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An internet realtime conference: design, experience and future applications

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Abstract

This paper outlines the design of an Internet Realtime Conference (IRC) and reports on the experiences gained in running it. The IRC is believed to be the first ever full scale technical conference conducted over Internet in real time. The system architecture, software design and realtime conference procedure are illustrated. The first hand experience of running the conference and the conference attendees feedback are reported and analyzed. The technology issues and extensibility of IRC are discussed in view of encouraging results. Other possible applications based on the concept and system solution developed are pointed out.

Keywords

Internet Realtime Conference, Internet Applications, Homepage

1 INTRODUCTION

Internet has its roots in academic institutions and, for years, was principally used as a communications tool for researchers (Krol 1994). However, its recent rapid growth both in the number of nodes and in the number of users at non-academic institutions and organizations has stimulated many more applications. Numerous information services now appear on the Internet overshadowing the previous research and academic usage of the network.

While the new information service applications are valuable and interesting to the academic community, there are other possible applications on the Internet being developed by and for the

B. C. Glasson et al. (eds.), *Information Systems and Technology in the International Office of the Future*

academic community. In this paper, we report a new application of Internet, namely the Internet Realtime Conference (IRC). With rapid advances in sciences and technologies, there are many technical conferences being organized each year. These technical conferences are vital to researchers and professionals. Many need to participate not only in new specialty meetings but also in the meetings of overlapping disciplines. However, academicians, increasingly find it difficult to attend conferences due to the travel time and cost. This is a particular problem in the case of a global conference. In a global conference, the potential rewards are high but so are the costs. This dilemma caused us to develop an IRC model. The IRC can offer almost all of the features of a conventional conference yet is more economical in terms of cost and time.

One of the major benefits in attending conferences is the social interaction. One may argue that communication technology even with video bandwidth may never be able to provide the same experience as meeting colleagues face-to-face. However, while funds available for travel and meetings are shrinking and meeting organizers are under pressure to increase revenue by cramming a lot of activities in a few days, hence, expensive registration fees, it is difficult for conference attendees to justify the costs. Furthermore, an activity crammed conference does not give people much chance to engage in meaningful interaction in a leisurely manner. Therefore, the motivation behind the IRC is that we would like to use communication technology to simulate technical conferences with the hope that solutions may be developed to augment or even transform our present day costly and ineffective conferences. It is anticipated that Internet technology may be used to increase the participation of certain meetings both in frequency and duration and to moderate the need for attending other meetings, perhaps in part-time bases. We believe that the cost of conducting IRC can be very low, therefore, the above objective can be easily met. New communication technology may also provide new forms of interaction which can improve the effectiveness of a conference. For example, video conference technology has been used in a physical conference to link remote facilities. Internet web pages have been used to solicit conference papers. On-line post-conference forums have been used to strengthen interaction following a meeting.

In this paper, we report the first full scale IRC, which was sponsored by the Global Information and Software Society (GISSIC95, October 17-20, 1995) and supported by Polytechnic University (Polytechnic University 1996). The authors designed, participated and monitored the conference. The next section describes the conference system architecture and design, The details of our first hand experience with IRC is reported in section 3, section 4 discusses future extensions of IRC and possible other applications. Concluding remarks are given in section 5.

2 SYSTEM ARCHITECTURE AND DESIGN

World Wide Web (WWW) is an extremely effective mechanism for distributing and sharing information. The IRC system design takes full advantage of the Internet architecture. In the following, we describe the architecture and design of GISSIC95 - a virtual conference environment accessible via the Homepage. The basic idea of IRC is to build an environment, where conference preparation can be processed via Internet and attendees can investigate conference papers and discuss with authors or other attendees in realtime in the conference sense supported by multimedia and hypermedia technologies through the global network. Figure 1 gives the general system architecture with the Polytechnic University network system specifically defined. The client site can generally be a LAN supported site with or without a dedicated server for enhancing the system performance. At least, a dedicated HTTP (HyperText Transfer Protocol) server is required to store and fetch conference papers. The load may be distributed if multiple servers are linked to share the

