section 3 explains technical aspects of examined integration solution at logical level, including new model of the running application systems, integrated by means of message-oriented middleware of the complex military system.
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