Architectures and Simulation: Why Fault Tolerance is not at a Maximum Level?

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Abstract: - This paper is focused on difficulties in information technology (IT). Information technology has an important and stable place in the lives of people. A number of applications are installed on computers, mobile devices or tablets every day. There are verified methods and methodologies concerning optimal implementation. Although an appropriate interest is focused on architecture, major controversy still exists. Numerous surveys relate of problem with budgets, time, aims and quality. Even IT users prefer using MS Excel over complicated software. The high level of diversity and variety of relations are frequent issues. The software reflects the actual conditions recorded at a given moment into applications, although the real environment changes over time. The well-known object and multidimensional approach from the designing of information systems supports an active solution to this reality. Good experiences are achieved based on simulation with link to these approaches and intelligences as artificial, business, competitive, customer, swarm, and computational. This combination of objects, multidimensions, intelligences and simulations brings a higher level of fault tolerance in relation to mistakes and errors in the IT field. Simulation helps understand new conditions and changes. In simulation, all objects may be modified, new objects may be added, or certain objects may be dropped by preferences. The IT designers learn more about behavior in changed conditions, and unexpected relations are found.

Key-Words: - Architecture, data science, information technology, intelligence, method, object, simulation.

1 Introduction

Computers and information technology (IT) are key terms in a global information society. People use software in many forms for supporting communication and everyday work with data. The amount of data which is created by IT users in a number of formats is remarkable.

Standard storage for data is a database system. [3] At the end of the last century, there were doubts about its development in the future. The object database [39] provides a certain inspiration but without a unique inspiration. Object database systems follow the object approach using all the benefits from object-oriented programming. Traditional relation database systems [26] also provide new options based on an object-oriented interface.

Significant progress is linked to data science [11] and its analyses and prognoses. For many IT users, the natural question is “What connections are hidden in the stored data?”. This question is important at times of unexpected events and the major economic crisis. [31] Business and business owners are searching for help and advice in a wide spectrum of fields. The IT field is one of them.

IT users are familiar with the IT field. They use the Internet and share obtained knowledge and experience with the available software. It is a significant advantage for better IT implementation in practice with support of computer intelligence. [41] Based on existing recommendations, IT users select an optimal product for active use. One of the needed conditions is a user-friendly interface for intuitive navigation and visualization. [33]

Intuitive navigation in IT products, a user-friendly interface or optimal work methods with software are well-known conditions for software. The difficulties result in a major volume of preferences and interest of IT users. There are standards and recommendations in the form of verified methods and methodologies for IT design and implementation. Significant inspiration is provided by:

- Objects. [6]
- The multidimensional approach. [20]
- Simulation analysis. [23]

For many of them, started analyses (information study) and design are key areas. Optimal design of software is a responsible issue. Traditional work is focused on data and functions via designed models. Additional options are available based on behavioral models, models of analyses, system models or model of assignment. [12]

In this situation, IT products have to be extremely sophisticated without mistakes and errors. The reason for this is the common support of optimal methods via the Internet. Unfortunately, there are major reservations. Many IT specialists experience problems with the available software [34], and IT users often give up on the best solution that information technology brings.

There is a luck fault tolerance for mistakes. Major errors and computer crashes are solved extremely quickly. Information technology offers continuous information support based on a redundancy of hardware sources, but there are challenges as well. [13] The needed operating and database systems are in good condition and IT users have interrupted access to data. This reality influences the optimal work of IT designers. They also rely on the adopted architecture of IT products and the realized simulations.

2 The Importance of Architecture in Software Development

Architecture is an established term which is used in a number of fields. The aim is a description of the needed objects and the relations between them. Architecture is also important for information technology.

It is commonly believed that architecture is used to describe existing structures. [5] Art and science, which specify the style of design and method of construction of individual structures, has an essential place here. [38] This inspirational approach defines:

- Building architecture as the art and science of designing and erecting buildings.
- Medicine as the art or science of treating disease with drugs or curative substances.
- IT architecture as the art or science of designing and delivering valuable technology strategies.

For information technology, architecture is focused on various IT products. Their authors create a design of the optimal architecture of selected objects for unique stability software and applications. There are interesting solutions for products of information technology such as:

- Operating systems.
- Database systems.
- CRM products.
- Business Intelligence.

The above-mentioned list consists of only a small part of the examples where architecture has a needed usage. There are various solutions from the simple to the complex. The degree of complexity is different in terms of authors and IT products. Unfortunately, the degree of complexity does not create a mirror for the degree of stability and the quick implementation of IT products. There are major differences between the individual IT products. Additional excellent definitions of IT architecture are, for example:

- Specification of results. [22]
- Method creating. [30]
- Way of integration of information technology. [37]
- Style work. [29]

IT users have a number of expectations with a link to software. They need immediate support without mistakes and difficulties. The problems create processes which transform data concerning knowledge for optimal decision-making. This approach is complicated and there are no unique solutions. Architecture may also help [2] in the areas of:

- Organization of strategies, processes, information and information technology.
- Support of business needs by technology strategy.
- Integration of technology projects in business.
- Specification of business value based on technology.

