Accomplishments of the ICEIMT'02

Summary Paper

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Abstract: The purpose of this paper is to analyze the activities of this initiative on Enterprise Intra- and Inter-organizational Integration--International Consensus (EI3-IC) and especially of its conference the ICEIMT'02. We have extracted the major accomplishments, identified how the discussions have furthered our knowledge about enterprise integration, and attempted to show how the information was parlayed into better knowledge about the topic. In addition to the analysis of the initiative as a whole and of its results, we report results from a plenary discussion, held as the closing session of the conference.

1 ICEIMT'02

ICEIMT'02 strove to improve international consensus on issues in enterprise engineering, modeling, and integration technologies with emphasis on inter-organizational relations. The conference identified barriers, proposed solutions, and communicated results, thereby helping to justify the technology to industry so that key technology can be moved profitably from the international R&D domain to broadly based implementation.

The conference agenda comprised reports from workshops and invited papers. The papers were intended to communicate status and a sampling of the many different views on enterprise integration. The program especially emphasized results from the four workshops that preceded the conference. The workshops produced recommendations on research directions and a number of proposals for R&D projects.

Selected experts in the fields of engineering, business administration, and computer science attended the workshops. About 75 persons from 18 coun-

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tries on 5 continents attended the ICEIMT'02, coming from academic institutions, government, industry, and consortia. The majority was aligned with academia. These conference proceedings provide about 40 papers that offer a very comprehensive overview of the state-of-the-art in of enterprise integration as well as providing directions for further research.

2 PRESENT STATE OF INTEGRATION

In *ICEIMT: History and Challenges*, in the introductory section of this book, Ted Goranson has detailed the things we thought we knew about integration in 1992 and 1997. In fact, we knew enough to implement solutions in some cases. These solutions have produced mixed benefits. Some of them have served us well. Others have performed as planned but have created significant barriers to further improvement.

For example, as the chunks of enterprise that are able to share information in an electronic format get larger, the more diverse the context, the more varied the granularity of the concepts, and the more difficult the subject is to model. In addition, the level of executive necessary to approve improvement projects rises as the scope of improvement increases. Often this level is beyond the technical ability of the executive so there is increasing trepidation about such large improvements.

Some of the large integration products, such as enterprise-resource planning, are expensive and to achieve the interoperability needed, they force the enterprise to conform to the model of the software. This sets up a larger barrier within the enterprise. But also, with the advent of the Internet, global commerce, and virtual enterprises these systems also become formidable barriers to electronic commerce and, so-called supply-chain integration becomes more frustrating to accomplish.

Past attempts to integrate migrated from installing better information-transmission conduits, to mandating similar hardware, common software packages, and common languages. We have not succeeded because we have avoided the real problem, the hard problem, the semantics involved. Regardless of investments in mandating the above assets to be common, for there to be information exchange in which the receiver acts as the sender intended, connoting an understanding, the sign and symbols in the syntax must convey the same meaning, no more or no less. We now have concluded that a tool called ontology is the key to congruence of meaning between the sender and receiver. Five years ago we were just beginning to appreciate the importance of a good ontology.

The purpose of ICEIMT'02 has been to address the difficult parts of transferring information among applications and organizations.

3 VISION

As in the past, cultural inertia continues to limit the effectiveness and use of standards to constrain enterprises. Enterprise management will insist upon retaining the freedom to tinker with the enterprise and process design. This will be a survival maneuver to improve operational efficiency and to differentiate products. Therefore, attempts to standardize enterprises, processes, or reference architectures will most probably be ignored.

A primary focus of the conference was on similar visions for a new enterprise environment that would use a combination of standards and tools to allow inter-operating business processes to determine the best way to communicate information among those processes in a way that elicits desired behavior. These are called self-integrating processes and they may be thought of as software that adapts to its environment with no human assistance. We assume an environment in which not all interfaces are known, but the nature of the interfaces can be discovered, such as by, querying, learning and guessing. The new environment would operate for intra-organizational transactions and inter-organizational transactions on a global scale.

3.1 Model-Driven Enterprises

Another part of the vision is to have the enterprise model, to the most extent practicable, operate enterprises. This EI3-IC spent considerable time in its working groups exploring how these model-driven processes could work, and discovering that very little, if any, new technology is required to make that happen. We determined that the engines that accomplish the model-driven enterprises, software agents, need knowledge of enterprise goals, process goals, a system to trigger and accomplish the work, and a system that oversees the work that also knows the enterprise and process goals. These agents can adjust the enterprise to benefit the enterprise, and, perhaps, at the expense of the good of individual processes. To act this way the agents will need some sense of self, and information that humans use to form patterns of knowledge, with which it can assess value. This is real-world information with which humans create what we call tacit, implicit, or unspoken knowledge. Setting this up will require skill in knowing what to model, what to include in knowledge bases, and knowing what is unnecessary to include.

