Project report

Design and implementation of DNS Client and Server

Course Title: *Internet Application*

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1. Overview

This project requires us follow the DNS protocol and write our C program through Linux system to implement the domain name resolution function.

2. Requirements Analysis

The requirement of the project is analyzed here, including,

- Development Environment:

Our Group is based on the Linux system and usage of C language for project development.

The test environment for the project's results is Ubuntu system.

The running environment of the project is Linux command line terminal.

- Functional requirements in details:

1.Implement Chinese domain name resolution 2. support four top-level domains Support Resource Record type 3.Support iterative and recursive parsing 4.Support cache check, and can print query trace records 4.Client and Local server connection using TCP 5.Local server and DNS server connection using UDP 6.DNS packets can be correctly parsed by Wireshark.

3. Preliminary Design

Preliminary design includes

- Decomposition of functional modules

Client is responsible for reading user input and encapsulate the packet to send to local server then displaying the returned result.

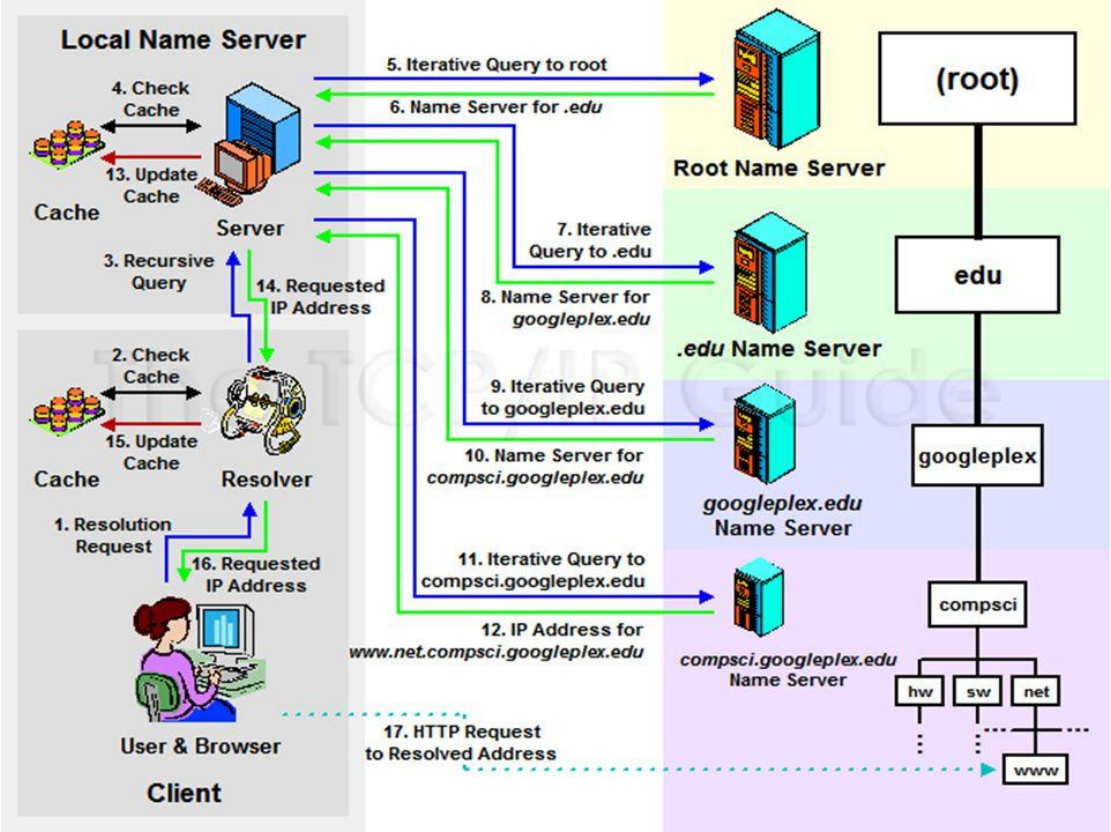
Local Server is responsible for resolving domain names, and query to domain name server if must, then response to the client

Domain name server received the query and response to local server

- Relationship and interface between the modules

Client sends a DNS request packet to the server based on the user's input. The local server returns the DNS packet to the client. Local server send query to domain name server. Domain name server response to local server.

