IRI-Easy: A Distance Education Software System

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Abstract:

At Old Dominion University, we have an ongoing project developing tools to support distance education delivery. IRI-Easy is our latest effort. It not only executes on heterogeneous computer platforms and networks and continues to provide audio, video and tool sharing services within a synchronous virtual classroom environment but also extends these functionalities to make it simple to setup and join collaborative sessions. IRI-Easy also overcomes the network difficulties like firewalls, NAT and low-bandwidth that are often issues for home users. In this paper, we present an overview of IRI-Easy and some details newly added features and functionalities.

1 Introduction

The Interactive Remote Instruction (IRI) project has been an ongoing project for several years in the Department of Computer Science at Old Dominion University. We have completely redesigned and re-implemented the system twice in response to advances in network technologies and protocols, multimedia technologies and increased performance of desktop and laptop computers, and repeated use of IRI in a variety of instructional settings [3]. The second generation version of IRI, IRI-h, provided support for heterogeneous network environments, heterogeneous platforms, and introduced the notion of a commonly shared view of any shared activities among all participants [1]. The current version of IRI, IRI-Easy, extends IRI-h functionality to allow simple on-the-fly set up and joining of collaborative sessions and is suitable for groups of participants located in isolated multicast-enabled Intranets through an efficient "group of groups" communication paradigm, as well as individual multicast-disabled participants such as home users. In this paper, we present an overview of IRI-Easy and some details of newly added features and functionalities.

2 IRI-Easy Overview

The older versions of IRI were designed on the assumption that the computers and networks required were relatively expensive so that primary use would be in university settings for regularly scheduled classes at pre-established locations and registered students. To simplify start-up for a class, IRI used several configuration files to start several servers required in a session, start the IRI software on designated computers at designated locations and only allow registered students to logon. Users had no means to change most of the parameters once they join a session. As hardware and networks became more capable, the requirements for IRI-Easy eliminated the administrative burden of building the required configuration files so that it now supports creation of spontaneous sessions as frequently occurs in business settings and

in university seminars and PhD courses without reducing its utility for regularly scheduled university courses or meetings.

We designed IRI-Easy to provide most functionalities with only two or three mouse clicks. The interface also simplifies user actions needed to start and manage sessions. Sessions can be started with two button clicks if defaults are acceptable. After someone starts a session, others can join it with a simple button click. While IRI-Easy keeps user operations simple, it still provides the key functions that previous versions of IRI provided such as audio, video conferencing, tool sharing [2], gateways, white board, and pointer service. IRI-Easy is implemented completely in Java and uses inexpensive audio and video components. It and in both Windows and UNIX environments and adjusts to different network bandwidths (primary by adjusting video bandwidth needs) for different participants by use of an IRI gateway. We have successfully tested IRI-Easy on virtual private network connections as a solution for users at home with high bandwidth internet connection or users situated behind firewalls.

3   System Architecture

IRI-Easy is designed with a typical client-server architecture. A particular IRI-Easy meeting is called a session and involves several participants and a central session manager (an IRI-Easy software component) with the assistance of directory server, a java server and gateway. A directory server provides a lookup service of scheduled and currently active sessions, and registered and online users for use by people who want to search for and join a session already started by someone else.. A java server provides all system management functions like session start-ups and shutdowns, user registrations, user logon and logoff. An application gateway is included in IRI-Easy to support session participants with no multicast capabilities or limited bandwidth such as home users by offering data packet relaying and rate adaptation services. A gateway is session independent and can provide service to multiple simultaneous ongoing sessions.
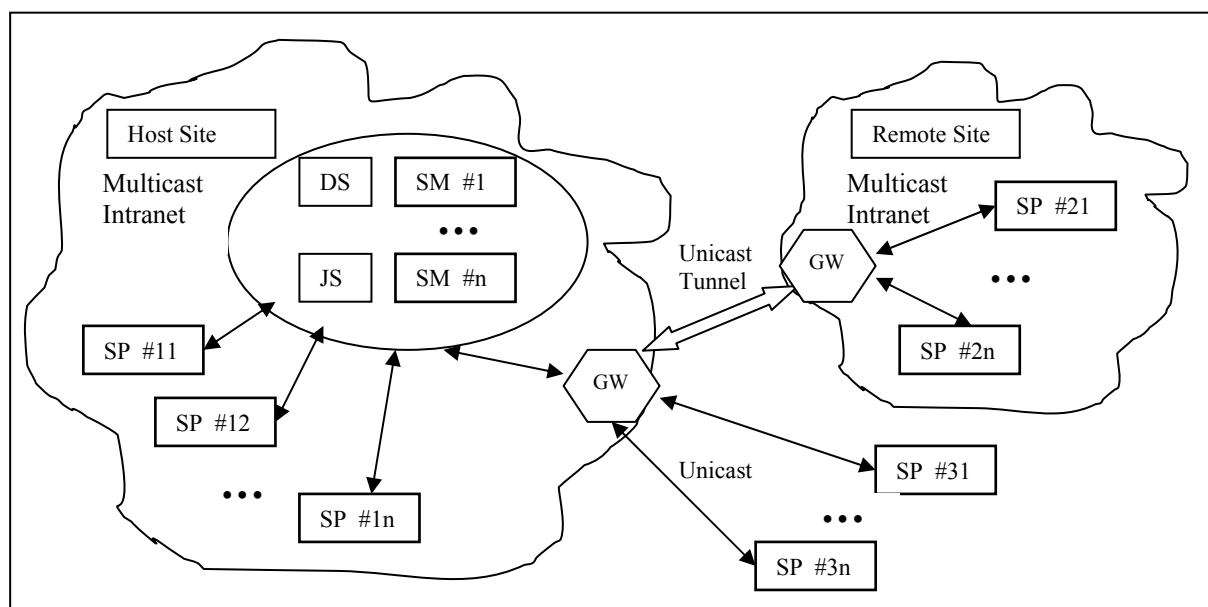
DS: Directory Server, JS: Java Server, SM: Session Manager, GW: Gateway, SP: Session Participant
Figure 1. A typical IRI-easy Session

