Chapter 2.16
The Essential Elements of Interactive Multimedia Distance Learning Systems

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ABSTRACT

In recent years, we have seen the introduction and use of many distance learning systems. Some of these systems are characterized as interactive, which means the dominant mode of instruction is live or synchronous using networked multimedia technology such as audio, video and shared workspaces. In this chapter, we present the common features and essential elements that should be implemented in such systems. Throughout this chapter, we will use as a model and case study the IRI-h system (for Interactive Remote Instruction-heterogeneous) that we have developed and implemented in Java and have used to support distance learning at Old Dominion University.

INTRODUCTION

In recent years, interest in using the Internet and the World Wide Web as tools for distance learning has increased. Many of these systems are based on an *asynchronous learning* paradigm which makes course contents available on the Web; students learn the material at their own pace,

they may seek help from the instructor using email and various multimedia teleconferencing tools (e.g., Hilt & Kuhmunch, 1999; Ibrahim & Franklin, 1995). Other systems are based on a *synchronous learning* paradigm where the instructor and the students meet at the same time, but not necessarily in the same room, and use the Internet as the primary means of communications (Hilt & Kuhmunch, 1999; Maly et al., 1997; Synnes, Lachapelle, Parnes & Schefstrom, 1998). An example of such synchronous systems is the *interactive remote Instruction* (IRI) project that has been developed and used in the Department of Computer Science at Old Dominion University over the last six years (Synnes et al., 1998; Maly et al., 2001). The IRI system offers a synchronous virtual classroom environment, with audio, video, and tool-sharing capabilities. Past experience with the original IRI system (Synnes et al., 1998) has enabled us to identify several inherent deficiencies that limit its large-scale deployment. The main identified deficiencies were platform dependence, limited scalability, and the need for a homogeneous controlled network environment. The need for a multi-platform, multi-network environment scalable system prompted us to embark on the design and implementation of a new IRI system which we termed *IRI-h* (http://www.cs.odu.edu/~iri-h; Maly et al., 2001). The "h" in the acronym stands for heterogeneous; it distinguishes the fact that IRI-h is designed to run on heterogeneous platforms and within heterogeneous network environments. An IRI-h prototype (Maly et al., 2001) was fully implemented in Java (http://java.sun.com) and has been tested on multiple platforms, including PCs running various versions of Windows and Unix machines running the Solaris operating system. In addition, the developed prototype has been successfully used to teach a semester-long computer science course across sites 20 miles apart.

In this chapter, we leverage our previous and ongoing experience in the distance learning arena to identify a set of essential features for interactive distance learning systems. We present as a case study our own IRI-h system, highlighting how most of the identified features are integrated and implemented. Next we discuss a set of features that we believe should be available in any interactive distance learning system. Then we present a general design overview of IRI-h highlighting main design components and functionality, including the session participant, the session manager, application-level gateways to handle network heterogeneity, and recording and playback services to provide asynchronous learning capabilities. The next section summarizes how most of the essential features identified earlier are supported by IRI-h design and components. Finally, the chapter is concluded along with future work.

ESSENTIAL ELEMENTS OF AN INTERACTIVE DISTANCE LEARNING SYSTEM

In this section, we identify a set of essential elements that we believe should be present in any interactive distance learning system. Typically, a semester-long class meets as a series of synchronous *sessions* lasting an hour or so. Some of the session participants can be gathered or co-located in specially equipped sites, e.g., a university lab, or a conferencing room in a corporate network setup. Other class members participate from home or work. In terms of network connectivity, some participants can utilize high-speed scalable group communication, e.g., by being located on a high-speed multicast-capable intranet (Deering, 1989) while others may be less capable in terms of the unavailability of multicast communications, limited connectivity bandwidth or long incurred delay. It is desirable not to reduce quality of service to some participants even when others have more limited connectivity.

Based on our experience with IRI, we strongly recommend that most, if not all, of the following features should be available in any interactive distance learning system: