Human and Artificial Agent's Conversations on the GRID

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Abstract

This position paper supports a conversational and social view of future e-Learning activities on the GRID. This evolution of the Web seems to be nicely synergic with current developments in Agents and Agent Communication Languages. Exactly what e-Learning needs in order to go over from a multimedia-based, passive or at best retroactive view of e-Learning resources to a proactive, peer-to-peer approach of social conversations among human and (progressively) artificial autonomous Agents.

Keywords: e-Learning, Grid, Social Informatics, Agents, Agent Communication Languages .

1. INTRODUCTION

While e-Learning is a quite established concept, to be traced back in its roots in the 60ties (the PLATO and TICCIT experiences in the US), the GRID notion is considered as the evolution of the WWW and therefore is quite novel both as a technological solution and as its associated opportunities. It would not be convenient if emerging solutions around the GRID will be in search of their problems in the short term, causing the well known gap that generates frustrations and economic unbalances both in the producers and in the users.

The LeGE WG is an important effort that aims to avoid this possibility by anticipating the conditions for an effective diffusion of the GRID, i.e.: by identifying design constraints that will fit a large significant class of expected uses of the GRID, those around e-Learning. Therefore, it seems to us important from the very beginning of the LeGE WG activities, to point out where e-Learning and the GRID may eventually cross, i.e: why e-Learning's traditional problems may find adequate solutions from developments around the GRID and, vice versa, what kind of developments on GRID's properties will be required by e-Learning needs.

In order to identify the link between GRID's potential technological innovations and e-Learning, one has first to agree about a few basic assumptions concerning the GRID and e-Learning.

2. ASSUMPTIONS ABOUT THE GRID

As to our current intuition, the most important aspect of the GRID concept consists in going beyond the client-server model of communication between software applications for a peer-to-peer one. The same principle has been for years a major objective of autonomous Agent's technologies, even if one may still ask how many multi-agent systems indeed are equipped with a peer-to-peer communication model and thus whether software Agents are really autonomous.

This view of the GRID as the large scale embodiment of autonomous Agent's concepts has certainly to be refined during the LeGE WG project, thanks also to the colleagues more directly concerned with the GRID. By now, we will assume in a first approximation that the GRID will consist of technologies allowing autonomous Agents to perform computations and to communicate on the Net in an optimal way, i.e.: exploiting resources where they are available in a fashion transparent for the Agent user. In the following, a few remarks on how we came to this conclusion.

Looking more deeply into the GRID fundamental notion (movement of processes in order to optimize resource allocation) one indeed discovers that, in order the movement to be useful (effectively optimizing), it has to be decided and executed dynamically. This dynamicity has as a

consequence that a. we have to shift to the GRID the responsibility to execute the movement at run time; b. we have to assign to each process the responsibility to propose to GRID at run time such an optimizing event. Processes, therefore, have to decide autonomously (at least for what concerns their potential reallocation) taking into account the expected workload, their proximity to other processes, etc. The decision process, within each computational process on the GRID, may be very complex - as well as very useful -. Processes, being autonomous on the issue, have to be granted the liberty to formulate requests to other processes about Information necessary for them to decide. Conversations among processes become necessary, initiated by any process and addressing, in principle, any other process. The client-server model is thus insufficient.

Once processes may take the initiative to trigger conversations, they may arrive at the conclusion that it would be good to move to a more suited computational resource to perform their task optimally. This movement has then been decided dynamically by the process as a result of conversations. If we consider that the relocation of processes for optimizing the workload of processors in a distributed environment is a typical service asked of the network, the conclusion is that a service is dynamically generated by processes thanks to previous autonomous conversations. If a service may be generated dynamically, many other services do, as they would use a similar technology (autonomy of taking an initiative, conducting adequate conversations with peers, deciding and finally asking the GRID to perform the physical service). One comes to the conclusion of Foster et al. [1,2] that what initially was conceived for supercomputing and optimization may offer a new generation of models, tools and infrastructures for any activity on the GRID, including e-Commerce, where the dynamic generation of service from conversations is a necessary step for credible transactions. One immediately realizes also that the Web, as it is, has its major shortcoming in the lack of state of the TCP-IP protocol, thus the lack of persistency of conversations.