The importance of architecture is shown by the following preferences from practice. IT users evaluate higher [15]:

- Financial improvement: saving money and available scenarios.
- Relation to society: growth in customers and partners, increasing cooperation and satisfaction.
- Conceptual integrity: eliminating unnecessary system.

- Performance development: interest in growth and innovations, exploring new initiatives.
- Risk identification: support of sustainable development and market democracy.

Based on the above-mentioned views on architecture, there are number of visions and ideas. This spectrum provides both benefits and negatives. The benefits are focused on the use of IT architecture in various conditions in respected limits. The negatives are focused on the ambiguity which may provide a source of resentment, misunderstanding or mistakes. The differences between the positives and negatives are reflected in the differences between the respected limits and mistakes. The question is "When does the presented solution evaluate within respected limits and when is this same solution a mistake?". This divergence introduces existing controversies into information technology.

3 Existing Problem and Controversy

Information technology influences all activities in various fields of human activities. It is the default tool for everyday work with data, but also information technology brings inspiration for active solution to existing problems. From this point of view, information technology is one of the most important fields. There are verified methods and methodologies for optimal IT implementation in practice with a link to major data and computational intelligence. [1] A corresponding interest is focused on IT architecture.

Information technology, in contrast, has to solve difficulties and problems. It is difficult to read that IT users and IT projects have problems and all the realized works are not successful, or that IT users prefer MS Excel over complicated software. Out of the numerous examples, a list is provided of some of them:

- Excel is powerful and has a place in business processes worldwide – based on the idea that you can do anything with a spreadsheet. [32]
- About 37% of business process projects fail in terms of benefits. [27]
- Excel is the most widely used tool – 86% of respondents chose Excel. [19]
- 45% of large IT projects are over budget, 7% over time, and 56% bring less benefits. [25]
- 75% of respondents confirm – projects are usually "doomed right" from the start. [10]
- About 50% of respondents say the project failed in the adopted aims. [21]
- Only 40% of projects met schedule, budget and quality goals. [16]
- IT projects frequently fail – a number of large projects fail between 50%-80%. [7]

A number of recommendations and advice are available in the scholarly literature and on the Internet. The main focus is on:

- The aim. [36]
- Cooperation. [9]
- Detail description. [18]
- Methodology. [35]
- Monitoring. [17]
- Relations to business. [24]
- Verification. [14]

The natural question is "Why do such controversies exist?", and "How can these difficulties be solved by information technology?". Mistakes are often linked to human skills and poor decisions in the given environment. IT projects should lead to optimal support via installed software or applications. The basic condition is to provide the needed information.

Generally, data is stored in database systems. Modern information technology has unique tools and methods for correct solution of this task. Similarly, there are well-known query languages for selection data from a database with visualization support. Good examples from practice, advice and experiences are shared via the Internet, and the available knowledge is disseminated extremely quickly, although the difficulties bring about diversity and frequency relations.

There are many views concerning an attractive solution. Created teams of IT designers work under various conditions and communication is difficult. Various conditions are linked to the internal and external environment. Rate changes complicate the actual perception of the solution. Another difficulty is the frequency of relations. The processed data is examined from a number of contexts. It is difficult to maintain the interplay of individual differences. Existing crises indicate that people do not understand these changes and their frequency with relations. The solution may lead to the use of simulations and learning about unexpected conditions from them based on intelligences.

4 Simulation for Support of Fault Tolerance

Simulation is one of the useful tools for an analysis created view on existing reality. The benefit from simulation is based on an acceptable simplification of reality into a model (simulation). An additional positive aspect relies on active work with the created simulation. The simulation may be modified by the preferences of the author with the goal of answering the given questions.

For many development teams, simulation represents a tool for manipulation with existing data linked to a wide spectrum of relations without other costs. All the changes are realized in an environment of simulation: the created object may be deleted, a new object may be created, or the existing object may be edited by a mouse. These changes depend on the author's intuition and the courage to try a new arrangement for the adopted solution.

A similar situation applies for simulation of architecture adopted solutions for IT products. Objects with links to actual reality have an important place. The actual reality is described well by various intelligences such as artificial, business, competitive, customer, swarm and computational. Effective simulation must consequently use these intelligences for a suitable description of existing relations (visible and hidden). The visible relations between data are well-known and IT designers are familiar with them. Visible relations create the basis for searching for a hidden relation based on the number of views via intelligences. The designed architecture of such a view is shown in Fig. 1. Active work with data uses also various intelligences for description existing relations. Detail description relays on well-known rules in selected intelligence.

