Application of an integration platform for ontological model-based problem solving using an unified semantic knowledge representation

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***Abstract*—This article describes a solution in the form of an intelligent integration platform based on the model of an unified semantic knowledge representation for the development of applied knowledge-driven systems. The model of an unified semantic knowledge representation using semantic networks, models and methods of measure and probability theories, methods of descrete optimization and applied mathematics, computer simulation and multiagent approaches were used. The purpose is to develop computer tools with cognitive architecture relying on elements of artificial consciousness and being able to communicate and to be flexible and adaptive in complex educational applications. Virtual machines, subsystems of integration platform and tutoring applied multi-agent software system were developed and implemented as part of humanmachine interaction system.**

***Keywords*—artificial intelligence systems integration, integration platform, multi-agent system, knowledge-driven system, knowledge processing model, unified semantic knowledge processing model**

I. Introduction

The basis for the success of a learning intellectual system is integration openness [42], [45]. When it is possible to integrate not only new knowledge related to different types but also various mechanisms for solving problems. Integration is one of the important understanding mechanisms for knowledge systems allowing the acquisition and improvement of problem-solving skills which is important for knowledge-driven systems [42], [45]. This article presents a solution in the form of an integration platform based on the unified semantic knowledge representation model. This presentation attempts to answer the following questions.

1. What goals can be achieved using such platforms?
2. What developments are already in this direction?
3. What are the architecture, mechanisms and rules for using the platform?
4. What are the positive and negative peculiarities of the platform?
5. What results have been achieved in the process of its application?
6. What are the perspectives for the development of the platform?

The general goals planned to be achieved are:

- creation of dynamically updating knowledge-based system able to accept new knowledge via machine learning and high-level or natural language communication;
- creation of scalable knowledge-driven systems maintaining big knowledge and large scale integrated ontology;
- creation of artificial consciousness systems which are self-descriptive and introspective;
- creation of multi-agent distributed applied intellectual systems.

II. Overview of models and approaches

The necessity of artificial intelligence integration historically caused by the existence of separate artificial intelligence solutions for specific problems such as reasoning knowledge, speech synthesis and recognition, computer vision problems. General approaches to the integration of information systems: integration through translation with control passing, integration through interpretation or through communication without control passing. In the case of control passing each process or agent of system should store own state. Therefore, the corresponding storage is available for one control flow and both are shared by all processes or agents on the system.

From the other side, consciousness as a more advanced kind of intelligence is determined by social experience of natural language communication. Thus, by natural way, such communicative models as actor models [1], [5], [13] or multi-agent systems are the basis [6], [45] not only for concurrent computer system but artificial intelligence systems. Therefore, concurrent models are integration models. These models are divided into two classes. The first class is models without shared common memory or storage. The second class is models with shared common