Journal of Business; ISSN 2233-369X

Integration of Corporate Information Systems and Dynamic Analysis of Distributed Business-Processes on the Basis of SOA and Petri Networks

Gia SURGULADZE *
Davit CHIKOVANI **
Nino TOPURIA ***
Beka URUSHADZE ****

Abstract

The web-application forms on Ms Visual Studio. NET platform by The NORMA software and Ms SQL Server package are realized as a result. The attention is particularly focused on the issues of modeling of business processes of corporate systems, automation of designing of database structures, and consumers' interfaces.

Keywords: BPMN, CPN, distributed business-processes, information management systems, integration, Markovian processes, ORM, Petri Networks, SOA
JEL: C02, C60, M10

Introduction

A part from being the era of information and telecommunication products, the 21st century turns out also to be the age of globalization and integration. Economy is defined as economy based on knowledge or global economy. Which is determined by development of the sector Information and communication technologies. These are not only the driving forces of the new economy and services, but they prove to be significant instrumental in the achievement of the "fifth liberty" and of a society based on knowledge.

Nowadays, modern corporations need a strategic information system to entry on the market and become a leader in the market. Therefore, companies need to create an information system that supports business performance in line with this strategy. The role of information systems carried out in a corporation supposed to support effective strategy. It expected to make a profit and competitive advantage. Implementation of information systems cannot be separated from the integration of information technology. Because the computer is one of the information systems, it can use to support the achievement of the company has made.

The task of Integration of corporate information systems is especially relevant today. It requires reengineering of existing systems and addressing the agreed connection of new systems with existing ones. At this stage, most important is the time factor of upgrading the system and use of CASE technology for reducing time plays important role in this respect. In order to create a unified corporate information system software based on distributed business processes, needs proper implementation of software systems life cycle management, which will significantly improve of them quality (Langford, 2012).

The design of distributed systems of electronic business and commerce control needs the solution of the problems of informational support, software and hardware of separate functional units on the basis of new network information technologies (Watson et al., 2008; Robinson et al., 2001).

System operation conditions have to satisfy the following main demands:

- system functioning has to be done with the use of internet-intranet networks;
- it has to provide information safety and protection;
- the system has to have friendly relation interface with users;
- its service has to be simple.

* Prof. Dr., Faculty of Informatics and Control Systems, Georgian Technical University, Tbilisi, Georgia.
Email: g.surguladze@gtu.ge
** Assist. Prof. Dr. Advisor of MSc. & PhD.c., Faculty of Computer Technology and Engineering, International Black Sea University, Tbilisi, Georgia.
Email: dchikovani@ibsu.edu.ge
*** Assoc. Prof. Dr., Faculty of Informatics and Control Systems, Georgian Technical University, Tbilisi, Georgia.
Email: n.topuria@gtu.ge
**** PhDc, Faculty of Informatics and Control Systems, Georgian Technical University, Tbilisi, Georgia.
Email: b.urushadze@gmail.com

Computer network system of commercial objects control is oriented for operation in multi-user mode that requires the guarantee of system functioning safety. Relativistic, network base systems of data have special parole systems for registration (Login ID) and operation of users (Surguladze, Turkia, Topuria, Lominadze, & Giutashvili, 2012; Surguladze, Shonia, & Kvavadze, 2004).

The main content

Business – process modeling with BPMN The work presents the problems of inter-corporate business process management. The questions of business processes integration, information composition and synchronization related to multi-application environment are suggested. Considering the inter and intra-corporate management aspects, main attention is given to the strategies of software product development in the organizational systems (Surguladze & Bulia, 2012). To provide the Integration of the horizontal and vertical management in the inter-corporate applications, the possibilities of service-oriented architecture and its practical realization examples are described. Based on the business-processes model, which occurs between the Tax Service of Ministry of Finance and the Banks, formation of the in capsulated business-functions in the web-services and the inter-corporate application process functioning.

Represents the service business-process scheme of the request of received encashment process: “in the Bank received encashment process starts at the predetermined time. Windows’s service in the database tables views the processing encashment lists, call the Get Active Order-’s method, adopted encashment number lists will transmit to the Request Amount From Mof method, which forms XML messages and calls Revenue Service’s Web – service. Revenue Service returned XML messages to the bank’s Web – service, which includes encashment numbers and the corresponding amount, this information is recorded to the database. Employees of the Bank views encashment list using program, then Web-service method “Get” is called, which accepts that, after this calls procedures from database, which performs transactions, pays sums from account in the Revenue Service’s account, whether the amount will be repaid in full the status will change to `active” and will unlock the card by the employee”, etc. (Surguladze & Bulia, 2012).

