INFORMATION TECHNOLOGIES

ANALYSIS OF MOBILE NETWORKS 4TH GENERATION AND PROSPECTS FOR IMPLEMENTATION IN UKRAINE

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The article contains the analysis of the current state of 4G mobile networks in the world and the problems and prospects of their implementation in Ukraine. An extended LTE-Advanced and WiMAX-Advanced technologies functions have been researched, through which the developers could provide requirements for 4G.

Due to the beginning of preparations for the introduction of 4G technologies in Ukraine it was advisable to highlight the main achievements in the development of these technologies and trends to overcoming the problems encountered in implementing them in our country.

The results of research have revealed that LTE-Advanced extended functions, such as Carrier Aggregation, the introduction of 8 x 8 MIMO in the DL and 4x4 MIMO in the UL, support of heterogeneous (HetNet) networks, the convergence of radio access for paired and unpaired spectrum, along with retransmitting allow to increase transfer of data: up to 3Hbit/s in the downlink (DL) and to 1,5 Hbit/s in uplink (UL) and increase spectral efficiency up to 30 bps/Hz. The development of WiMAX-Advanced led to the appearance of versions of WiMAX-Advanced Release2.1 and WiMAX-Advanced Release2.2, which are aimed at convergence of WiMAX and TD-LTE: WiMAX-Advanced Release2.2 must support load balancing between LTE TDD and WiMAX, load balancing within a base station or between pico- and macro cells, it must provide Link aggregation etc.

One of the main problems to the introduction of 4G technology in Ukraine is lack of necessary frequency bands occupied by 2G-communications, the need for reforming the frequency spectrum and introduction of «technological neutrality» principle. To solve these issues it is extremely important to fulfill the research of the modern technology trends and use the experience of leading telecommunication companies.

Keywords: wireless mobile communication, WiMAX-Advanced, LTE-Advanced, IEEE802.16m, 3GPPRelease10, WiMAX-Forum.

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OPENFLOW-BASED SOFTWARE-DEFINED NETWORKING

page 9–13

The number of public and corporate networks in the world is increased. In this regard, it is increasing the number of consumers who wish to enjoy high quality and secure transmission of data over the network channels. Thus, the legacy network is no longer coping with the increased requirements of successful operation and increased load. The way out of this situation is to use software-defined network SDN.

SDN no need to increase the number of network elements or procurement of improved routers, switches, firewalls. This technology offers the implementation of networks, which are based on software platforms that are easy to administer, and make adjustments to the management operators. With the mediation of specially designed software applications, such as OpenFlow protocol, it is possible to ensure the optimization of traffic flow, efficient data processing and secure transfer of the channel.

The aim of this study was to identify the main features and benefits of using software-defined network, the principles of OpenFlow protocol and highlight the main benefits of joint operation of OpenFlow networks.

It is concluded that the use of OpenFlow-based software-defined network is a modern, relevant and promising solution to the problem of the effectiveness and efficiency of existing networks.

In the future OpenFlow-based software-defined network will be needed in all modern telecommunication networks. OpenFlow can be used in the networks of mobile operators, but this would require upgrading or replacement of network equipment.

Keywords: telecommunication network, OpenFlow protocol, channel capacity, channel utilization, OpenFlow switches.

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CHOOSING THE SERIALIZATION PROTOCOL FOR SOFTWARE DEVELOPMENT

page 13–16

As a result of the research it was determined the scope of application of modern data serialization protocols. Necessity for such work is due to the fact that currently there are many serialization protocols such as JSON, XML, Protobuf, presenting data in rows and binary serialization, which leads to errors of developer when selecting the most optimal serialization. After analyzing all the advantages and disadvantages of the abovementioned protocol it was done conclusions about an application of these protocols for software development.

It is shown when you can use a simple and very popular serialization method using flat lines or simple binary serialization. The article answers the question under any circumstances it is used more sophisticated serialization, such as XML, JSON and new protocol Protobuf, shows the scope of application of these protocols. Its strengths and vulnerabilities are given that will help the developer of automated systems to choose the most effective one for his application.

The results are important on the stage of choosing competent technical solution about serialization by software developer, which increases the speed and security of data.

Keywords: protocol, XML, JSON, Protobuf, serialization, parsing, packaging, binary.

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DEVELOPMENT OF THE METHOD FOR CHECKING THE FLOWCHARTS OF MEDICAL ALGORITHMS

page 16–20

This paper is about the using of the information technologies in medicine for ensuring the unambiguity and reliability of the algorithms of doctor's actions in the stages of diagnosis and therapy. The main goal of this work is development of the method for errors detection in the flowcharts of medical algorithms. The error is an any record or figure drawing, which do not correspond to the requirements of existing national and international standards (ISO 5807-85 etc.) for denoting flowchart algorithms.

