Telecooperation: Concept, Applications and the Need from the Internet*

Maki K. Habib

GMD-Japan Research Laboratory
AIM Building 8F,
3-8-1 Asano, KokuraKita-ku,
KitaKyushu-Shi, 802-0001, Japan
Tel: + 81 93 512 1566
maki.habib@gmd.gr.jp

Abstract Telecooperation stands for the fusion of computer science, telecommunication and multimedia to carry out a cooperative process among organizations, individuals, systems or combination of them by having better access to resources and share timely information over a distance between two or more locations. Telecooperation comprises procedural and collaborative modes of work and its focus lies on cooperation in the broader sense. It is concerned with a series of issues ranging from particular application domains such as the global office, global teams, innovative services, commerce and businesses, medical services, technical and professional services, entertainment, education, information services, to tools for communication and cooperation. Due to their ability to overcome the restriction of time and space, telecooperation systems promises to enable the virtualization of workplace, project and research teams, manufacturing, business units, etc.

The most suitable environment that realizes such systems is the Internet and the World Wide Web (the Web). The Internet and the Web represent the suitable infrastructure technologies that facilitate virtual presence via electronic communications between entities, human populations and machines. The Internet and the Web provide low cost and widely available media rich interface that can make resources accessible to broad range of users regardless of geographic location and time. In addition, Internet based systems with tools supporting human communication and interaction with real world, will inevitably lead to many useful applications in various sectors of the society, professionally and socially.

But, there are technical issues associated with the development of telecooperation applications and the current Internet and Web technologies that affect the performance of telecooperation systems and also affect enabling a new generation of applications. This paper addresses some of these technical issues along with the needs and requirements.

Key words Internet, Telecooperation, Multimedia, Virtual Organization, Awareness, Bandwidth, Integrated User Interface

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1 The Internet and the World Wide Web

The Internet in its early stages reserved as a tool for scientific and academic and it has emerged as an appliance of everyday continue to be more integrated into our daily life and being accessible from every point on the earth. The Internet enters the mainstream of daily life (such as, education, healthcare, finance, work and leisure activities) and will affect all aspect of human life. Dispersed groups and populations, that once being separated by distance and time, will experience these changes as part of a global community. Improvements in speed, accessibility, and usefulness coupled with the lowest prices ever for computers and Internet access will likely make for the most explosive growth yet. And business is expecting to make the most of that growth.

Tim Berners-Lee created the WWW at CERN, in Geneva, Switzerland. In 1989, he proposed the hypertext network for CERN. In 1990, the first prototype Web server (NeXTStep) was built, and client machines added. It used a standard form of database that could be searched by all networked machines. Berners-Lee chose the name World Wide Web (the Web).

The Web is an exciting and innovative front-end to the Internet. It represents the popular image of the Internet. It was originally envisioned by its designers to become a collaborative tool for the Internet. However the initial Web was designed as a hypertext distributed information storage system to facilitate the sharing and dissemination of documents between geographically distant laboratories.

The addition in 1992 of a simple and friendly user interface increased the Web appeal and usefulness, which in turn has fuelled its rapid growth and remarkable popularity since then. WWW is purely information focused environment and has officially defined as a wide-area hypermedia information retrieval initiative aiming to give universal access to a large universe of documents. The WWW provides Internet users with a uniform and convenient means of accessing the wide variety of resources (pictures, text, graphics, data, sound, video) available on the Internet. Popular software interfaces, such as Explorer and Netscape, facilitate navigation and use of the WWW. The hypertext capabilities of the WWW facilitate linking of information within a home page and with all other home pages on the WWW. The capability to link documents and the platform independence of the content format were the main advantages.

The widespread adoption of the Web has radically changes the use of Internet and dramatically extends our scope and reach, and this impact is increasing as the Web evolves. During the last few years, the Internet has evolved with an enormous speed. The Internet has become a governing technology of the last period of this century, with huge impact on global society. Internet is changing the way we work, learn, and communicate with each other. It has increased our tele-connectivity by allowing us to electronically connect places and exchange text, graphics, images, sound, and video with anyone whose interest we share, professionally and socially, and virtually anywhere in the world.

