SIGABIS Exchanges,

an official publication of the Association for Information Systems (AIS)

Special Interest Group on Agent-based Information Systems (SIGABIS)

Volume 4, Issue 1

May 1st, 2006

SIGABIS
www.agentbasedis.org

History

This SIG was founded by Chris Schlueter Langdon and Riyaz Sikora and is one of the first six officially sanctioned groups announced in ISWORLD in July 2001.

Officers

Chris Schlueter Langdon
[Co-founder/chair; Web site, SIGABIS editor] (USC CTM)

Riyaz Sikora
[Co-founder/chair; INFORMS] (U of Texas at Arlington)

Selwyn Piramuthu, University of Florida
[VP of Finance] (U of Florida)

Vijay Sugumaran
[VP of AMCIS] (U of Oakland)

Board of Advisors

Prof. John H. Holland, Honorary Member
(U of Michigan, Santa Fe Institute, World Economic Forum)

Prof. Steven O. Kimbrough
(The Wharton School, University of Pennsylvania)

Prof. Dan O'Leary
(USC Marshall School of Business)

Prof. Mike J. Shaw
(University of Illinois at Urbana-Champaign)

Inside this issue:

S I G A B I S: An Introduction

History

The Special Interest Group on Agent-Based Information Systems (SIGABIS) is affiliated with the Association for Information Systems (AIS), the premier global organization for academics specializing in Information Systems. Our Web site went live in 2002, and 2003 was our first year of operations.

Purpose

The **agent metaphor** has become popular in mainstream computing and business schools largely due to its suitability for the study of distributed systems, such as the Internet and the Web.

We expect to see the emergence of new **distribution channel structures** and **customer interfaces** (e.g., 1-to-1 customization, recommendation 'engines'), **supply chain topologies** (e.g., virtual business networks), and **market-making mechanisms** that use new kinds of intelligent, distributed computational processes in the form of agents.

Mission

SIGABIS is a forum to bring together like-minded researchers and practitioners to:

- Collaborate in rigorously building agent-based computational theory and practice.
- Promote the advantages of agent-based computational modeling.
- Advance scientific research in areas that can benefit from agent-based techniques. (csl)

Calls for Papers + Work in Progress + Upcoming Events

Call for Papers:

(1) Track at **INFORMS 06**, Annual Meeting, November 8-9, Pittsburgh, PA; Chair: Riyaz Sikora.

(2) Tentative announcement: Track at **WeB 06,** the 5th, pre-ICIS Workshop on E-Business 2005, December 8-9, Milwaukee; Deadlines: To be announced; Co-Chairs: Riyaz Sikora and Chris Langdon.

(3) Please check Web site for updates.

Upcoming Events:

Track at **AMCIS 06** Americas Conference on IS 2006, August 4-6, Acapulco, Mexico; Co-Chairs: Vijayan Sugumaran, Oakland University, and Stefan Kirn, University of Stuttgart/Hohenheim.

Announcement:

In order to continue to grow SIGABIS while maintaining the high quality of events new officers have been added.

Please welcome our new SIGABIS officers.

VP of Finance: Selwyn Piramuthu, University of Florida. Selwyn is an expert with a strong publishing record that includes top IS Journals, such as *ISR*.

VP of AMCIS Meeting: Vijay Sugumaran, University of Oakland. Vijay has been a prolific contributor. He is the founding editor of *IJIIT*.

The Association for Information Systems (AIS) is "the premier global organization for academics specializing in Information Systems" (www.aisnet.org).

SIGABIS Focus

Our group is strictly focused on agent-based information systems. It is therefore important to explain how we define this and the scope of our SIG.

What is an IS?

In line with the research literature, we define an IS as a group of information technology (IT) components serving a common purpose, which is to automate a particular set of business activities (S. Langdon 2003, Bakos 1985; Dewett and Jones 2001, 317-320).

What is an "agent?"

According to the Merriam Webster Collegiate Dictionary 2002 the origin of the term "agent" dates back to 15th century. The term can be defined as "one that acts or exerts power" or "a means or instrument by which a guiding intelligence achieves a result". We follow Holland, an artificial intelligence scholar and genetic algorithms pioneer, in our conceptualization of an agent in IS. In his research on complex adaptive systems--nonlinear systems defined by the interactions of large numbers of adaptive agents--Holland borrowed the term "agents" from economics "to refer to active elements without invoking specific contexts" (1995, 6-7).