- Overall flow chart

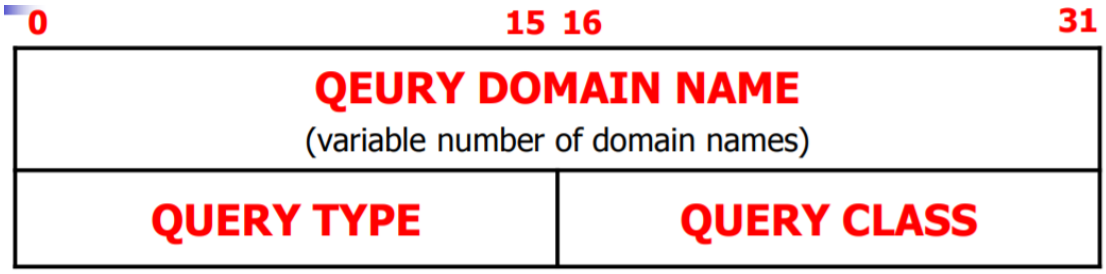


- Design of data structures

DNS Message Format

0 15	16 31						
ID	QR	OPCODE	AA	TC	RD	RA	Z	Rcode
Question count	Answer count						
Authority count	Additional count						
Question Section (variable number of questions)							
Answer Section (variable number of RRs)							
Authority Section (variable number of RRs)							
Additional Section (variable number of RRs)							

Question Section



4. Detailed Design

- Decomposition of functional modules

Client is responsible for reading user input and encapsulate the packet to send to local server then displaying the returned result.

Local Server is responsible for resolving domain names, and query to domain name server if must, then response to the client

Domain name server received the query and response to local server

- Relationship and interface between the modules

Client sends a DNS request packet to the server based on the user's input, there are three types of the request: A, MX and CNAME. The local server returns the DNS packet to the client. Local server send query to domain name server. Domain name server response to local server.

