

Romanian Schools of Collaborative Systems

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***Abstract:** This paper describe the general evolutions of the Romanian schools specialized in collaborative systems. In this article are identified the main collaborative systems schools from important cities in Romania, are presented the results of the scientific research and personalities of the collaborative systems field. The paper ends with a regard to the future in which are described the directions of future work in this area.*

***Keywords:** collaborative systems, research, schools, personalities.*

1. General evolutions

In the context of transition from the information society in the knowledge-based society, research on collaborative systems are conducted at the Babes-Bolyai University in Cluj-Napoca, Aristotle University of Thessaloniki, Massachusetts Institute of Technology, Harvard University, Stanford and University of California Los Angeles.

The Romanian scientific research has crossed for years important steps in the evolution, which has conferred a level of performance recognized in the country and abroad. The research programs, oriented to the peak areas of science, led training researchers from research institutes and laboratories of major universities to develop projects and to run them after obtaining the financement through the competition.

This explains the strong development of researchers in collaborative systems field and we can talk now about a strong school of Romanian research in the collaborative systems field.

Abroad, renowned researchers in the field of collaborative systems are Barbara J. Grosz from MIT University, Tom Gruber, J. Rice and A. Farquhar from Stanford University.

Andreas Veglis and Andreas Pomportsis from Aristotle University of Thessaloniki define collaboration as a collective work of two or more persons, work undertaken on a shared goal or a careful direction, sensitive and adapted to the environment. A collaborative work system is an organizational unit which will be established each time the collaboration takes place, whether formal or informal, intentional or unintentional.

Nathanael Thompson and Haiyun Luo from the University of Illinois Urbana-Champaign have described a model of collaborative system for the access to the Internet in a residential neighborhood.

2. The school of Cluj-Napoca

The school from Cluj is the name under which is recognized the research team coordinated by Professor Stefan NITCHI from Babes-Bolyai University in Cluj-Napoca. This group has developed the work on three directions:

- realization of fundamental research in the collaborative systems area, taking into account the latest trends that are converging towards the idea of increasing the efficiency of

systems by developing the collaborative manner which includes elements of artificial intelligence;

- identification of practical areas where are applied the research results, validating in this way the models, the techniques discovered in the research process;
- clarification of specific concepts, obtaining in this way is a unitary approach in our country of the problems concerning the collaborative systems.

The collaborative systems school from Cluj is a real landscape in the Romanian scientific research through the results and doctoral thesis developed and sustained, PhD thesis which includes many original solutions.

Scientific events organized and works published come to prove the high capacity of polarization of this important core of researchers of creative energies of our country for this domain.

There is about the collaborative systems writing of a well developed specialty. In *Collaborative Multi-Agent Systems* [1], the book most often cited in articles and presentations at conferences, are considered the following issues:

- *agents - key concepts*: the definition of, formal and concrete architecture of the agents;
- *fundamentals of agents interaction*: the concepts of interaction between agents, the communication between agents, fundamentals of game theory;
- *formal models of collaboration*: essential characteristics of interaction between agents, elections, auctions, negotiations, general equilibrium models of the market, forming coalitions;
- *agents-oriented to the methodologies of software engineering*: software development methodologies, evaluation, agents-oriented to the methodologies;
- *developing agent systems*: FIPA standards for agent systems, FIPA implementation compliance;
- *agents based on personal tools of collaborative search*: problem specification, information retrieval, hyperlink analysis, collaborative recommendation, the concept and design of the AgentSearch.

