

## MIST/C DEVELOPMENT PHILOSOPHY

### Synchronous or Asynchronous? Yes.

Distance Education (DE) approaches generally are categorized as either synchronous DE, where student and instructor communicate electronically in real time, or asynchronous DE, where the instructor commits the learning materials to some medium, from which the student receives them afterward. It is recognized that these two approaches are synergistic; they are complementary and can enable better effect together than separately [1][2]. However, the open source educational software community has been slow to produce systems combining the capabilities. Our research addresses how to create the most effective, open source (and therefore robust and inexpensive) software to enable educators to exploit that synergy.

### Moodle

The GMU C4I Center Networking and Simulation Laboratory has been engaged for the past decade in implementing open source DE software for synchronous online education. We have observed that synchronous and asynchronous modes are more effective when combined. Thus when we discovered the software integration facilities in the Modular Object-Oriented Dynamic Learning Environment (Moodle), we were motivated to rework our previous efforts into the Moodle environment. Moodle is widely recognized as a high-quality Learning Management System (LMS) supporting asynchronous DE [7], with over 49,000 currently active sites registered in 211 countries. Our previous product, Network EducationWare (NEW), integrates a collection of open-source synchronous communication tools into an online teaching environment that also has been used to a significant extent for Internet conferencing. Because of its low cost and user-friendly interface, we already were using Moodle as an LMS for course delivery supported by NEW; upon discovering the developer-friendly facilities offered by Moodle, we brought Moodle into our development plans. The result is Moodle Integrated Synchronous Teaching/Conferencing (MIST/C).

### NEW

The capabilities of NEW are described in the papers linked to this website. NEW features audio, video, and whiteboard interfaces, a floor control/chat panel, a recorder, and a playback unit, all operating under control of a master client. The system can function well (absent video) over a 56 kilobit/second modem, and even better (including video) over a good Internet connection. From 2002 to 2009 we continued to enhance the functionality, performance, and reliability of the NEW open source

software. This included extending NEW from the Windows platform to Linux and MacOSX and building the comprehensive NEW Course Management (NEWCM) system for file maintenance and user authentication that won IASTED's 2005 award for non-commercial, Web-based educational software. It also provided an ever-growing suite of documentation that supported use of NEW by fifteen faculty members teaching about twenty different courses, mostly at the graduate level, a program well suited to our region's need for telecommuting to class. Particularly notable was the infrastructure, both computer and human support, that provided for libraries of teaching slides and lecture recordings, captured as a by-product of using NEW to teach in a normal classroom setting. The versatility of NEW was demonstrated by its use to support international teleconferencing in a software development program.

### Adding Synchronous Media to Moodle

Moodle is open source software, designed with a modular architecture. It supports a plugin application programming interface that makes enhancing Moodle's capabilities or adding features relatively straightforward. There is a library with hundreds of plugins available from the Moodle community. MIST/C was developed to use this plugin interface as a Moodle "activity module." As a result, it is very simple to install (or uninstall) the plugin in an existing Moodle environment. Installing the plugin automatically creates the required database tables and entries to support the MIST/C server software. By integrating with Moodle, MIST/C is able to take advantage of existing Moodle infrastructure, thereby avoiding the need to maintain a Web application for file management and user authentication. This allowed us to focus our development effort on improving the synchronous software components without maintaining a separate Web interface.

Most educational institutions maintain systems for managing student accounts and enrolment using technologies such as the Lightweight Directory Access Protocol (LDAP). Moodle is built to take advantage of such systems; MIST/C inherits this capability. The Moodle *student*, *instructor*, and *administrator* roles provide appropriate privileges for synchronous class sessions. Instructors and administrators have the ability to control the "floor" in the context of the online class, determining who can send audio or manipulate slide content. Moodle also has extensive capabilities for managing content and organizing it in formats appropriate to the type of course. Courses can be organized into weekly, topic-based, social, or SCORM-based formats. Using Moodle's file management capabilities, instructors

can arrange their MIST/C slides and recordings in the way best suited to their course format.

## MIST/C in Moodle

MIST/C is a client-server software system. The MIST/C plugin adds a new activity module called a "MIST/C Virtual Room" to Moodle. Instructors can have a synchronous capability for their course simply by adding this activity, using the Moodle editing interface. In the context of the synchronous class, a virtual room is a dedicated meeting space used only for a specific course, which is available for use at any day and time. In the context of the software architecture, a virtual room also is a specific server process, which must be running on some networked computer that is reachable by the MIST/C client.

One of the most useful features of MIST/C is the ability to record all of the online activity in a live class session. This includes audio, chat, video, and whiteboard slides with real-time annotations, all fully synchronized. MIST/C includes a capability to automatically create recordings of class sessions on the server as well as the client. These recordings can be retrieved through the instructor's client and posted for students in Moodle if the client-side recording is inadequate.

