

# Organizational Engineering: Support for Real-Time Auditing

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## Abstract

This communication's focus will be on the organizational engineering as a support to real-time information systems' auditing. The implementation of this kind of auditing implies the existence of internal control, more dynamic and less self-contained, within the organizations. The attention that has been given to internal control has had some effects, i.e., the change of organizational behaviour, from structure to process. In this paper, we made the extension of the CEO framework suggested by the Centre for Organizational Engineering (CEO), research group at INESC-INOV, using the "Enterprise Risk Management – Integrated Framework", published in September of 2004 by "Committee of Sponsoring Organizations of the Treadway Commission" (COSO), as a basis to the modelling of internal control mechanisms, based on the software agents technologies, and so support the real-time auditing.

**Palavras-chave:** organizational engineering, real-time auditing, CEO framework, COSO

## 1. Introduction

The trend that has been verified in the evolution of the organizational development (clearly relying on an on-line approach) simultaneously backed by a strong evolution of the communication and information technologies, has confirmed the inefficiency of traditional auditing in assuring the integrity of organizational transactions, making, thus, no sense that these should not be audited in real-time [Onions 2003].

As an equally important factor, we can not forget to mention the change in the pattern of evidences gathering that has been changing over from paper supported documents to digital format [Kanter 2001], which will become the main form of evidences in a near-by future, becoming increasingly important for the good performance of the organizations [Pollitt 2002].

In the last years, with the aim of solving these problems, the issue of real-time auditing has been debated, but this discussion has been restrained to academic circles only. Now, due to constant news of financial scandals, to the market globalization, to the eastern economies liberalization, to the increase in the diversity of working power and to the rising ubiquity of the internet [Julian and Scifres 2002], it is necessary to bring this discussion into practice.

The feasibility of real-time auditing is connected to the existence of an internal control system. Thus, side by side with the strategic and operational aims, control goals should also be supported by adequate processes using adequate resources.

This paper contributes for the promotion of real-time auditing using the CEO framework (CEOF), suggested by the Centre for Organizational Engineering (CEO), research group at INESC-INOV. The CEOF, as verified by several researchers [Aveiro 2002, Castela 2001, Mendes 2001, Sinogas 2002, vasconcelos 2001], is consistent and coherent enough.

Even if the metamodel CEOF suggested by [Sinogas 2002] clearly specifies an association “controls”, it is necessary to proceed to its extension, in order for it to support the modelling of real time auditing.

The present communication is divided into four sections, including this one where a brief introduction is made to its aims, context and organization. In section 2 refers real-time auditing, its importance on the developments of the information technologies and the possibility of modelling real-time auditing based on the software agents’ technologies and support by an architecture based on agent oriented approach. In section 3 we presented an extension of CEOF for agent modelling.

Finally, in section 4, the conclusions and established guiding lines are presented, since the later could be useful in future research projects, related to the topic of real-time auditing.

## **2. Real-Time Auditing**

### ***2.1 Importance of Real-Time Auditing Face to the Developments of the Information Technologies***

With today’s dynamic business environment there are increasing calls for more frequent financial reporting to ensure the different users have timely access to information to make informed decisions [Hunton, et al. 2003].

Recent advances in information and communication technology make possible the presentation of financial information on the Internet. In the many developments meets eXtensible Business Reporting Language (XBRL) that constitutes a revolution in financial reporting. The initial goal of XBRL is to provide a framework that the global business information supply chain will use to create, exchange and analyze financial reporting information including, but not limited to, regulatory filings such as annual and quarterly financial statements, general ledger information and audit schedules [Weisel 2002].

As organizations increase the use of XBRL and the presentation of financial information on the Internet more frequent financial reporting, it is possible that should reduce uncertainty and enhance investors’ perceptions of a company. So, the need to adopt new security technology is growing because it is absolutely necessary to guarantee the authenticity of financial data. More frequent audit will ensure the integrity of the data.

In order for Internet-based, real-time financial information to have value, decision makers need real-time assurances from an independent third party that the information is secure, accurate, and reliable. In order to make this possible it is urgent to develop file protection and data security standards and regulations, which will permit the implementation and adoption of real time auditing [Chen 2003].

Recent developments, proposed extensions to XBRL termed eXtensible Assurance Reporting Language (XARL) designed to address the issue of information reliability on the Internet [Boritz and No 2003].

Architecture for real-time auditing making possible designs an adequate technological and organizational architecture and will allow, consistent form, to generalize the adoption of XARL.

## ***2.2 Architecture for Real-Time Auditing***

Real-time auditing is supported by a strong theoretical component that renders easy its conceptualization in an epistemological perspective, making it thus easier the design of an adequate technological and organizational architecture.

The efforts that have been developed in the nowadays practice of real-time auditing systems have been isolated and haven't led to the desired results [Mantilla 2001], probably because of their mostly practical component.

The approach to real-time auditing has been discussed mainly according to two perspectives: equal in the main aspects but with substantial differences on the means of achieving the objective [Mantilla 2001]:

- Real-time auditing with embedded auditing modulus [Vasarhelyi, et al. 2004];
- Real-time auditing with agents [Nehmer 2003].

In this paper, we chose the approach with software agents' technology because it seems to us particularly suitable for the dynamic characteristics of the internet; most adequate means for inter-organizational transactions; and of the intranets, most adequate means for intra-organizational transactions.

