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# The Systematization of Disturbances Act upon E-commerce Systems

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**Abstract:** There are many processes on Internet, on web servers, in ERP and company running an e-commerce system which can be influenced by disturbances. In order to minimize their impact it is necessary to identify and collect all disturbances, to determine their evaluation metric and to propose necessary remedies. Modifications proposed should be tested by means of modeling taking internal and external environment needs into consideration. Necessary information can be captured using the e-commerce system components monitoring. Particular system environment properties like company structure, system architecture, hardware, software, methods of connection with the supplier's e-commerce system, customer communication interface are to be taken into account. Important social indicators like legislative and economic development, development of the global information society and others should also be considered. Disturbance and failure models can be designed using various methods like e.g. multi-agents modeling, simulations, fuzzy methods modeling etc. Generic e-commerce system model using control circuit as a fundamental notion can be used as a base for modeling.

**Key words:** e-commerce system, disturbances, categorization of disturbances, modeling of disturbances, agent, simulation of disturbances.

## Introduction

Recent economic development in context of global markets advancement evokes the needs to look for new methods supporting all processes enabling domestic and cross-border business activities. In reference to global status of market activities, there is more important standard of using the Internet and e-commerce systems. For our purposes, e-commerce (electronic trading) is defined as a subset of e-business (electronic business). E-commerce affects the areas from distribution, purchasing, sales, marketing up to service of products via electronic systems, especially through the Internet. Research results from the Czech Statistical Office and international researching and statistical agencies show that the portion of electronic commerce in Czech and foreign companies grows up constantly.

Questions of increasing the effectiveness and safety of e-commerce systems to enable their further development are important every day. In our opinion, one of the methods to achieve this goal is the modeling techniques. E-commerce systems can be modeled in different ways. General view of e-commerce system in the above concepts, we can imagine a system that perform Shiplap communication interface with customers, which is connected with the enterprise information system.

Enterprise information systems are in today's large, medium and small companies ERP (Enterprise Resource Planning). Advantage of current ERP systems is their modularity. This is the reason that ERP are finding more using in small companies because small companies can purchase only the necessary modules.

Interface between Web servers and ERP is usually resolutely defined and includes unique settings of attributes. Our view interprets e-commerce system as complex, which consists of many of components. Every component can be influenced by many disturbances have originated in internal and external environment. Some of these disturbances may have a significant impact on the achieved efficiency of the system as a whole.

Models and approaches used in this article will become one of the starting elements of the research in terms of project OP VK č. CZ.1.07/2.3.00/09.0197.

# 1 E-commerce systems development

Electronic commerce or in short e-commerce, refers to business activities like selling and purchasing of products and services carried out over electronic systems like the Internet and computer networks. (BORA, 2009) The Internet changed the way customers, suppliers, and companies interact to conduct business, communicate, and collaborate. The Internet is creating huge opportunities to expand existing businesses, and enabling the creation of completely new businesses unthinkable without the business and technology advances fostered by the onset of the Internet age. (BROWN, 1999) E-commerce brings benefits to organizations that use this with their business partners, benefits to consumers and benefits to society. (RICHARDSON, 2009) E-commerce provides customers with a platform to search product information through global markets with a wider range of choices, which makes comparison and evaluation easier and more efficient. E-commerce systems, when designed and implemented correctly, can generate drastic reductions in administrative, sales and marketing overheads.

E-commerce systems can be modeled in a number of ways. Primary model describes an e-commerce system as a web server linked by company information system. Theoretical conclusions and especially practical experiences show that each component of an e-commerce system can be influenced by quite a number of disturbances affecting its functionality, efficiency and stability. Generally, e-commerce is different and requires a high degree of business innovation and responsiveness. (ROSSI, 2004) Main basic components of e-commerce systems are: (Figure 1)

- customers,
- internet,
- web server,
- CRM (Customer Relationship Management),
- ERP (Enterprise Resource Planning),
- payment system,
- supply,
- after-delivery (after-sales) services.

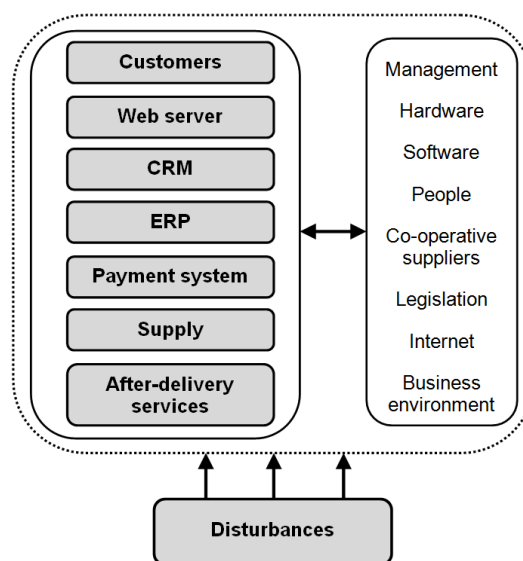


Figure 1 – Components of e-commerce systems.

