

# Software Submission using Client/Server Architecture in a Windows Network Environment

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## ABSTRACT

*This paper describes a system for program submission using the client/server model. A Visual Basic front-end is combined with a C client to provide access to a C server:*

**INTRODUCTION** In the fall of 1994, the curriculum of our department changed from a PUI mainframe based programming environment to one using C on microcomputer development systems. In addition to the changes in language and platform, a weekly two hour closed laboratory component was added to the introductory programming course. Previously in programming courses, faculty had been able to easily control mainframe test data sets so that grading student programs could be carried out by carefully checking program listings together with program output. With the implementation of the new curriculum, student programming assignments had to be submitted to faculty in the form of both a program listing and a floppy diskette containing the program source code.

The introductory programming course is organized into forty students per lecture section with two twenty-student laboratories per lecture. There are typically six programming assignments per lecture section. After the first two weeks of each semester, students are required to write from one to three small programs per week as a part of the closed laboratory experience. These activities produce approximately 30 programs per student, per semester, for a grand total of 1200 programs. Of course, most of these programs are small and easy to grade, but the overhead of grading either twenty laboratory or forty lecture programs that reside on separate diskettes is considerable. A non-trivial amount of time is consumed in inserting and removing diskettes, as well as in accessing the program files that reside on the diskettes.

In addition to the time required in manipulating so many diskettes over the course of the semester, the instructor must invest additional time in order to maintain the connection between a student's program listing and the proper diskette containing the program source code. Although it is true that some of the laboratory programming activities are short enough that they could be adequately graded without a program listing, none of the lecture pro-

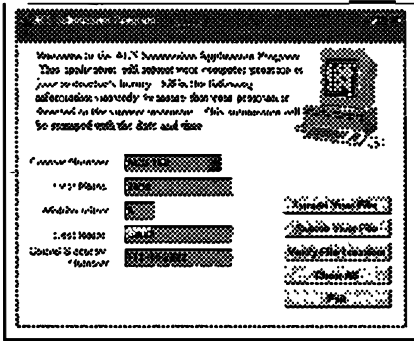
gramming assignments fall into this category. In order to keep their program listing and diskette together, the students were required to submit their assignment materials in a folder or envelope. While this solution maintains the required connection between listing and source, it does add even more overhead to the grading process.

The process described above proved to be workable, but was so tedious that a better solution was sought. Since the faculty had little experience with PC based networks, the obvious solution did not present itself immediately: However, by the second year of the new curriculum, a program had been developed and placed on all departmental computers that would allow students to submit their source code directly from their diskette in the a: drive to a network server. The server was organized by course and section, so that programs for a given class were all collected together.

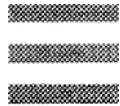
Visual Basic was chosen as the tool with which to develop the Submit program because of the GUI front end it provides. The faculty member who actually wrote the program already had experience in using this development environment, so there was no initial learning curve. However, new facilities incorporated into the tool by Microsoft have led to improved usability characteristics of the Submit program.

**DESIGN OF GUI INTERFACE** The first problem in the program design was to determine a methodology for saving the student's files on the server. It was decided that each course would have a directory on the file server with each section

**FIGURE 1**

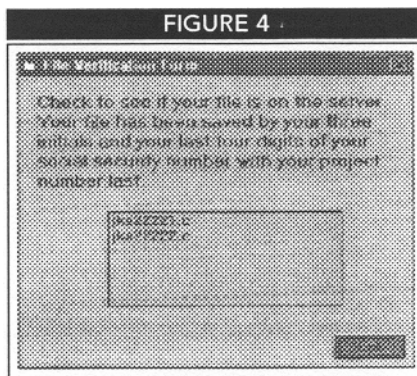






program when a student file is copied to their instructor's directory. A program can be submitted any number of times, and only one copy is saved, that being the most recent submission.