The explosive growth of the Web along with the evolution of HTTP and HTML and other standards has enabled many applications that would not have been feasible just few years ago. Recently two additional standards have been added and will have their impact on the Internet: the extended hypertext markup language and the synchronized multimedia integration language (XHTML and SMIL, respectively). Together, they alter how Web documents are created, in the process making it much easier to use more content, or data, in each Web page. The two new standards are likely to result in much more active and changing Web pages, with lots of animation and sound. Given those capabilities, the world of Web design will have to mature really quickly.

When researchers were asked to predict the future of the Internet, they said that it would support on-line multimedia collaboration, sophisticated information retrieval and remote control of expensive or unique scientific instruments via tele-experimentation. Many users are looking for more interactive solutions in which they can interact in real time seamlessly to cover wide range of activities while using a Web browser.

2 Telecooperation as a New Paradigm

Telecooperation stands for the fusion of computer science, telecommunication and multimedia to carry out a cooperative process among organizations, individuals, systems or combination of them by having

better access to resources and share timely information over geographically distributed locations. Telecooperation is the use of electronic networking methods among individuals and groups to achieve mutual benefits. It is the application of information and communication technologies by individual, groups and organizations to enhance communications, dramatically reduce cost and enabling organizations, professionals, individuals in having a better access to timely information that lead to make a well informed decisions. The effective use of telecooperation will affect almost every aspect of society and economy. In addition, telecooperation entails new skills for individuals, and new organizational structure.

As information resources are scattered across the globe and may not be available where they are needed, it is important to look for alternative forms of physical movement of people, equipment, utilities, records and information, preferably through the use of telecommunications and multimedia facilities. Telecooperation is an outstanding example for the power of enabling technologies as well as it is the latest appearing manifestation of those guiding visions and paradigms that have governed application development. Telecooperation comprises procedural and collaborative modes of work and its focus lies on cooperation in the broader sense. It is concerned with a series of issues ranging from particular application domains such as the global office, innovative services, medical services (medical records, medical information, diagnosis, consultation), technical and professional services (businesses and technical consulting, accounting, architectural design, legal advice, travel service, etc.), entertainment products (motion pictures, videos, sound recordings), education (classroom, libraries, seminars, training, books), information services (databases (general and technical), on-line newspapers, magazine), product licenses, advertising, to tools for communication and cooperation.

Due to their ability to overcome the restriction of time and space, telecooperation systems promises to enable the virtualization of workplace, project and research teams, manufacturing, business units, etc. Organizations, professionals, and individuals that successfully apply telecooperation methods can enhance customer and supplier communications, improve quality of services, sharing unique and expensive resources, minimize risk associated with hazardous and dangerous environments, access timely information and expertise that support diagnosis and decision making, and to reduce overall operational and maintenance cost and utilize resources efficiently.

The emergence of global, decentralized, and distributed organizations and businesses along with the growing of computer network and their on-line users substantially increase the need for integrated solutions of workflow management systems and, telecooperation and communication tools. This aims to support overall business processes and cooperative work between peoples within and outside their organization in an efficient way. Working together in co-located or geographically dispersed individuals/groups/organizations needs particular technologies. I addition, methods for analysis and design have to be developed that can cope with the characteristics situation of management, cooperative and interactive work. But, convincing solutions that enable organizations and individuals/groups to adopt it are still weak due to a variety of reasons, ranging from social and organizational problems to purely technical issues. With regard to telework and virtual organizations, there are different sides of the organizational goal to use telecooperation technology for redesigning work. Although such innovations can be regarded as advantageous, they may induce an amount of change to organizations and staff members/users yet far from being managed adequately. While considering the case of Electronic Commerce and Electronic Government, both applications have become the main beneficiary of telecooperation with progress prompted by the wide spreading of the Web. And yet significant questions remain open, and they have to be solved in order to achieve the same degree of reliability, security and entrustment by electronic means as it is guaranteed in the conventional ways of doing business.

