INFO0010 Introduction to Computer Networking
First part of the assignment

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1 Software architecture

How have you broken down the problem to come to the solution? Name the major classes and methods responsible for requests processing.

I decomposed the problem in 3 major steps which are using a socket to send a query and finally to parse the response.

1. Using a socket:

   I created a socket connected to port 53 at the specified IP address. This socket has a timeout of 5 seconds. With this socket, bytes can be sent and retrieved.

2. Sending a query:

   Firstly a query must be created. The query is composed of a header and a question section. Therefore, I created a `Query` class which calls the `Header` and `Question` class. To increase the readability of the header code, I also created a `Flag` and a `Counts` class to be able to set those specific fields in the header. In the end, the query composed of the length of the message, the header and the question is sent by the socket.

   In summary, my query looks like:

<table>
<tr><td colspan="8">length of the query message</td></tr>
<tr><td colspan="8">ID : random 16 bits</td></tr>
<tr><td>QR: 0</td><td>Opcode: 0000</td><td>AA: 0</td><td>TC: 0</td><td>RD: 1</td><td>RA: 0</td><td>Z: 000</td><td>RCODE: 0000</td></tr>
<tr><td colspan="8">QDCOUNT : 0x0001</td></tr>
<tr><td colspan="8">ANCOUNT : 0x0000</td></tr>
<tr><td colspan="8">NSCOUNT : 0x0000</td></tr>
<tr><td colspan="8">ARCOUNT : 0x0000</td></tr>
<tr><td colspan="8">QNAME: sequence of labels
...
with the last one being 0x00</td></tr>
<tr><td colspan="8">QTYPE : 0x0001 for A or 0x0010 for TXT</td></tr>
<tr><td colspan="8">QCLASS : 0x0001</td></tr>
</table>

3. Parsing the response:

   I created a `Response` class. In it, I tried to verify a maximum that the response was correct. I verified that in the header QR and RCODE are 1 and stored the ANCOUNT. In the question section, I verified that the qtype is the same as requested and that the CLASS is 1. After this, for each answer, I verify that the type is either A or TXT and that the class in 1 (IN). Then I set the type, TTL, RDLength and Rdata and print what was asked.

2 Message-oriented communication using a stream

Explain how you handled the recovery of a message-oriented communication scheme using a stream protocol such as TCP.

TCP is only able to read bytes not messages. So at the beginning of the message, I put the length of the message. This allows my program to recognize this number and to read that amount of bytes which consists of reading until the end of the message. TCP did not know it was the end of a message, but knows the length of byte to read, so he read what was necessary. After reading this, as I knew it was a message and how a message was composed, I could analyze its different fields based on their byte position and look for the necessary information.

3 Limits & Possible Improvements

Describe the limits of your program, especially in terms of robustness, and what you could have done better.

Even though I tried to test a maximum that my answer was the right one, I was not able to check all the fields of the response such as if the ID was the same as the one in the query. Otherwise, I tried to implement what was asked, so for example, I can not manage other types of records, but that was not asked. Therefore, in case of an answer being of another type, the type and data printed are "notSupported". I did that to allow my program to continue as it was just not asked to support those type, but I still want the relevant information asked. In addition, another problem is that if anything wrong happens, except wrong type in the answer, the programs cannot recover and terminates with an exception thrown. Furthermore, My implementation could also have been better than just forcing to set some flags, or counts, or QCLASS. The way I did this was just sending a message to set the flag, but in a case where I could have to implement another class than IN, my program wouldn't work.