3.2 Interoperability

One of the important changes from prior ICEIMT endeavors is the focus on process interoperability. There were attempts to define exactly what we mean by interoperability. Francois Vernadat, in his paper that is presented in

the first-session section of this book: *Enterprise Modeling and Integration: from Fact Modeling to Enterprise Interoperability* has provided a flexible and extendible definition of system interoperability. We have extended that definition toward the part of the system that will provide better information transfer.

- System interoperability = Ability of a system to use parts of another system
- Enterprise interoperability = Ability of an enterprise to use parts of another enterprise
- Process interoperability = Ability of a process to use parts of another process
- Information-aspect interoperability = Ability of the information aspect of one process to use part of the information aspect of another process

4 INTEROPERABILITY SITUATION

Processes that communicate information were the focus of the last two ICEIMT efforts even though the problem was identified as an enterprise-integration problem. The earlier ICEIMT vision foresaw that true integration would be next to impossible and advocated a concept called federation. Federation led to the concept of self-integration, in which processes learn to deal with the situation they encounter on an ad hoc basis.

In his history paper, Goranson analyzed the changing integration situation, which can be summarized as:

- Worse now than in 1992 and 1997. Because the scope of what is needed is larger, and because of the inflexible nature of some solutions, the problem is now more difficult to solve
- We are now dealing with a supply-chain problem that is larger than the enterprise, rather than dealing merely with intra-enterprise processes.
- The Internet on a global basis has allowed the problem focus to migrate from inside the company border, past the country border, and back to the process border, however now, the processes may be on different continents
- The process-border issue has been reduced to the meaning of information, or semantics--the other problems have been solved largely, leaving the difficult ones yet to be solved.

In other words, the core problem always was meaning of information, and we chose not to recognize it or solve it, because the solution is difficult and expensive.

5 RESULTS OF THE ICEIMT

The Conference ended with an open, interactive discussion on what to do next. Noting that some key leaders and advocates of the process are exiting the scene, or at least reducing their activity, the starting question was if and how to continue the initiative on enterprise integration.

Of the three ICEIMTs, this conference had the fewest attendees, but attendance at the workshops in 2001/2002 was higher than in the two earlier initiatives, 1992 and 1997. People in attendance were mostly from the research aspect of academia. Others attended from consortia--a very few were from individual industries. Some at the conference believed the core research community was as large as always with the loss apparently being among corporate users. One conclusion could be that our workshop-based ICEIMT model provided experts in small working groups with opportunities for detailed discussions and ensuing insight. This process probably provides much more satisfaction to the participants than the paper presentations at the conference. Apparently, because of this perceived value, approval to travel to the workshops is easier to obtain than approval for a conference; plus, attendance is possible on a regional basis when the workshops are conducted in various locations.

The planning for next steps identified discrete areas of need. These are listed below in no particular order. Discussants had diversity of opinion on priorities. Everyone agreed that the core focus of the community on enterprise integration must be maintained, and that the bias toward manufacturing applications be shifted more to the enterprise as a whole. Also, some participants expressed unanimous agreement that the interdisciplinary nature of the work in terms of approaches be emphasized. Most participants seemed to agree that the "demand" side of the equation, attracting users, should not be a focus. Rather, emphasize the "supply" side by consistently improving solutions and the supply of practitioners.

In supporting the supply side, all agreed that the future of the community should be taken into its own hands as an international concern; this is opposed to counting on forthcoming support from the EU as the driving factor. Independently, the immense influence of the Web indicates that the EI community needs to be more active in relevant Web developments.

The group also noted that because EI concentrates on a core set of problems, and because EI is also interdisciplinary in approach, that we should be careful about the "buzzwords" used to characterize the problem and community. Specifically mentioned was the preponderance at this workshop of the term "interoperability". The discussant questioned whether the dilution of focus is worth the discrimination of the concept. Apparently not everyone shared the concern, and no specific recommendation ensued.

6 ACTION LIST

6.1 Create an educational program

This is the core action proposed to create a science of enterprise integration. The notion is that there needs to be a "seed" set of education materials and consonant support for creating (probably graduate) curricula. All agreed on the general need for this as a top priority. Other than including the need for a textbook(s), no details were discussed other than this important action: Mark Fox, University of Toronto, took responsibility for hosting a working session to develop a plan for bringing this about. At least one of these details is the understanding of the academic positioning, whether in industrial engineering, business management, computer science, or other departments. The theme of an article, *Who Needs a Whole MBA?* Business Week, March 25, 2002, was that a specialized master's degree may be more relevant than an MBA. Mentioned is the Massachusetts Institute of Technology's System Design and Management program that combines engineering and business courses. This model seems to be attractive to industry. There could be enterprise engineering included in such a program.