Indeed, we share the following vision of GRID computing [3]: "The grid metaphor intuitively gives rise to the view of the e-Science infrastructure as a set of services that are provided by particular individuals or institutions for consumption by others. Given this, and coupled with the fact that many research and standards activities are embracing a similar view, we adopt a service-oriented view of the Grid throughout this document (see section 2 for a more detailed justification of this choice). This view is based upon the notion of various entities providing services to one another under various forms of contract (or service level agreement)."

Shifting from a product-oriented to a service-oriented view of the Network is a challenging goal that has necessarily to pass through the analysis, definition and implementation of dynamic conversation protocols. The most recent direction clarifies even better the value added by the GRID with respect to the Web [4]: "The Semantic Web is widely accepted as a means to enhance the Web with machine processable content. However, mostly the Semantic Web is aiming at techniques and technologies for static information, in contrast to dynamic services or distributed computing".

3. ASSUMPTIONS ABOUT E-LEARNING

There is currently much interest in e-learning. We will not survey here the reasons for this interest (see, for instance, the Introduction to [5]).

However, in spite of the apparently massive growth of the offer of e-Learning products and services, and, in principle, of the demand for human learning as it is expressed at individual, institutional and corporate level, we are not convinced at all that the offer and the demand meet in an acceptable way. There are exceptions, but the rule holds that effective, large scale applications of e-Learning are rare.

Our primary interpretation of this paradox concerns the quite simple observation that e-Learning requires a profound transformation of an established practice, for individuals and for Institutions. In e-Learning the three axiomatic assumptions for traditional educational settings: *same content, same time, same location* are not valid. Even if we keep the "same content", yet e-Learning implies asynchronous interactions at a distance. These properties are claimed to be the value added to e-Learning with respect to traditional Education.

Historically, distance learning has been implemented and studied since many years (for an impressive list of contradictory scientific reports on pro's and con's of technologies in Education in the last century, see: http://teleeducation.nb.ca/nosignificantdifference). From those studies, as well as from our own experience in the domain, the lesson we have learned is that we cannot consider e-Learning as an electronic variant of classical Education. That is indeed the problem. Not only the conditions of the educational offer are totally different, but also the cognitive and social attitude of humans require a completely dedicated analysis that most of the times has no precedents and thus requires a research attitude.

e-Learning is therefore NOT an application of technologies to human learning, in the sense that assuming to know what to apply (the technologies) and how (the pedagogy) one puts things together and the result will be a success (people learn). On the contrary, each serious effort risks to be unique in the sense that it requires specific technologies and specific pedagogical principles to be *developed and applied* in a trial and error fashion. This is the challenge of e-Learning.

We believe that the major obstacles for e-Learning are bound to the innovation for individuals and Institutions of the asynchronous distance interactions among humans and electronic resources (documents, but also programs). Surprisingly, the available technical tools are quite sophisticated and ripe, in many respects (for instance, looking at the recent Intelligent Tutoring Systems or AI in Education Conferences one may notice the progress). Perhaps one may better the offer by putting efforts in the integration, or in the dialogue management, that is yet poor in real situations. However, we believe that the bottleneck is more to be found on the human motivation for engaging in e-Learning practices. By "human" we encompass any role: learners, teachers, managers, experts, ... as well as combinations thereof, i.e: societies (classes, groups of teachers, etc.). One of the reasons for a lack of motivation in learners is the difficulty for certification of their learning when is has occurred at a distance. Another is the relative lack of friendlyness of systems (when I'm stuck: who helps me?). The list of problems continues, yet human motivation is crucial in order technologies to be successfully introduced in human social practices.

4. REQUIREMENTS

If the above outlined assumptions about the GRID and about e-Learning are correct, our priorities should be consequent. Hereafter a few consequences.

