Dissemination Resources on Collaborative Systems

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Abstract: *This paper show the publication sources where collaborative systems are presented. It analyze journals, conferences, books and websites with collaborative systems topics. Each dissemination resource is described and are listed some significant recent articles in the field of collaborative systems. International conferences are identified and important books are reviewed. In this paper is presented a taxonomy of collaborative systems.*

Keywords: *collaboration, collaborative systems, dissemination, journal, conference, book, website.*

1. Introduction

Collaborative systems are an important research field of the knowledge-based society. Every human activity is better realized if the people work together in order to achieve a common goal. Collaborative systems are widely used today in various activity fields. Their complexity is high and the development involves numerous resources and costs.

In The Cambridge Dictionary, *collaboration* is defined as working with someone for a particular purpose. For example, two directors collaborate on writing a movie script or a company from one country collaborate with a company from another country to develop a product.

In The Wordsmyth Educational Dictionary-Thesaurus, *collaborate* mean to cooperate or work with someone else, especially for an artistic or intellectually project.

In IEEE Distributed Systems Online, the intransitive verb *to collaborate* mean, first, to work jointly or together with others, especially for an intellectual endeavor. Moreover, *to collaborate* mean to cooperate with someone in an action which requires the immediate involvement.

If ten different people are being interviewed regarding what means for them *collaboration* in informatics area there are received ten different answers. Some of them understand by *collaboration* changing e-mails. For others *collaboration* means videoconference through Internet. Most of people have difficulties defining this notion because in informatics have been implemented so many technologies and as a result the definition of collaboration is quite wide. Collaboration represents the integration of different technologies in one application that facilitates information share and management. Integrated technology is only one aspect of collaboration as it is defined. The other aspect is timing. People are accustomed to real time collaboration, meaning working at the same time with other persons. New technologies offer an entire different way of collaboration, for example asynchronous collaboration, meaning that one doesn't have to be present in order to participate. Asynchronous collaboration allows us to collaborate with other people as we wish: through e-mail, Internet, Intranet and all the other asynchronous communication forms.

A collaborative system is defined through a construction having the form:

< activity, place, material resources, people, energy resources, procedures, flows >

These elements builds the four components of a collaborative system: the material component, the human component, the energy component and the information component.

The *material component* is represented by the elements *activity*, *place* and *material resources*, the *human component* is represented by *people*, the *energy component* is shown by the *energy resources*, while the *information component* is presented by *procedures* and *flows*. Collaborative systems are ordered systems, meaning that includes a set of procedures, uniform governing relations between components.

The collaborative systems are classified in many categories and there are a lot of criteria for collaborative systems classification. Collaborative systems are classified according to the following criteria:

a) *level of complexity*, and by this criterion are identified:

- *collaborative systems with low complexity level*, have few components and the number of relationships is limited;
- *collaborative systems with medium complexity level*, have small number of components, but do not have large number of streams or *systems with large number of flows* and which have large number of components;
- *collaborative systems with large or highly complexity level*;
- *collaborative systems extremely complex*, have many components and many streams: banks, police, internal chain of hotels, airline transport; the banking system is among collaborative systems with very high level of complexity, because it consists of many components and is characterized by a large variety of links between them;

b) *type of application*, criterion which groups the systems in:

- *collaborative systems in education*, they are applied in the educational field and aimed at evaluating and enhancing the educational process performance;
- *collaborative systems of defense*, they are encountered in the military field and are characterized by strict rules of organization and functioning;
- *collaborative systems in production*, designed to increase production capacity and product quality in different units producing goods and services;
- *collaborative banking systems*, they are analyzed to determine factors affecting the banking system and its components;

c) *method of organization*, criterion which divide the systems into:

- *linear systems*, in which subsystems interact with each other in both directions;
- *tree systems*, organized by hierarchical levels;
- *network systems*, in which the components communicate one with each other regardless of the level that is;

d) *field of application*, collaborative systems being classified in:

- *collaborative functional systems*, include the *collaborative banking systems* and cross all the activities taking place in the economy, providing necessary information and overall coordination for production and finance management;
- *collaborative micropayment systems*, allows customers and content providers to use their payment system of choice; [1]
- *collaborative planning systems*, present the most appropriate way to tackle certain kind of planning problems, especially those where a centralized solving is unfeasible; [2] [3]
- *collaborative tagging systems*, which provide a new means of organizing and sharing resources; [4] [5] [6]

- *collaborative writing systems*, their major benefits include reducing task completion time, reducing errors, getting different viewpoints and skills, and obtaining an accurate text; [7]
- *collaborative medical systems*, in which modern communication technologies allow doctors from around the world to work on the same patient. [8]

In the world are many journals and conferences which have topics on collaborative systems. On the internet, there are many websites dedicated on collaborative systems issues. Also, very interesting books have been written and published in order to underline the importance of collaborative systems study. Some of these resources are presented below, detailed by categories.

