

MULTIPLE-MODE COMMUNICATION ENVIRONMENTS WITH IRI-H

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ABSTRACT

Recent years have seen the development and use of many distance learning and interactive collaboration systems. Some emphasize interactive use among participants in which the dominant mode of communication is live and synchronous using networked multimedia technologies including audio, video and shared workspaces. We describe key features and alternative uses of IRI-h, a JAVA-based system implemented and in use at Old Dominion University and how those features support a variety of interactive, multi-person, multi-location communication needs.

INTRODUCTION

Recent years have seen increased use of the Internet and World Wide Web for communication and distance learning; many commercial tools support these uses. Often a system, particularly if intended for instruction, is based on an *asynchronous mode* where course content is available on the web; students study the material at their own pace and may seek help from an instructor using email and other multimedia teleconferencing tools (see, for example, Hilt and Kuhmünch 1999, Ibrahim and Franklin 1995). Other systems are based on a *synchronous mode* where all participants meet at the same time, but not necessarily at the same place and use the Internet as the primary means of communication (Hilt and Kuhmünch 1999, Maly et al. 1997, Synnes 1998). An example of such synchronous systems is the *Interactive Remote Instruction* (IRI) project developed and used in the Department of Computer Science at Old Dominion University over the last six years (Maly 1997, Maly 2001). The IRI system offers a synchronous virtual classroom environment, with audio, video, presentation, recording and tool sharing capabilities.

OVERVIEW OF IRI-H

Our experiences with the original IRI system (Maly 1997) led to a recognition of the need for a multi-platform, multi-network environment scalable system and prompted us to redesign and implement a new *IRI-h* system (IRI 2002, Maly 2001). The “h” in the acronym emphasizes that IRI-h is designed to run on *heterogeneous* platforms and within *heterogeneous* network environments. The IRI-h prototype (Maly 2001) is fully implemented in Java (Sun 2002) and has been tested on multiple platforms including PCs running various

versions of Windows and UNIX machines running the Solaris operating system. It has been successfully used to teach a semester-long computer science course across sites 35 km apart.

IRI-h's primary focus is supporting live communication among people in different locations; its strength is in person-to-person rather than person-to-machine interactions (such as is used in some tutoring and simulation-based training environments, for example).

Figure 1 is a screen-shot of one IRI-h interface. In this image, two participants, each seated at a multimedia workstation, are discussing a web page: a presentation tool has been used to highlight (with an oval and a rectangle) features of the web page. A variety of personal and presentation tools are available to all participants. Several of these are listed in the next section; see Maly (2001) and IRI-h (2002) for more complete descriptions of the interfaces and tools available in IRI-h.



Figure 1: Example IRI-h Interface

IRI-h Functionalities

Table 1 gives a listing of major IRI-h functionalities. Its organization primarily reflects how these features appear on the interface: two toolbars are used to control and access IRI-h features. For the Lower Toolbar, the effects of actions are visible to all participants (Shared View Resources) while the effects of others are seen only on the initiator's monitor (Private Control Options).

IRI-h Functionality	Brief Description
IRI-h Online Management	Class and Intranet configuration from Web
IRI-h Initiation	(a) Automatic Start Session – Web-based (b) Manual command line start up
Late Join Session	Feature for joining late during a on-going session
Online Notes Access	Notes taken during any session could be accessed online at any later time
Presenter Control	Controls window layout and available services
Pointer	Pointer options - cursor attached, click activated
Annotation	To share drawings and annotations Options: pencil, text, clear, others
Audio	To listen to the audio of participants Options: speaker on/off, microphone on/off, Kill/restart Sender or kill/restart Receiver
Video	To view a live video of participants Options: activate/deactivate video, Kill/restart sender or kill/restart/on/off receiver
Tool Sharing	Sharing tool- Share application windows on the user's computer with all other participants Options: Local and remote tool sharing
Survey	Conduct instantly tabulated surveys and quizzes
Replay	Replay an earlier class-session
Problem/Situation Awareness	Identify problems related to class material, audio/video or interactivity/network.
Notebook	Create and store online text notes, snapshots.
Site Video	Complete video mage of entire class
Call Student	Option for controlling IRI-h services of students
Monitoring tools	Provides participant monitor, service monitor
Bandwidth control	Controls transmission rates for non-multicast users

Table 1: Summary of IRI-h Functionalities

In IRI-h, every participant can send video (up to 4 videos simultaneously with easy switching to new videos), audio, data and shared tools. For each site, IRI-h has a site video, a pointer service. whiteboard (annotation) and other services are integrated into each user's view. An advantage of IRI-h is that it provides capabilities such as video/audio support as well as the possibility to share arbitrary tools (typical windows word processors or UNIX simulation tools) together with annotations and a global pointer. In addition private note taking allows for participants to keep their personal notes that are not shared. If needed, such as in consultations among lawyers and their clients, sessions can be recorded to document the happenings at the session.