The modern multimedia communication technology provides many attractive features, but it lacks the ease of usage and control of this technology by the end user. Also, the available cooperation and communication tools do not provide an integrated and homogeneous cooperation environment that is suitable for collaborative application domains. Accordingly, there is a need of a new approach covering the development of an integrated multimedia collaboration environment, which integrates cooperative document management and processing together with Multipoint multimedia conferencing with features that fulfil the requirements by the end user.

Therefore, the challenge is the integration of existing basic technologies into new application environments

adapted to the newly evolving distributed and autonomous organizational structures and other collaborative application domains. Existing communication and cooperation support services and newly developed coordination tools are integrated to form an overall system aiming to provide a platform which is necessary for the communication and cooperation infrastructure between distributed and autonomous performance units. The infrastructure has to be well suited for the increased requirements of adaptable teams, businesses, and corporate structures.

Collaboration deals with all the various efforts aimed at improving joint work mediated by technology. The goal here is an effective and agreeable interaction that comes close to habitual and natural ways of communicating and cooperating.

The most suitable environment that realizes such systems is the Internet. The Internet represents the suitable infrastructure technologies that facilitate virtual presence via electronic communications between entities, human populations and machines. The Internet provides low cost and widely available media rich interface that can make resources accessible to a broad range of users regardless of geographic location.

The Internet is no longer a technical revolution, but rather a social revolution. Internet based systems with tools supporting human communication and interaction with real world, will inevitably lead to many useful applications in various sectors of the society, professionally and socially. Entrepreneurs are able to start new businesses more easily with smaller up-front investment requirements by accessing the Internet's worldwide network of customers; Engineers, product developers, and managers thousands of miles apart can collaborate to design and manufacture new products more efficiently; Businesses can work more efficiently with their suppliers and customers; Consumers have greater choice and can shop in their homes for a wide variety of products from manufacturers and retailers all over the world. They will be able to view these products on their computers or tele-visions, access information about the products, and order and pay for their choices, all from their living rooms. Teachers and Students across the world are discovering vast treasure troves of data via the Web. They can have immediate access to the world's information from their classrooms. Possibilities are opened for distance educators to overcome time and distance to reach students. Doctors are utilizing tele-medicine to administrate off-site diagnoses to patients in remote parts of the globe from their offices. Citizens of many nations are finding additional outlets for personal, professional and political expression.

One of the most significant uses of the Internet is in the world of commerce. Already it is possible to buy books and clothing, to obtain business advice, to purchase everything from gardening tools to high-tech telecommunications equipment over the Internet. This is just the beginning. Trade and commerce on the Internet are doubling or tripling every year. New models of commercial interaction are developing as business and consumers participate in the electronic marketplace and harvest the resultant benefits. The Internet is changing classic businesses and economic paradigms. It revolutionize commerce by accelerating the growth of trade and by dramatically lowering transaction costs and facilitating new types of commercial transactions and new arrangements of buyers and sellers that would make commerce easier.

The network makes it possible to have complex relationships with individuals and groups of people all over the globe. The workplace and even the home may not be the focal point of one's social interactions. Virtual corporations, offices, communities, universities, teams, governments are coming into existence on a regular basis due to the support and the capabilities of the Internet. This will lead us to think about the convergence of television, the Internet, cable TV and the telephone and try to predict how and when these communication mediums will intersect. Hence, it is difficult to predict exactly what the Internet will develop into, but it is safe to say that we are about to enter an age of rapid dissemination of products, services, and information facilitated by technology and shared by businesses and individual alike.