2. Journals

Were identified the journals which deals with collaborative systems issues. Some of them are dedicated to this field, such as: *International Journal of Collaborative Research on Internal Medicine & Public Health*, *Journal of Applied Collaborative Systems*, *IEEE Distributed Systems Online*. Others have topics on collaborative systems: *IBM Systems Journal*, *IBM Journal of Research and Development*, *Informatica Economica Journal*, *IEEE Communications Magazine*.

International Journal of Collaborative Research on Internal Medicine & Public Health is an open access online journal and an interdisciplinary publication for the collaborative discussion and debate on international Internal Medicine and Public Health issues. The journal promotes discussions, studies, collaborative researches and current activities on the current internal medicine and public health topics. [9]

The *Informatica Economica Journal* issues cover various topics regarding the research, practice, and education in economic informatics field, like: collaborative systemns, digital economy, applied informatics in economy, ICT security, information and computer-based systems, education and research in economic informatics, qualitative and quantitative models applied in computer science. One of the unique features distinguishing this journal is that *Informatica Economica Journal* is the main publication on economic informatics from his region. The topics of the second issue on 2009 of *Informatica Economica Journal* was Collaborative Systems.

The *Journal of Applied Collaborative Systems* is open to all that develop theoretical approaches and practical activities in the collaborative systems domain and wish to publish the newest results obtained. The journal contains original results obtained in the collaborative systems field. Each issue is oriented to a collaborative system theme. Collaborative systems, ways of developing collaborative sources, evaluation methods for collaborative systems are presented. Collaborative experience is analyzed for domains like banks, universities, public administration and industry. Theoretical and practical results are included concerning the risks of collaborative systems functioning. Also, aspects of definition and utilization of intelligence agents are included.

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 the 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. [10]

In *IBM Systems Journal* and *IBM Journal of Research and Development* were published papers on collaborative systems, such as:

- *Estimating the efficiency of collaborative problem-solving, with applications to chip design*, published in *IBM Journal of Research and Development, Volume 47, Issue 1, 2003*, by Mary Wisniewski, Emmanuel Yashchin, Robert Franch, David Conrady, Giovanni Fiorenza and Cevdet Noyan;
- *The GeneMine system for genome/proteome annotation and collaborative data mining*, published in *IBM Systems Journal, Volume 40, Issue 2, 2001*, by Kristopher Irizarry;
- *Ethnographic study of collaborative knowledge work*, published in *IBM Systems Journal, Volume 45, Issue 4, 2006*, by Sandra Kogan and Michael Muller;
- *Business activity patterns: A new model for collaborative business applications*, published in *IBM Systems Journal, Volume 45, Issue 4, 2006*, by Paul Moody, Dan Gruen, Michael Muller, John Tang and Thomas Moran.

In IEEE journals, like *IEEE Communications Magazine* and *IEEE Distributed Systems Online*, there are many published articles related to collaborative systems issues. Some of these articles are the followings:

- *Collaborative Virtual Environments: From Birth to Standardization*, published in *IEEE Communications Magazine, April 2004*, by Chris Joslin, Thomas Di Giacomo and Nadia Magnenat-Thalmann;
- *Communication Architecture for Cooperative Systems in Europe*, published in *IEEE Communications Magazine, May 2009*, by Timo Kosch, Ilse Kulp, Marc Bechler, Markus Strassberger, Benjamin Weyl and Robert Lasowski; [11]
- *Globule: A Collaborative Content Delivery Network*, published in *IEEE Communications Magazine, August 2006*, by Guillaume Pierre and Maarten van Steen;
- *Collaborative Web Computing: From Desktops to Webtops*, published in *IEEE Distributed Systems Online, Vol. 8, No. 4, 2007*, by Haifeng Shen, Zhonghua Yang, and Chengzheng Sun;
- *MoCA: A Middleware for Developing Collaborative Applications for Mobile Users*, published in *IEEE Distributed Systems Online, Vol. 5, No. 10, 2004*, by Vagner Sacramento, Markus Endler, Hana Rubinsztejn, Luciana Lima, Kleder Gonçalves, Fernando Nascimento and Giulliano Bueno;
- *Collaborative Computing Community - Leveraging Single-User Applications for Multiuser Distributed Collaboration*, published in *IEEE Distributed Systems Online, Vol. 7, No. 4, 2006*, by Haifeng Shen and Chengzheng Sun.