load. The HTTP server, located at New York, USA, runs on a Sun SPARC-20 with 128M RAM and RAID Level 3 disk subsystem. It connects to a 10 Mb/s Ethernet LAN and T3 link to the Internet. Papers are stored as separate HTML (HyperText Markup Language) files on local hard disk or machines over the network. Clients from different countries send requests to the server using HTTP protocol. The protocol provides very fast search and retrieval capability of ASCII text over a Telnet-style Internet protocol but for displaying images or video it requires extensive network bandwidth hence a time consuming task for users outside of the US. The more generic system architecture is a distributed system where multiple servers are distributed world-wide. A particular server may be selected to host a particular session of papers for operational ease as well as for balancing the information retrieval load. Digital library technology (Fox 1994) and Network Multimedia File System (NMFS) (Patel 1992) protocol will be very useful for multimedia presentation and system performance. However, these were not incorporated in the GISSIC95.

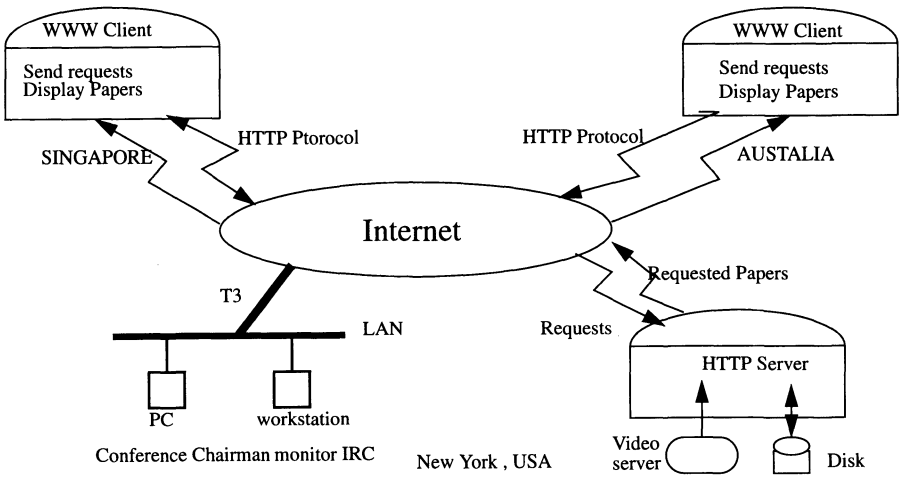

Figure 1 GISSIC '95 system architecture

On the user interface design, a number of alternatives were developed. The final choice was very much influenced by the size of the conference. Since the GISS conference is young and the IRC model is new, GISSIC95 did not get a large number of papers as desired. A simple user interface was adopted. The system provides an opening screen containing a list of paper titles with hyperlinks to full papers. The attendees can read HTML format papers (with ASCII text, images and even MPEG video clips, however, none of the conference papers provided video). HTML does not contain information about fonts and paragraph spacing which should be used for displaying the papers. On the one hand, this gives great advantage in that HTML format papers can be rendered successfully on whatever platforms they are viewed. On the other hand, the original author 's intended format is not guaranteed which sometimes annoys the readers and the authors. This is an issue deserving some consideration in future IRC; perhaps a user defined common standard should be adopted. To help navigating within the paper lists, the attendees use an interface matrix to link to a specific paper. During or after viewing the paper, attendees can access related information by clicking references (hyperlinks) if provided or can send questions or comments to authors by on-line

Q&A HTML forms. The HTTP server sends questions to authors using CGI (Common Gateway Interface) (CGI 1996) mail gateway. The authors send explanations back via e-mail which can contain textual data, images, WWW sites leading to other files, a bibliography or further references, etc. Listserv (Listserv Server 1996) is used by the conference organizers and attendees to distribute ideas, questions and answers or to organize fora. At GISSIC95, two post-conference fora were organized.