We developed the algorithm for check-up flowcharts. The executor of the algorithm will check the strict implementation of the standard requirements for the blocks and links in the flowchart. In addition, the algorithm provides text checking. If there are detected the phrases specific for the other types of blocks, such blocks and texts require additional analysis.

The developed method allows systematizing the detection of common errors in flowcharts. Any employee who has a higher education can perform this method. We tested the method with the group of medical students. A case of errors finding in the flowchart from the clinical guideline «Psoriasis and psoriatic arthritis» is given.

The results of this papers will be used in the public discussion stage of the new medical and technological documents on medical care standardization as well as at stage of reviewing for updating the documents, that are scheduled every five years for the documents accepted in the registry.

Keywords: algorithm, standard, flowchart, clinical protocols, clinical guidelines.

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RESEARCH OF APPLICABILITY OF ONTOLOGY-BASED APPROACH TO BUILDING COMPLEX INFORMATION PROTECTION SYSTEMS

page 21–24

Use of ontologies in the field of information protection is discussed and some of the results of our research in this area are given in the article. The main aim of the article is studying the possibility of using ontology-based method to the formal modeling of stages of building complex information protection systems in the information and telecommunication systems. Formalization of building information protection systems will ensure the completeness and consistency of the created models, replicability and repeatability, as well as verification of the approaches to the implementation of protection systems by outside researchers. Presented taxonomy and ontology of violator may serve as an example to other stages of formalizing the building complex information protection systems. Ontology can also be encoded in OWL language and is presented using common tools. Obtained knowledge base can subsequently be used by developers of complex information protection systems to create models of the violator in the specific conditions of operation of information and telecommunication systems.

Keywords: information protection, information and telecommunication systems, ontology, violator.

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RESEARCH OF METHOD FOR DETERMINING RELIABILITY OF TECHNICAL SYSTEM USING SIMULATION TESTS

page 25–29

To analyze the reliability parameters such probability of failure need to collect statistics. It is necessary to test certain objects. Often such tests spent a lot of money. It is not effective, for example, in cases where you just need to check out the new method and model. Therefore there is a need to develop a method to simulate the reliability test for sample party.

As a result, this task has received the following: it was further developed Monte Carlo method, which is known as the method in which it is considered checking of plausibility of the hypotheses that led to the improvement of its adaptation for simulation process of the tests, leading to increased likelihood of probability of failure The use of this statistics in the proposed improved Monte Carlo method results in reduces of errors during the simulation modeling and the processing of the actual statistics. Use of checking of plausibility of the hypotheses result in adequate choice of theoretical distribution and planning of testing is reduced to collect the necessary statistics.

Keywords: probability theory, mathematical statistics, checking of plausibility of the hypotheses, probability of failure.

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AN EXPERIMENTAL RESEARCH OF SHIPPING COMPANIES' MULTIPROJECT FORMING

page 30–33

In a highly competitive and dynamic environment companies often conduct their activities in a number of different directions and invest in several projects synchronically that inevitably entails a parallel project management. As practice shows it is impossible without using of multi-project management methodology. Lack of project management systems on enterprises leads to low efficiency and losses. And most importantly it does not allow to reach target goals.

This featured paper is devoted to improving the efficiency of shipping companies through the use of the project approach. The approbation of the multiprojects' forming structure model in a shipping company, which forms the background of creating effective tools for development of the organization in a competitive and dynamic environment was conducted. Method of forming the multiprojects' content development of companies based on the unity of the system of strategic goals, portfolio and multiproject was tested as well as model of optimizing the content of the multiproject in shipping company was approved.

With the approach proposed as a central objective of this study we consider to be the following: the development of a method of multiproject's organization of enterprise based on the system unity of the strategic objectives, the project portfolio and multiproject.

Thus, the application of the multi-project management is highly flexible in the projects selection; however, for improving of the effectiveness of project activities it is necessary to develop a mechanism of structuring the strategic goals taking them into account while selecting appropriate projects into portfolio, which will model the multiproject at the tactical level.

Keywords: formation of the content of the multiproject, tool development company, the shipping company.

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MODELING DOMAIN KNOWLEDGE BASED ON THE CENTRAL LAWS OF INTEGRATIVE BRAIN ACTIVITY

page 33–41

It is shown that the four dimensions of knowledge for central integrative brain activity patterns provide a synthesis of objectives and deciding on its achievements on the basis of the dialectical relationship between pairs of process factors and resource factors of implementation.