The most important researchers in the field of collaborative systems, like 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, Nathanael Thompson and Haiyun Luo from the University of Illinois Urbana-Champaign wrote numerous articles in devoted periodicals, such as: CIO Magazine, XML Magazine, AIIM E-DOC Magazine, D-Lib Magazine, NASA-Ask Magazine, SIGNAL Magazine, LINUX Magazine, M&S Magazine and American Economic Review.

3. Conferences

At conferences, the volumes which publish the communications groups these communications in sections like:

- collaborative applications;

- industrial collaborative systems;
- collaborative technologies;
- collaborative engineering;
- industrial computing.

In time, there were numerous conferences on collaborative systems, such as *The 2nd International Conference on Collaborative Computing: Networking, Applications and Worksharing,* sponsored by IEEE Computer Society, Create-Net and the International Association of Communication in Science and Technology (ICST), conference held in Atlanta, Georgia, USA, during November 17-20, 2006. This conference was launched to serve as a first international forum for discussions of industrial and academic researchers, practitioners and students interested about collaboration in networks and shared applications. The users collaborative applications allow people and computers to work together productively.

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 on collaborative systems issues.

Other workshops and conferences on collaborative systems organized by the Babes-Bolyai University 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. [10]

The goal of the *International Workshop in Collaborative Systems and Information Society* was to bring together Romanian specialists oriented on collaborative support systems and The Information Society issues. The workshop was held at Babeş-Bolyai University, Cluj-Napoca, Romania, on 10-12 October 2008**.**

The paper *Serial vs. Concurrent Scheduling of Transmission and Processing Tasks in Collaborative Systems*, written by Sasa Junuzovic and Prasun Dewan and presented at *The 2008 CollaborateCom Conference, Orlando, Florida, USA*, outline the authors preoccupation in the collaborative systems field. Other international conferences dedicated on collaborative systems are *The 2009 18th IEEE International Workshops on Enabling Technologies: Infrastructures for Collaborative Enterprises, The 2008 International Symposium on Collaborative Technologies and Systems (CTS 2008), The 16th IEEE International Workshops on Enabling Technologies: Infrastructure for Collaborative Enterprises (WETICE 2007)*.

There are also international conferences which have topics on collaborative systems. These conferences are *The 2009 Second International Conferences on Advances in Computer-Human Interactions (ACHI 2009), The 11th International Conference on Parallel and Distributed Systems - Workshops (ICPADS'05)* and *The 2007 3rd International Conference on Collaborative Computing: Networking, Applications and Worksharing*.

The *Ninth International Conference on Informatics in Economy*, held in Bucharest, Romania, on 07-08 May 2009, was a great opportunity for the researchers in the collaborative systems to present their results. The conference had a special section dedicated on this field.

The *Second International Conference on Advances in Computer-Human Interaction*, held in Cancun, Mexico, on 01-07 February 2009, was originally proposed as a result of a paradigm shift in the most recent achievements and future trends in human interactions with increasingly complex systems.

The *4th IASTED International Conference on Knowledge Sharing and Collaborative Engineering* from 29 November - 1 December 2006, held in St. Thomas, US Virgin Islands, uderline the progress in research and current applications in the filed of collaborative engineering and tried to predict future trends and developments.

In the *Proceedings of the International Conference on Cooperative Information Systems (CoopIS)*, held between October 31 – November 4, 2005, in Agia Napa, Cyprus, the researchers Steven Xia, David Sun, Chengzheng Sun and David Chen have published the paper *A collaborative table editing technique based on transparent adaptation*, that describe the CoWord – a real-time collaborative editing system.