A conference program structure and its operating rules have been defined for the users to follow. Although they are specific for GISSIC95, they can serve as a reference for other IRC's. The GISSIC95 program consists of a keynote speech, invited papers and contributed papers. Papers are accessible during specified dates, over 24 hours per day with US Eastern Standard Time as the conference standard time. Authors of accepted papers are given specific time slots to receive questions and comments (limited to 1KB) and append responses to their papers (limited to a total of 10KB). The questions and responses must be addressed to the authors and session chairpersons and copied to the conference chairman. The session chairperson has the duty to monitor the Q&A process making sure it is properly and effectively done. On the last day of the conference, all Q&A will be accessible for review.

3 FIRST HAND EXPERIENCE WITH IRC

IRC is different from conventional conferences in that its conference structure and operational rules are implemented to make this conference intensively focused and efficient in information exchange and peer interaction. Preparation of the GISSIC95 took less than 6 months which is very efficient compared to a conventional conference taking about 12-24 months. (The six months included the delay caused by the author (IFC) moving from an industry position to an academic position, hence, the entire process may take even less time if no firewall had to be dealt with). As shown in Figure 2, the workflow of preparing & running a conference can be represented by a set of function modules. The first module is organizing the conference committee. The conventional way may take more than 2 months (phone calls, snail mails, even physical meetings may be required, of course rarely one can get everyone to agree on a singe date to attend the physical meeting) whereas GISSIC95 only took 3 weeks to organize the committee by sending and receiving HTML forms for confirmation. Due to the lack of a credible past for GISSIC95 as a viable conference in an IRC model, there was difficulty to organize an enthusiastic committee for the first time. This, in our analysis, is not due to the mechanism of the IRC model. They next module is publishing and distributing Call For Papers. The conventional way needs to schedule physical meetings to discuss themes, topics, sessions, schedule, etc. GISSIC95 used Listserv services to discuss those issues and took only one month. Instead of sending snail mail for registrations, all GISSIC95 registrations are done by on-line processing. Naturally, the conference may have missed some individuals who do not have access to the Internet. Naturally, the conference took the position that since the growth of the Internet users may exceed the population of the earth by the year 2000, according to its current growth rate, it is reasonable to assume that IRC can reach everyone. GISSIC95 is meant to be an experiment for assessing the effectiveness of the IRC model. The next module is paper submission where authors submit papers on-line and the system will automatically distribute papers to the proper committee members with an evaluation form for review. After reviewing, the committee members send back the evaluation forms and the system will automatically collect and rank scores for further review and confirmation. Unfortunately, GISSIC95 was not overwhelmed by paper submissions, hence the paper review and ranking process was not used.

