

Improve e-Research by Building a Virtual Society

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ABSTRACT

Though many infrastructures have been and are still to be built to enable e-research, they concentrate mainly on the sharing of resources with human collaboration generally unconsidered. While we favor the idea that resource sharing is important to the success of e-research, we also think human collaboration is of at least the same importance as, if not more than, resource sharing in achieving the goal of e-research. To support human collaboration more effectively to improve e-research, this paper suggests building a virtual society on top of the existing infrastructures. Furthermore it discusses some key issues related to fulfill such a vision.

Keywords

CSCW, Information Seeking, Overlay, Community, Web

1. INTRODUCTION

Driven by the advances in information and communication technology (ICT) as well as the ever more complexity of research issues, the way of scientific research conduct has changed greatly forming the so-called e-research. Nowadays there is a growing dependence on e-research capabilities to access research instruments and facilities, data repositories, common services and application tools.

In the past years, most countries are investing heavily to deliver the capabilities needed by e-research. As a result, many initiatives (e.g., e-Science in the UK and Cyberinfrastructure in the US) are seen and the corresponding technological infrastructures have been set up and put into use. These infrastructures, though they can facilitate resource sharing, leave human collaboration in general unconsidered. Consequently, their potentials are not fully opened.

In our opinion, human collaboration is of at least the same importance as, if not more than, resource sharing in e-research. To achieve the vision of e-research, as pointed out in [1], it is necessary to provide adequate and usable support for collaboration across geographical, institutional and disciplinary boundaries. In this paper, we suggest some collaboration services be built on top of these existing infrastructures and discuss some key issues related.

2. E-RESEARCH PRACTICE

Some typical scenarios of current e-research activities are listed below:

- Search on the Web to gather information related to a certain topic or to find desired products and/or services.
- Publish research results including academic papers, common data sets, application tools, and so on.
- Keep touch with partners via email and/or instant messaging.

- Utilize research instruments and data repositories remotely. Driven by grid technology, this can be done transparently and efficiently.
- Conduct seminars, lectures, tutorials, and training online.

From the scenarios above, we can see that the development of ICT has brought great convenience to scientific research making it possible to do things that are considered impossible ever before. However, at the same time we also observed that the activities above are usually conducted separately and as a result, the improvement is limited.

The reason for such a situation is that current infrastructures are built focusing on resource sharing which, though plays an important role in enabling e-research, itself is not sufficient to implement the goal of e-research. Indeed, failures and/or deficiencies with technology have already been observed [3, 4]. The most known example to us is that search engines can not always return satisfied results.

To provide better support for e-research activities, in our opinion, a comprehensive collaborative working environment should be built on top of existing grid infrastructures. Based on our previous work [2, 5] and as the first step to such a goal, this paper suggests building some collaboration services to form a virtual society.

3. BUILDING A VIRTUAL SOCIETY

3.1 Design Philosophy and Goals

The design of virtual society benefits from the following research:

- CSCW. We base our design on the following findings and/or experiences: 1) real-world work has an ad hoc nature, and 2) to derive the greatest benefit from CSCW, the supporting technology must infiltrate as widely as possible throughout the populace, and 3) a successful collaborative systems must provide enough respect to social habits of end users.
- Ubiquitous computing. It tells us that the most successful technologies are those that recede into the background as we use them. To e-research, this means human is in the first place whereas technologies only function as assistant.
- Social network. It tells us that people can be connected through common associates.

Borne the findings above in mind, our virtual society aims to provide a virtual place for people to interact freely as we do in real world without feeling the existence of computers. Here we focus mainly on informal interaction to show how ICT can be used to expand the channel of interaction.

3.2 System Architecture

The architecture for our virtual society is shown in Figure 1 where different servers (grid node or WWW server) are interconnected forming an overlay and each server serves a portion of users. The

overlay adopts a centralized structure with grid information service as the central point. Functions supplied by a server include: 1) providing personal and/or public space for its users to publish research results and store information received, and 2) maintaining users' profile including interests, expertise and so on, and 3) interacting with other servers (e.g., message forwarding, notification receiving, etc), and 4) other business services (e.g., instant messaging, goods list, computing, storage, etc). Users interact with servers via various devices such as PCs, PDAs, and laptops. We suggest Web be used for interaction because it has penetrated into the society and becomes familiar to people.

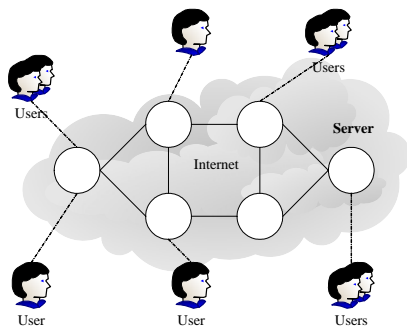


Figure 1. Architecture for Virtual Society

In our system, each server is an autonomous unit that can provide collaboration support for the users connected to it independently. Besides, multiple servers can be combined forming a distributed collaborative supporting environment where users connected to different servers can collaborate. A server could be added to or removed from the system dynamically and easily (the only thing needed is to register the server to or delete the related information from the information service) according to real application requirements, making the system well scalable in terms of both group size and the number of groups it could accommodate.

3.3 Application Scenario

In this section we will take information seeking as the application scenario to show how people interact in our system and how the system provides support for that. The procedure is as follows:

- 1) The user specifies some keywords or a question along with one or more subject areas that he/she thinks the content to search belongs to. This can be done via a Web browser at any device.
- 2) The server accepts the request and begins to search the history records. If the similar results are found, it returns them and the session ends. Otherwise, it adds the query to user's space (to keep the thread) and does the following steps.
- 3) Start local search and global search in parallel. By local search we mean the request is forwarded to those users that are considered having the expertise and are willing to provide help via instant message (for online users) and/or offline message added to their personal spaces (for offline users). By global search we mean the request is forwarded to other related servers (determined by querying information services) for them to conduct local search as stated above.
- 4) Accept responses and process them (e.g., evaluate relativity, determine similarity, remove redundancy, etc).
- 5) Add the results to user's space and notify user of it.

- 6) Accept the feedback from user and log the search in the history repository.

From the procedure we can see synchronous and asynchronous interactions are uniformly supported via online/offline message. As a result, the two approaches are mutually enhanced.

4. CONCLUDING REMARKS

It is believed that improved access to knowledge and information will enable researchers to perform their research more creatively and efficiently. To achieve this purpose, we propose a virtual society system to synthesize users' knowledge to online/offline resources and show its application by a scenario in this paper. We call it virtual society in the sense that it functions like in the real world with server to organization and online message to telephone and offline message to email.

Though the progress in technology especially the practice in Web 2.0 has provided a good basis and made it possible to build such a virtual society, challenges still exist to unfold its potentials. The foremost challenge is the heterogeneity in subject and expertise representation, which is important to determine the related users and servers. Semantic Web technology can help to reconcile the heterogeneity by defining some common ontologies. As for social aspect, experience with wikis has told us that online people are willing to help and therefore, it is no need to worry about.

In summary, we think the virtual society system is an ideal platform for e-research because from the end-user's perspective, users can not only gain accurate knowledge and information about the desired topic but disseminate their research outcomes with greater effect (to those who are most interested in them) and from system's perspective, information on the Internet are tagged and classified (done via the interaction with users), providing a good basis for later use.

5. ACKNOWLEDGMENTS

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