ITP30002 Operating System

Grading
Programming Assignment
by InstaGrap

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Operating System PA2

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Demo URL : https://youtu.be/qAcAspDPkQM

- Describe your design and implementation in write-up

On the day when PA2 was released, professor shin hong showed us several examples that were needed to implement PA2, InstaGrap. When we saw the example of server and client, we thought that it can be used between modules such as between Submitter and Instagrap, and between Instagrap and Worker to deliver some information like a file. Thus, we used that example in both of the cases.

However, the problem was that in that example, client and server can interchange message that does not contain any space. If there is any space in the message, only letters before the first space is delivered from client to server or vice versa. As we had been thinking how we could deliver the whole file which contains a lot of spaces and line switches. What we implement was to concatenate every file in a single character pointer by continuously allocating the memory as each line of the input file is being read by fgets function.

- Support that you used proper techniques to address different requirements & Describe your protocols of network communication

At first, we thought that we can use TCP/IP connection several times to deliver information. However, the professor told us that TCP connection is so costly because while UDP does not assure the arrival of the data sent, TCP makes sure that data is delivered and received. We thought ourselves that what would be best to make communication between process through the network since we have to deliver several information like a C source code file, a user information, and a path of testcase directory. Finally, we found something called "Named Pipe - using FIFO file". There are two kinds of pipe, one is Unnamed pipe which is used between

parent and child processes, and the other is named pipe which can be used two or more independent processes if they know the name of the file called FIFO. Thus, we used TCP/IP connection to deliver a C source code file and used a named pipe to give a user information from Submitter to Instagrap and a path of testcase directory from Instagrap to Worker. And there is still a TCP/IP connection so we send back the result message from Worker to Instagrap and then to Submitter.

In the server and client example, the server code originally is capable of dealing with multiple clients, so we used that function in Instagrap to accept several submitters simultaneously. To elaborate, firstly, a Submitter and Instagrap make a socket to communicate briefly to set a place for further communication, and then the Instagrap forks a child process and give the place number to that process and make it deal with the submitter. In this way, Instagrap can have multiple submitters at the same time.

Just as what Instagrap does when it listens if a submitter comes, Worker also listens for a visit of Instagrap. Worker use 'system' function to build and execute the input files whose path that they belong are given through a named pipe. When a C source code file and a path to the testcase are given, Worker build the code, execute it by using the input files, and then compare its results with the output file which are also in the same teestcase directory.

We used dup2() function in order for an execution program from the C source code file to get inputs from the file by using standard input function like scanf(). We made a file descriptor by using open() function and then redirect standard input file descriptor with the file descriptor that I made by using dup2(). And We also redirect the standard output with a file descriptor that points to a resulting file which contain the result of the execution of the file with given inputs.

After implementing it, we could see that how Baekjoon or Programmers evaluating system are working. (I was wondering how I can get inputs from nowhere by using scanf().)

- How can multiple submitters give instagrapd users' information simultaneously?

At first, we tried to give through socket but TCP connects only once. It is ineffective to connect TCP whenever a submitter gives information(id, pw) to instagrapd. So we found that not parent-child relationship processes can communicate through Named Pipe. We also got a problem that when multiple submitters give informations, each name of named pipes should be different. Submitter should use a variable to make FIFO name but instagrapd can't connect to submitter through the pipe because it doesn't know any information about submitter. Thus, we thought that because two process(submitter and instagrapd) are connected by specified port, we named FIFO with port number which we already know. However, we don't know why but we failed to make file name with port number due to segmentation fault.

- protocol of communication between submitter and instagrapd

Submitter frequently asks instagrapd whether the result is ready with its information. If the password is wrong, instagrapd rejects the request. We tried to communicate using signal but signal is interchanged within parent-child processes. Therefore we failed to check whether the result is ready or not.

- limitations of InstaGrap

InstaGrap only evaluates one kind of problem. It is because submitter doesn't give information of what the problem is and instagrapd gives testcase to worker only once.