Integration of Intelligent and Blockchain Technologies in Information Management Systems

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Abstract—Tendencions the use of intelligent technologies in information management (IM) are done. Main directions of semantic technologies are discused. The use of block chain technologies for various actives management is shown. The use of intelligent technologies in information management with cloud computing (CC) and intelligent agents (IA) are represented. The analysis of management activity particulars in area of CC directions is done. As IM trend development of methods and models creation of jointly activity IAs in cloud area is given. As conception development of information management activity the crtiating instrumental platform on the multi agents base, integration semantic and blockchain technologies in cloud area is proposed. The automation design of such intelligent IM system (IIMS) with proposed concepts can be realize on the base of semantic technology.

Keywords—semantic, block chain technologies, information management, intelligent agents, integration, cloud area, cloud computing

I. INTRODUCTION

The information management (IM) theory and practice development is following: with one hand – the strength attention to investigation for information technologies, increase in requirements to the international standards in information management field, the growing expenditures on their support, with another – the non sufficiently IM effect, subjective human factor in control of resources, what the published data to world economy confirm [1].

The first way to improve this situation are the collection and processing information about state and trend for goods and services in would economic and synthesis knowledge what will give new more exactly forecast situation on would markets. The other way is the use in information management intelligent technologies (decision making) and block chain technologies (control and resources accountant) for creating information corporate systems (ICS) of new generation [2] and the clarity of all resources management [3].

II. INTELLECTUALIZATION IN INFORMATION MANAGEMENT

One of main task of innovation economic is intellectualization. It idea is the development of effective mechanism of forming, actualization and mass using innovation knowledge in information management. Among such knowledge can propose the following: intelligent agents, intellectual web-services, cloud computing [4]. These proposes can be taken in base during the intellectualization of management activity:

- the use of semantic technologies in IM, electronic marketing, electronic and mobile commerce giving new quality;
- the create of integration decisions on the base of semantic web-services let to decide new management tasks;
- the use of mobile technologies and cloud computing create new platform for IM.

III. THE BASE OF SEMANTIC TECHNOLOGIES

President of W3C Tim Bernes-Lee has proposed the Semantic Web conception in 2001 year on the 8-th consortium W3C conference and has published the article in Scientific American magazine [5]. The distinguish between Semantic Web (SW) and classical Web environment is that – the each page of semantic net include information in two languages: human (shown by browser) and special (conceal from human but it is clear for special programs – intelligent agents (IA). IA finds for the owner task the need information, asked data, checks it on some search criteria and gives the results in convenient for user forms.

Three principles: aggregation, safety and logic are in the base of semantic net. Aggregation is the common using of data. Any type of data can be used in SW, on its base is creating the semantic information (ontology). The last is the fundament of SW and adduce the project area description on some formal language of intelligibility and relations between them.

The security base of SW ensures the digital signature technology, which can be used by IA for checking, that some information received from authentic source.

Logic includes the rule set for description of information data structure, protocols and page description. The RDF language has been developed by W3C for the meta data description in semantic net. It is used for relation description between resources. Propositions coding by RDF can be interpreted by the ontology creating on RDF-Schema and OWL standards for receiving the logical conclusions [5].

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Belarus in project OSTIS, the main idea it is to create and improve the component design of any intelligence systems. In article [6] the such new open project is devoted, aimed at creation of technology of component design of intellectual systems.

Among the key provisions underlying proposed technology of intelligent systems design, the following provisions apply [6]:

- component design method is based on permanently expandable libraries of reusable components;
- formal models of designed intelligent systems are based on the unified semantic networks, which creates the necessary conditions for the semantic interoperability of intelligent systems and their components;
- for decreasing the complexity of the design and modification intelligent systems, the maximum possible independence of the knowledge base update process from the knowledge processing methods and the technical implementation is used;
- the technology of component design of intelligent systems is realized as intelligent meta system, which is built on the same proposed technology and stores all accumulated to this time models, means (including the library of standard components) and methods that are the part of this technology;
- the permanent development of component design technology is performed within the scope of open source-project.

In the proposed design technology for intelligent systems special attention is paid to the upgrade during their operation process and to meta technology of updating of component design of intelligent systems.

IV. THE BLOCK CHAIN TECHNOLOGIES BASE

Bloch chain – it is multifunction and multilevel information technology, which destination is the reliable discount of various actives. This technology covers all area of economic activity and has multitude of using. These are: finance, economy; operations with material and nonmaterial actives, counting in the state, private and hybrid organizations. In common, block chain is new paradigm for coordi-nation of any type of management activity [3].

