xFlow Research Inc.

Candidates Evaluation Assignment

XFLOW RESEARCH

Foreword

This assignment has been designed to evaluate your competency in the domains of technology that you will work in, here at xFlow. This document includes all the details and hints you need to complete the assignment and we encourage you to read it carefully and work diligently, making best use of your time.

We understand that this can be something advanced for you and you might not be able to complete it in time. This is why the ***way you approach the implementation*** is more important to us than your ultimate solution. For that reason, it is *recommended* that you create a work log that you maintain throughout the assignment and submit it. Make sure that the log clearly reflects your approach of solving a particular problem.

Your work log needs to include the following:

1. Your approach/methodology for solving a task
2. Challenges/problems faced while working on it
3. Steps followed with descriptions and snapshots where applicable for each task
4. Your overall analysis of the assignment
5. Your takeaways from the assignment

All the best and **Good Luck**!

Assignment Objective

This assignment evaluates the following domains of knowledge and experience:

1. Usage of Linux in development/operating environment
2. Concepts of computer networking
3. Ability to program network applications

In these domains, you'll mainly be tested for your knowledge of:

1. Ubuntu/CentOS operating systems; installing packaged software, building it, running it, troubleshooting services, IP address assignment etc.
2. C++ programming - writing networked applications that are scalable, well tested and maintainable through packaging.

Some non-technical skills it evaluates are:

1. Problem solving approach - how would you go about solving an unknown problem?
2. Information gathering approach - how would you learn something you've never heard of?
3. Time management - how would you prioritize things when you can't do everything?
4. Logging and writing skills - how do you decide what to write and what not to write in your report/log? (The format and beautification is *not important* for us)

Technical Background

This section will provide you with all the technical background you need to perform these tasks. The idea is to equip you with all the data points you need to help you keep track of your progress as well as make your research/study easier and well directed.

Packet Processing Using Libpcap

The assignment is to read, modify, and write packets to and from a pcap file using libpcap. The assignment should be well tested and documented. The idea here is to walk you through the entire process of creating an application, testing it, then packaging it and creating a finished project. You will ***have to use C++17 or above***.

You will need to be able to perform the following, plan your research accordingly:
Using libpcap to read and write packets to and from a pcap file. Using C++ to filter out specific portions from a packet, working with classes, writing unit test using google test, project organization, database programming with sqlite3

Assignment Details

Note: *We recommend that you perform this assignment on a Linux computer. If you're on a Microsoft Windows OS, you can work with Linux in a dual-boot environment or set up a virtual machine. Search online to figure out how to do this if new to this sort of stuff!* ***(If you are attempting dual boot and have never tried doing it before, please back up your data).***

The goal of the assignment is quite staightforward. You need to read packets from a pcap file, modify the required sections (detailed further below), and write the packets back to a new pcap file. In addition, you will need to write unit tests and work with databases.

We highly recommend reading through the whole assignment before solving any of the sections.

Note: If something is unclear or not specified, you're free to make reasonable assumptions **(please document those)** and proceed forward.

Task 0

Study git and use git and GitHub to manage your code. When your assignment is complete, share the repository link. Make sure your repository is private.

Task 1

Reading and writing packets

- You are provided with a pcap file named ***'sip-rtp-g729a.pcap'.*** We would highly recomemend taking a look at the file in wireshark before starting to code to get a feel of what the packets look like
- You will need to read all the packets from the pcap file and extract the SIP portion of the packet. *Hint: All the packets have the same header length up to the SIP content*
- Next, you will need to extract the 'To', 'From', and 'Call ID' fields from the SIP portion of the packets. Please maintain these as these will be used later on in the assignment.
- Next, you will need to extract the contents of the 'From' field and modfiy it such that it includes your name as the prefix. For example, if the from field is '"G729/8000"

<sip:sipp@10.0.2.20:5060>;tag=1' it should be updated to 'name"G729/8000" <sip:sipp@10.0.2.20:5060>;tag=1'.

- After the field has been modified, you need to write all the modified packets to a new pcap file. The modified packets should be read correctly by wireshark (wireshark should highlight incorrect parts). To do this, you will need to modifiy a few fields in other parts of the packets. Figuring out which fields to modify and how to correctly modifiy those is part of the assignment. To identify incorrect parts, you can use wireshark.

Task 2

Writing some database manipulation code

- You need to write the 'To', 'From', and 'Call ID' fields extracted in the first part to a database. You can use any database you like and can design the database however you like.

Task 3

Testing the code through unit testing

- You need to use the google test framework to write at least three unit tests for your code.
- One required unit test is for the database. You will need to run a query (you can run any query) on the database to check if it is working correctly. For the other two tests, you can write any test you prefer.

Conclusion

The assignment has been designed carefully and deliberately to test your technical and analytical skills in the best way possible. Your ability to learn a new technology quickly, perform your work with it and solidify your understanding of it, is the core metric of this assignment.

Send ***a single ZIP file with your name*** containing the work log, and source code back to HR and feel free to provide us feedback on the tasks that you've performed to help us make these better. If a detail is missing, you're allowed to make reasonable assumptions and record them in your work log for us to review.

Thank you and good luck!