The field of economics that Holland was referring to is **Agency Theory**, which explains how to best organize the relationship between one party--the **principal**--who determines the work, and another party--the **agent**--who undertakes the work (Ross 1973; Grossman and Hart 1983; and for a survey, see Sappington 1991). (csl)

Agency theory analyzes the costs of resolving 2 types of conflicts that can arise between principals and agents under conditions of incomplete information and uncertainty: (1) **Adverse selection** is the condition under which the principal cannot ascertain if the agent accurately represents his ability to do the work for which he is being paid. (2) **Moral hazard** is the condition under which the principal cannot be sure if the agent has put forth maximal effort (Eisenhardt 1989).

Research Area Strategy: Promoting Depth and Breadth

SIGABIS promotes rigorous research and, therefore, emphasizes depth by hosting highly focused **Research Areas (RAs)**. The breadth of agent-based IS knowledge grows with every new research area that is added to the SIG. Each RA is edited by an expert in this field, the Area Editor (AE). In 2003, our first year of operation, we have launched our first three RAs:

RA1: Study of **Emergent Behavior** and Strategic Simulation using Complex Adaptive Systems (CAS).

RA2: **Agent Learning**.

RA3: **Distributed Systems Architectures** and Web Services—How innovation with I*T* (*T*echnology components: protocols, etc.) affects I*S* (*S*ystems: e-delivery, etc.) capabilities.

We need your involvement: Please don't hesitate to contact us if you are interested in running a RA or if you like to write a piece or research note in *SIGABIS Exchanges*! (csl)

RA1 follows the tradition of laboratory experiments as a tool in **empirical economic analysis** established by Smith. He pioneered tests of predictions from economic theory by way of laboratory experiments (Smith 1962; overview in Kagel and Roth 1995).

Smith "initiated the use of the laboratory as a "**wind tunnel**" in order to study the performance of proposed institutional mechanisms for deregulation, privatization, and the provision of public goods" (The Royal Swedish Academy of Sciences 2002, 9).

RA3: "A **Web service** is viewed as an abstract notion that must be implemented by a concrete **agent**. The agent is the concrete entity (a piece of software) that sends and receives messages, while the service is the abstract set of functionality that is provided" (W3C 2003, 7).

Update RA 2: Learning and Adaptation in MAS (by Riyaz Sikora)

Multi-Agent Systems (MAS) can typically become very complex and their behaviors can be hard to specify. Since, by definition, a MAS consists of a group of autonomous agents, one of the key challenges in designing a MAS is coordinating the actions of the agents. In a dynamic environment where the actions of the agents are also interdependent on each other, it is especially critical that the agents learn to adapt their actions to the actions of other agents. Furthermore, when designing agent systems it is impossible to foresee all the potential situations an agent may encounter and define behavioral repertoires and activities optimally in advance. Agents therefore have to learn from, and adapt to, their environment, especially in a multi-agent setting.

Until recently, research in the field of machine learning (ML) mainly concentrated on learning techniques and methods in single-agent or isolated-system settings. More and more, ML is being explored as a vital component to address challenges in multi-agent systems (Weiss and Sen, 1996). For example, many application domains are envisioned in which teams of software agents or robots learn to cooperate amongst each other and with human beings to achieve global objectives. Learning may also be essential in many non-cooperative domains such as economics and finance, where classical game-theoretic solutions are either infeasible or inappropriate. Today the area of learning in MAS receives broad and steadily increasing attention. This is also reflected by the growing number of publications in this area (for collections of papers related to learning in MAS, see Huhns and Weiss, 1988; Imam., 1996; Sen, 1998; Weiss, 1998) .

At the same time, multi-agent learning poses significant theoretical challenges, par-

(Continued on page 3)

ticularly in understanding how agents can learn and adapt in the presence of other agents that are simultaneously learning and adapting. This is a fertile area of research that seems ripe for progress: the numerous and significant theoretical developments of the 1990s, in fields such as Bayesian, game-theoretic, decision-theoretic, and evolutionary learning, can now be extended to more challenging multi-agent scenarios (Weiss, 2000).