Bloch chain technology (BCT) can be been the economic shell of Internet for online paymentearnings, non centralize exchanges, expenditure of valuable tokens, receive and send of digital actives, issue and execute of smart contracts. Block chain as decentralization technology can bebeen the next stage after mobile and social nets [3].

As technical the block chain technology is the elseone application level over stack of internet protocols. It gives in the Internet the new support element of economic transactions the moment payment in universal crypto currency, or so more complex financial contracts. The block chain technology will state as high economic level of various computers connection set: mobile, digital unit of self fixation, "smart homes, smart autos and smart region" [3].

The functionality implemented within the framework of the paradigm block chain can look like an integrated physical level of calculations with many devices, on top of which there is a layer for servicing payments. But it's not just about payments, but about micro payments, a decentralized exchange, earning and spending tokens, getting and transferring digital assets, and drawing up and executing clever contracts - that is a full-fledged economic layer that has not yet been available in the Internet [3].

V. NEW IN INFORMATION MANAGEMENT

Intelligent network (web 3.0) is becoming the stage of development of the Internet. The ontology forms the semantics, creating new opportunities for IA to fulfill user requests. This ensure the liberation of the user from the task of documents examination receiving search engine. To cope with the complexity of business processes linking multiple enterprises or value chain in Web 3.0 companies will demand smart processes [2, 7].

Distributed artificial intelligence – DAI is based on agent-based technologies. IA has three properties: autonomy, the ability to respond and to get in touch. IA can chat with other "entities": people, other IA, objects [6]. Adding to that the ability to plan and set goals, to support view models, to reason about actions and to increase the level of knowledge and quality of work through training, and get advanced IA.

IA can be integrated into the structure of cloud computing (CC) that contains specific functions in solution of tasks, data processing and management. IA supports the connection of information and technology, knowledge base and can support the process of logical reasoning (for example, including business regulations). IA allows to enable learning and improvement both at the level of infrastructure (adaptive routing) and application-level (adaptive user interfaces). IAs are used to gather business intelligence (BI) and complex event processing (CEP). The number of visits of pages is out of date. It is important the number of connections in social networks, the number of sent messages and time spent on a particular site [7].

Information receiving and real-time analysis in cloud area is the next task for corporate intelligence, especially when, in order to find the valuable information and to "manage the reputation", it is necessary to move from "search data" to "search blogs". It is necessary to go beyond the Google search engine, to handle the online noise and to understand what is happening in the industry, the situation of the goods and services of the company, i.e., it is need the analytics in Web 3.0.

Using complex event processing for corporate intelligence, you can create feedback between them and management system business processes, which in turn, affects corporate intelligence.

Service Science Management and Engineering (SSME) – a term used by IBM Research in its development of service systems. HP has created a "Research center systems and services". Oracle Corp. joined IBM to create an industrial consor-

tium called the Service Research and Innovation Initiative. A group of NESSI (Networked European Software and Services Initiative) in the European Union created working group on science services. At the University of California Berkeley has a program SSME. This is due to the fact that the services sector now employs more than 50% of the workforce in Brazil, Russia, Japan and Germany, and 75% of the workforce in the US and the UK [8].

Time of monolithic, vertically integrated companies left. Main and auxiliary business processes (BP) of the company occurs in four interrelated areas: suppliers direct procurement, production resources (indirect purchasing), trading partners, customers. These multiple chains should be included in the new business ecosystem in cloud area, combining "all-with-all". They will be available for the connection, gap and the new connection giving the company opportunity to work in multiple markets or to create a new proposal for a "market of one".

Successful companies become representatives of the interests of their clients. They work with suppliers from all over the world in order to offer customers the best value. The answers to the questions who owns the business processes of the entire value chain lie outside of CRM-systems – for new systems of cloud area (CA): relationship management in the value chain and relationship management with the community of customers. Ties are portals, business ecosystems and formation system of information, processes, for example, "individual request for a product" coming through many channels and from many communities of customers [2, 7].

Management CRM 2 is located in CA. The same can be said about the life-cycle management of goods in the new world of innovations generated by consumers: computer aided design, management of supply chains and contractual relationships will have to go beyond the boundaries of the enterprise to include customers and partners in the design and manufacture. The since is not company "owns", the entire sequence of value creation, the business processes of companies and their management will be unified and moved to CA.

