Using The Internet to Provide Support for Distributed Interactions

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Abstract

While technologies like Group Support Systems have been shown to improve the interaction process of face-to-face meetings, organizations search for ways to improve the interaction process for individuals at different locations. One solution to this problem may be the use of Internet. As access to the Internet becomes more readily available, organizations are seeking ways to take advantage of the existing Internet services and capabilities to support distributed interactions such as meetings. This paper discusses how the Internet could be used to support distributed, or virtual, interactions. A discussion of the Internet, its evolution, capabilities and the services provided is followed by issues that the use of this technology raises, potential applications and their implications, and directions for future research in this area.

1.0 Introduction

Information Technology (IT) has at once increased the speed at which business is conducted while simultaneously decreasing the apparent size of the globe. These rapid and ongoing changes accelerate the need for increased interaction and exchange of information for businesses at the local, national and international level. The need for increased interaction and exchange of information is not just limited to businesses, but also applies to schools, governments, charitable organizations, and even at the individual level. These interactions involve the communication of information from one person to another, from one person to many others, as well as the interaction of several people. This exchange of information may take place at the same time or may occur at different times for different individuals. Finally, the parties involved in these interactions may be at the same location and/or at two or more different locations.

Different technologies have emerged to support many of these organizational communication needs. One to one interaction may be supplemented by the use of the telephone or electronic mail (e-mail). Distribution of information to one or more individuals can be accomplished electronically via e-mail or bulletin boards. Face-to-face interactions (i.e., meetings) can be supported by Group Support Systems (GSS). Finally, several individuals from different geographic locations can interact with one another through audioconferencing, videoconferencing and, more recently, through Distributed Group Support Systems (DGSS).

DGSS "...use computers and telecommunications networks to compose, store, deliver, regulate, and process communication among the group members and between the computer and the group." (Hiltz and Turoff, 1992; p. 68) DGSS are designed to allow group members to interact with one another from different geographic locations at either the same time (synchronously) or at different times (asynchronously). These interactions represent two of the four squares in Johanson, et al.'s (1991) "any time any place" 4-square map groupware options (the other two squares are: same time/same place and different time/same place—which can both be supported by traditional GSS). DGSS supported interactions are often referred to as "virtual meetings" since the participants are at different locations [12]. The meeting does not take place in a meeting room, as do traditional face-to-face meetings; rather it takes place electronically in what has been come to be known as "cyberspace" or the "Net" [15].

Hiltz and Turoff (1992) indicate that the major advantage of asynchronous communication rests in the ability of the individual to participate in the problem solving process where they feel they can best contribute and in ways that best fit with their unique problem solving approach or style. They stress that the issue is not how to make asynchronous meetings like face-to-face meetings, but how to take advantage of the technology to actually improve upon the face-to-face meeting process. One advantage reported by Hiltz, et al. (1991) was that in asynchronous mode "messages are longer, better organized, and planned." (p. 148)

While there are a growing number of off-the-shelf GSS packages that can be used in the same time/same place environment, and even in a limited distributed environment, the costs of these packages still tend to be quite prohibitive for many organizations (e.g.,...
For research in this area.

surrounding the use of the Internet for distributed interactions. This is followed by a discussion of the issues and potential applications and future directions. This paper will present information on the Internet, its historical background, functions, capabilities to support distributed interactions, and the ability of the Internet to function as a platform to support new DGSS tools. One potential solution to this problem is the use of the Internet to provide this necessary computer and communications technology. The Internet has already been promoted for use by businesses in a number of ways (e.g., see [6]). This paper will present information on the Internet, its historical background, functions, capabilities to support distributed interactions, and its ability to function as a platform to support new DGSS tools. This is followed by a discussion of the issues surrounding the use of the Internet for distributed interactions, potential applications and future directions for research in this area.

2.0 The Internet

This section will explore the historical background and evolution of the Internet, the functions it currently performs, how existing Internet protocols could be used to support distributed interactions, and the ability of the Internet to function as a platform to support new DGSS tools.