Global-local network integrated model where the software-hardware problems and the ways of information protection and renewal are presented (Surguladze, Petriashvili, & Shonia, 2005).

Information protection requires the solution of two problems: the provision of data continuity and guarantee of secrecy (installation of limitations for data receiving). In order to provide data base continuity the structural limitations and directly data value limitations are used. Limitations on structural level are based on the description of functional dependences (relations, attributes, etc.) in data bases. The special notions of key attributes, indexes (simple or composite) are introduced. They help to realize information ordering, retrieval and selection in relational files. Continuity limitations on data value variation is realized with triggers. These are key on-key out functions that provide data continuity in logically connected tables (relations). Initiation of standard or private functions in the system is determined by the user, while the triggers do not depend on the program. It is keyed-on every time when information renewal happens in data base. One of their functions is to report data change statistics in the system.

Methodology

Problems of integration of corporate information management systems, for their object process- and service-oriented analysis, design and implementation are considered. On the basis of open and closed models of mass service the analysis of the developed network commercial control system indices is done. Using Markovian processes the model of service organs optimum number determination of user-server architecture and algorithmic schemes of its solution are worked out. Object-role modeling problem for inter corporate automated systems and its implementation is considered. The creation concept for the distributed databases for various financial structures on the basis of Service-oriented architecture is offered.

The paper presents the solution of general resources synchronization problem of the distributed system. The corresponding stochastic Petri network model is constructed and investigated. It is constructed with graphic-analytical editor and is realized as cause and effect predicative Petri network, provides control of sequential and parallel processes and fixing of time parameters of their execution.

The server of the system’s main office is modeled with Petri network position (S). For request formation (say, it satisfies Poisson distribution) random-generator (G) is introduced (Bolch, Surguladze, Petriashvili, & Chikhradze, 2001). The results of request analysis (I) and processing is given in positions (Oi - the results are obtained without general local resources, OLi - the results are obtained with general local resources, OSi - the results are obtained with general global resources).

Process simulation is done as follows: if solution block gives .F. then the request is formed using general resources and it applies to local servers (precisely speaking, the request passes to waiting position of processing), marker is placed in Mi and is waiting until Ti (local resource) or Tsi (global resource) adapter opens. Generally we can assume that elements of S vector of synchronization receive markers on sequential (synchronous) opening of adapters. When there is a request in the block and marker has arrived in

position then the adapter opens. By means of a channel the request receives the necessary data and the marker passes to position Ei. In tables of Fig.4 the results obtained with simulation of this scheme are given. The relation of requests satisfied with local and global resources are given in case of different time parameters of network components (service organs).

For investigation of the proposed scheme the mass service model for steady state regime has been used (M/M/m, M - Markov property, Poisson/Exponential distribution; m - number of servers).

Consider the corporate network model, where there are several users and several servers (service) with services. Suppose, that one of the servers performing a distribution function i.e. receives a request from a user and sends it to the server (which is available). If all servers are busy, the request is queued and waiting until one of them will be available. As soon as server (Ni, i=1,6), receives request from distribution server (Nmain), it serves with some specific services and returns the results back to the distribution server, which in turn sends the response to user.

Our goal is to identify the critical point of network functioning with the help of existing parameters, to choose the characteristics which ensures it's normal functioning and to create software product, which performs all of abovementioned. According to the theory of mass service the abovementioned system is M/M/m type (Bolch et al., 2001).

The object-oriented, visual program modules have been developed. For computer network a class (new type) has been developed the closed parameters of which are: request arrival frequency, service time, number of servers, etc., while class methods absolutely present the steady-state regime of network operation and provides the estimation of optimum values of its parameters.

The problems of modeling and studying the processing of requests in the banking corporation based on service applications and systems analysis. Introduced the concept of building an integrated automated UML-based standards and service-oriented architecture. It is proposed the use of colored Petri nets (CPN) (Surguladze, Turkia, & Gulua, 2008; Jensen, Kristensen, & Wells, 2007) to construct a simulation model of inter-corporate service processes and study the temporal characteristics of its functioning.

Object-Role Modeling (ORM) problem for inter corporate automated systems and its implementation is considered in the article. The creation concept for the distributed databases for various financial structures on the basis of Service-oriented architecture is offered (Fig.8). The web-application forms on Ms Visual Studio.NET platform by The NORMA software (Surguladze, Bulia, & Urushadze, 2012; Halpin, 2005) and Ms SQL Server package are realized as a result (Surguladze et al., 2004).