The proposed model of the future outcome is both cognitive model of knowledge about the subject area.

It is shown that the model of balanced scorecard is quite theoretical justification for its structure on the basis of binary relations in the form of dialectical unity categories of «general» and «identity» and cause-effect relationships and is a practical example of a model of knowledge about the subject area based on central laws integrative brain activity.

It is shown that the architecture of knowledge in methodology PEST-analysis is also based on the principle of binary relations in the form of dialectical unity categories of «general» and «identity» and the causal relationship between categories and is a practical example of a model of knowledge about the subject area based on central laws of integrative brain activity.

Examples develop models of architectural knowledge about the company demonstrate the practical application of the principle of dialectical relationship categories in the form of «general» — «single» with no awareness of the availability of this type of relationship and their role in the investigated models.

Keywords: subject area, activity, neuron, neural network, functional system.

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DEVELOPMENT OF ELEMENTS OF PARAMETRIC DATABASE FOR INFORMATION MODEL OF CONSTRUCTION PROJECTS

page 41–47

A database information system structure, which is designed to improve the integration of information about construction projects from different systems of computer-aided design and rapid access to data for display. On the basis of developed database structure in the SAPFIR-3D computer-aided design system has been developed subsystem of model integration, which gets a different model from CAD and structured their settings according to the formed model types.

Today the urgent task is structuring parameters of information model of construction projects, because on the one hand, there are a large number of CAD systems, which cover the majority of 90% of design problems, on the other — the communication mechanism between the programs has not yet been developed. This is due to the fact that in all these systems, the elements of the model are described in different ways and use of common formats of data integration (IFC, XML, DXF-DWG, PDF) leads to the transmission only part of the information about the object. Option of model transmission in incomplete form and fill in the missing parameter is time consuming and leads to a partial loss of information about the model.

As a result of the study were summarized and structured parameters of the elements of information models of construction projects, by means of what is solved the problem of heterogeneity of model information from different sources.

Developed database structure can be a basis for the implementation of the basic principle of BIM-technology, namely

the formation of a single generalized parametric model of the construction projects.

Keywords: integration, computer models, parameterization, information modeling, design technology, computer-aided design, BIM-technology.

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MATHEMATICAL MODELING

RENEWAL OF EQUATIONS OF FLOODING DEVELOPMENT BY THE METHODS OF CONVENTIONAL DIFFERENTIAL EQUATIONS

page 48–51

The method of construction of linear and nonlinear models of the flooding taking into account their main characteristics, duration, speed of distribution, intensity.

Areas for further research based on developed differential models of flooding may be related to the statistical description of known flood situations in order to select environmental conditions, soil properties (mechanical and water-physical) terrain, initial and boundary conditions under which it is advisable to use different proposed models — linear and non-linear.

The models will serve as baseline data to develop information-measuring monitoring system of flood waters, which allow real-time monitoring the progress of changes in water level of rivers during floods or flooding, which will prevent their negative impact and ensure the environmental safety of the environment.

Keywords: flood waters, boundary conditions, statistics, environmental safety.

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ALGORITHM OF SOLVING CORRODING CONSTRUCTION OPTIMIZATION PROBLEMS BASED ON FLEXIBLE TOLERANCE METHOD

page 51–57

In current paper authors formulated a new problem of hinged-rod constructions optimal design, which considers physicochemical processes in construction elements that cause reduction of their bearing capacity and assumes that solution is obtained with a given accuracy. The search for an optimal solution is made on discrete non-metrical space of varied parameters.

Actuality of the problem of corroding constructions optimal design is determined by the requirements for their high reliability and minimal consumption of materials. Utilization of existing

algorithms for optimal design of such constructions allows to achieve required solution accuracy only with high computational cost. The paper describes creation of effective algorithm based on flexible tolerance method which allows to obtain solution with given accuracy and, therefore, to ensure required level of reliability of designed construction. Optimization algorithm uses neural network module of computational error control, which allows to change parameters of numerical solution of differential equation system modeling the influence of aggressive environment while solving the optimization problem. It allows to reduce computational cost at initial stages of search for the solution and to ensure required solution accuracy in the vicinity of the extremum.

Analysis of results of numerical experiments allows to make a conclusion about high performance of optimization algorithm while ensuring given accuracy of problem solution. Utilization of developed algorithm will allow to solve the problems of corroding hinged-rod constructions optimal design.

Keywords: corrosion, discrete optimization, flexible tolerance method, neural networks, genetic algorithm.

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