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DOCTORAL THESIS

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Monitoring systems for e-business solutions

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Contents

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Resume

The contribution of this work consists in making an original connection between the IT process applicability framework (ITIL), the monitoring systems used in the performance analysis of e-business applications, as well as the ETL mechanisms used in the automatic detection and correction of some system errors. Thus, the paper presents case studies, analyzes and simulations directed towards the development of a monitoring system that includes, in the most original way possible, current elements from the IT field, which represent research points, in continuous development. By means of cloud-type solutions, integrations with platforms dedicated to data storage and analysis, as well as external monitoring elements (third-party applications connected to the main application), a complex monitoring system with novel elements can be conceived, but in a procedural framework such as IPCC (ITIL). The elements of the IPCC (Incident, Problem, Change, Configuration) work together, in an integrated IT system, with the ETL and monitoring mechanisms in order to create a complex and efficient structure that will contribute to the improvement of the operational activity, of optimal management of processes and resources of e-business applications.

The increase in the degree of complexity of informational structures, in today's society, implies the development of some models, in the first phase at conceptual level, which corresponds to the requirements of information society. Due to the fact that more and more economic activities, and not only that, widen their scope of applicability, moving to the online environment, the need to implement monitoring and control mechanisms to cope with the largest flow of data is imposed. In order to develop an information system with different degrees of complexity, it is necessary to firstly know the theory of information systems and to develop a

viable model based on it. Thus, in order to create a monitoring system for e-business solutions, it is necessary to correlate information related to the economic activity itself, with the infrastructure, technologies and IT processes. All this assembly leads to the realization of an IT system in itself, and for the realization of a monitoring system elements from: systems theory, hazard theory, the construction of a cybernetic model, IT infrastructure, IT processes, technologies, as well as other relevant elements, will be involved, associated with those mentioned.

The present work aims to define the place of monitoring systems for e-business solutions within IT systems and to give direction in the development of elements necessary for both monitoring and e-business activity, by exposing some conceptual models.

The development of control and monitoring solutions will have a particularly important role in restricting, as much as possible, the informational hazard and providing relevant data in order to make the most correct decisions in the shortest possible time. Since in the specialized literature, in the context of explaining and exemplifying information systems, no reference is made to a specific method of controlling the data or the processes involved, I propose considering the development of a control mechanism that captures as many aspects as possible of the efficiency of e-business processes and the possibility of their quantification, measurement, with the highest possible precision. The information society uses and proposes new work methodologies to find a balance between the information systems created. In order to be in agreement with the specifications related to the work methodology in the IT field, I propose the relationship of all the elements described with ITIL, in this case with the IPCC framework (Incident, Problem, Change, Configuration). Due to the fact that the IPCC offers a customized work framework, I will consider a more general approach to it in accordance with ITIL, according to the attempt to define an information system as complex as possible, with as many relevant components as possible. Within these work methodologies it is important to take into account interdisciplinarity, multidisciplinarity as well as the inevitable occurrence of risk. Control mechanisms will also have the role of reducing, as much as possible, the risks arising in various processes.

A monitoring and control system that completely eliminates any risk will not be possible, but there is the possibility to prevent certain incidents and highlight the sections that require special attention due to high risk. This equation includes risk management as well as

organizational management, any enterprise with an economic character being essentially an organization. Economic IT systems describe, as clearly as possible, the constitutive elements of an organization as well as the control mechanisms aimed at eliminating informational redundancies and reducing, as much as possible, the risks of unforeseen incidents. The infrastructure analysis, as well as the information, the correlation of all the elements involved in an organization can only be done with the help of a complex IT system that has both the role of regulation and evaluation but also monitoring and control. Between all the mentioned elements involved in various e-business processes, there is a relationship of interdependence and biunivocity, the systems being interrelated.