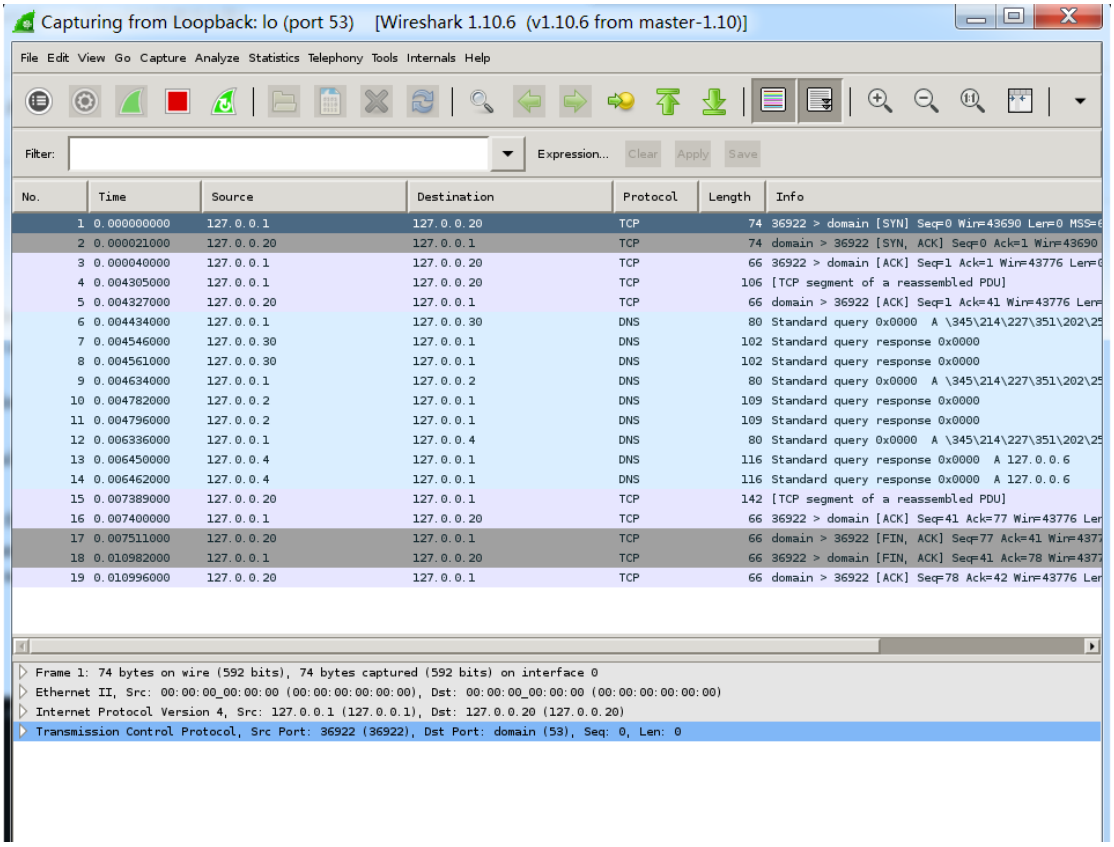
5. Results ：

A:

```
student@BUPTIA:~/DNS$ sudo ./client A 北邮.教育.中国
连接到本地DNS服务器 127.0.0.20@53...
【准备发送报文】
<---- DNS 报文开始 ---->
  id:0  status:NO ERROR   报文头信息
Query Section: 1
  北邮.教育.中国        A       IN
Answer Section: 0
Authority Section: 0
Additional Section: 0
<---- DNS 报文结束 ---->


【接受报文】
<---- DNS 报文开始 ---->
  id:0  status:NO ERROR   报文头信息 qr aa
Query Section: 1
  北邮.教育.中国        A       IN
Answer Section: 1
  北邮.教育.中国        A       IN      86400    数据长度 = 4    127.0.0.6
Authority Section: 0
Additional Section: 0
<---- DNS 报文结束 ---->

【请求用时】: 10.305000 ms
Wed Jun 20 06:03:51 2018
```



Trace:

```
添加数据库资料    .,86400,IN,A,127.0.0.30
本地DNS开始运行 127.0.0.20:53
开始DNS解析 127.0.0.1:36922
<---- DNS 报文开始 ---->
  id:0  status:NO ERROR   报文头信息
Query Section: 1
  北邮.教育.中国        A       IN
Answer Section: 0
Authority Section: 0
Additional Section: 0
<---- DNS 报文结束 ---->
准备访问 127.0.0.30@53
Authority Section
  中国  A       IN      86400    数据长度 = 4    127.0.0.2

Authority Section
  教育.中国     A       IN      86400    数据长度 = 4    127.0.0.4

Answer Section
{0}   北邮.教育.中国    A       IN      86400    数据长度 = 4    127.0.0.6
```