2.1 Historical Background of the Internet

Contrary to popular opinion, much of the physical implementation of the "Net" has been in place for over a century. The new technologies of electronic communications are facilitated not by electronic switching and digital communications technologies but by low-cost, high-speed, high-capacity electronic computers that take advantage of them. Digital communications networks first became accessible with the advent of the telegraph in the nineteenth century (Morse code is a base three code using dots, dashes and spaces to represent characters, numbers or other forms of data) and the first automatic telephone switching systems in the first part of this century.

Using these technologies to meet the needs of business, education, government and charity is certainly not new. Business meetings have been augmented by conference calls for over 20 years. Correspondence and documentation have been transmitted via facsimile not for the 15 years that most people today can recall but for the past 60 years. Although cellular phones seem like a relatively new technology, they are really just an improvement of radiotelephone systems that have been available for decades. Finally, computers separated by great distances have been exchanging data over data communications links since the 1960s.

The innovation in using these systems comes not from their existence but from their increasing availability to the general public. This has not been the case, however, until quite recently. In the 1960s, ARPA (Advanced Research Projects Agency) began funding development of a robust, national computer network called the ARPANet. It used packet-switching technology (where data is broken into small packets that are routed through a series of nodes to their final destination) to implement a network robust enough to survive a nuclear conflict. Through the next two decades various other networks were developed, some based on ARPANet technology, some not. In the 1980s organizations began connecting these networks together, using gateways and bridges, so that a user of one network could send electronic mail or data to a user on another network. This interconnection of networks was formalized in the late 1980s and was dubbed the Internet (i.e., Inter-Network). The Internet is really just a network of networks, all conforming to a common node address and data delivery scheme.

2.2 Internet Functions

While many discussions focus on the various services available via the Internet, the "Net" really only has one function: to get data from "here" to "there." Anything that can be utilized by or generated by a computer can be broken down into packets and transmitted to another node or many other nodes on the Internet. This data can be text, binary data, audio, video or images. Using the Internet effectively then simply means acquiring or writing the software that makes use of the data-carrying ability of the "Net." It does not necessarily mean the ability to use any specific services as well as an Internet expert.

Most current Internet connections are made through low-speed [14,400 bits per second (b/s)] or slower modem links. Only Internet service providers and larger organizations can afford the higher speed leased-line (56,700 b/s) or T1 (1.544 megabits per second) connections to an Internet backbone required for shipping around massive quantities of data packets. Affordable modems that will perform at 28,800 b/s are becoming
available to the public from such vendors as Hayes and US Robotics, but it is difficult for the average user to justify the cost of a new modem. As Gilder (1993) points out, however, this will not be the case for very long: "My thesis is that bandwidth is going to be virtually free in the next era in the same way that transistors are in this era...it does mean that people will have to use this bandwidth, they'll have to waste bandwidth rather than economize on bandwidth." (p. 38)

In other words, technologies such as light fiber will make high-speed cheap connections on the Internet feasible for not only the smallest business but, indeed, the individual home user! A Massachusetts cable television company reportedly will provide, for a fee of $100 per month, a 10baseT (500 kilobits per second throughput) ethernet connection to the Internet that will plug into the back of virtually any consumer workstation or microcomputer. Because one voice channel requires 64 kbs of throughput, this solution would provide approximately eight times the capacity.

Data-carrying capacity alone is not enough--protocols and software are necessary in order to make use of the capacity. In terms of software development, the Internet provides a number of services that, while not ideal for DGSS use, are at least adaptable as an inexpensive substitute for commercially available systems (especially for use in research involving DGSS). These protocols, services and utilities are mostly publicly-domain in nature and readily available in source-code form. "The Internet, for instance, is an exciting kind of metaphor for spontaneous order. It shows that in order to have a very rich fabric of services you don't need a regimented system of control." (Gilder, 1993, p. 39) Gilder is saying here that these services are available for free, are innovative and are likely to survive in one form or another as the Internet and networks like it or based upon it evolve. In addition, an organization need not request permission to use the Internet services since there is no centralized authority governing their use.