3 Critical Issues Facing Telecooperation Applications

To run telecooperation application associated with group of people/organizations efficiently and successfully there is a need to fulfil some of the critical issue that affects the performance and simplify the operational procedure. Some of these issues may include:

a. Integrated user interface, workspace sharing and awareness

An important factor for the acceptance of remote services and cooperative applications is the

presentation of the user interface. The design of a good user interfaces is a demanding task because of the requirement for real-time reproduction of motions, actions, monitoring, result analysis, etc. In general, the available user interfaces of many systems suffer from their single-user origins. The design of interfaces for multi-user applications offers many more challenges than the design of interfaces for single user applications, because details that are not relevant for single users have to be integrated. The interface must provide information about what others are doing to efficiently support cooperative work-it must support *awareness*.

The selection of a good user interface is of critical important to the success of any cooperative system. The interface needs to be available over a wide range of machines, should preferably be intuitive and graphical, and must be to integrate team members, tools, process/equipment control with on-line and multimedia based educational and instructional material. It is important to have a consistent user interface over different platforms and operating systems.

b. Workspace sharing and awareness

In real world, shared physical workspaces and the resources they contain act as a stage and offer advantages for rich person to person interaction. It is not only the information available within such space is important, but also the ways that interaction over the information is facilitated. Awareness is such natural phenomenon that people rarely need to think about it. Awareness, which can be defined as an understanding of the overall state of a system, is a key factor for any form of cooperation. Awareness encompasses an understanding of past activities, present status and future options. It allows users to coordinate and structure their work, because they can perceive what others are working on. Without awareness, coordinated cooperative work is difficult and almost impossible. To support awareness, a team based integrated user interface must be able to support the act of making other's activities perceivable at the user interface of each user.

c. Communication and the support for real time interaction

There is a need to have communication services that are independent of specific protocols, network, languages, or media types to enable telecooperation application domain and work on various disciplines flexibly.

d. Privacy, confidentiality and Security

The are two issue related to the privacy: The first is covering the privacy principles that rest on two precepts: notice and consent:

- Data-gatherers should inform users/consumers what information they are collecting, and how they intend to use such data; and
- Data-gatherers should provide users/consumers with a meaningful way to limit use and re-use of personal information.

The second issue is safeguarding financial and personal information that users might typically keep on their computers: home addresses and phone numbers, checking account numbers, pass-words, credit card numbers, and such. Helping users manage this type of information is already a highly competitive business.

The goal of any security design is to provide maximum security with minimum impact on legitimate users accessing the resources by reducing connection time and reducing network management requirements as necessary. A security policy should be simple, efficient and dynamic to enable users (team members) and their organization to maintain a proper access to the resources. Access to remote data base, or collection and manipulation of data, requires that authentication and access control mechanisms be in place in order to provide safeguards against unauthorized access, and to assure privacy of proprietary, confidentiality, data integrity, etc.

The objective is to provide, especially for on-line technical systems, the same level of, and expressiveness of, access control that is available to a local human controller of information and facilities, and the same authority, individual responsibility and accountability, and expressiveness of policy that one sees in specific groups/organizations.

Since the type of business determines the suitable type of security policy, and since a cooperative environment may consider a geographically dispersed teams/groups. This will include the possibility of having different organization participating in a common project. This will lead us to consider that, a security policy that support hybrid security requirements.

e. Collaborative environment and telecommunication infrastructure

Presently there is vertical integration in our telecommunications infrastructure, i.e., telephony, video, and data. We need horizontal applications that combine all aspects of multimedia. Telephony, video, and data exist in totally separate user architectures: we have separate media bringing our telephone service and video entertainment into our homes and businesses. High bandwidth data communications must also be provided over separate communications lines or even separate media. We need a communications format, available to all, that combines voice services, both video broadcast and video transmission, and high-speed data lines available in a multimedia format to a customer base that includes all households and business (large or small). Also, there is a need to have multimedia collaboration environment that offers an efficient and reliable infrastructure to support synchronous and asynchronous collaboration within virtual teams/offices/organizations or among individuals. Such infrastructure may cover a range of components management and control along with variety of collaboration services.

f. Scalability

Applications need to be scalable as the service-based environment grows with the business, and the field of application.