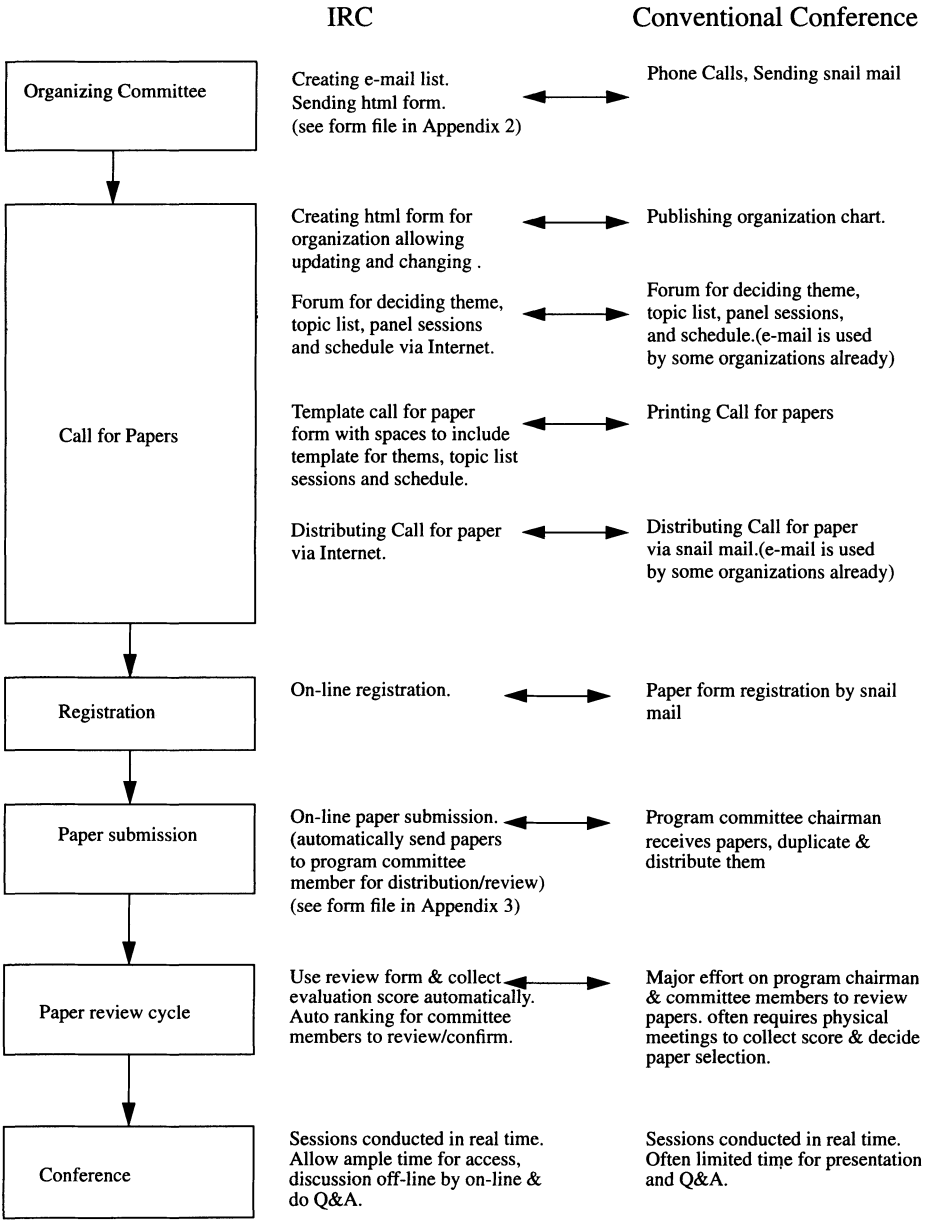

Figure 2 Workflow - IRC vs. conventional conference.

Both IRC and conventional conferences are conducted in realtime. In the conventional conference, there is a serious time limitation for both presentations and Q&A periods. IRC stretches its realtime procedure to allow detailed presentations to get ideas across and ample time for Q&A. In the conventional conference, authors have no way of sorting out questions by priority or refer to a co-author and other colleagues for giving meaningful answers. IRC accommodates multiple authors and cross references in dealing with Q&A. In the conventional conference, people are required to pay extreme attention to the presenter or to listen to the condensed speech. It is also extremely difficult to attend concurrent sessions and absorb everything. IRC allows attendees to take time to digest the paper and to hop across sessions without losing information perhaps even gaining correlated information. The paper proceedings of a conventional conference in a full paper version distributed at the conference would be useful for the attendees and could serve some of the purposes stated above, however, often they were too heavy to carry and too expensive to purchase and rarely in full paper version. The worst of it in a conventional conference is that one cannot easily identify the authors on site to shoot off a burning question. IRC e-mail is a good remedy to that.

There were more than 300 attendees from a dozen countries in the four-day IRC conference. There were more than 1800 browsers to the GISS homepage which links to the GISSIC95 conference. The four-day event ran smoothly except that some of the conference staff, including the authors, had to stay up late hours. (Well, we do that in conventional conference for different reasons). We were excited to know about what and how everything was going on. An official survey was conducted at the end of the conference. A lot of positive feedback was received even months after the conference. A summary of these comments, good and bad, stated below can certainly serve as a good guide for the future IRC's. Most attendees like this type of conference citing the following: 1) it is convenient to access updated information, 2) it fits in their time schedule (since the conference is 24 hours), 3) there is no reason to leave work (or office), 4) to know people in other countries working on the same topics (GISSIC95 had a strong Australian presence), 5) enjoyed the questions and answers posted behind the presentation and 6) the cost is low (GISS decided a registration fee of $20 but waived it after receiving an anonymous donation).

