实验报告

实验二 HTTP与DNS

Lab2 HTTP & DHS

PART 2

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实验目的

2. **研究学习DNS协议**

    1. 实践学习DNS功能与工作原理
    2. 学习使用`nslookup`工具分析DNS工作过程
    3. 学习使用`ipconfig`工具调试网络
    4. 利用Wireshark捕获并过滤DNS分组并加以分析

实验内容

学习使用`nslookup`指令工具

1. 运行指令

```
nslookup www.nju.edu.cn
```

以获取南京大学(www.nju.edu.cn)Web服务器的IP地址

```
C:\Users\瞳木水杉>nslookup www.nju.edu.cn
Server:  mx.ustc.edu.cn
Address:  202.38.64.56

Non-authoritative answer:
Name:    www.nju.edu.cn
Address:  202.119.32.7
```

2. 运行指令

```
1 nslookup -type=NS ed.ac.edu.uk
```

以确定英国爱丁堡大学(ed.ac.edu.uk)的DNS服务器

```
C:\Users\瞳木水杉>nslookup -type=NS ed.ac.uk
Server:  mx.ustc.edu.cn
Address:  202.38.64.56

Non-authoritative answer:
ed.ac.uk        nameserver = xlab-0.ed.ac.uk
ed.ac.uk        nameserver = dns0.inf.ed.ac.uk
ed.ac.uk        nameserver = lewis.ucs.ed.ac.uk
ed.ac.uk        nameserver = dns1.inf.ed.ac.uk
ed.ac.uk        nameserver = dns2.inf.ed.ac.uk
ed.ac.uk        nameserver = cancer.ucs.ed.ac.uk
```

3. 运行指令

```
1 nslookup mail.Yahoo.com ns.ustc.edu.cn
```

向中国科学技术大学DNS服务器(ns.ustc.edu.cn)请求解析Yahoo邮箱的服务器(mail.Yahoo.com)的IP地址

```
C:\Users\瞳木水杉>nslookup mail.Yahoo.com ns.ustc.edu.cn
Server:  ns.ustc.edu.cn
Address:  2001:da8:d800::1

Non-authoritative answer:
Name:    ds-any-ycpi-uno.aycpi.b.yahoodns.net
Addresses:  2001:4998:28:800::4001
          209.73.190.12
          209.73.190.11
Aliases:  mail.Yahoo.com
          fd-geoycpi-uno.gycpi.b.yahoodns.net
```

> 向爱丁堡大学的服务器请求会不被接受而超时
>
> ```
> C:\Users\瞳木水杉>nslookup mail.Yahoo.com cancer.ucs.ed.ac.uk
> Server:  cancer.ucs.ed.ac.uk
> Address:  129.215.200.7
>
> DNS request timed out.
>     timeout was 2 seconds.
> *** Request to cancer.ucs.ed.ac.uk timed-out
> ```