The book *Collaborative Multi-Agent Systems* is centered on collaborative multi-agent systems in terms of technologies activation, concepts, methods and instruments. Fundamentals of collaboration are necessary when defining the new societies of any kind (human or artificial). The main conclusion of this work is that multi-agent systems represent a new paradigm for modeling the social realities and for acquiring software development. Collaboration is best learned when it is based on simple rules, leaving the agents to fulfill their interests within their societies. The design and development of agent systems should be adopted because they provide the envelope in which must be put the intelligence of AI. But, while the object-oriented methodologies have to be engaged so that software projects become executable in the software industry. [2]

In the year 2005 was organized the International Workshop *Collaborative Support Systems in Business and Education*, where young researchers from Babes-Bolyai University have presented papers, as follows:

Raluca ARBA – *Collaborative Electronic Marketplace* [3]

Vasile Paul BRESFELEAN, Mihaela Antonia BURCA – *Collaborative E-learning Systems* [4]

Ovidiu DOBRICAN – *An Example of Collaborative System* [5]

Daniel MICAN – *Collaborative System in Handling Freelancer IT Projects* [6]

Mihaela MUNTEAN – *Collaboration – A Business Strategy in The Global Economy*

[7]

Gheorghe Cosmin SILAGHI – *About a Naive Algorithm for Producing Collaborative Recommendations* [8]

Also Mr. Stefan NITCHI and Ms. Rodica NITCHI have presented the paper *On the Paradigm of Collaborative Systems* at the 2005 International Workshop. [9]

In [10] are presented the concepts of cooperation, communication and coordination, as well as the relationship between them: the cooperation involves communication and a specific kind of coordination.

The young researchers from Cluj have realized PhD thesis in which they have presented original results in the collaborative systems field.

In [3], collaborative systems represent a new interdisciplinary domain at the intersection of economics, computer science, management, sociology, etc. Using IT technologies new collaboration opportunities were developed on the electronic products and services market. Collaboration involves organizations with same goals that are uniting in order to form a new structure.

In [5], a collaborative system is one where multiple users or agents are engaged in a shared activity, usually from remote locations. In the large family of distributed applications, collaborative systems are distinguished by the fact that the agents from the system are working together towards a common goal and have a critical need to interact closely with each other.

Other workshops and conferences on collaborative systems organized by the school from Cluj are *International Workshop in Collaborative Systems and Information Society*, organized in October 2008, and *Knowledge Engineering: Principles and Techniques Conference*, organized in July 2009.

3. The school of Timisoara

The school from Timisoara is popular with special achievements obtained in collaborative systems area. The team of researchers coordinated by Professor Mihaela MUNTEAN has noted for years by outstanding contributions in the application of artificial intelligence in collaborative systems development.

Participation in prestigious scientific events in the country and abroad come to emphasize the efforts that Timisoara researchers have undertaken.

In the year 2009 Ms. Mihaela MUNTEAN presented a PhD thesis entitled *Contributions to Conception, Design and Implementation of Some Collaborative Systems*, which tackle an issue of particular importance for the scientific research in the economic informatics field. The contents of the thesis reveals the author's ability to conceive a balanced structure in which first of all are presented the basic concepts and the arguments which have stated on the basis of whole approach.

In [11] are described intelligent agents, perceived as being autonomous and having skills of collaboration and learning from previous experiences.

Starting from the classical architecture of a collaborative system based on software agents, it is clear that it behaves as a poorly connected network of autonomous entities that collaborate to solve problems that can not be resolved individually, and which supports various transactions to achieve pursued common goals.

Intelligent agents are perceived as being autonomous, with capabilities for collaboration and learning from past experience. Referring to Brenner's cube, and taking into account criteria such as number of agents, mobility and intelligence of the agents, it can shape the field of multi-agent distributed systems, which are able to shape collaborative virtual communities.

Agents members of multi-agent systems presents, usually a BDI architecture (Belief-Desire-Intention), their behavior resulting from the actions they undertake in accordance with their beliefs, formed on the basis of perceptions, but also the wishes expressed. [11]

In [12] is considered that the development of collaborative software applications can be simplified by appealing to the open-source market. On this market are some solutions for sustaining on-demand collaboration anytime and anywhere. The collaborative applications concur decisively to the creation of new knowledge, the on-line conversations helping to refine this knowledge and thus generating pieces of knowledge relevant for the organization. The email remains one of the most common communication tools in business, at the level of the collaborative environment being necessary to establish a management politics for the messages propagation.

