# Network Programming Exam

August 23rd, 2007

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**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?

```
#include <unistd.h>

int main() {
  int i;

  for (i=0;i<3;i++) {
    if (fork()==0) {
      execl("/bin/echo","echo","foo",0);
    }
  }

  execl("/bin/echo","echo","bar",0);
  return 0;
}
```

The `/bin/echo` program simply outputs all parameters passed in the command line, plus a new line at the end.

## 2 Questions (5 points)

1. What is a zombie process? How can you destroy it?
2. What is the network byte ordering? When is it used?
3. In Java RMI, when calling a remote method, which parameters are passed by value and which parameters are passed by reference?
4. What is a message-oriented middleware?
5. When does GPG ask a user for his/her passphrase?

## 3 An Expense Tracking Application (4 points)

A company wants to build an application to track expenses (like buying flight tickets, computer hardware, etc.). Before making any expense, employees must first request approval through the application and submit details like an estimation of the expense, the reason why the company should pay for it, etc. A supervisor can then decide to authorize the expense or not. Employees can connect later on to check if the expense has been authorized.

When an authorized expense has been made, employees can submit more information to the system, like the exact amount spent. The expense tracking application can then transfer the right amount to the employee's bank account. The expense tracking application does not perform the transfer by itself, but sends requests to a financial server, which does the transfer. The financial server is implemented using Sun-RPC. It is already in use, you cannot modify it.

1. Which technology are you going to use to build the expense tracking application? Why? Explain which types of requests it can receive from the employees, and how it is going to treat them.

2. We want to extend the application so that employees can access the application via the Web when they are traveling. Which modifications do you need do apply to the application? Draw a figure with the new structure of your application (clients, servers, etc). Do not worry for security issues at this stage.

3. The company wants to secure the expense tracking application so that malicious Internet users cannot harm it. After analysis, you defined the following issues: (i) Unauthorized users must not be capable of using the application; (ii) An attacker must not be capable to read or modify the network traffic containing expense-related informations.

   How are you going to enforce these properties?

**— the end —**