The *International Conference on Intelligent Networking and Collaborative Systems (INCoS 2009)*, organized in Barcelona, Spain, on November 4 - 6, 2009, covers the latest advances in intelligent social networks and collaborative systems that lead to gain competitive advantages in business and academia scenarios. The ultimate aim is to stimulate research that will lead to the creation of responsive environments for networking and, at longer-term, the development of adaptive, secure, mobile, and intuitive intelligent systems for collaborative work and learning. Virtual campuses and organizations strongly leverage intelligent networking and collaborative systems by a great variety of formal and informal electronic relations, such as business-to-business, peer-to-peer and many types of online collaborative learning interactions. This has resulted in entangled systems that need to be managed efficiently and in an autonomous way. Social network analysis is also a rapidly growing field to investigate the dynamics and structure of intelligent Web-based networking and collaborative systems. [12]

4. Books

The names of the most important books published on collaborative systems are the followings: *Designing Collaborative Systems: A Practical Guide to Ethnography*, *Cooperative Systems Design: Scenario-based Design of Collaborative Systems*, *Collaborative Multi-Agent Systems*, *Metrics of collaborative systems*, *Distributed Artificial Intelligence, Agent Technology, and Collaborative Applications*, *Multiple approaches to evaluating multi-modal collaborative systems* and *Collaborative Intelligent Educational Systems*.

Andy Crabtree has published the book *Designing Collaborative Systems: A Practical Guide to Ethnography* at Springer Publisher House in 2003. Andy Crabtree is rightly acknowledged to be a major exponent of the use of Ethnomethodologically informed ethnography in design. In this book, he makes three recommendations to designers of interactive systems.

- they should broaden their conceptual frameworks to encompass and address the collaborative nature of work rather than adopt the somewhat narrow, task focus adopted by HCI;
- they should complement their reliance on formal methods for requirements analysis with the findings of informal ethnography;
- they should replace ‘constructive’ analysis of the context of use based upon bowdlerised versions of the scientific method with descriptions of the patterns of typification used in the workaday world of work. [13]

Crabtree define collaborative systems like interactive systems. Collaborative work can be successful if all members show goodwill and responsibility. Collaboration in a virtual campus is necessary to deal with such large projects. The collaborative and essentially social character of work need to be appreciated in undertaking the design of interactive systems. [14]

Francoise Darses, Rose Dieng, Carla Simone and Manuel Zacklad have published the book *Cooperative Systems Design: Scenario-based Design of Collaborative Systems* [15] at IOS Press in the year 2004. The book focuses on the following subjects:

- understanding and modeling of collaborative work situations which are mediated by technical artefacts, either computational or not;

- developing appropriate design methodologies for cooperative work analysis and cooperative systems design;
- developing new technologies supporting cooperation; evaluating and measuring the performance of cooperative systems.

This publication puts a special emphasis on the issue of Scenario-Based Design of Collaborative Systems. It discusses issues such as scenarios as means for understanding how computer systems might enhance cooperation and scenarios as a common language between users, developers and management. [16]

There is about the collaborative systems writing of a well developed specialty. The book *Collaborative Multi-Agent Systems* [17] 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 Al. But, while the object-oriented methodologies have to be engaged so that software projects become executable in the software industry. [18]

Ion Ivan, Catalin Boja and Cristian Ciurea have written in 2007 the book *Metrics of collaborative systems*, published by ASE, and presented at the scientific seminar Octav Onicescu in 13 May 2008.

In 2009, Vijayan Sugumaran have published the book *Distributed Artificial Intelligence, Agent Technology, and Collaborative Applications* which covers significant artificial intelligence subjects such as information retrieval, conceptual modeling, supply chain demand forecasting, and machine learning algorithms. [19]

Lee Silber, Andrew Chapman and Linda Krall have launched in 2009 the book *The Wild Idea Club: A Collaborative System to Solve Workplace Problems, Improve Efficiency, and Boost Your Bottom Line*, which has 192 pages and is structured in seven chapters. The Wild Idea Club will help you get there, by providing managers with an easy, step-by-step approach that harnesses the collective genius of their people to drive innovation, improve efficiency, and increase morale. In tough times like these encouraging employees to work together to tackle tough issues on their own is not a luxury, but a survival tool. When people start seeing possibilities instead of problems something amazing happens: they find themselves actually working together toward a common goal that benefits everyone and their organization. [20]

In 2009, at Babes-Bolyai University of Cluj-Napoca, Mihaela Muntean presented the PhD Thesis *Contributions to conception, design and implementation of some collaborative systems*, in which are described intelligent agents, perceived as being autonomous and having skills of collaboration and learning from previous experiences. 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. [21]