4. The school of Bucharest

The school from Bucharest includes a small number of people working in the same area of research, with the direction of establishing practical methods to estimate the performance of collaborative systems. Starting from the experience in quality management software, has moved to the analysis of the collaborative systems through:

- identifying the quality characteristics of these systems with the tendency to form a system of quality characteristics;
- defining the performance criteria for collaborative systems, so that when analyzing the evolution of a collaborative system to accurately use widely accepted methods of assessment;
- building metrics for evaluating quality of collaborative systems; in this sense have been established structures of indicators, was analysed the measure in which they meet the representative requirements and was developed a method of their validation which takes into account the particularities of this category of systems .

It was passed to study collaborative systems by identifying specific elements of banking systems and of aided instruction systems specific to virtual campuses. For implementing metrics oriented on collaborative systems has been developed an online application available and has been proceeded to present the different results obtained in the research.

In [2] is defined the collaborative information system as a distribution company whose goal is to sell increasingly quantities of its products. The difference between a collaborative and distributed system is given by the following characteristics:

- the system elements, described both by users and agents, interact each with one another, influencing the systems behaviour;
- the system components use shared resources so as to fulfill their goals and their common objectives;
- in the collaborative systems, between users and agents are permanent channels of communication;
- the agents interests are the same (the agents have common interests and not against).

In [13] are presented the quality characteristics of collaborative systems, structures of collaborative systems and the quality estimation of these systems.

Among the quality characteristics studied in the literature:

- complexity;
- reliability;
- maintainability;

- portability;
- stability;
- integrity;
- functionality.

The scientific research aims to further documentation in the collaborative systems field, so that:

- to identify other collaborative systems specific to the knowledge-based society, in which the complexity level is very high and the number of people interacting is high;
- to develop aggregation techniques of existing collaborative systems, in order to increase the economic competitiveness and to develop the knowledge-based society;
- to increase their quality level and to identify new indicators for measuring the quality;
- to propose new indicators for evaluating collaborative systems and to follow correlations between the indicators evolution and systems development.

The detailed results of the research were made in writing the book *Metrics of collaborative systems*, published by ASE, in 2007, and presented at scientific seminar Octav Onicescu in 13 May 2008.

The metrics defined for collaborative systems serve to assess the performance of a collaborative system from the banking system. The choice is based on the complexity of the banking systems components and their structure as functional collaborative systems.

Examples are given for the banking system, seen as a collaborative system, because:

- the banking system is a system with a broad development and strict rules for the organization;
- falls into the category of collaborative systems with high complexity level;
- has many components and a large variety of connections between components;
- is composed by three subsystems: physical, information and energy.

The three schools have one common denominator, namely the research project CNCISIS, no. 1470/18.04.2005, *Collaborative informatics systems in the global economy*, coordinated by the school of Cluj.

5. Regard to the future

Publishing the online journal *The Journal of Applied Collaborative Systems* is to create a favorable context to promote the most valuable results obtained in practice and in research related to collaborative systems.

An argument in addition to our efforts to achieve a journal for presenting original results in collaborative systems has been generated by the announcement in the fourth issue of the year 2008 of the Informatica Economica Journal of the publication in volume 13, number 2 / 2009 of the same journal of papers that deals with collaborative systems problems.

The avalanche of articles with exceptional quality from researchers of the three schools and not only showed the great potential of research, available in our country for this domain.

This explains the composition of contents for this number with the titles:

Mihaela I. MUNTEAN - Collaborative Environments. Considerations Concerning Some Collaborative Systems, in the abstract is presented that all collaborative environments are based on knowledge and between collaboration and knowledge management there is a strong interdependence. The evolution of information systems in these collaborative environments led to the sudden necessity to adopt, for maintaining the virtual activities and processes, the latest technologies/systems, which are capable to support integrated collaboration in business services. In these environments, portal-based IT platforms will

integrate multi-agent collaborative systems, collaborative tools, different enterprise applications and other useful information systems.