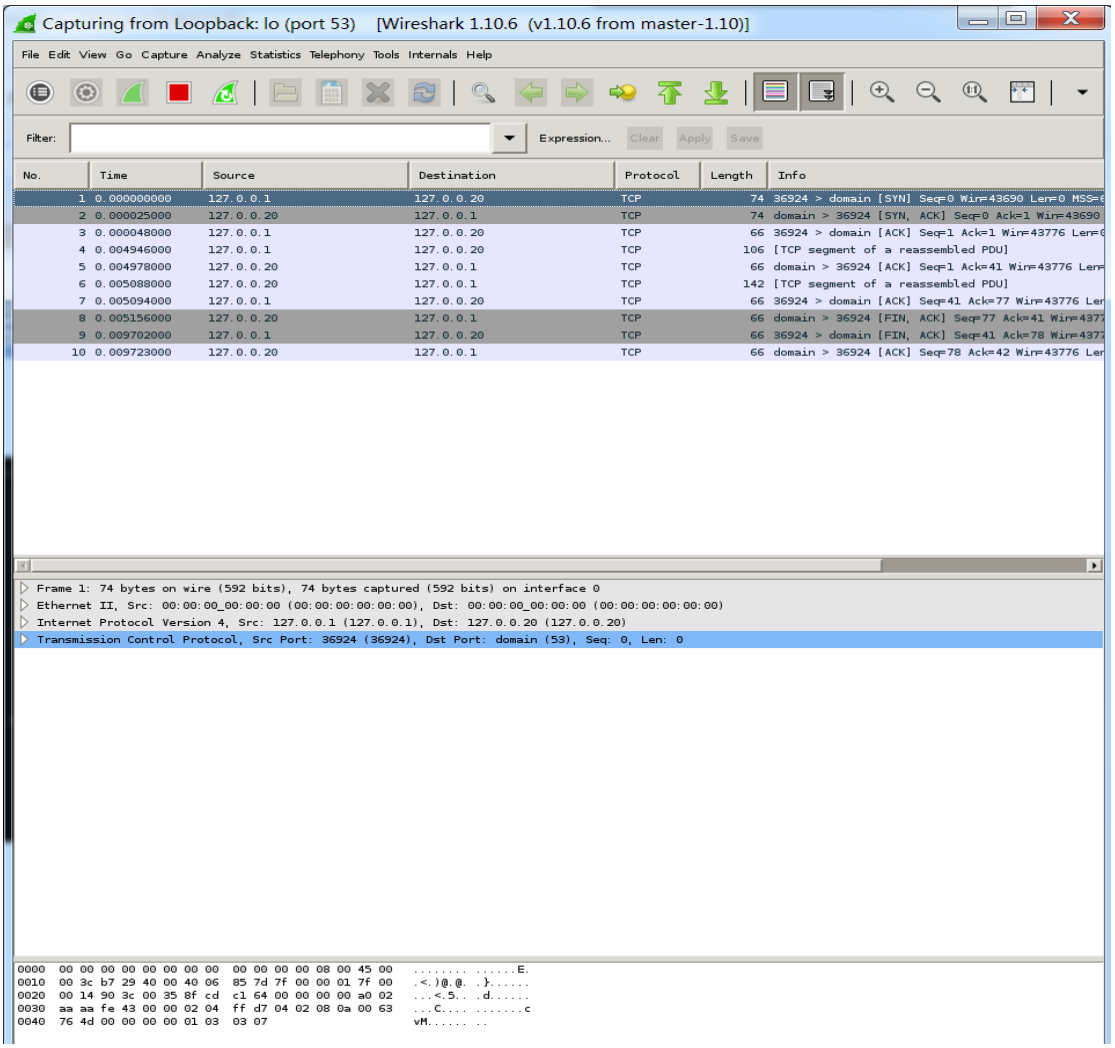
MX:

```
student@BUPTIA:~/DNS$ sudo ./client MX 北邮.教育.中国
连接到本地DNS服务器 127.0.0.20@53...
【准备发送报文】
<---- DNS 报文开始 ---->
  id:0  status:NO ERROR   报文头信息
Query Section: 1
  北邮.教育.中国        MX      IN
Answer Section: 0
Authority Section: 0
Additional Section: 0
<---- DNS 报文结束 ---->


【接受报文】
<---- DNS 报文开始 ---->
  id:0  status:NO ERROR   报文头信息 aa
Query Section: 1
  北邮.教育.中国        A       IN
Answer Section: 1
  北邮.教育.中国        A       IN      86400    数据长度 = 4    127.0.0.1
Authority Section: 0
Additional Section: 0
<---- DNS 报文结束 ---->

【请求用时】: 9.639000 ms
Wed Jun 20 06:07:01 2018

student@BUPTIA:~/DNS$
```