4. 由以上命令运行结果回答问题如下

    1. 南京大学(www.nju.edu.cn)Web服务器的IP地址为 `202.119.32.7`

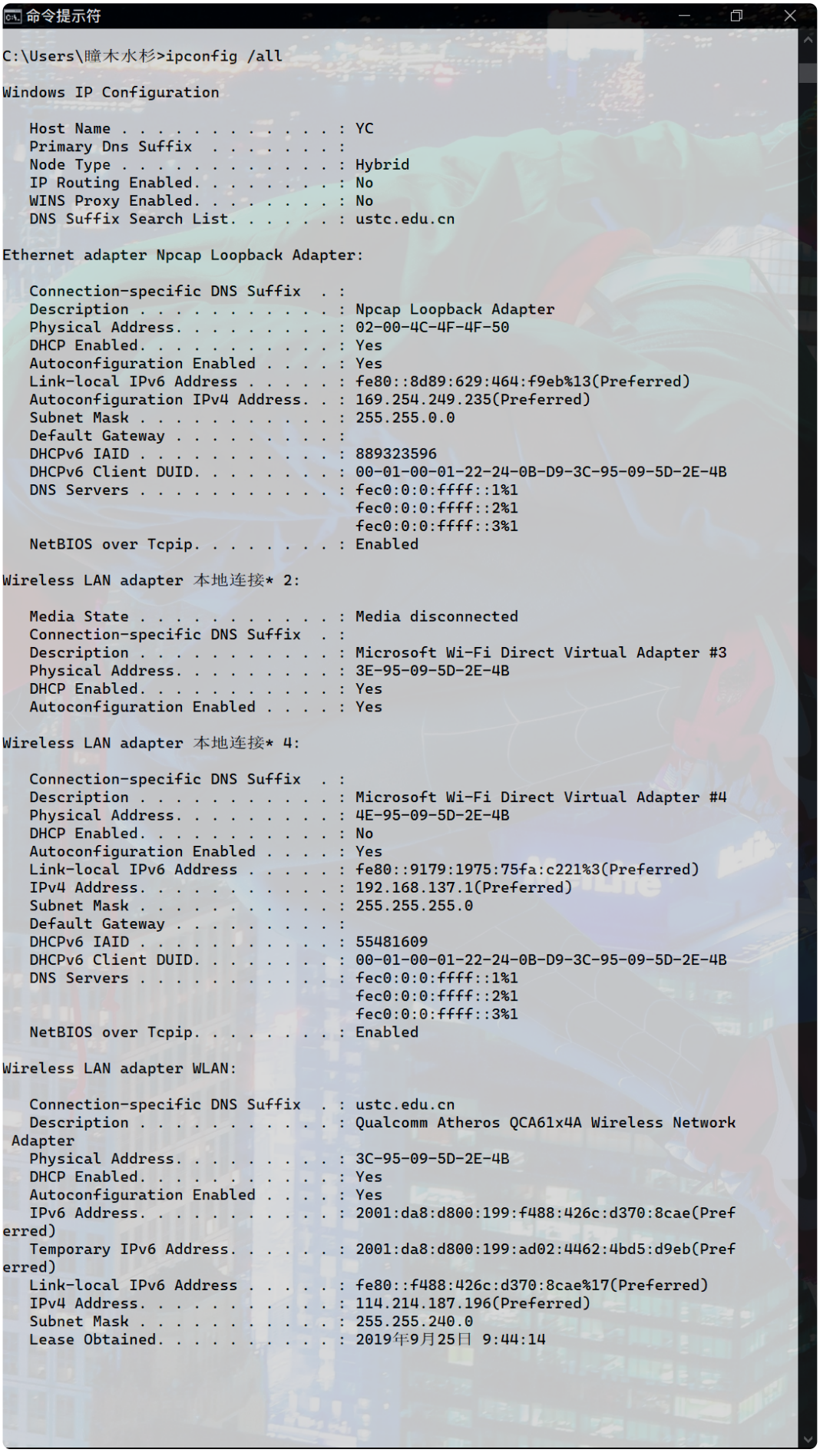
2. 英国爱丁堡大学的DNS服务器有`xlab-0.ed.ac.uk`、`dns0.inf.ed.ac.uk`、`lewis.ucs.ed.ac.uk`、`dns1.inf.ed.ac.uk`、`dns2.inf.ed.ac.uk`、`cancer.ucs.ed.ac.uk`
3. 向中国科学技术大学DNS服务器(ns.ustc.edu.cn)请求解析Yahoo邮箱的服务器(mail.Yahoo.com)得到其IP地址为`209.73.190.12`与`209.73.190.11`

学习使用`ipconfig`指令工具

1. 运行指令

```
ipconfig /all
```

以显示关于主机的所有信息



2. 运行指令

```
ipconfig /display
```

以显示DNS缓存记录所有信息

3. 运行指令

```
ipconfig /flushdns
```

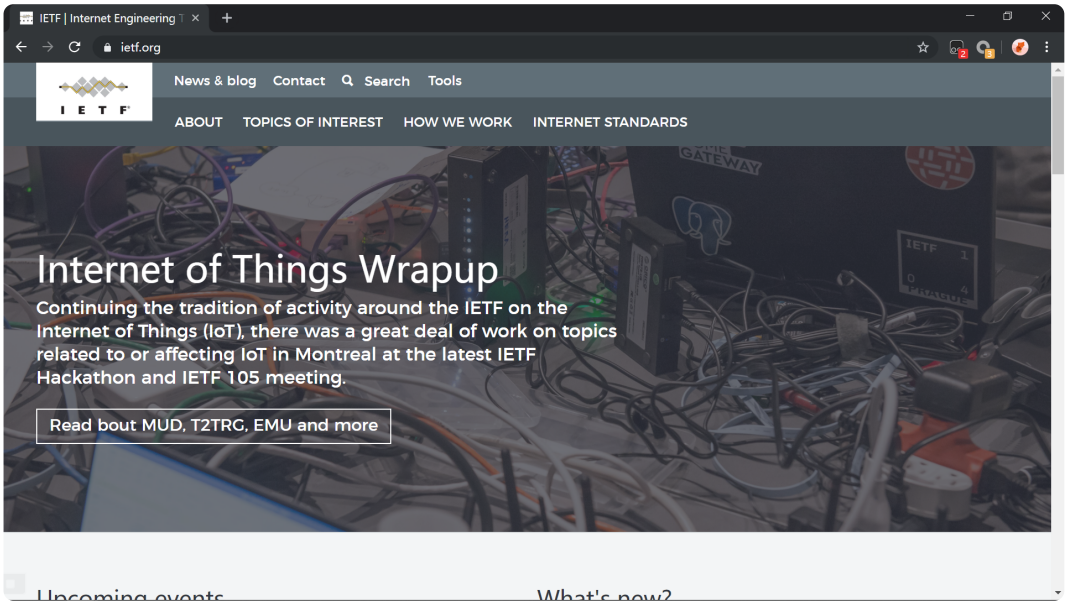
以清除DNS缓存

```
C:\Users\瞳木水杉>ipconfig /flushdns

Windows IP Configuration

Successfully flushed the DNS Resolver Cache.
```