We see two main streams of MAS research that incorporate learning:

(1) MAS that incorporate learning into the agents so that the agents learn to adapt to their environment, and

(2) MAS systems designed for learning tasks or for discovering new knowledge (e.g., data mining).

References

Huhns, M. and Weiss, G., editors. Special Issue on Multi-agent Learning, *Machine Learning*. Vol. 33(2-3), 1998.

Imam., I.F., Intelligent adaptive agents. Papers from the 1996 AAAI Workshop. Technical Report WS-96-04, AAAI Press, 1996.

Sen, S., editor. Special Issue on Evolution and Learning in Multi-agent Systems of the International Journal of Human-Computer Studies. Vol. 48(1), 1998.

Weiss, G. and Sen, S., "Adaptation and Learning in Multi-Agent Systems," Springer-Verlag *Lecture Notes in Artificial Intelligence*, Volume 1042, 1996.

Weiss, G., editor. Special Issue on Learning in Distributed Artificial Intelligence Systems of the Journal of Experimental and Theoretical Artificial Intelligence. Vol. 10(3), 1998.

Weiss, G**.,** *Multiagent Systems : A Modern Approach to Distributed Artificial Intelligence*, MIT Press, 2000.

Research Note: Agents in the Information Supply Chain

(by Donald J. Berndt and Alan R. Hevner)

As we expand the directions of our research on health care data warehouses [1, 2], a key area of investigation is the health care information supply chain. In this brief research note, we identify several research challenges in the effective use of information supply chains for decision-making and the potential use of intelligent agents to meet these challenges.

Data-intensive services in a service-oriented architecture contribute to the capture, generation, cleaning, transformation, delivery, and analysis of data. The service-oriented view of computing leads naturally to the notion of information supply chains as cooperating services that deliver data for decision-making activities. Past research on supply chain management can shed light on information supply chains, however clear differences between the physical and digital world will need to be considered.

One major difference between physical and information supply chains is the continuous, possibly real-time, nature of many data generation services. Recent research efforts have recognized the importance of managing streaming real-time data in such domains as traffic control, communication networks, geospatial mapping, astronomy, and many other fields. Handling streaming data places a number of new requirements on systems beyond traditional data management [3]. By definition streaming data are unbounded. There is no identifiable end to the data which must be monitored, chunked, and subsequently analyzed. In addition, real-time streaming data carry no guarantees of quality. Consumers must depend upon the data sources and transmission facilities for the accuracy, timeliness, and completeness of the incoming data streams. Robustness in the face of intermittent source or transmission failures, data arriving out of time order, and incorrect data resulting from systemic errors or transmission corruption provide additional challenges.

The problems of querying data streams may seem similar to traditional database querying, online analytic processing (OLAP), and data mining. However, the high-volume and unbounded nature of data streams along with the need for real-time results call for new query concepts and optimization strategies. Challenges in data stream query processing include data reduction, chunking or punctuation, sliding windows, disordered data, and summarization.

Thus, the management of data streams is critical to the effective application of information supply chains. Using the language of water management, streams must be directed and controlled (aqueducts and sluices), with adequate flood control, in order to be compatible with information supply chains. Thinking further about hotly debated water rights, data privacy and security challenges enter the debate. Any time a data-intensive service is used in a complex information system, the boundaries must be explicitly managed. The boundary locations could affect service quality levels, threaten privacy and security policies, or otherwise compromise reliance on underlying services.

"We see tremendous potential for […] agents to support information supply chains. […]

The research challenge is to build […] agent-based analytic environments and to evaluate their effectiveness in […] automating critical decision-making tasks."