2.3 Using Internet Services to Support Distributed Interactions

The use of the Internet and public domain protocols and software utilities to facilitate an inexpensive alternative to expensive, commercially available DGSS products could become increasingly prevalent in the near future. Although current high-speed connections to the "Net" are rare, two statements can accurately be made. First, if one wants to develop a text-only DGSS, current "dial-up" connections to the "Net" are more than adequate. Second, although very high-speed connections are not readily available as yet for voice or video GSS applications, they are rapidly becoming so through initiatives by cable television and telecommunications companies. While these changes are yet to occur, a number of Internet services that can and are being used today do support distributed interactions. Each of these services, along with its potential applications in support distributed interactions, will be presented.

At the simplest level e-mail (electronic mail) can be used to provide support for distributed interactions. E-mail has most commonly been used for one to one, or one to many, asynchronous communication. In support of distributed meetings e-mail can be used to announce a meeting, distribute agendas prior to a meeting, distribute other necessary materials prior to or after a meeting, as well as distribute minutes after the meeting. Meeting participants can use e-mail for premeeting or follow up correspondence, or to carry on private discussions that need not involve all meeting participants (e.g., to cover topics not appropriate for discussion during the meeting).

Another Internet service that could be used for distribution of materials to participants is FTP (File Transfer Protocol). FTP allows users to move files between computers. Participants could use FTP to copy meeting minutes or required materials as well as to make them available to be copied by others. FTP also provides a means for participants to access directories to see what information is available. Additionally, FTP could be used to copy software files, such as new DGSS tools as they become available.

There are a number of Internet services that can be used to help facilitate the search for additional information on the Internet (there is a large volume of publicly available and accessible information and software already on the Internet that may be of use to participants). Archie is a tool that aids in the search for information (files and directories) from "anonymous" FTP sites. Gopher is a menu-driven system which aids in the process of locating and retrieving files. Veronica uses keyword searches to locate and index titles of Gopher items. WAIS (Wide Area Information Server) allows for searches of multiple Internet sites for specific subjects. Finally, WWW (World Wide Web or W3) allows for "browsing" and retrieval of files by using hypertext with pointers to other text and hypermedia, possibly involving images, sound, or animation.

USENET NEWS, although not originally or specifically an Internet service, could also be used to make certain information available, either before or after a meeting, for the participants, as well as to facilitate news conferences between participants. USENET NEWS allows for the exchange of information organized around specific groups or topics. Topics are organized in hierarchies and may further be divided into subtopics (just as a meeting agenda may have a number of items). When a participant transmits a message, that message will be distributed to anybody who wants to read that message. Other participants can respond "publicly" to that message, so that all other participants can read the response or "privately" directly to the person who generated the message (while not a capability of USENET NEWS, this could be accomplished via e-mail). USENET NEWS also allows for "dialogues" to be created and conducted over extended periods of time.
These dialogues could support a broad range of distributed interactions, from meeting planning (e.g., what should be discussed at the next meeting?), meeting follow-up (e.g., posting minutes, reporting on subsequent meeting activities), to actual different time/different place (asynchronous) meeting activities such as idea generation, categorization or evaluation. A number of participants could join a "channel" where every message that is typed by any participant is automatically transmitted to all other participants. In an unmoderated IRC environment the number of messages could become overwhelming, particularly as the number of participants increases. Additionally, some time lags (delays) may occur. A moderator could be used to determine which messages are distributed, either based on the message or the person who generated the message. They could also allow for round robin generation of comments, one at a time by each participant (this is a procedure that has become quite common in face-to-face GSS meetings in order to keep the number of ideas manageable, mainly by trying to eliminate redundant ideas, given the large number of comments that could be generated quickly by a group).

Moderated IRC sessions could also be used for idea evaluation, where the votes are submitted to the moderator who in turn tallies and reports the results of the vote back to the participants. IRC sessions could be set up to provide anonymity for participants and all IRC activities can be logged, both by the moderator and each participant, such that "meeting minutes" of all activities could be recorded. Both of these capabilities, anonymity and automatic recording of the meeting activities, are common features provided in, and usually promoted as benefits of, most GSS packages.