Source: own

Shown basic components of e-commerce system are supported and controlled by the

management (SCM - Supply Chain Management, FRM - Financial Resource Management, HRM - Human Resource Management, MRP - Manufacturing Resource Planning, CPM - Composite Product Mapping, etc.), hardware, software, people, co-operative suppliers, legislation, internet services and all e-commerce system is a part of business environment.

If we want e-commerce system to be efficiency and offers the customer full-value service, it is possible to implement into e-commerce system many services especially related to modern electronic domain. As an example, the various components or subsystems making up the e-commerce super system include: (MURTHY, 2001)

- digital payment systems,
- payment server,
- payment gateway,
- wallet,
- and security systems like firewall and intrusion detection.

Every e-commerce system component and components' interfaces can be influenced by different types of disturbances. Disturbances are usually causes of negative effects to e-commerce system:

- usability,
- stability,
- performance,
- security,
- availability,
- functionality,
- operability.

Problem with one or more of shown e-commerce system characteristics can have an adverse effect to companies' business activities and be the cause of a financial loss. E-commerce system is an information system. The biggest emphasis should be putting on the functionality of the information system from the point of view of its performance. This kind of approach can also be implemented in similar solutions to interactive systems. (BUCKI, 2007)

As the critical parts of e-commerce systems are very often considered website (critical component through which the online client interacts with the ecommerce), getting a merchant account, the ecommerce software (major critical component through which all the ecommerce business activities take place), the web server, shopping carts (considered as a one of the major critical components for ecommerce mechanism), security protocols, digital signatures etc. Generally, it is necessary to consider the all e-commerce system components and their interfaces as critical parts. There are a few of books and papers deal with e-commerce system disturbances and failures but consistent theory don't exist.

## **2 Systematization of disturbances and risk resulting from them**

In every physical system many disturbances can cause. There are many factors that can influence the failure of certain e-commerce system. Disturbance can be considered on the one hand as the reason of system instability caused by:

- a technical defect,
- an improper or incorrect use,
- an active or passive attack (for example by hacker).

On the other hand, disturbance can be considered as a cause of system instability. It can

be for example:

- wrong definition of input values,
- untimely designed system architecture,
- economic crisis,
- the selection of inappropriate technologies,
- lack of guaranteed security,
- the change of laws,
- the change of current state of the market in the sector,
- etc.

Disturbances effect on the whole system and its individual components and processes. It is generally shown in Figure 1. Important is to specify basic methods for monitoring of these disturbances and manage the risks that follow from them.

We have two possibilities in terms of monitoring disturbances and their consequences how we can identify disturbances:

- We can identify disturbances that are in moment real, identifiable and expectable in the view of a current status of internal and external system environment. These disturbances are known as priori.
- We identify disturbances as reason of arisen unbalanced state of the system. These disorders are known as posterior.

The different types of disorders can be divided into:

- Directly identifiable disturbances.
- Disorders of stochastic type (chance quantity).
- Disturbances, which are not in terms of decisions clearly quantified, but we can estimate the degree of their influence (we call it here as a fuzzy disorders).

Any disturbance of e-commerce system means for its operator risk. Risk Management offers a systematic approach to determine risk and reduce them to acceptable level. We can consider these basic steps in risk management:

- identification of risks,
- determine their significance (analysis),
- economic analysis of potential impacts of risks.

It can be concluded that the risks are due to the effect of disturbances. We can designate disturbances for the purpose of certain models as risks.

### **3 E-commerce system components disturbances**

The consequences of the some disturbances are coming out on the instant (for example technical trouble etc.), at the some others can be display delayed and mostly it influences business economy results for longer time level (for example bad setting spread, miss-defined required accents, astray work of the staffs, astray or vague work of the management).

Whole e-commerce system is represented of hardware, software and organizational components which are automated in the part or anywise (human activities). The hardware- and software- components (servers, work-stations, ERP, CRM, interface, hubs, switches and so on) present local computer network (LAN) with counter to external atmosphere (Internet). The technical failure of some components LAN come out immediately and it's detected by user or monitoring technical system. In case that, when we want observe individual components of the e-commerce system (for example perspective on availability of individual

components or actions which is running in network, we can use special servers or software that can monitoring the system, for example NetInf, LAN Viewer, NetResident, BWMeter, Alchemy Network Monitor, PRTG - Paessler Router Traffic Grapher, The Dude, Network Probe and others (at shown software products isn't added numbers of version, because there is time lag between write this paper and it is publication).