Ștefan Ioan NITCHI, Alin MIHĂILĂ, Marius PODEAN - Collaboration and Virtualization in Large Information Systems Projects, which shortly present a general framework developed by the authors for collaborative systems in general and adapted to collaborative project management.

Daniel MICAN, Nicolae TOMAI, Robert Ioan COROȘ - Web Content Management Systems, a Collaborative Environment in the Information Society, the aim of this paper is to analyze the main models of collaboration and the use of a Web CMS, in order to develop an online community.

Ion SMEUREANU, Andreea DIOȘTEANU - A Collaborative System Software Solution for Modeling Business Flows Based on Automated Semantic Web Service Composition, presents a software application architecture based on Business Process Modeling Notation standard and automated semantic web service coupling for modeling business flow in a collaborative manner.

Cristian CIUREA - A Metrics Approach for Collaborative Systems, presents different types of collaborative systems, their structure and classification. This paper defines the concept of virtual campus as a collaborative system. It builds architecture for virtual campus oriented on collaborative training processes. It analyses the quality characteristics of collaborative systems and propose techniques for metrics construction and validation in order to evaluate them. The article analyzes different ways to increase the efficiency and the performance level in collaborative banking systems.

Liviu Adrian COTFAS, Mihai Cătălin CROICU, Dumitru COTFAS - A Collaborative GIS Solution for Public Transport, the system presented here intends to fully providing a modular, extensible collaborative one-stop-shop for public transport needs based on multi-source collaborative data inputs from both official and user-submitted sources with the usage of a flexible, genetic-algorithms based route-finding application.

Răzvan PETRUȘEL - Collaborative Virtual Enterprise Environment and Decision Mining, provide an environment for collaborative decisions using a DSS-like approach.

Ioan PETRI - Quorums Systems as a Method to Enhance Collaboration for Achieving Fault Tolerance in Distributed Systems, this paper tackle quorum systems, which is a particular sort of distributed systems where some storage or computations are replicated on various machines in the idea that some of them work correctly to produce a reliable output at some given moment of time.

Claudiu VINȚE - The Informatics of the Equity Markets - A Collaborative Approach, aims to provide a high-level overview upon the information technology that supports the electronic transactions performed on the equity markets.

Nicolae MĂRGINEAN - Intelligent Decisional Assistant that Facilitate the Choice of a Proper Computer System Applied in Business

Loredana MOCEAN, Monica CIACA - About Parallel Programming: Paradigms, Parallel Execution and Collaborative Systems, propose an overview in parallel programming, parallel execution and collaborative systems.

All of these papers are available at <http://www.revistaie.ase.ro/current.html>.

The field is open for other Romanians researchers to join those three schools to become a powerful force in the Romanian research from the area of collaborative systems, seeing:

- deepen the fundamental research;
- extending the system applicability to another areas, now knowing that in the new conditions, the performance of the organizations is guaranteed if and only if is used the collaborative approach, favored by the usual information technologies;

- including in programs of Doctoral Schools the disciplines that are related to collaborative systems, so that increase the number of doctoral thesis which deals with topics of this area;
- boost efforts to make known the results obtained in the process of documentation by publishing summaries and original results under the form of articles and specialized studies;
- creating an environment specific to the presentation of research results both in the form of communications in the sections of informatics conferences or artificial intelligence, but especially by publishing articles in informatics or cybernetics journals.

6. Conclusions

The Romanian schools of collaborative systems make a whole that communicate and cooperate in order to achieve a common goal.

All the results obtained by us until now make to believe that the research in the field of collaborative systems is extremely favorable land and the efforts which have been made shall be submitted now and will be tabled in the future. With certainty these results will be reinforced and will be created an more complete image of the research on collaborative systems in Romania.

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