If there is a question regarding the capability of such Internet services for supporting distributed interactions, it has certainly been considered carefully by a variety of government and government-supported organizations. One of these organizations is beginning the most extensive effort ever to distribute ecological data to the public. "The goal: Take every ecological aspect of that spinning blue-green ball of rock and water we call Earth and transform it into data that is instantly available for analysis and experimentation anywhere, anytime." (Culhane, 1993, pp. 95) This project, administered primarily by NASA, will generate a terabyte of ecological data every eight days and provide it to scientists and the merely curious using a variety of Internet and Internet-connected services. If the Internet can be used to organize and distribute this much data in a digestible form, then it can surely be used to meet most organization's distributed interaction needs.

In addition to providing the types of services that can be used to support virtual interactions, the Internet has also proven itself capable of providing the type(s) of virtual environments necessary for the support of DGSS and DGSS-type tools. In fact, the Internet has been doing just that for some two decades. One example would be what is known as a MUD (Multi-User Dimension or Dialogue). A MUD is a "network-accessible, multi-participant, user-extensible virtual reality whose user interface is entirely textual." [8] Curtis, who works as Xerox PARC, has moderated the interaction of "gaming playing" on one MUD for several years and has recorded over 3,500 different players from dozens of countries, with up to 44 connected at one time. He is currently adapting the MUD he moderates "for use as an international teleconference and image database system for astronomers" which includes "allowing the scientists to give on-line presentations to their colleagues around the world, complete with 'slides' and illustrations automatically displayed on the participants' workstations." Curtis goes on to state that "the same approach could be used to create on-line meeting place for workers," much as we have discussed in this paper. Curtis' report testifies to the ability of the Internet to support the types of interactions discussed in this paper. Another example is reported by Watson (1994), who indicates that "Meeting Space (TM) is a MUD refashioned as interactive, electronic meeting software. As such it is one of the few groupware products that supports meetings that are held same time/different place. Furthermore, it supports TCP/IP (Transmission Control Protocol/Internet Protocol) and can thus be used to permit meetings among groups on the Internet." (p. 4) Meeting Space (TM) currently supports such meeting activities as the development of agendas, keeping of minutes, and facilitating presentations. Planned enhancements include: collaborative whiteboards, voting and additional meeting support functions [19].

3.0 Issues to Consider When Using the Internet to Support Distributed Interactions

While the availability to support distributed interactions exists on the Internet, there are a number of issues that need to be addressed concerning the appropriateness of the
use of these capabilities for all tasks. Bease (1994),
based on a series of interviews with people from nine
organizations who are experimenting with DGSS (GroupSystems (TM)) use, provides five guidelines for
success with DGSS (pp. 12-13):

1) Selecting an appropriate task and making sure it is
clearly defined;
2) Clearly defining roles in the meeting (e.g.,
session leader, facilitator) and why each person's
participation is needed;
3) Pre-meeting planning is critical;
4) It helps if teams have built some trust, to have
developed their social relationships prior to
participating in distributed electronic meetings;
5) Having a stable technical infrastructure.

While there are many issues to address in the support of
distributed interactions, only issues specific to the use of
the Internet for supporting these interactions will be
discussed in this section.

3.1 Match of Task to Technology

The first issues concern the match of task to
technology: how do the capabilities of the available
Internet services match the particular needs of
organizations? This becomes an educational issue as
individuals in organizations must develop an
understanding of capabilities of the Internet and its
appropriateness for supporting the tasks performed by
the organization. Bease (1994) indicates that organizations
are currently experimenting with DGSS use for such
tasks as strategic planning, event planning, idea
generation, presentation preparation, re-engineering,
software design/JAD, team building and training. The
participants themselves do not need to have a high degree
of expertise on the Internet. However, before attempting
to utilize any of the Internet services discussed above, an
organization should make sure that it has an
administrator (or moderator) who is experienced and
knowledgeable about the services, protocols, and risks
associated with the use of the services.

3.2 Meeting Management and Facilitation

The next issue deals with the management of distributed
meetings on the Internet. There are several factors to
consider here: who calls meetings, how are they
scheduled, how are participants motivated to participate
in asynchronous meetings, how is closure brought to a
meeting, and how is facilitation handled in both the
synchronous and asynchronous modes provided by the
Internet?