The design of IRI-h reflects the recognition of several current trends: 1) in networks: increasing bandwidth is available to home and elsewhere, but multicasting is used only in Intranets, Internet traffic is still bursty; 2) synchronous courses are hitting pocketbook problems – income does not materialize and many universities have dropped out of the distance learning market though many capabilities continue as enhancements to regular courses; 3) active learning is widely accepted for all levels of education; 4) commercial use of simple web based video conferencing/simple tool sharing tools is becoming more accepted.

Current IRI-h Status

The IRI-h prototype is a stable complete system, providing administrative support for setting up classes (class roles, autostart of assigned machines, for example). It is easily installed as a client but poses significant needs for server installation and maintenance. In its present form, its complexity is such that deployment needs experienced technical support.

ALTERNATIVE USES OF IRI-H

A central goal in the development of IRI-h is to support the a variety of communication styles and approaches, supporting the communication needs for many common situations, including, for example:

1. Active free-flow interactions where participation is initiated by people on a when-desired, as-desired basis;
2. Prepared presentations by a single presenter to a group of people, with questions and some discussion from participants;
3. Discussions where participation is primarily initiated and managed by the moderator.

In this section, we identify our view of the key communication support needed for several different situations. We also list the features of IRI-h, if they exist, which address these needs.

Video-Conferencing/Tool Sharing Environment

Video-conferencing sessions are frequently ad-hoc, highly interactive meetings with participants individually located at multiple sites. In this mode the IRI-h environment allows for spontaneous or scheduled conferences across the Internet for a limited number (less than fifty) of participants. Several commercial packages also support this mode of use, each with advantages and limitations. We only describe a couple and refer readers to company websites for more information (see, for example, www.eblvd.com, www.callconnect-us.com, www.polycom.com websites). PlaceWare (Placeware 2002) is an online presentation tool that uses PowerPoint and Internet Explorer or Navigator. Only the presenter can send audio and video. Other participants cannot, but can control slides and shared applications/desktop. It provides several other features (for example, recording, annotation, audience polls and a whiteboard). WebEx's OnStage (www.webex.com) combines conference calls with shared applications and meeting organization tools.

Typical uses of this environment might be:

- ?? Commercial: attorneys/clients meeting, lawyers/experts report generation, sales meeting, contract negotiation, proposal response writing
- ?? Educational: team projects, collaboration on homework, research collaboration, thesis defense, paper/proposal writing, panel review of proposals, group brainstorming.

The minimum requirement for any participant is a reasonable modern workstation (for example, 1.8GHz windows machine or a Sun Blade 100 workstation) that has speaker/microphone/camera over USB port (if these are not available a user can still see what is happening in the shared environment but cannot be heard or seen by others).

“Lecture-Mode” Class-like Structure

Typical characteristics of class-like situations include: regularly scheduled, single presenter, potentially large audience, material prepared beforehand, most common interactions are in the form of audience questions to a presenter and questions from a presenter to individual class members. Table 2 lists capabilities needed for this use and how they are met by IRI-h.

Desirable Capabilities	IRI-h Support
Present prepared materials	Shared tool for slides, simulations, graphics, pointers, annotations. Because of the tool sharing engine used, IRI-h may not perform well with rapidly changing images (videos)
Presenter audio and video	Presenter video; audio only if speaker not in same room
Audience audio and video	Multiple audience videos and audios, but no audio for people in the same room
Audience list and location	Participant list and location
Autostart for large group	If machine and participant list is provided, IRI-h can be centrally started for all users
Identification of speakers and questioners	Names displayed on videos and pointers
Recorded sessions	Available for replay during a regular class or privately out-of-class
Notebooks	Private on-line note available after class
Feedback to presenter	1. Video of remote classes 2. Instantly tabulated survey, quizzes 3. Participant initiated direct feedback tool
Attendance records	Not available

Table 2: Desirable Properties for Class-Like Meetings

“Free-Discussion” Class-like Structure

Typical characteristics: often short presentations followed by discussion though discussion can also occur during presentation, regularly scheduled, many “presenters,” often prepared material.

The desirable capabilities for this mode of interaction include those listed in Table 2, along with the ability for any participant to take control of shared resources (with others notified of who currently is in control) and for rapid switching of video images initiated as needed as new participants join the discussion. Both of these capabilities are available in IRI-h.

SUMMARY

We have very briefly discussed many of the salient features of IRI-h and described the current status of the IRI-h prototype. We identified several types of use for interactive communication systems, what features are important for these uses and how IRI-h meets these needs. We continue to explore and experiment with other group communication needs using IRI-h as the prime vehicle for this work in order to better understand how people choose to communicate in different contexts. We recognize the administrative and technical overheads of the current prototype and are exploring the possibilities of creating several subsets of IRI-h where each subset better meets the needs for particular limited uses. This will be particularly beneficial if these simplified versions can reduce administrative overhead and technical complexities.

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