- The technological research priorities for the Learning GRID concern the integration of simple yet very powerful tools supporting the communication in virtual human communities in such a way that the concerned human Agents feel safe, are motivated and trust the effectiveness of the learning process in wich they engage. Included in this confidence we may consider the effectiveness of heavy computational processes, when required, such as videostreaming, simulations, virtual reality. However, very large potential audiences for e-Learning are far from even envisoning those applications, as they are not convinced that e-Learning helps them to solve their problems. In order to avoid the GRID to become a set of solutions in search of the problems (as it has been sometimes the case in e-Commerce: once more people overestimate short term effects of innovation and underestimate long term ones), we should give the priority to the motivation of humans for e-Learning, we should assume a human-centered or - better - social view of system design. The peer-to-peer model of human learning by focused conversations with teachers, experts and the like (for instance: the pragmatics of dialogues as it is currently expressed in a rudimentary way by Agent Communication Languages and Speech Act Theory) may become a fundamental inspiration for autonomous Agent's software technologies to be developed in order to realize the GRID. Complex standards for interoperability of educational documents - such as SCORM, IMS, EML and the like - may be considered as an important technology push attitude, complementary to the social-user-pull one outlined in these pages. The last deserves a priority as it is relatively immature and at the same time crucial for success. The Semantic GRID will emerge insofar the technologies for Agent-to-Agent conversations and their pragmatic layers will be realized.

- The strategic priorities for the Learning GRID concerns the evaluation and certification of learning effects. Traditional Institutions (in particular teachers) do not trust e-Learning unless in a quite trivial utilitaristic fashion. Teachers do not have the right to consider their e-Learning activities as part of their pedagogical duties. Traditional Institutions are not prepared to certify the knowledge and skills of learners independently from the way they have acquired them (in presence). Retrospectively, in spite of the recommendations to teachers and Institutions, the practice of e-Learning is rare because no one sees his or her interest in investing into a fundamental modification of traditional behaviors. One may show any impressive result of e-Learning experiments, but unless the practice is considered useful by the delegated people and Institutions (the teachers), as a consequence of a reformed statute, it will not be accepted at a large scale as a serious complement to traditional Education. Perhaps it will be useful to look for non institutional potential users, having sincere learning needs, instead of pushing technologies into reluctant Institutions.

- The tactical choices for the Learning GRID should be guided by an experimental, socially oriented and evolutionary view of the infrastructure supporting generic virtual communities. Dialogues are central. As it has been nicely stated in the project, any human collaborative activity requires and implies human learning. Initially the GRID technologies may be dedicated to facilitate mainly human-to-human dialogues (by written, by voice, by video and voice); considering that artificial Agents may incrementally be introduced, once the communities are stable and motivated, in order to enhance learning effects in suitable conditions. The Learning GRID will be a success when communities of users will eventually testimony their positive experiences, not just when communities of producers will advertise their performant solutions. The challenge will be to transform virtual communities into virtual organizations.

5. CONCLUSIONS

If these basic considerations will be elaborated and will influence the follow up of the LeGE WG and the associated projects, we are quite optimistic for its success. After almost 40 years of applications of Computers to Education, one may be skeptical about a large scale success now. Hereafter a reason for our optimism.

The success of the Web consists of the opportunity to access any electronic information wherever it has been produced and stored. The limits of the Web (potentially overcome by the GRID and the autonomous Agents) consist of the lack of conversational, collaborative tools: HTTP is a stateless protocol, and most activities on the Web consist of finding a static page somewhere. The Web is mainly a library. The GRID may transform the source of Information into a source of Knowledge, i.e: a set of documents, programs and humans accessible at any time from anywhere capable to proactively assist "me", a human, in my daily problems by means of conversations. If that is the new scenario for e-Learning, the success is ensured as the major limit of traditional educational applications was due to a multimedia, passive, book-like, at best: retroactive offer while real learners (as well as teachers or humans with other roles) require one (or more) partner(s) in conversations, patient but authoritative, that keeps the motivation high while offering assistance just in time, collaboratively and dialectically.

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