Most students were uncomfortable about relying on blind faith that the file was stored in the correct instructor's directory. An addition button was included, *Verify File Location*, that allowed students to verify their file was copied to the correct location. The directory location is again invisible to the student. The student will only see the filenames that have their own initials and last four digits of their social security number, as shown in Figure 4. Files are copied with the original file extension because of the various courses that are using this Submit program.



**IMPROVED VERSION** The first version of the Visual Basic Submit program was used successfully for a full academic year and it greatly improved the program handling process for the instructors. However, two observed potential problems led to the consideration of further changes. The first possible problem is related to the fact that student programs are collected to hidden subdirectories on a network server to which the students have write and create only access. Using the *dir* command with the *ah* switches, hidden file and directory names can be listed. Once the name of a hidden directory is known, the *dir* command can be used to list the files in the hidden directory. Then it would be a simple matter for someone with write and create access to systematically destroy all the student files. The existence of virus programs strongly suggests that someone might do just that.

The second possible problem is related to the use of the date/time stamp associated with submitted programs. This stamp is typically used to determine if a program was submitted by the assigned deadline, and if not, how many penalty points to assess. In the initial system, this date/time stamp is generated by using the date/time values of the computer from which the student submits his/her program. It is a very simple matter to reset these values backward so that a late program appears to have met the deadline requirements. This is not as malignant an activity as destroying other student programs, but is much more likely to happen.

The solution to both of these problems is to convert the existing Submit program into a client/server application. The server will save programs on a network drive to which the students have only the access provided by the server. This access will consist of saving a program submitted by a student to the appropriate subdirectory, and providing a student with a directory listing of programs that he/she has previously submitted. The first problem is defeated because students cannot use the *dir* command on the server drive since they have no direct access to it. The date/time problem no longer exists because the server uses the date/time values of the computer on which it is running, and not those of the client computer.

Converting to the client/server model allows the use of the existing Visual Basic Submit program to continue to provide the GUI interface to the students. The necessary network protocol sequence to access the services of the server is added by using a Dynamic Link Library (DLL) that is called by the Visual Basic module once all student information is collected. The **DLL** actually read the file from the student's diskette using information collected by the Visual Basic program, and sends it to the server.

An added benefit of the client/server version of the Submit program is that students are now able to submit their programs remotely using their own computers through a modem to access the university network. This is seen as a great convenience by students.

**CONCLUSION** The Visual Basic module is written in version 4.0, so it can be run on both Win NT/Win 95 (32-bit) and Win 3.x (16-bit) systems. The server is written in Visual C++, version 4.0, and can run on Win NT and Win 95 systems. Because there are still a large number of Win 3.x systems in use, there are actually two versions of the client DLL module, one in Visual C++, version 4.0, for 32-bit systems, and one in Visual C++, version 1.52, for 16-bit systems. This software will be made available to interested parties from our departmental Web site.

It is too early to determine how gracefully the current version of the Submit software will handle the necessary volume of student program submissions. But the multitasking capabilities of the 32-bit operating systems virtually guarantee that a version can be developed that will handle the required load.

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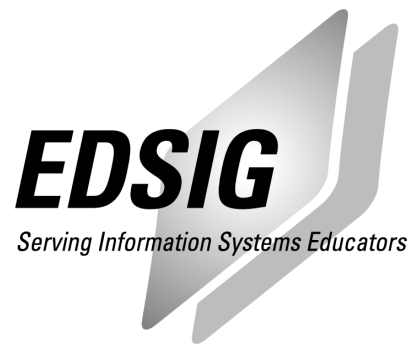
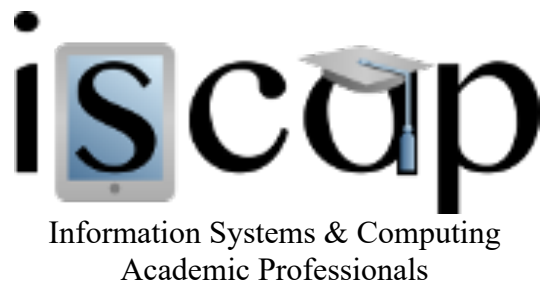
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ISSN 1055-3096