Network Programming Exam

May 29th, 2007

This is a closed book exam: no documentation is allowed

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1 Program Output (1 point)

What will be the output of the following program? In which order will the messages appear on screen?

```
#include <stdio.h>
#include <sys/types.h>
#include <unistd.h>

int main() {
    int  fd[2];
    char buf[32];

    pipe(fd);
    if (fork()==0) {
        dup2(fd[1],1);
        printf("foo");        --> Pipe
    }
    else {          <- pipe
        read(fd[0],buf,31);
Unreachable  execl("/bin/echo", "/bin/echo", "bar", buf, 0);
        --> printf("baz\n");
    }
}
```

The echo program simply outputs all parameters passed to it, plus a new line at the end.

2 Questions (5 points)

1. Can one implement a `Mutex` class in Java? If you think it is possible, then write the code of its methods `lock()` and `unlock()`. If you think it is impossible, then explain why.

2. In Sun-RPC, when is it wrong to use UDP as the transport protocol?

3. Why does the `accept()` function create a new socket when receiving an incoming connection?

4. Write the HTTP request which needs to be sent to fetch document
   `http://www.foo.com/dir/bar.gif`
   Write the corresponding HTTP response.

5. Give one example of an application where a mobile agent implementation is better than a client-server implementation for <u>performance reasons</u>.

3 A Virtual Organization System (4 points)

We want to build a system to allow a consortium of several companies to collaborate on a specific project. For example, when constructing a building, one company can be responsible for making the walls, another one will make the water system, another one will do electricity, etc. Companies need to share each other's plans so that the electricians do not install electric boards in the same room as the water tanks, etc. On the other hand, the same companies may compete against each other on different projects, so they no not want to share all their informations.

3.1 Initial Design

It has been decided that each company would store its own informations itself, and would give other companies a read-only access to the informations they are authorized to see. To facilitate the portability of the system, it has been decided that the project would be programmed in Java with RMI.

We first want to design a client program which can access information from all the concerned servers. We need to answer the following questions: how can a client program learn about the list and location of all the concerned servers? Which informations are necessary to return to a client so that it can contact one given server afterwards?

Write the sketch of a program where servers can register their location, and that the clients can query to obtain a server location.

3.2 Interoperability

One new company wants to join the consortium. The problem is, its internal computer system is entirely written in C, so it cannot directly join the Java-based data sharing system. It is impossible to reprogram everything in Java.

What should this company do to be able to join the consortium?

3.3 Security

The informations which are shared among the different companies are often confidential, so they must be kept secret to people who are not part of the consortium. Explain what are the possible attacks to the system, and what should be done to prevent these attacks.

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