The incidence of unforeseen events within an IT infrastructure has increased greatly in recent years, in particular due to the increase in the complexity of systems used in networking, distributed application systems and all the factors that influence the composition of IT systems of any kind. In the research related to management of incidents and changes in the IT infrastructure, a very important role was played and is still played by Systems Theory, which tries to define, as I mentioned above, both the elements that are part of an IT system and the connections between them. Based on the research results, also using empirical and statistical methods, we can define what role has an IT system in the business environment, how it can influence economic processes and what is the general contribution to the economy. Today, most activities in an organization depend on information technology and the way it is implemented, which is why a large part of the investments made go in this direction. The IT systems and technologies implemented have reached such a high degree of complexity that this aspect can be observed not only within an organization but also between different organizations, the companies being even dependent on each other through various economic or business relationships. Thus, one can observe, at a general level, a network of IT systems that require various methods of approach regarding the implementation and monitoring of solutions. It must be taken into consideration that creating such a network does not make the activities of companies more difficult, a fact that can only be achieved by implementing the most efficient monitoring solutions, taking into account the specific work methodologies both at the organizational level and at the general level. Basicaly, in this paper, I will propose some approaches regarding the creation and implementation of monitoring solutions, according to ITIL processes, as a general working methodology in an IT organization.

Using the ITIL methodology, the set of IPCC concepts, in this framework, the need to introduce monitoring systems, which quantify the efficiency of the applied processes, through different measurement indicators, the creation of performance reports and incident reports, makes its presence felt, highlighting: what was the level of activity recorded, how many interruptions were there in the system and of what nature, what inconsistencies or major problems appeared, what was the degree of impact and how problems can be avoided, by analyzing the risk factors.

In this paper, I propose to bring a contribution to the working methodology - monitoring system relationship through a new approach that allows the inclusion of all aspects related to the IPCC in a complex monitoring platform/application. The implementation of the pilot project will involve, from the point of view of the IT system, the following:

- A very well-defined framework of everything IPPC processes mean and how they can be applied to bring a real contribution to the business environment, on the e-business side. Here, a case study will be carried out on various concrete situations.
- Establishing the technological capacities in order to realize the solution and its implementation. Documentation on the chosen technology, Php, and analysis of various functions, procedures to evaluate the possibility of implementing what a complex monitoring system entails. Also, establishing the adjacent technologies used (HTML, CSS, Javascript, etc.) as well as defining the integrations (APIs, embedded objects, if necessary).
- Establishing the IT infrastructure (number and types of servers, number and types of hard drives, type of network used, as well as other necessary elements)
- Defining an e-business process that represents the central element, based on which the analysis of the need to implement the monitoring system is built, as well as the possible elements adjacent to the process, constituting the object of a complex e-business idea.

The contribution made can be seen both at the general level, of the entire computer system created, and on each point described above, highlighting a different approach compared to what the classical applicability of a monitoring computer system means. Also, the possibility of cloud integration of the created monitoring system will be analyzed and what would be the benefits of its realization.

In the chapter **"Current stage of research"** I aim to present the current situation of monitoring systems in the APM sphere (Application Performance Monitoring) as a constitutive part of the IT field, in the context of the increasing complexity of IT ecosystems, with a direct influence in the information society. Thus, it is desired to highlight the importance of the development and implementation of monitoring systems, in this case, within e-business applications.

In the **"Case studies and measurements"** chapter, relevant aspects of the research are presented, starting from statistics involved in the development of a monitoring application (statistics performed on data sets of the Dynatrace application, using specific methods) and reaching simulations on recorded data, near real time, in monitoring applications such as Grafana and Monday. Aspects of web metrics are presented as an important part of the monitoring process, using the Lighthouse web metrics tool as well as web platforms such as Pingdom and GTmetrix. The web metrics tests were carried out on an experimental website.

The penultimate section of the thesis, and the most comprehensive, **presents the results of the research carried out using various experimental methods**, tests carried out in various monitoring applications: Grafana, TrueSight, Nagios, as well as simulations using various parameters in some scenarios from the operations segment. Also, from an experimental and conceptual point of view, visualization panels (dashboards) were used in order to highlight the meters as well as the parameters analyzed in the study on monitoring aspects. Thus, by building some Tableau-type visualizations, we simulated a type of panel that integrates IPCC elements within a complex monitoring mechanism, thus making the connection between the applicable ITIL framework and the infrastructure elements.

The **conclusions and recommendations** at the end of the thesis summarize the main elements of novelty as well as the important aspects regarding the implementation of monitoring systems as well as various ways of approaching them in a complex digitized society, in the age of the information society. Thus, the main point of interest is centered on the (innovative) approach to monitoring systems in relation to IPCC elements within ITIL, emphasizing the contribution to the development of IPCC processes (Incident, Problem, Change, Configuration) in the created research context. From the drawn conclusions and recommendations result new approaches regarding the development of the relationship between complex monitoring systems

and the IPCC framework, as well as the contribution of this whole in the development of the e-business area as well as the digital market segment.