The software disturbances present errors of work routine application, which support e-commerce. Over software disturbances is also bad or backward reaction of system to change terms neighborhood (for example: change in legislation) or disability of application – software to reacts on change at the market.

The consequences of bad action of business management are slower than immediately technical failure of system. Their demonstration can be look out retroactively financial indexes. Business management is again important to lay down right entrance and control variables on account of those consequences.

#### 4 Categorization of e-commerce system disturbances

We can implement the basic categorization of disturbances according to data from Chapter 2 and Chapter 3. The first step is the categorization of the possible web server disturbances. Web server serves as a communication interface between the user and e-commerce system. We can consider these web server disturbances:

- **Hardware** - damaged hard drive, RAM failure, backup failure, communication interface disturbances, network failure, insufficient server capacity, etc.
- **Software** - incorrectly programming, using of outdated versions of programming standards, computer viruses, etc.
- **Functional** - nonstandard functionality of web applications, inappropriately defined interface for communication or synchronization with ERP, inappropriately or insufficiently updated SEO (Search Engine Optimization), absence of functionality for obtaining feedback from users etc.
- **Content** - inappropriate content of websites in the context of the focus of e-commerce system
- **Security** - an active attack on a Web server - for example rewriting content, passive attack - such as reading personal information about customers from orders, etc.

Input data for ERP are output data from the Web site. For detailed description is necessary to consider possible disturbances actuating on a Web site with links to ERP. It may be these disturbances:

- **Hardware** - technical trouble connection, insufficient transmission capacity
- **Software** - inappropriately programmed communication, robustness of synchronization, traceability and repeatability of traffic between the two components
- **Security** - monitoring of network transmission by hacker (passive attack), overwriting of transmitted data by hacker (active attack), etc., registering customers, its security and flexibility

The next step is to analyze the disturbances actuating business ERP. Even in this case, there are a number of disturbances related to technology, structure, capacity, process management, personnel security, etc. We can consider these ERP disturbances:

- **Hardware** - server failure, transmission failure in the LAN, workstations disorder, insufficient capacity of some components in a LAN, inappropriately technical and logical LAN architecture.

- **Software** - inappropriately selected ERP modules, inadequate parameterization of modules, inappropriate defined data formats for transfer, inadequate structure of database, etc.
- **Security** - inappropriately defined security policy in relation to enterprise IS/IT, insufficient virus protection, inadequately or improperly configured user rights for work within the LAN and e-commerce system, inadequately secured monitoring of system, inadequately or insufficiently protected servers, etc.
- **Functional** - inappropriately defined structures of processes, incorrectly defined data flows, incorrect filtering and data analysis for various levels of management, inappropriate or insufficient database management system, slow access to data in databases, restriction of system functionality in consequence of overloaded LAN parts etc.
- **Personnel** - wrong operation of employees with the system, illegal activities of employees, theft of data by employee, insufficient motivation and loyalty of employees, etc.
- **Legislative** - inadequately or insufficiently established principles for dealing with e-commerce system, inappropriately set of processes and outcomes for processing purposes in the economic department, insufficiently secured archiving of accounting data, changing Tax Act, any changes in circumstances and the privacy data law, etc.
- **Purpose** - inappropriately designed e-commerce or ERP system in the context of its focus, inappropriate choice of analytical programs, insufficient marketing research and incorrect interpretation of their results, inadequate definition of the input (desired) value for management of system, inappropriately set of communication with suppliers and customers, etc.

LAN is a basic internal communication medium of e-commerce system. The rule is configured only those network services that are necessary for the operation and ensure all system functions. Unused services are a potential safety problem. It can be considered as disturbances.