The MIST/C Moodle plugin is available on our website as a virtual machine module, complete with Moodle and all supporting open source components, making server installation very straightforward in a VMWare environment on all major platforms (MacOSX, Linux and Windows). Clients for these platforms also are available on our website [12]. The source code for MIST/C client and server also is available there. Tables 1 and 2 below summarize capabilities of MIST/C

Table 1. MIST/C Hardware/Software Requirements

<i>Client Operating System:</i> Windows XP/7; MacOS X; Linux
<i>Browser:</i> all major
<i>Communication:</i> wired/wireless Internet and dial-up
<i>Security:</i> LDAP authentication
<i>Limitations:</i> seats and classes unlimited
<i>Remote hosting:</i> available at moderate cost

Table 2. MISTC Functional Requirements

<i>Customizations:</i> accessible/expandable/enhanceable
<i>Whiteboard:</i> able to accept graphic files in real time
<i>Authoring formats:</i> PowerPoint, PDF, Keynote, OpenOffice
- all participants able to annotate slides during session
<i>Video:</i> common computer formats (mpg, avi, mov); camera
<i>Recording of sessions:</i> automatic on server; including chat
- able to render as mpeg for podcasting
<i>Interaction:</i> testing; polling/hand-raising; voice + chat
<i>Student tracking:</i> login status; participation statistics
<i>Configurable to screen:</i> by user; application window capture
<i>Breakout:</i> able to partition class into separate groups

## Teaching with MIST/C

In our experience, encouraging students to test your software is a good way to find problems. In the Spring 2010 semester, 27 students in a graduate Computer Science course tested MIST/C as part of classes taught in the simluteaching style. Moodle was used as the LMS and was combined with MIST/C for attending class in real time and reviewing recordings. Homework assignments and lecture slides were posted in Moodle. As a project in the class, 17 students chose to use MIST/C to create their own oral reports including audio, slides, and annotations. The reports were recorded by the students independently, using MIST/C in offline mode with no assistance. In addition to recording the lectures, students provided feedback on their experiences with the software. Of the 17 students who attempted the project, all successfully produced presentation recordings. Most of the feedback was positive, although several students reported on a specific documentation problem that confused them. We modified the software to incorporate their suggestions before expanding its use to the full online graduate teaching program.

In the following two academic years, MIST/C was used by over 380 students in 35 online sections in graduate courses taught by the CS department, ranging from Introduction to Algorithms to Software Project Management. Teaching styles ranged from traditional lecture to project-based seminars. The experience

generally was very positive. Of course we did have some problems, but these we resolved quickly.

The GMU Department of Computer Science has offered online courses since 1995 and has offered a full Master of Science in Computer Science degree online since 2004 [20][21]. Teaching faculty tailor their use of delivery technology to their subject and individual style. As a result, there is significant variation among the 17 courses now offered online. However, it is possible to generalize that all courses are offered in some variant of simulteaching mode, and all have been offered using MIST/C.

We believe the question “which is better, online or classroom delivery?” has no general answer. Research shows that, all other things being equal, there is no significant difference in student learning across a wide range of delivery methods and technologies. This is borne out by our own data collected over five years.

We believe the appropriate question is “How can we best help the student to learn?” Clearly, the answer to this is highly dependent on the student’s learning style and personal situation. For example, two situations, common among our students, contribute to their enthusiasm for online course delivery:

- Our school is in a major urban area that is well known for traffic congestion. Our graduate courses are delivered in after-work “rush hour” time, with the result that commuting to and from class can require as much of a student’s time as does the class itself.
- Many of our graduate students are employed in government and industry and must travel as part of their work, but can either connect remotely or attend class “time-shifted” via recordings.

We find that offering students the choice between online and classroom delivery lets them adjust most effectively to their situation and learning style.

## **Simultaneous Online/Classroom Teaching**

Our distance education program is based out of our regular classroom teaching. We use MIST/C to deliver each class to online students and classroom students at the same time, which we call *simulteaching*. This is a less popular mode than the asynchronous courses favoured by many programs. However, while it has both advantages and disadvantages, we have documented a preponderance of advantages in our IASTED CATE 2012 paper.

### **Advantages**

- Low Barriers to Participation
- Good Interaction With All Students
- Reduced Faculty Preparation/Support Time
- Faculty Salary Savings
- Enables More Distance Education Courses

- Low Support Cost
- Enables Flexible Distance Education Delivery
- Enables Expansion of Local Programs

### **Disadvantages**

- Classroom Equipment Requirements
- Administrative Complexity
- Faculty Technophobia
- Technology Problems Can Disrupt Class

Because we find simulteaching to be advantageous, we have incorporated a number of features into MIST/C, some of which are not available in any other system, commercial or open source:

- Auto-reconnect, so the instructor can keep teaching if there are network problems
- Both client and server recordings
- Improved, simplified user interface
- Added whiteboard functions for flexibility
- Voting (the online equivalent of hand-raising)
- Breakout rooms where subgroups can meet

We hope you will find MIST/C useful. Please give it a try – it’s simple to install and the price is right!

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