Meetings are defined by Bostrom, et al. (1993) as: "a
guided or outcome-directed interaction between two or
more people (teams, groups) that can take place in any
of four environments (same time/same place, same
time/different place, different time/same place, and
different time/different place)." (p. 148) Meetings
consist of a number of activities which compose a
meeting cycle. There are pre-meeting, meeting and post-
meeting activities. Events and issues for each of these
activities for Internet-supported distributed meetings will
be discussed.

Pre-meeting activities include establishing a shared
outcome, agenda, rosters (people to invite), ground
rules/roles, and allowing for participant preparation [5].
Ground rules, while important in any meeting, are even
more crucial in distributed meetings. Curtis reports that
ground rules have been established through practice and
reflect the "common will" of the participants in a MUD
he monitors. Some of the ground rules that have evolved
and are published for all participants to read include: be
polite, avoid being rude, and respect other's sensibilities
differences. These types of rules could easily be sent
out via e-mail or published using USENET NEWS
(where the rules could be expanded as they develop over
time). Successful completion of pre-meeting activities
are crucial to the success of any meeting, but particularly
true for distributed meetings as organization and
communication become more critical to ensure active and
constructive participation. As with any meeting, all
participants must be notified (e.g., via e-mail or posting
on USENET NEWS) of the starting time of the meeting
(if in synchronous mode), or the starting point of an
activity (e.g., idea generation) in asynchronous mode.

Bostrom, et al (1993) divide the meeting stage into
two sets of facilitator activities: open (setup), during
(agenda), and close (wrap-up). Setup involves:
clarification and establishment of shared outcomes,
clarification of roles and rules, and establishment of a
positive group spirit. During the meeting the facilitator's
role is that of moderator for such tools as
IRC and USENET NEWS. The facilitator must be very
active in monitoring both the process and the progress made by a group. In using the
services provided by the Internet, one of the roles the
facilitator may play is that of moderator for such tools as
IRC and USENET NEWS.

By effectively educating participants as to the best uses
of the Internet services, it becomes very easy to restrict
discussion to selected topics without getting off track and
without having the usual disruptions that often occur in
face-to-face meetings with people going to a different
subject that is not related to the meeting outcome or isn't
appropriate at that time. In this way, the technology
actually provides the advantage of keeping participants
more focused, thus reducing that aspect of the facilitator's
job. In the distributed environment provided by the Internet, this part of the facilitator's job that occurs most frequently during the meeting, has been done prior to the start of the meeting. Therefore, training, procedures, documentation and practice become even more critical in this environment.

3.3 When to Use this Technology

In addition to what types of tasks for which an organization chooses to use this technology, it must also carefully consider when to use this technology. Should this technology be used for all phases of a meeting, or only if the participants have already met face-to-face? Johanson, et al. (1991) in a discussion of the Drexler/Sibbet (TM) Team Performance Model recommend that certain stages should take place in certain environments. Orientation and trust building should take place in a same time/same place environment where people can get to know one another and develop the rapport and trust necessary to work cooperatively on a task. Bease (1994) also recommends that groups have at least one face-to-face meeting prior to any distributed meetings. Goal/Role clarification and commitment do not need to occur in the same place, but should occur at the same time, in order for the necessary dialogue to occur. It is the next two stages (implementation and high performance) that can occur in any time/any place mode (allowing for asynchronous interaction) which could best utilize the capabilities provided by the Internet. The final stage (renewal) is best supported in the same time/same place environment to allow for the necessary completion activities that bring closure at the end of a project or task.

3.4 Technical Infrastructure

While many of the issues presented in this section have dealt with either organizational or group dynamics issues, there are some technical issues that must be addressed. Bease (1994) points out the need for a "stable technical infrastructure" that can provide access to the technology for everyone in the organization. Additionally, Hiltz and Turoff (1992) point out that additional DGSS requirements, such as privacy, security and reliability are essential to the acceptance and, ultimately, the widespread usage of any technology.