Assuming that an information supply chain is established, fed by a collection of data-intensive services, there still remains the challenge of effectively using the resources for knowledge management tasks. Consider a set of key decision-making activities that make use of a variety of data streams for analysis. The decision could be an ad-hoc task requiring ongoing revisions or a well-structured task, with clear a priori goals, or somewhere in between. What tools sit on the current desktop to help? There seems to be a knowledge management gap between our desktop inventory and the demands of

(Continued on page 4)

(Continued from page 3)
interacting with the information supply chain. Which tools "plug and play" with data streams, provide localized information storage, and define a natural set of operations on the output of data services? As knowledge workers, we draw on a set of pre-existing tools that often requires building a one-of-a-kind data analytic environment each time we face a new decision-making challenge. Spreadsheets, statistical packages, and desktop databases are typically cobbled together to implement a solution using macros, query languages, and proprietary scripting facilities. Some data mining tools or mathematical packages are becoming available, but they still provide only isolated capabilities, lacking real integration features in the emerging world of service-oriented computing.

The challenge is to consider the natural mental models of data and essential operations that best support our decision-making activities. These are likely to be context specific, such as the requirements of the health care field. However, there are some cross-cutting operations that provide the basis for re-thinking the desktop for use with the information supply chain and service-oriented computing. The first step could be to extend the evolving SOA standards (e.g., XML, SOAP, WDSL) through the information supply chain onto the desktop. More complete decision-making capabilities will require the design of a data (or rather information) manipulation language that aligns more easily with human decision-making, rather than the underlying technologies. For instance, the structured query language (SQL) is well suited to the relational data model, but at times can require significant cognitive effort for inclusion in knowledge management tasks.

While there have been some significant alternatives to the current desktop metaphor, most have focused on simply organizing and searching local content. Commercial offerings include several initiatives by Google and the new desktop designs by Apple Computer. All of these are inward facing, focused on the growing amount of information stored on personal computing devices. The goal of our research is more outward facing, reconsidering the designs of desktop tools that can organize and navigate the growing number of data-intensive web services that serve as resources in decision making.

We see tremendous potential for the development of software agents to support information supply chains. The idea of agents acting on your behalf to scour and organize information sources, learning and improving with each task, may lead to innovative approaches for decision-making on the desktop. It is easy to imagine an agent between you and one or more potentially overwhelming data streams, keeping back the flood waters while diverting the most relevant, highest quality information to an integrated analytic toolkit on your desktop. The research challenge is to build such agent-based analytic environments and to evaluate their effectiveness in supporting or, eventually, automating critical decision-making tasks.

References

1. D. Berndt, J. Fisher, A. Hevner, and J. Studnicki, "Healthcare Data Warehousing and Quality Assurance," *IEEE Computer*, Vol. 34, No. 12, December 2001, pp. 33-42.
2. D. Berndt, A. Hevner, and J. Studnicki, "The CATCH Data Warehouse: Support for Community Health Care Decision Making," *Decision Support Systems*, Vol. 35, June 2003, pp. 367-384.
3. N. Chaudhry, K. Shaw, and M. Abdelguerfi, Editors, *Stream Data Management*, Springer, Inc., 2005.

Donald Berndt and Al Hevner are professors in the Information Systems and Decision Sciences Department in the College of Business Administration at the University of South Florida.

Dr. Hevner holds the Citigroup/ Hidden River Chair of Distributed Technology. His research interests include IS development, software engineering, distributed database systems, healthcare IS and telemedicine. He has published over 120 research papers on these topics.

SIGABIS @ WEB 05, Las Vegas, NE

Session 2c: Web Intelligence (II) (11:00-12:15PM)

"What Will You Like? Ask People Who Are Like You: Past and Future Research on Collaborative Filtering in Recommender Systems,"
Zhenxue Zhang and Dongsong Zhang

"Adaptive Information Systems for Mass Customization: A Web Services Based Architecture and Case Study,"
Andreas Dietrich, Vijayan Sugumaran and Stefan Kirn

"Web User Navigation Prediction: An Integrated Model Using Sequence-based Clustering and Markov Chain Model,"
Sungjune Park and Nallan C. Suresh

"An Ensemble Approach for Text Categorization with Positive and Unlabeled Examples,"
Chih-Ping Wei, Hsueh-Ching Chen and Tsang-Hsiang Cheng
(csl)

Impressum

SIGABIS Exchanges is the official newsletter of the Association for Information Systems (AIS) Special Interest Group on Agent-based Information Systems.

Editor in Chief: Chris S. Langdon, csl@ebizstrategy.org, 310.623.7340 phone, 415.680.1549 fax.