There were, of course, some negative comments as well. The most cited were 1) it loses the social aspect of meeting people (IRC encourages post-conference meetings for people to meet fact to face; even when video conferencing technology becomes affordable in a ubiquitous way; this requirement will still not be satisfied), 2) the response time of their systems are too long (these mostly come from outside the US. It is the network bandwidth issue, hopefully it will be improved as the global information infrastructure advances). Overall, the feedback is very encouraging. The authors are motivated to improve the system solution for future IRC's. Table 1 summarizes a list of Do's and Don'ts based on user feedback.

Table 1 Dos and don'ts list

Dos	Don'ts
Use distributed servers to improve system response time and balance system load	Avoid using too many images and graphics in the paper
Adopt standard paper format and user interface	Do not over use hyperlinks
Test system performance before conference begin	Do not have dead-end links
Encourage Post-conference meetings for follow up	Do not use browser specific enhancements

4 FUTURE EXTENSION AND OTHER APPLICATIONS

The first IRC conference offered a learning vehicle for defining a new conference paradigm and for developing appropriate groupware and software system for other applications. The first implementation had concentrated on interactive session activities to mimic a conventional conference's good features, to exploit the asynchronous characteristics of the internet and its future synchronous interaction possibilities. In a conventional conference, there is a standard set of audio-visual equipments and tools available to the presenters. These might include a whiteboard, projector, video play and sound system. The virtual conference environment can have equivalent equipment and tools using network-based software applications. Some of these tools are available and some are still emerging. Their potential use in a virtual conference environment is not yet understood which is definitely worthy of research. Some of the tools which may be considered for future IRC are:

- The whiteboard: the presenter will make use of a whiteboard for further clarification of a point. In an Internet environment the presenter may make use of shared whiteboard tools such as NCSA Collage (NCSA Collage 1996) and XTV (XTV 1996). Such tools allow images to be displayed, manipulated, annotated, and shared between two readers or among a group of people.
- The Video conferencing: Body language is one component of physical contact that is difficult to convert to pre-packaged text and still images. Incorporation of these might be accomplished in the future through video teleconferencing technologies over the Internet to achieve realtime effect. Work on the MBONE (Kumer 1994) and the CUSeeMee (Cogger 1994) have potential in this area.
- The Video/Audio Clips: Using video/audio clips managed by video servers (Chaney) can also achieve realtime effects or give demonstration support. They may be used in Keynote speech or vendor exhibits.
- The Forum/Panel discussion: An important part of any conference is the personal interactions as questions and answers discussed. Use of a listserv to redistribute e-mail questions or a usenet newsgroup are simple methods for sharing this interaction. A more dynamic period could be created using a chat session such as Global Chat (Global Chat Servers 1996). These, however, may require a different culture and a different interaction style. Although these communication styles are new but they may be more effective for large IRC's.
- The note: In a conventional conference, the attendees use pen or pencil to take notes on what is spoken. The presenter will use pen or pencil to jot down important points. The annotation capability with Netscape or Mosiac browsers is very limited. CoNote (Davis 1996) annotation system may be explored. The creation and use of audio-visual tools for IRC over the Internet are still problematic. The same functionality (or at least interpretability) must be available across all popular operating systems and graphic user interfaces. These are technical challenges for IRC designers. Java language (Java Programmer's Guide 1996) which is a machine independent and distributed Internet programming language may be used to build an interface for IRC.
- A graphical user Interface tool: A set of standards perhaps should be defined for IRC to facilitate the design of a common user interface for a particular IRC.