As indicated earlier in Section 2.1, the origin of the Internet (ARPANet) was designed to survive a nuclear attack; therefore, the Internet is quite reliable. Even if a significant number of the servers and communications links could be unavailable (e.g., through routine maintenance or systems failures), data packets, which are dynamically routed from node to node, will be routed around nodes that are unavailable at that time. Privacy and security are more complicated issues on the Internet. The many advantages of the Internet--its increasing availability, ease of access, and growing Internet-literate user base--are also disadvantages when it comes to privacy and security. For example, in IRC if a channel is open or public, anyone can join in the dialogue; likewise, topics on USENET NEWS are also accessible to outsiders. Yet in both cases, these services have the capability to have their access restricted to only those who are "invited" to participate. Again, one of the advantages of the Internet, the dynamic routing of packets, can become a liability as "netsplits" can occur resulting in the channels becoming vulnerable to outside infiltration. However, if an IRC session is restricted to one or two servers in an organization, then this won't be a problem. This reinforces the need for an experienced, knowledgeable person heading up any efforts to use the Internet.

4.0 Specific Applications and Implications for the Use of Internet Services and Capabilities

There exist a wide variety of ways in which Internet services and capabilities can be applied in real world settings. These technologies can be utilized to help meet the diverse and increasing needs of businesses, schools, governments and charitable organizations. Some examples of potential applications of Internet services and capabilities will be presented.

The volume of procedures in any organization can become overwhelming for any one employee to master. Nevertheless, any employee might be required to correctly perform these procedures during another employee's absence. An on-line help desk system, where questions are routed to knowledgeable staff, can increase productivity as well as employee morale and confidence during these periods. These types of procedures could be used for training new employees as well. Additionally, procedures could be stored by topic on USENET NEWS to allow for retrieval of the necessary information. Coworkers could also be afforded greater access to organizational staff, information and services through electronic systems that can serve them asynchronously.

E-mail provides the easiest asynchronous access to employees while IRC would enable synchronous dialogues to occur when necessary.

During software development, users, analysts and programmers rarely are accorded adequate time to perform the systems development life cycle to its fullest extent. Distributed interactions can increase the availability of these individuals to one another by providing e-mail or USENET NEWS for asynchronous discussion and IRC for interactive dialogue facilities for synchronous, ad hoc meetings. While the previous example dealt with interactions within an organization, organizations can benefit from increased dialogue with vendors, suppliers, customers, buyers and even competitors. Any type of project team in an organization, or a team composed of members from different organizations, could take advantage of these Internet services. The potential here
exists for interorganizational interaction to create linkages between people and organizations in much the same way that EDI (Electronic Data Interchange) has extended the linkages between organizations for data transfer. These linkages can build mutual trust and increase cooperation. However, unlike EDI, if participating organizations have access to the Internet, then no additional hardware and software costs may be incurred.

Another advantage of using the Internet would be to pilot new services in an inexpensive and relatively low risk manner. Organizations could take advantage of reduced travel expenditures by creating virtual teams. Likewise, virtual focus groups using IRC to provide feedback about products or services could also be utilized. The ability for organizations to have instant access to focus groups in numerous geographic areas could save an organization both time and money by not requiring staff to travel to various cities to run focus groups, or contract with outside agencies in different geographic areas. As the use of Internet services becomes more pervasive and society becomes more computer literate, these types of applications could become more commonplace.

Increasingly government offices are being asked to respond to constituents as a business would to clients. Thus many of the applications of Internet services that can benefit business can similarly benefit government. E-mail could be used for direct correspondence, USENET NEWS for information retrieval (e.g., tax assistance from the IRS, employment positions, posting of legislative action, or contracts for bidding) as well as ongoing dialogues (e.g., "suggestion box" for ideas), and finally, IRC for interactive dialogues (e.g., electronic town meetings between politicians and their constituents, press conferences with local media, or emergency instructions). As the volume of material that must be learned by students increases, it is imperative that a means for the instructor to distribute additional materials and field questions between class sessions be available. This can be achieved electronically through a variety of asynchronous meeting strategies as well as on-line information retrieval systems. Exam review sessions involving the instructor and any number of students need not consume class time or classroom space. Rather, these sessions can take place electronically, allowing instructors and students to participate via IRC from the comfort of their respective home or study areas wherever these may be.