## 5 The monitoring and modeling of disturbances

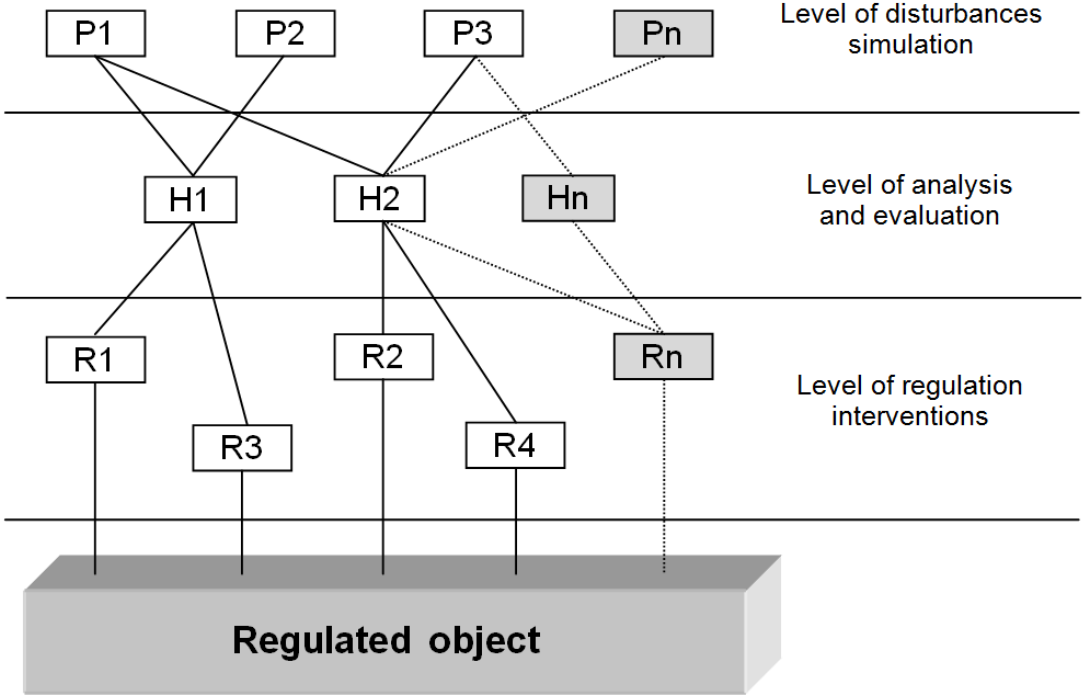
It results from the classification of disturbances and risks that it has not same source, characteristics and the importance to managing of e-commerce. From this is evidently that we can uneasily find proceeding for responding in a standard way on disturbances at company level. There is probably a heterogeneous system at entry level and at level of regulatory outputs. This heterogeneous system can be realized hardly with using of standard structure proceeding. There is idea of using a modular approach with support for various functions and services by local intelligence. This idea can be realized for example by using agents.

Agent-based paradigm is based on the following ideas:

- **Agent is autonomous** – it has in a measure control on own activities and in certain circumstances may take decisions to achieve defined objective.
- **Agent is a proactive** – it reacts to external impulses, it can exhibit goal-seeking behavior or develop own initiative.
- **Agent has social behavior** – it is able and need to communicate with other agents.

Communications between agents, which is one of the basic ideas of this approach is not based on remote calls (RPC-remote procedure call), but it is based on system of asynchronous messages. The principle of asynchronous messaging allows agents to communicate with other agents. It is possible without feedback of activities to the outcome of communication. This approach clearly leads to need for standardizing the behavior of agents and their mutual communication. The best known standard in this sphere is standard of FIPA consortium

(Foundation for Intelligent Physical Agents). FIPA consortium published a reference model of agent services platform in 2002. (FIPA, 2002) This standard is based on the idea that agents communicate with each other on the principle of peer-to-peer (P2P). This principle is not optimal for our purpose. If we emerge from generic model of business that uses e-commerce, then we take the view of necessary hierarchy. Formulation of strict hierarchy means deflect from agent paradigm, because it disclaims the basic idea that agents can operate largely autonomously. We will consider in our approach different levels of independent operating agents of specific type (Figure 2).



**Figure 2** – A conceptual proposal of system of simulation and evaluation of disturbances cause the information systems and regulation interventions.

Source: own

In the section of simulation of disturbances the individual agents simulate disturbances of different categories according structuring from Chapter 3. The Agent – based approach makes it possible not only spread objectives of next types of agents in this sphere, but as necessary, it can define and simulate possible dependencies midst ones (form of asynchronous messages between agents at this level). In the next sphere there are agents which performed classification and analyze these disturbances. They prepare individual regulation equipment, which designing to agents on lower level, along criteria goal seeking behavior. In this sphere it can be spread evaluative objects and their bindings. By these present may be get by fair candour of whole system. In the sphere regulating hits agents can prepare individual hits. With this hits agents can influence regulating object – company. For the principle by agent: there are equipments for this sphere, whose agents realized without engagement. The concept also can prepare a next extending action, agents and techniques that they are going to support the candour of system despite of the next development or surprisingly disturbances which would hobble the speed of their reaction on the status entourage in case relative rigid hierarchal systems with clearly defined structure.



## 6 Conclusions

Disturbances are to be treated as a real aspect impacting all types of systems. In order to eliminate or minimize their influence it is necessary to identify the disturbances and to apply necessary counter-measures. To identify the disturbance some monitoring and categorization is needed while the weight of various categories is to be assessed. Disturbance monitoring can be achieved by various automated measuring methods or using human activities. The resources of various disturbances can differ in a wide scope; it is therefore rather difficult to define structured, static and exact methods how to eliminate their impacts. One of possible solutions of this challenge is the agent approach which can be considered as a modular design comprising various functions and services of disturbance analysis and necessary counter-measures supported by certain local intelligence.

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