6.2 Create a publication venue

Mark Fox also offered to host the first EI conference in Toronto in 2004, which is seen as the earliest practical time. The planning for this will need a substantial committee, many of whom seemed pre-committed to help. The rationale for the conference primarily is to provide a publication forum, feeding existing journals, or perhaps creating a new one. A substantial majority of the group believes that the key value is in preserving the EI focus of the community. But some voices were raised in support of attaching to one of the large IT conferences instead.

6.3 Continue the workshop process

Many people spoke of the value of the ICEIMT workshops as the primary vehicle for sharing ideas, getting reality checks, and establishing consensus research directions. The preference was for more frequency, perhaps yearly. No action leader volunteered, and the default position now is that this might be folded into the conference, at least initially. However, some murmuring of proposing for EU support for a series of ICEIMT-type workshops was heard, and this might emerge under the banner of proposed projects. The

European Union Sixth Framework has identified an "instrument" that can support these. The EU IST representative and James G. Nell of NIST were impressed by the quality of the workshop attendees, discussions, and reports.

6.4 Support EI standards

The reasoning behind this suggestion was that the EI community depends on standards as a key strategy and focus for interaction. Yet few standards are rationalized from a focused EI perspective and those that do, conflict and compete with others. The idea was that coherent, strong support would help define and center the community.

6.5 Form, propose and execute research projects

Obviously, there was much interest in proposing projects to the EU IST Sixth Framework Program, which seems well disposed to the EI agenda. Probably, this will proceed in the old-fashioned manner, with small affinity groups forming alliances for specific projects. Very likely, the CIMOSA Association may propose for support for some near-term ICEIMT-like workshops.

6.6 Support the vendor base

A vendor spoke up on the reliance of his sector on being exposed periodically to the state-of-the-art. He suggested a *Handbook of Enterprise Integration* that is frequently updated. Peter Bernus, Griffith University, spoke of work underway to fill this need partly. Many others mentioned the importance of feeding the vendor base, but seemed to believe that other actions listed here would be sufficient. One suggestion was that when vendors are invited to another event to give them all a single case study so that comparisons can be made,

6.7 Outreach to parallel communities

As EI is highly interdisciplinary, the importance of outreach to other disciplines is essential. The Web connection has been noted, and also the co-gent academic disciplines. Of special interest is the human-factors community. Presumably, this outreach is not a separate activity (no one volunteered) and will be supported as a philosophy underlying the other actions.

6.8 Develop a clear business case

Only one voice articulated this concern, but the voice was forceful. How this can be supported as an individual activity is not known, so it probably will be satisfied through practical user consciousness in the above listed actions.

7 MAJOR FINDINGS FROM ICEIMT'02 AND EI3-IC

7.1 On agent-oriented solutions

- No additional enterprise modeling languages or methodologies are required to represent the information used to simulate knowledge as used by agents and enterprise models.
- There is a need to plan carefully the amount of tacit knowledge to be made available; that is, provide no more or no less than is necessary to support autonomous agents that perform reasoning-type tasks.

7.2 On process-model concepts

- To improve model reuse and to reduce the complexity and cost of enterprise models, move the semantics-intensive content from the enterprise models to the ontology of the application being modeled.
- Find a way to match up the global, more soft, less deterministic, enterprise-level models with more deterministic, process-level models by modeling the process-level material in the enterprise-level format.
- The ontology is the place to resolve verb-oriented process models and noun-oriented enterprise- and product-object models. These resolutions are necessary to permit such activities as computer-based simulations.
- If we are talking about improving the information sharing and interactions in an enterprise, and the enterprise is a system, then enterprise engineering must use a systems-engineering approach when re-engineering an enterprise.

7.3 On Enterprise Integration community building

- There is a need to meet and discuss these integration issues in a workshop format more often than every five years.
- Pursuant to that end, the group welcomed Mark Fox's proposal to organize the next ICEIMT in Toronto in 2004.
- Formalize an academic curriculum around a to-be-created science of enterprise integration.

8 SUMMARY

The group concluded that we need to create a single focus in the enterprise-integration and enterprise-engineering fields, and publish papers, articles, and success stories in some venue. Implementing this action should be on the agenda for the educational meeting proposed by Mark Fox of University of Toronto. A business case is very complicated, but important to justify significant investment; therefore, a progressive approach would be beneficial if it was created, planned, and undertaken by a group of vendors, users, and R&D types. Planning should begin immediately to preserve the momentum apparent at the ICEIMT'02 in Valencia.