While the use of GSS tools to support research collaboration by faculty and/or scientists has been promoted (Anson, et al., 1992), providing the same type of support in distributed environments could provide even greater benefits. Many research often collaborate with colleagues at other institutions, which are often far from their own institution. While e-mail and USENET NEWS are frequently used for communication, greater advantages from technology have yet to be realized. Watkins (1994) reports on an ongoing study of space researchers using a computer conferencing system that utilizes the Internet to allow them shared access to data collected from experiments occurring in remote places. The system, called the "collaboratory," consists of 20 workstations at six locations. Data is collected from an experimental site, sent via the Internet, archived and then is available from a host server to the other sites. The collaboratory allows the scientists access to experiments and data collected from sites great distances away, without the time or expense required for travel, as well as...
allowing them to interact with one another. In addition to the use of the system by the space scientists to conduct and collaborate on their research, the scientists who use this system are themselves being studied by behavioral experts and computer experts. The behavioral experts are interested in the impact of the computer technology on the way the scientists work; the computer experts are developing prototype systems to allow the researchers to work in teams. In an era of decreasing travel budgets available to some faculty, with increased pressures for collaboration and publication, such technologies can greatly facilitate the research process.

5.0 Future Research Directions

As with any new or emerging technology there are numerous unanswered questions and research opportunities to address. One advantage for research on the use of the Internet to support distributed interactions is the low cost and easy access to the technology. Most universities have computer labs with several computers and/or numerous individual computers in offices or student residence hall rooms that could be used for research. Most of these computers probably have sufficient hardware capabilities, necessary software, and communications connections to access the Internet (e.g., the computers on campus at Drake University (Macintosh PowerMacs) have Mac TCP and sufficient applications software, are linked via LocalTalk to a VAX 4600 which acts as both a router and a bridge to the Internet). Additionally, most students (who are frequently used as subjects in such research) are often computer literate and have used the Internet and many of the services provided. Additional research subjects, such as graduate students (e.g., MBAs) who are usually professional employees, may not have the computer expertise of the students, but may alternatively have an intellectual curiosity or motivation to learn about the Internet.

For experimental research in this area, comparisons could be made for the following independent variables:
- Internet services versus other technologies (e.g., commercial DGSS, audioconferencing, videoconferencing, telephone);
- different software (e.g., Meeting Space (TM) versus GroupSystems (TM));
- different services (e.g., IRC versus USENET NEWS);
- different features (e.g., anonymity versus identified; moderated versus unmoderated);
- capabilities (e.g., asynchronous versus synchronous);
- constraints (e.g., group size; number of participants; number of locations; number of participants at each workstation);
- experience of participants (e.g., novice versus experienced Internet users; students versus professionals);
- different applications (e.g., educational versus business);
- tasks (e.g., planning versus problem solving).

Potential dependent variables that could be measured include the following:
- individual or group performance (e.g., quality of the task solution);
- satisfaction with the process used to complete the task;
- satisfaction with the task outcome;
- time to complete a task;
- amount or type of participation;
- technical problems encountered.

A substantial research program could easily be built in this area, for applications in any of the aforementioned sectors (e.g., business, education, government or charity). Beyond laboratory experiments, opportunities to utilize and analyze the results of the use of such technologies for real organizations should also become abundant as organizations seek to determine ways to capitalize on the Internet and its services and capabilities. Several factors, including the increased use of teams and increased need for communication and interaction; increased access to the Internet and the increasing capabilities and numbers of Internet services, as well as packages, such as Meeting Space (TM) and DecisionWeb; along with increasing technological literacy by the society makes research in this area both very important and quite timely. Additional areas of investigation could include, but are not limited to, development of new tools (including expanded multimedia capabilities), establishing user environments, user training, facilitation issues, interface design, and the use of this technology to forge alliances or garner a competitive advantage.

6.0 Conclusions

As availability of Internet services continues to increase and new tools to take advantage of its capabilities appear, many new opportunities and challenges are afforded to those individuals and organizations willing to explore the use of the Internet and existing Internet services to support distributed interactions. This paper has provided background information on the Internet and its services and how they could be used to support future distributed interactions. New technologies raise new issues to be addressed, applications to be pursued, and research questions to be explored. This paper has yielded more questions to be answered, while endeavoring to provide some direction for those who are interested in pursuing the answers.
7.0 References