4 The Internet and the Need

Some of the issues related to the Internet and the need are listed below:

- The Internet, as it is today, is so congested that it does not allow for the development of cutting-edge applications. Internet congestion and reliability problems derive partly from the Internet's inability to set priorities. In an ideal environment, mission-critical traffic would take precedence, particularly when the network is congested. This will allow different kinds of traffic to be handled with different priorities, as well as allow businesses to offer users different types of service at different prices In other words, it is necessary to generate benefits by providing the right information to the right people at the right time.
- The need to provide services for application specific communication and cooperation processes as well as integrated means for service definition, adaptation and management.
- The need to have a focus and address the issues related to quality of service and multicast
- It is clear that the policy issues are important as technology with respect to the Internet. One of the largest problems the Internet presents is how to apply laws to it, because it crosses all national boundaries. For instance, if one company wins a judgment against another in one jurisdiction, how can it collect if the loser is not subject to that jurisdiction? International laws and organizations have dealt with such trade problems in the past.
- The need to create and sustain a leading-edge network capability for the research community; direct networking development efforts that result in a new generation of applications that will fully exploit the capabilities of broadband networks media integration, interactivity, and real-time collaboration; and integrate with continued efforts to improve Internet services for all members of the research community, and eventually the worldwide Internet community.
- Solving the excess bandwidth problems. The need to come up with new ideas to allow us to be ahead and faster than the base technology is moving.
- Today, the Internet works by having each router, or network node, try its best to deliver each packet of data, and treat all data packets as equal. So packets may be delivered in no particular sequence or, even worse, not at all. While out-of-sequence arrival may not matter for electronic files that can be reassembled at leisure in a computer, it is disconcerting when it happens during an IP phone call.
- There is already a need for an information technology infrastructure that goes well beyond the simple capabilities offered by the current development environments for Internet applications.
- The need to determine technical standard and other mechanism for interoperability. Interoperability and reusability are powerful and enabling capabilities that have helped improve effectiveness of computer-based environments in many domains. In the case of the Internet, interoperability is evident in the ability of network communication software and hardware from

multiple suppliers to follow standardized protocols, and facilitate the reliable transfer of files across their interconnected networks.

- The need to support mobile users and extend their networking capabilities.
- Electronic commerce has to give shoppers options not available through traditional commercial channels. This implies the further need for an infrastructure that can support complex and flexible services to manage customer-tailored requests in the context of highly dynamic networks and federations of providers. To address these issues, there is a need to develop a framework that supports the integration of multiple component functionalities based on a multi-user and collaborative considerations.
- Applications require protection against unauthorized access to sensitive data. If Internet users do not believe that their communications and data are secure and protected against interception or modification, they will be unlikely to use the Internet on a routine basis in business, healthcare, and other fields. Although SSL and SHTTP protocols protect the transfer of data between a Web browser and Web server, additional features must be built into applications to ensure security from the Web server to back end data resources. Also, efforts to protect the privacy of personal data and to protect intellectual property on-line are futile unless there are technologies and policies in place that ensure the security and integrity of on-line information.
- Intellectual property issues have become very visible. Applications on the Internet often will involve with digital content creation, the sale and licensing of intellectual property. To promote an effective environment for such application environments, sellers must know that their intellectual property will not be pirated and buyers must know that they are obtaining authentic products and not pirate copies.

5 Conclusions

The concept and applications of the new telecooperation paradigm has been presented in this paper. Due to its ubiquity, low cost, it is clear that the Internet and World Wide Web represent the best environment to realize such systems. But, to enhance performance, flexibility, and to support different application domain and complexity, the Internet should fulfil the need and the requirements of such applications by improving the Quality of Services. Also, to have a successful telecooperation applications, it is essential to establish a multi-user, real time, interactive, shared environment enhanced by integrated human media technologies that can be reached from anywhere on the Internet.

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