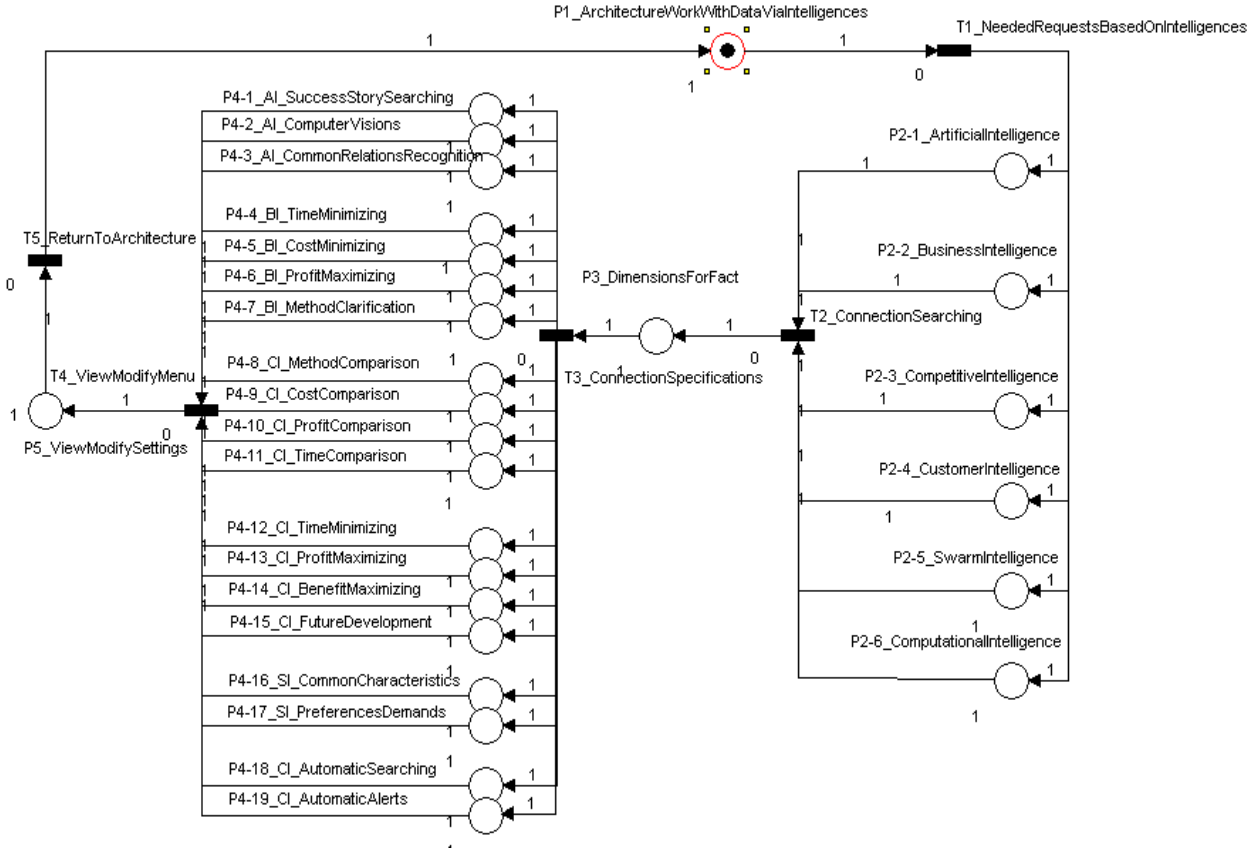

Fig. 1: An architecture of active work with data based on dimensions (intelligences) and objects.

Complications are brought about by higher requirements on the skills of the development team, continuous switching between selected intelligences, although the benefit is clear to searching for unexpected relations and setting of the fault tolerance at a maximum level. The above-mentioned Fig. 1 describes the architecture of work with data focusing on selected fact – Open Case Duration. This variable describes the volume of time needed for a solution of the customer requirement.

It is the default item at the centre of interest from the view of suppliers and customers. One can look at this item from the perspective of various intelligences:

- Artificial Intelligence

Intelligence is process that releases the idea for benefits and advantages. This process works with stored data and available information. Modern approaches use also artificial intelligence with machine learning. Of interest is, for example, searching of success stories, computer visions and recognition of common relations.

- Business Intelligence

Business and relations between suppliers and customers are defined for maximizing profit. Of key importance is obtaining needed information at a given time and in a suitable format for support of optimal decision-making. Of interest is, for example, minimizing solution time, minimizing cost solutions, maximizing profits for solution, or clarification of the specified method for solutions for similar cases in the future.

- Competitive Intelligence

Competition influences all the objects in global society. Companies and individuals face major pressure from other objects which provide better services and products. The market gap and existing barriers for market entry have a key place. Of interest is, for example, a comparison of the solution of the method with competitors, a comparison of the achieved costs and profit with competition, or a comparison of the available time with other companies.

