CREATING OF MODEL-ANALITICAL INTELLIGENCE OF INFORMATION AGENTS FOR REACTIVE INFOCOMMUNICATION ENVIRONMENTS

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***Abstract* – The article deals with the problem situation in creation of model-analytical intelligence of information agents for reactive infocommunication environments. It is suggested a formal approach for resolving this situation. The article describes a formalization of the proposed approach. It contains information about models and methods of formalization. It is spoken in detail about the main stages of construction of object-oriented models of information agents for reactive environments. Much attention is given to key transformation of methods for the analysis of object-oriented models of information agents for reactive environments. It deals with methods of obtaining invariants for the verification of the model-analytical intelligence of information agents. In conclusion, the article describes providing quality assurance of information agents functioning in reactive environment through the use of their model-analytical intelligence.**

Keywords – information agent, reactive environment, conditions of uncertainty, model-analytical intelligence, quality profiles, object-oriented models, methods of analysis for distributed systems

One of the main directions of IT-sphere development is associated with the Intelligent agent technologies. The Intelligent agent technologies have enormous potential in the improvement of the information infrastructures efficiency and expansion their application's. In the information infrastructures of the Intelligent information agents are:

- Organizing interaction with users.
- Reacting with Information Systems.
- Performing administration of Information Platforms and Networks.
- Implementing task management.
- Sharing computing resources and telecommunications.
- Managing quality computing resources and telecommunications.
- Resolving information security problems.

Intelligence agent technologies is considered as reference basis for unmanned technologies operations in the information infrastructures. First of all flexibility of the Intelligent agent technologies are ensured by their key properties: autonomy, activity, reactivity and communicative. The implementation of these properties is carried by subsystem of the Intelligent information agents scheduling tasks. The definition, monitoring and observance of the functioning quality's guarantees of the Intelligent information agents are imposed by their model-analytical intelligence [1].

Known formalizations for generation model analytical intelligence are considering various differences in the synchronizations mechanism [2, 3]. In the development of these formalizations provided expansion of existing methods analysis information agents with confirmation [4].

Main driving force for implement formalizations is the increasing of requirements for the intellectualization's level of information agents. With the increasing importance of information infrastructures in regular activity comes out need in the impact reactivity environment for quality of functioning information agents. Problem of the accounting of this effect remains open now. Relatively to this, proposed new methodology for modeling information agents in the reactive environment.

The proposed methodology is focused on the formation of a model-analytic intelligence information agent for reactive environment $\mathbf{M}_{MAI}$.

Methodology **M** consists of three components:

$$\mathbf{M} = \langle \mathbf{M}_M, \mathbf{M}_A, \mathbf{M}_V \rangle .$$

First component of methodology $\mathbf{M}_M$ is method of constructing an extended object-oriented model of action's system information agent. Expansion object-oriented model regards to submission description statistics properties of actions.

Second component of methodology $\mathbf{M}_A$ includes methods of analytical determination indexes for quality operations of the information agent. As the result of execution requirements method $\mathbf{M}_M$ and methods analyst $\mathbf{M}_A$ generate model-analytics intelligence $\mathbf{M}_{MAI}$.

Model-analytics intelligence's core is the part of analytical relations for quality's determination and calculation of functioning information agents.

The role of quality indications are:

- Probability distribution's density of the time to overcoming a priori uncertainty about the composition of the information infrastructure.
- Mathematical expectation of time to overcoming the a priori uncertainty about the information infrastructure's composition.
- Time limits risk overcoming of a prior uncertainty concerning the composition information infrastructure.
- Probability's density of time for the agent's goals achievement.
- Mathematical expectation of a time to reach the agent's goal.
- Time dispersion for goal achievement by the agent.
- The risk of failure of the time limits for achieving the agent's goal.

Third component $\mathbf{M}_V$ includes methods of verification for the forming of model-analytics intelligence $\mathbf{M}_{MAI}$.

Methods $\mathbf{M}_V$ provide output of analytical relations for determination of the expected values and time dispersions of the agents functionalities in the alternative routes. Building of system of invariants is a based on alternative analysis relations of determination of quality parameters for the Intelligent information agents.

Agent's model in the reactive environment is described by the tuple:

$$\mathbf{M}_M = \langle \mathbf{N}_O, \mathbf{U(k)}, \mathbf{A}, \mathbf{P}_A, \mathbf{S}_A, \mathbf{S}_B, \mathbf{S}_N, \mathbf{S}_O, \mathbf{Q} \rangle ,$$

$\mathbf{N}_O$ – modeling notation;

$\mathbf{U(k)}$ – vector of density functions $\mathbf{k}$ of discrete time performing agent's actions;

$\mathbf{A}$ – incidence matrix of graph's describing an object-oriented model of agent's actions parallel;

$\mathbf{P}_A$ – plurality of matrices for describing of consecutive actions in the parallel profiles of agent's functioning;

$\mathbf{S}_A$ – function's vector of consecutive agent's actions;

$\mathbf{S}_B$ – disconnecting function's vector of consecutive agent's actions;

$\mathbf{S}_N$ – a priori uncertainty functions vector of actions connecting;

$\mathbf{S}_O$ – function's vector of agent's paralleling actions;

$\mathbf{Q}$ – vector of probabilities of the environment's reactive effects on information agent.

$\mathbf{U(k)}$-vector is described:

- time density by determining state of the environment;
- time density by the environment modeling;
- time density by pre-planning;
- time density by establishment of link with the environment;
- time density by transfer of data, information or knowledge from the environment object;
- time density by breaking a link with the environment;
- time density by establishment of link with the information resource;

- time density by transfer of data, information or knowledge from the information resource;
- time density by making a decision about updating of information, knowledge or the environment model;
- time density by refined planning;
- time density by performing the simulated agent's functional action.

A tuple of methods for quality index determine of intelligent information agent's functioning:

$$\mathbf{M}_A = \langle \mathbf{M}_S, \mathbf{M}_{P\wedge}, \mathbf{M}_{P\vee}, \mathbf{M}_{PMN}, \mathbf{M}_O, \rangle$$

$\mathbf{M}_S$ – method for analysis of consecutive agent's actions;

$\mathbf{M}_{P\wedge}$ – method for analysis of parallel agent's actions, which are synchronized according to the function «$\wedge$»;

$\mathbf{M}_{P\vee}$ – method for analysis of parallel agent's actions, which are synchronized according to the function «$\vee$»;

$\mathbf{M}_{PMN}$ – method for analysis of parallel agent's actions, which are synchronized according to the function «M from N»;

$\mathbf{M}_O$ – method for analysis of reactive agent's actions.

The proposed methodology allows create a new generation intelligence of information agents with the quality assurance of functionality in the infocommunication environment.

References

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