Figure 1illustrates a typical IRI-Easy session involving two multicast enabled sites connected by a unicast tunnel between two gateways and several home users that require gateway service. A java server authenticates users when they log on as a session participant. A session starts when a user initializes a session through the java server which creates a new session manager process. All session activities and user information are updated in directory server. Users also see information about scheduled and ongoing sessions on the session participant. A user can join an ongoing session by simply highlight the session name and click the "join" button. If multicast is disabled at someone's site, the participant can switch to unicast by selecting an available gateway. A unicast tunnel could be established between two multicast-enabled sites to provide a "group of groups" communication paradigm.

4   IRI-Easy Features

IRI-Easy provides support for heterogeneous network environments, heterogeneous platforms, and introduced the notion of a common shared view of any shared activities across all participants. Support for network heterogeneity is provided through an application-level gateway that performs packet forwarding between multicast-enabled sites and individual multicast-disabled participants, and rate control services for video and tool sharing streams [4]. IRI-Easy features a sharing tool service which allows a participant to share any running application with other participants. At the sender side, images of the windows in the application being shared are captured, compared to previous images to detect change, compressed, and transmitted over a group communication channel. At the receiver side, the images are received, decompressed, and displayed. Moreover, a floor control facility is provided to enable receiver side participants to take control of the shared tool. This tool was completely redesigned and adapted to function with home users behind NATs and possibly low bandwidth networks.

Figure. 1 shows the new IRI-Easy user agent interface. The interface and operations are much simplied than previous versions. Once a user signs in, all users (online/offline) are listed on Start panel, by selecting one or more users on the list, the user can start an instant session or send instant messages to other possible participants to let them know that the session is starting. On the "Join" panel, all available sessions are listed, and a user can select one to join, invite others to a session, or close a session if he/she is the person who started the session. With this user agent interface, users can adjust several parameters for audio, video and networks while a session is running and these adjustments have an immediate effect.

Once a user joins a session, the IRI-Easy client interface appears. In figure 2(a), the presenter can be seen in the large video image along with two smaller student videos. In figure. 2(b), a shared presentation is partially covered by a list of participants along with status of the IRI-Easy software running on their machines.
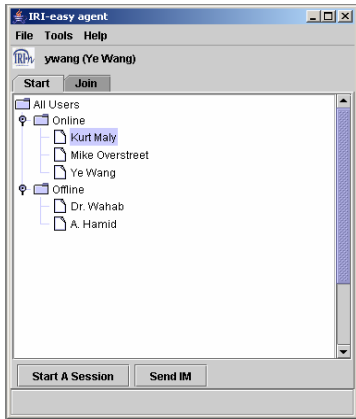
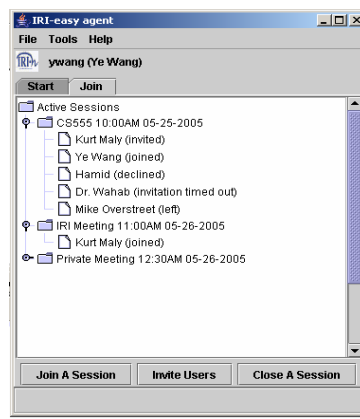Figure 1. a. IRI-Easy user agent Start panel   Figure 1. b. IRI-Easy user agent Join panel

Figure 2. a. The IRI-Easy discussion mode.   Figure 2. b. Tool sharing and status information

5   Summary and Conclusions

The current version of IRI, IRI-Easy, significantly simplifies ease of use primarily through the elimination of the configuration files needed in previous versions and a modified user interface. Now starting a session on-the-fly is easily and quickly performed without limiting its use in regularly scheduled sessions.

As networking and computing capabilities evolve, and as our understanding of beneficial techniques for communicating and interacting with each other in cyberspace, communication tools such as IRI-Easy will need to change. The evolution of IRI over the several years since its original creation illustrates this necessity. Its changes are based on our improved understanding of desirable features based on our use and the services of other computer-based communication tools, reduced hardware costs, improved network performance, and changing assumptions about user computer capabilities.

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