## ***2.3 Agent Oriented Approach***

Although the principle of energy and mass conservation "... Nothing is created, nothing is lost, everything is transformed..." has a direct significance in organizations and, consequently, in its information systems, the same hasn't been fully understood, little less applied, in the control of information systems.

Bearing in mind this essential physics law and transposing it to the information systems, we shall consider that each transaction within an organization is bound to have two components. A "direct action", that will be the main, to which will correspond always an "indirect action", to maintain the balance of the organizational system. The internal control systems should assure this balance through the implementation of adequate technological resources.

The resource to software agents enables the construction of flexible systems, with complex and sophisticated behaviour, combining highly integrated modulus' components. This approach is particularly fit for the internal control systems.

The approach to real-time auditing with the software agents' technology can be confused with the behaviour of the internal control system (thus leading to a change of paradigm). The main attention focuses on the software agents, that can be described as internal control and not as a collecting data tool with consequences in the internal control [Nehmer 2003], as it happens with the use of the "computer assisted audit tools" (CAAT).

In the context of the present paper, we will consider the control as a resource which is consumed by the business processes and information systems and also produced by a control process.

## **3. Extending CEOF for Agent Modelling**

The extended CEOF metamodel (see Figure 1), supports: control objectives; control processes and control resources (particularly digital agents).

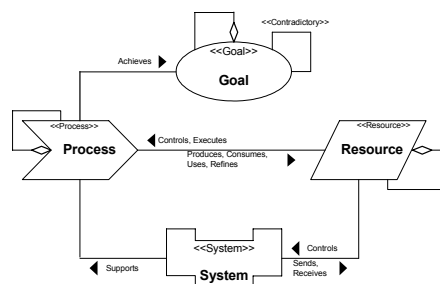


Figure 1 - Metamodel of the framework CEO's Evolution

The CEO with the COSO framework (see Figure 2), in our opinion, can be a good starting point to an agent based modelling software, since it is based in UML language, largely accepted as a standard for objects guided modelling and because the objects guided paradigm and the agents guided paradigm are highly congruous.

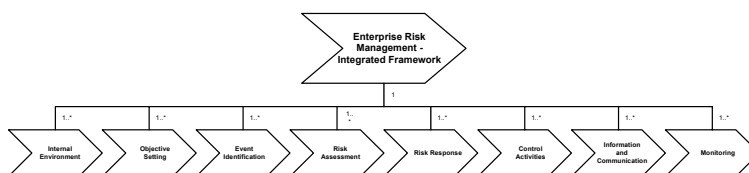


Figure 2 - Enterprise Risk Management - Integrated Framework

Any of the eighth elements of the “Enterprise Risk Management – Integrated Framework” can be executed in a software agents’ community [Nehmer 2003]:

**Control Environment** – the knowledge of the control environment establishes the basis for all other components of the internal control system, providing the necessary discipline and structure. The software agent responsible for the implementation of this element of the internal control system should continuously evaluate the endogenous and exogenous conditionings that affect the level of risk to which the organizations can be exposed. These factors will also, consequently, affect the level of risk that the organization is willing to support;

**Objectives Setting** – The knowledge of the aims shall help one to implement software agents which will simulate the restrictions that can be verified within the organizational objectives, divided into four types of aims, the business processes and the information systems;

**Event Identification** – The identification of events that can threaten the realization of organizational objectives can be implemented through software agents that allow verifying the effectiveness when in operation;

**Risk Assessment** – the evaluation of the risk that underlie the business processes themselves, alongside with the level of risk that the organization is willing to support is a factor of major significance in the implementation of control mechanisms through software agents’ technology. The activities of the above mentioned software agents, which implement this component of the internal control system, include data collecting in a time tendency analysis and the communication of this tendency;

**Risk Response** – The risk alignment, related to the risk defined in the component of internal control, is dealt with in the sphere of action of this component. Once the alignment has been established, it can be implemented through software agents. These will allow its real-time verification and the consequent decisions, should irregularities be found;

**Control Activities** – the control activities (or mechanisms) can be directly implemented by the software agents, specifically designed to decrease the risk always linked with determined process or through the interaction among agents;

**Information and Communication** – the information and communication can occur both within the community of software agents but also between that community and the organization management. The agents that implement this component of the internal control system have the special function of communicating with the directors' board, responsible for the maintenance of the internal control system;

**Monitoring** – monitoring is a clearly adjusted to the software agents' technology. Its function consist of permanently monitoring the records resulting from the transactions that should happen within the organization and referring to these according to the established patterns of the internal control system. Any recorded irregularity should become part of an exception file.

With the operational objectives of any organization there is always a control objective [Weigand and Moor 2001].

#### **4. Conclusions and Future Work**

This work has given positive indications on what regards the use of the CEOF in the internal control system's modelling, with the help of software agents implementations. In order for this to happen slight changes to its original metamodel are needed.

Using the theory of internal control and the "Enterprise Risk Management – Integrated Framework" published by the COSO, we suggest an evolution of the CEOF, so that, in any modelling process of a business, eventual control mechanisms are identified, or their implementation made possible. The extended CEOF metamodel brings only minimal changes to the original CEOF metamodel.

Lastly knowing that all that has been said is a mere contribute, and knowing that there is still a long path to be walked to achieve the effective and coherent modelling of the internal control in an organization; we suggest as future work the use of the extended CEOF metamodel in modelling business processes, main and support, in real situation.

Studies that theoretically strengthen the process guided real-time auditing model, here suggested should be developed, so as to provide answers to all organizations which are interested in maintaining the integrity of their transactions.

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