Term Project

Programming a DNS resolver

Objective:

Your task is to create a DNS resolver using a programming language of your choice (Java/Python/…). A DNS resolver is responsible for converting human-readable domain names (e.g., www.example.com) into IP addresses (e.g., 93.184.216.34). Your DNS resolver should be able to handle simple DNS queries and return the corresponding IP addresses.

Requirements:

1. The DNS resolver should be implemented as a command-line application.
2. Your program should be able to receive a domain name as input from the user.

Algorithm:

Your program should Implement the DNS resolution process using the following steps:

1. Contact a DNS server
    a. It is recommended to use public DNS servers like Google's 8.8.8.8 or Cloudflare's 1.1.1.1.
    b. You can also start from one of the root DNS servers listed here (https://www.iana.org/domains/root/servers)
2. Send a DNS query for the provided domain name.
3. Receive the DNS response obtained from that server
4. If the response contains the IP address of the required domain name, stop. Otherwise,
    a. If the response contains a canonical name, repeat step (2) but request the canonical name instead
    b. If the response contains the IP address of another name server to contact, repeat step (2) but send the query to that name server instead
5. Display the resolved IP addresses to the user.

Additional features:

1. Error handling: Implement appropriate error handling for cases where the DNS query fails or the domain name does not exist.
2. Implement caching: Create a simple cache mechanism that stores past resolved domain names and their corresponding IP addresses to improve response times for repeated queries.

Grading Criteria:

Your assignment will be evaluated based on the following criteria:

1. Correctness of DNS resolution process.
2. Clear and organized code structure.
3. Handling of A, CNAME, and NS record types.
4. User-friendly messaging.
5. Error handling and effective caching mechanism.

Note:

- DNS queries and responses are not sent as text but as binary instead.
- You are encouraged to explore online resources, programming documentation, and textbooks to assist you in completing the assignment.
- You cannot use any library that automatically does the DNS resolution for you. You must follow the algorithm mentioned in the section above.
- You can use programs like Wireshark to test if your DNS resolver is working or not during development
- Plagiarism is strictly prohibited. Ensure that the code is your original work.
- This assignment is designed to be challenging and to enhance your programming skills. Do not hesitate to ask questions if you encounter difficulties.