- Customer Intelligence

Customer intelligence is focused on better services and products for customers. The goal is higher customer loyalty, satisfaction, and an improved market position for company realization of services or sales. Of interest is, for example, minimizing the solution time, maximizing profits for solutions, or links on other benefits and future development.

- Swarm Intelligence

Swarm intelligence is focused on an evaluation of the collective behavior of individuals in a swarm. The basic inspiration has a link to nature and the behavior of animals such as birds, fish or ants. In a global information society, people (IT users) also represent individuals who are collected into swarms via the Internet. Their activities are compared with swarm intelligence. Of interest is, for example, the common characteristic of customer behavior, existing preferences and demands. A similar interest is focused on competition and its possibilities.

- Computational Intelligence

Computers are a standard device for work with data. Operating and database systems create a solid background for using CRM (Customer Relationship Management) and a data warehouse with a link to business intelligence. Unfortunately, the volume of data is so vast that searching for relations between data and a suitable architecture of work is extremely difficult. There is no unique solution, and analytical work will increasingly rely on computers. Of interest is, for example, automatic searching of relations between data and providing advice, alerts, or recommendations based on experiences which are stored on computers and IT products.

The above-mentioned examples are only created with links to “Open Case Duration” as fact that is interested for business. There are many more existing links with actual preferences and priorities from a number of perceptions of reality.

The actual design of the adopted solution is also complicated via the spectrum of level of importance. Business intelligence is important for one solution, but computational intelligence is not a priority. Customer intelligence is important for other solutions, but swarm intelligence is not a priority. For the next solution, swarm and computational intelligence are an important part of all the solutions. A pragmatic solution to this reality is to establish the key indicators for all the intelligences. These indicators reflect an interest in the given reality from a selected dimension (intelligences) via the numbers “1” and “0”. Number “1” indicates that there is an interest in such links, and number “0” indicates that there is no interest in such links. This work design may be more transparent via a sequence of numbers from 0 to 1 by individual preferences (for example, 0.1, 0.2, 0.3, …, 0.9).

5 Achieved Benefit with a Discussion

IT products always reflect the needs of IT users by actual conditions. In a global information society, IT users work with a number of IT products with interest. For IT products, the key is the adopted architecture based on a precise work design with stored data. There is no unique approach, but IT products may offer a better environment for work with a higher fault tolerance for mistakes and errors. One way consists of complex work via intelligences, but there are also other solutions. There is interest in:

- Complexity and international development [8]

There are differences between recognizing the complexity of a development problem. The focus is on selecting optimal methods of the academic complexity of the science to study this complexity.

- Working in Complexity [40]

The question is the complexity of science and the realized work. The complexity of science is described as the study of complex adaptive systems, and the understanding of complex problems is focused on their differences from other types of problems.

- Complexity theory and international development [4]

Available tools for programming and administration are focused on capacities and agreed goals. When these tools are used for a complex problem, however, they bring about a result which is controversial in the form of formal systems with box-ticking exercises, and where the declared goals are not met. There is also a question concerning whether "Development problems are complex?".

- Complexity in software development [28]

The complexity is evaluated as piece software which is derived from two different systems or models. There is an interest on focusing on problems of domain, technical architecture, decomposition and integration, abstraction, and other complexities with links to a system of humans, the project team and the customer team.

In all the above-mentioned studies, the complexity and existed controversies create default conditions in a global information society. These kinds of conditions have a close connection to higher entropy and the dynamics of relationships. There is no question about their importance. IT designers and scientists have to explore new relationships. For further IT development, these new relationships will default links with a number of intelligences in many fields. There are currently intelligences with links to artificial, business, competition, customers, swarms and computational. Additional intelligences will be added by preferences and improved knowledge. Further work will be focused on an improved description of interactions between well-known intelligences for fault tolerance at a higher level of support for optimal IT architecture.

6 Conclusion

Mistakes and errors are a permanent part of information technology. The IT field has numerous successes, but also a number of faults. The problem is that these faults are not eliminated on a maximum level.

Information technology has designed various methods and methodologies for optimal implementation of software. There are verified standards and many of the tasks are excellent solutions. Problems are brought about diversity and frequency relations. There is chaos and disorder, but the implemented software only reflects the current situation at the given moment. For a global information society, global crises and economic collapses create difficult conditions based on controversies between reality and the abilities of information technology.

One form of the solution is to use simulations based on an objective and multidimensional approach. The simulation is begun by preferences under various conditions. This simulation must be evaluated from various dimensions (views) with links on existing intelligences (artificial, business, competitive, customer, swarm and computational). Benefit is complex description existing relations with higher level of fault tolerance, but it is not a maximum level.

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