In the book *Multiple approaches to evaluating multi-modal collaborative systems*, it is analyzed a collaborative system model representing a training on different chirurgical activities that is done in a virtual medium. The training is based on the scenario in which the instructor and the trainee are on different locations. [8]

Nilufar Baghaei, member of the Intelligent Computer Tutoring and the Network Security research groups at the University of Canterbury, has written the book *Collaborative Intelligent Educational Systems*, published in 2008 at VDM Verlag. This book presents

COLLECT-UML, the first constraint-based ITS that supports collaboration. It teaches the design of object-oriented software, while providing feedback on collaboration between the users. The system was evaluated in two studies and was shown to be highly effective in teaching the domain knowledge as well as successful collaboration. This technique should be useful to professionals in Artificial Intelligence and Education fields, or anyone who may be developing online computer-based teaching tools. [22]

5. Websites

There are many public sites on collaborative systems, such as:

- *http://www.collaboratecom.org*: is the site where are presented some conferences on collaborative systems issues; the 5th International Conference on Collaborative Computing: Networking, Applications and Worksharing will be held on November 11-14, 2009, in Crystal City, Washington; the Fifth International Conference on Collaborative Computing (CollaborateCom 2009) will continue to serve as a premier international forum for discussion among academic and industrial researchers, practitioners, and students interested in collaborative networking, technology and systems, and applications;

- *http://www.iccs.inf.ed.ac.uk*: is the site of the Institute for Communication and Collaborative Systems of Edinburgh University, England, dedicated to research in human communication and communication between people and computers using text, speech, graphics and design of interactive dialogue systems;

- *http://www.usabilityfirst.com/groupware/awareness*: this site provides a series of knowledge in the collaborative systems field; when people use technology to communicate, different types of information are communicated through several channels, but implicitly or explicitly;

- *http://www.cs.umd.edu/~traum/PM*: on this site were posted discussions of the Symposium on Psychological Models of Communication in Collaborative Systems, held in 5-7 November 1999 to Massachusetts, USA; collaborative systems are getting more theoretical support offered by communication technology; the theories and principles of psychology are related to the same procedures that are crucial for the functioning of agents and collaborative systems;

- *http://www.wicollaborative.org*: is the site of the Wisconsin Health Collaborative Systems and serves as a resource for project coordinators, members of the coordinating committee and team members which are involved in collaborative health systems development;

- *http://cocasoft.csdl.tamu.edu/~lidu/courses/csm06s/index.html*: present models and collaborative systems; social activities like the economy, management, games, education and software engineering, are generally collaborative by nature; the collaborative support has become an integral part of modern computer systems;

- *http://ei.cs.vt.edu/~cscw*: on this site is described the human-computer interaction that exist within collaborative systems;

- *http://acsl.cs.uiuc.edu/acsl.html*: is the site of the Advanced Collaborative Systems Laboratory; the advanced collaborative systems describe the qualities required by the next generation of IT applications; these new generation systems will be advanced because they will operate in a rich and complex environment and, at the same time, they must be smart and must adapt in order to assist the man in the navigation and exploration of that environment.

- *http://www.collaborative-systems.org*: is the Alan Baljeu website dedicated for the idea and implementation of collaborative systems.

- *http://cooffice.ntu.edu.sg/coword/index.html*: is the site for the presentation of CoWord – a real-time collaborative editing system; CoWord converts Microsoft Word into a real-time multi-user collaborative word processor.

On the website *http://www.ctcevents.com/presentations* are presented the debates of the Collaborative Technologies Conference, conference made at the Seaport Hotel, Boston, on 19-22 June 2006.

6. Conclusions

The field of collaborative systems is very developed and become very interesting for researchers dealing with such problems. That explain the big number of books published, the launch of new journals and the organization of international conferences.

In every country and in many universities exist a group of professors, young researchers and students interested in collaborative systems issues. Their goal is to encourage researchers and industry specialists to discover and develop the field of collaborative systems.

The apparition of new journals help the researchers to disseminate their results and contribute to create relationships between they and other specialists in the collaborative systems.

The results obtained by researchers proves that the field of collaborative systems is an important subject of interest for the academic world and for the industry staff.

Acknowledgements

This article is a result of the project „Doctoral Program and PhD Students in the education research and innovation triangle". This project is co funded by European Social Fund through The Sectorial Operational Programme for Human Resources Development 2007-2013, coordinated by The Bucharest Academy of Economic Studies, project no. 7832, Doctoral Program and PhD Students in the education research and innovation triangle, DOC-ECI.

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