This architecture includes the knowledge base in the form of production rules, logical inference mechanism, receptors and effectors of the agent module for communicating with other agents. Applied to the problem of market analysis, receptors convey facts about the outside influences in the knowledge base. The logical result of the output produced solution which is passed to the effecter about changes in the external environment.

Distributed decision of IM system can be used by different types of agents: agent-subordinator, set of agents, an agent-integrator. Agents can be linked together in the complex architecture, which can be horizontal or vertical. In result of analysis of the information processes in distributed IM system it can be considered agents that delineate access rights of users, agents, detection of needs (that is, state changes of the market environment), agents of discovery innovation, agents that build the behavior for the spread of innovation, the agents are the coordinators of whole multi-agent system.

VI. REQUIEM'S TO NEW IM SYSTEM

In the article [9] are analyzed the main developments in the IM intelligent system (IMIS) and the main trends of their development. With result of BCT integration the list of criteria and their values which can meet the IMIS:

- multi level monitoring environment, collect data on market condition from various sources at different levels of observation – the level of network, server, CA and social systems;
- adaptability, the ability to detect modified implementation of known and new innovations of the market;
- proactively, a built-in reaction mechanisms on the emergence of innovations;
- openness, possibility of adding new analyze resource for information system, its control;
- management, IS needs to combine both centralized and distributed control and discount;
- security, IS must have a means of protecting their components.

As a result, presented the following solutions for multi agent IS of innovation market:

- the structure of multi-agent detection system of innovation including agents which allows to make conclusion about the state and prospects of development of the market;
- method of adoption by agents of the joint decision, in order to form the agent round table and on the basis of the analysis of information obtained from different sources, to appreciate the state of the market;
- detection technique the news using multi agent technology to teach a multi agent system for the detection of innovation and use it to further planning the new goods (services).

VII. THE CONCEPT OF SYSTEM IM DEVELOPMENT

As trends and concepts of development on the use of intellectual and block chain technologies in IM systems are invited to:

- the improving architecture of IM systems in cloud environments, to ensure effective management under conditions of uncertainty state of information environment;
- the development of new models of IM in CA with the IA use on the basis of choice of optimal variant of response to market events;
- the improvement of instrumental and software systems for IM with intelligent decision support and research on the effectiveness of methods, models and algorithms;
- the development of theoretical foundations, models and tools, cloud tool platform design intelligent systems IM based on semantic technologies;
- the development of application software of workstations or sites for managers and marketers using block chain technology.

As an example, the structure of a distributed IM system is described. It includes an intelligent portal, with has the

support of intelligent agents and block technology. The portal includes a knowledge base (KB), an intellectual solver, an explanatory subsystem, an interface with agents, and a KB editor. Intelligent agents scan the sites of the industry and the sites of scientific institutions and form the knowledge base of the portal. Solver finds coincidences and issues order variants. As a result of human negotiations, smart contracts are being formed, which are supported by block chain technology.

The automation design of such intelligent IM system (IIMS) with proposed concepts can be realize on the base of semantic technology [10]. The automation design of ontology's for IIMS is based on worked out theory, approaches, models and tools [11, 12].

VIII. Conclusion

First direction of the development of IM intelligent systems is the further development of models, methods, architectures and software tools for the solution of problems of adaptation in the markets. The second direction is – the development of models, methods, architectures and software tools for gathering, structuring information from the Internet, the formation of specialized knowledge bases and decision support. The third direction is – the creation of a cloud-based tool platform design of IM intelligent systems based on semantic and block chain technology.

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ИНТЕГРАЦИЯ ИНТЕЛЛЕКТУАЛЬНЫХ И БЛОКЧЕЙН ТЕХНОЛОГИЙ В ИНФОРМАЦИОННОМ УПРАВЛЕНИИ
Вишняков В.А.

Приведены тенденции использования интеллектуальных технологий в информационном управлении (ИУ). Обсуждены основные идеи семантических технологий. Рассмотрено использование технологии блокчейн для управления различными активами. Представлено использование интеллектуальных технологий в информационном управлении с использованием облачных вычислений (ОВ) и интеллектуальных агентов (ИА). Как тенденция развития ИУ рассмотрено совершенствование методов и моделей совместной деятельности ИА в облачной среде. В качестве развития информационного управления предложено создание инструментальной платформы на базе многоагентного подхода, интеграции семантических и блокчейн технологий в облачной среде. Автоматизация проектирования этой платформы будет использовать семантическую технология проекта ОСТИС.

Ключевые слова: семантические, блокчейн технологии, информационное управление, интеллектуальные агенты, интеграция, облачая среда