ORM is a method for designing and querying database models at the conceptual level, where the application is described in terms readily understood by users, rather than being recast in terms of implementation data structures. It views the application world as a set of objects that plays roles. Sometimes it calls fact-based modeling because ORM verbalizes the relevant data as elementary facts see (Surguladze, Turkia, Topuria, Gulua, & Iremashvili I. 2010). It may represent unity elementary facts.

Conclusion

During the systems projection stage, the joint work of the business analysts and systems (software) shall be required to precisely determine the major requirements for the realization systems. In this point of view, application of ORM and BPMN models, being currently considered as the agreed standard for all stakeholders of the business sphere significantly facilitates the elaboration of the problem detection phase thus giving the possibility to create the primary carcass of the automation system (Surguladze, Turkia, Topuria, & Giutashvili, 2009). However, the ORM instrument describes the system on the data structure level only and does not provide the determination of the process structures and scenario-relevant system behavior. To describe the workflow and business process lifestyle, the BPMN model is applied. Business Process Modeling Notation secures the opportunity of synchronization of the business model and informational model thus being considered as De Facto standard for description of the web-service based business processes. The priority is given to the visual side of the modeling graphic elements and compatibility of the diagrams.

References

Bolch, G., Surguladze, G., Petriashvili, L., & Chikhradze, B. (2001). Elaboration of the software for the management of resource of the multiprocessor systems using Borland_C++Builder. Trans.of the GTU, 4(437), 47-53.

Halpin, T. (2005). ORM 2 Graphical Notation, Neumont University. Retrieved from http://www.orm.net/pdf/ORM2_Tech Re- port1.pdf

Jensen, K., Kristensen, M. L., & Wells, L. (2007). Coloured Petri Nets and CPN Tools for Modelling and Validation of Concurrent Systems. Univ. of Aarhus. Denmark, 40.

Langford, G. O. (2012). Engineering Systems Integration: Theory, Metriccs, and Mmethods. CRC Press. Taylor & Francis Group, an Informa business. USA, 388.

Robinson, S., Cornes, O., Glinn, J., Harvej, B., McQueen, C., Moemeka, J., ... Watson, K. (2001). Professional C#, 1(2), Wrox Press, Birmingham, 1002.

Surguladze, G., & Bulia, I. (2012). Integration and Building of Web-Applications for Entererpises. GTU, Tbilisi, 334.

Surguladze, G., Bulia, I., & Urushadze, B. (2012). Management of the Integration of Information Systems with a SOA and UML/Agile based Methods. Transact. Georgian Technical University. Automated Control Systems. 2(13), 7-22.

Surguladze, G., L., Petriashvili, O., & Shonia, O. (2005). The Visual, Object oriented Modelling, Design, Analysis and Implementation using .NET technology and Petri Net. Bulletin of Georg. Acad. of Science. 172(2).

Surguladze, G., Shonia, O., & Kvavadze, L. (2004). Distributed database management systems. (Ms Access, SQL_Server, InterBase, JDBC, Oracle). GTU, Tbilisi, 230.

Surguladze, G., Turkia, E., Topuria, N., Lominadze, T., & Giutashvili, M. (2012). Towards an Integration of Process-Modeling: from Business Method: from Business-Content to the Software Implementation. *4th International Conference: Problems of Cybernetics and Informatics*.

Surguladze, G., Turkia, E., & Gulua, D. (2008). Perfection of Object-Oriented Projecting with a Process-Oriented Approach. *International Conference: Education, science and economics at university Integrat. to intern. educ. area"*. Płock, Poland. 557-562

Surguladze G., Turkia E., Topuria N., Giutashvili M. Development and Research of the Computer System Models Supporting the Human Resource Selection for the Project Management. 3rd *International Conference "Computational Intelligence (CI'09)"*. Tbilisi, Georgia, June 26-28, 2009. pp. 294-298.

Surguladze G., Turkia E., Topuria N., Gulua D., Iremashvili I. The Concept of Construction of Computer Systems for Support of Consulting of Organizational Management. Transact. of Georgian Technical University. Automated Control Systems. ISSN 1512-3979. No 2(9), 2010. pp 50-54.

Watson K., Nagel Ch., Pedersen J.H., Reid J.D., Skinner M., White E. Visual C# 2008. ISBN 978-0-470-191354. Wiley Publishing, Inc., Indianapolis, Indiana, 2008. 1211 p.