Although the present system does not have many of the function support discussed above, the system architecture is quite generic in that the new functions can be used for many other applications involving data transactions and data processing in a realtime application scenario. Examples may be Internet courseware for distance learning or conducting board meetings over the Internet or even running a university over the Internet. The non-education related applications are beyond the scope of this paper. We list only a number of educational applications in Table 2. The applications listed

have been differentiated from one (teacher) to N (students) teaching style with low interaction to an M (teachers) to N (students) teaching style. The latter paradigm (M to N interactive teaching) is the basis for the CARE project, Cyberspace Assisted Responsive Education (Chang 1995). A virtual learning environment is being built for CARE which supports M (teachers) to N (students) teaching style and a non-linear learning style can certainly benefit from the IRC system.

Table 2 Characteristics of Applications

Application	Description	Data Flow	User Interaction	Duration
Boradcasting Services	One sender many receivers	1 -> N	None	Minutes to days
Seminar / Lecture	Lecture with discussion	1 -> N	Low	Hours
Internet Conference	Q&A from a subset of participants	M -> N (M << N)	Moderated	Days
Workshop / Forum	Group discussion	M -> N	High	Days
Courseware for distance learning	Group of students learn from group of teachers	M -> N	High	Weeks to months
Internet University or Care	Virtual campus or alliances of universities	M -> N	High	Years

It is envisioned that with proper system design, a realtime application scenario conducted over the Internet not only can achieve realtime responses (given sufficient network bandwidth and computer processing power) but also can obtain realtime computer compiled statistics to support the application, for instance, tallying scores, counting votes or executing Robert's rules.

5 CONCLUSIONS

We reported the design and experience of running an IRC. The IRC application models the conventional conferences and provides similar features and functions except each attendee participates in the conference at his or her computer, in office, in laboratory or at home via Inter access. A distributed server system is used to support the multiple sessions of the conference conducted in realtime. Homepages are programmed to serve as the user interface for conference participants. Functions of query, registration, paper submission and question and answer period for each paper are all conducted on-line with electronic form and electronic mail. Browsing of the news bulletin, registration of the conference and reading of each paper are tallied, hence at any given time, available as statistics at his or her fingertips (so to speak). The keynote paper can be either broadcast to a large mailing list or accessed the same way as the contributed papers. Session chairpersons are responsible for monitoring the paper sessions and have a duty to receive and transmit questions and answers between audience and authors. The Q&A sessions are posted for each paper and made reviewable at designated time periods. The conference encourages "off-site" or off-line on-line (in the jargon of Internet) correspondences of private discussions or organizing and conducting fora on

some specific topics. A conference's content can only be as good as the organizers' effort to invite and/or solicit good papers. The entire process of organizing the committee, calling for papers and executing subsequent tasks is supported and conducted over the Internet.

The missing element of social (face-to-face) interaction in IRC is an issue that will not be solvable in the near future. Post IRC physical meetings may be used as a remedy. The advanced audio and video communication technologies may also be employed as partial solutions.

Based on our experience and user feedback discussed above, the authors believe that the model of an Internet Realtime Conference may very well be proven to be more effective than conventional conferences in many ways. Hence, the GISSIC95 experiment may trigger a paradigm shift in conferences especially those with a large global participation. People aided with computers are multi-tasking ever more than before. It is becoming increasingly difficult for people to drop everything else for a long period of time to attend a conference no matter how attractive the location may be. Hence a realtime event involving a large number of people from distributed places may be better off conducted on an Internet where flexible attendance and mutlitasking can be reasonably maintained. The first IRC was considered successful. The attendees' feedback are mostly positive. This encouraged us to consider further enhancement for IRC and to extend the system software to work for other applications.

The IRC support software developed by the authors can be licensed free of charge for non-profit usage per request basis. Please contact authors (ifay@quasar.poly.edu) for further information.

6 ACKNOWLEDGEMENT

The authors thank the Global Information and Software Society, for its generous support in conducting the first Internet Realtime Conference, and a number of colleagues, David Chang, Tony Monteiro, Wey Chang, Yu Zeng, T.W. Ma, Jintae Lee and P.S. Chang, whose encouragement and support are greatly appreciated.

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8 BIOGRAPHY

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