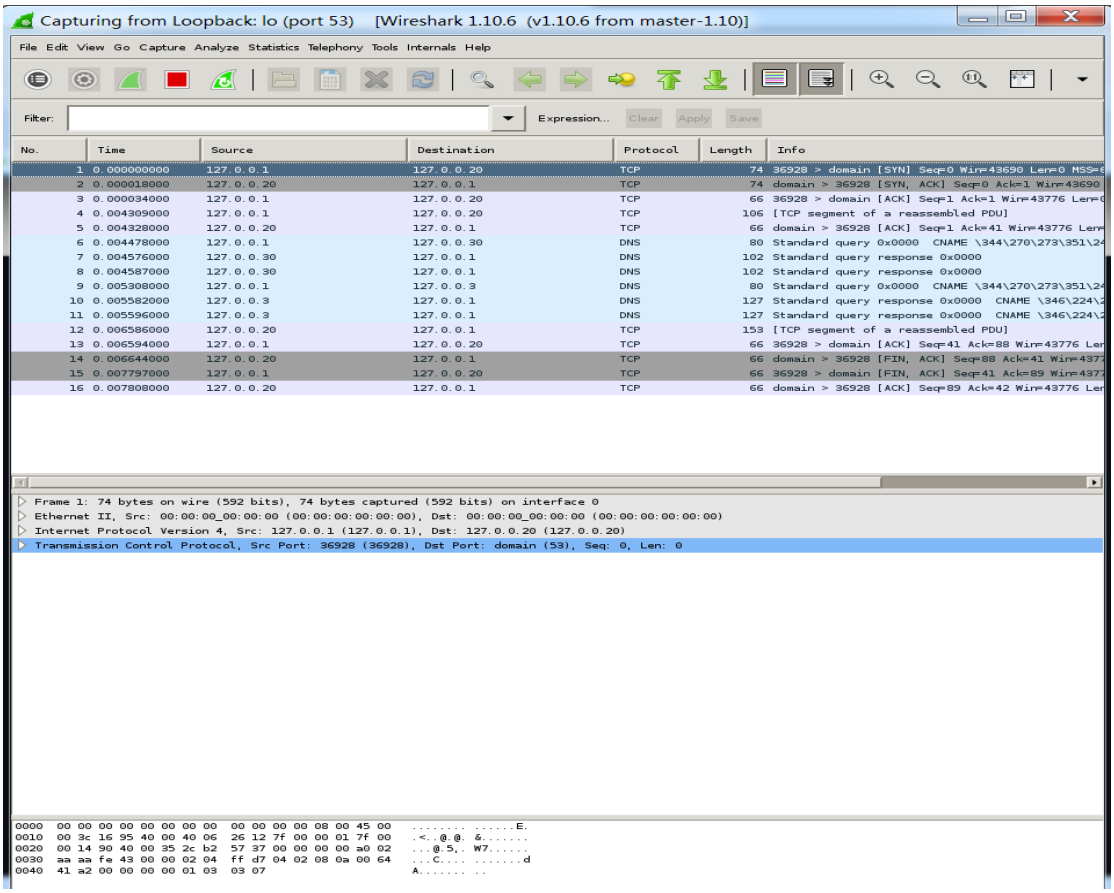


CNAME:

```
student@BUPTIA:~/DNS$ sudo ./client CNAME 主页.政府.美国
连接到本地DNS服务器 127.0.0.20@53...
【准备发送报文】
<---- DNS 报文开始 ---->
  id:0  status:NO ERROR   报文头信息
Query Section: 1
  主页.政府.美国        CNAME   IN
Answer Section: 0
Authority Section: 0
Additional Section: 0
<---- DNS 报文结束 ---->


【接受报文】
<---- DNS 报文开始 ---->
  id:0  status:NO ERROR   报文头信息 qr aa
Query Section: 1
  主页.政府.美国        CNAME   IN
Answer Section: 1
  主页.政府.美国        CNAME   IN      86400    数据长度 = 15   政府.美国
Authority Section: 0
Additional Section: 0
<---- DNS 报文结束 ---->

【请求用时】: 7.813000 ms
Wed Jun 20 06:10:29 2018
```



6. Summary and Conclusion

Through this project we have a comprehensive understanding of DNS, and the usage of C languages to program this project makes us have a profound understanding of socket program.