使用Wireshark捕获分析DNS报文

1. 清除网页缓存
2. 设置Wireshark过滤本机IP地址`192.168.1.103`
3. 浏览给定网址

   http://www.ietf.org



4. 捕获如下分组

   1. DNS请求

```
Domain Name System (query)
Transaction ID: 0x8547
Flags: 0x0100 Standard query
0... .... .... .... = Response: Message is a query
.000 0... .... .... = Opcode: Standard query (0)
.... ..0. .... .... = Truncated: Message is not truncated
.... ...1 .... .... = Recursion desired: Do query recursively
.... .... .0.. .... = Z: reserved (0)
.... .... ...0 .... = Non-authenticated data: Unacceptable
```

```
Questions: 1
Answer RRs: 0
Authority RRs: 0
Additional RRs: 0
Name: www.ietf.org
Type: A (Host Address) (1)
Class: IN (0x0001)
```

2. DNS响应

```
Domain Name System (response)
Transaction ID: 0x8547
Flags: 0x8180 Standard query response, No error
1... .... .... .... = Response: Message is a response
.000 0... .... .... = Opcode: Standard query (0)
.... .0.. .... .... = Authoritative: Server is not an authority for domain
.... ..0. .... .... = Truncated: Message is not truncated
.... ...1 .... .... = Recursion desired: Do query recursively
.... .... 1... .... = Recursion available: Server can do recursive queries
.... .... .0.. .... = Z: reserved (0)
.... .... ..0. .... = Answer authenticated: Answer/authority portion was not authenticated by the server
.... .... ...0 .... = Non-authenticated data: Unacceptable
.... .... .... 0000 = Reply code: No error (0)
Questions: 1
Answer RRs: 3
Authority RRs: 0
Additional RRs: 0
www.ietf.org: type A, class IN
Name: www.ietf.org
Type: A (Host Address) (1)
Class: IN (0x0001)
www.ietf.org: type CNAME, class IN, cname www.ietf.org.cdn.cloudflare.net
www.ietf.org.cdn.cloudflare.net: type A, class IN, addr 104.20.0.85
www.ietf.org.cdn.cloudflare.net: type A, class IN, addr 104.20.1.85
```

5. 阅读分组具体内容，对实验问题的回答如下

4. 通过UDP发送

5. DNS查询消息的目标端口和响应消息的源端口均为`53`

6. DNS查询消息发送至IP地址`8.8.8.8`，通过`ipconfig`查得本地的DNS服务器地址`192.168.1.103#53`两者并不相同

7. 由内容`Type: A (Host Address) (1)`可知，类别为`A`；由内容`Answer RRs: 0`可知，查询消息不包含任何回答

8. 由内容`Answer RRs: 3`可知，响应消息提供了3个回答，分别包括了如下主机别名和主机地址的信息

```
www.ietf.org: type CNAME, class IN, cname
www.ietf.org.cdn.cloudflare.net
Name: www.ietf.org
Type: CNAME (Canonical NAME for an alias) (5)
Class: IN (0x0001)
Time to live: 206
Data length: 33
CNAME: www.ietf.org.cdn.cloudflare.net
```

```
www.ietf.org.cdn.cloudflare.net: type A, class IN, addr
104.20.0.85
Name: www.ietf.org.cdn.cloudflare.net
Type: A (Host Address) (1)
Class: IN (0x0001)
Time to live: 206
Data length: 4
Address: 104.20.0.85
```

```
www.ietf.org.cdn.cloudflare.net: type A, class IN, addr
104.20.1.85
Name: www.ietf.org.cdn.cloudflare.net
Type: A (Host Address) (1)
Class: IN (0x0001)
Time to live: 206
Data length: 4
Address: 104.20.1.85
```

9. 有对应的TCP SYN分组存在

10. 主机没有发出新的DNS查询

6. 运行指令

```
nslookup www.mit.edu
```

以获取麻省理工学院(www.mit.edu)Web服务器的IP地址

```
C:\Users\瞳木水杉>nslookup www.mit.edu
Server:  mx.ustc.edu.cn
Address:  202.38.64.56

DNS request timed out.
    timeout was 2 seconds.
Non-authoritative answer:
Name:    e9566.dscb.akamaiedge.net
Addresses:  2600:1417:8000:4be::255e
          2600:1417:8000:4a2::255e
          23.57.56.98
Aliases:  www.mit.edu
          www.mit.edu.edgekey.net
```

7. 捕获如下分组

1. DNS请求

```
Domain Name System (query)
Transaction ID: 0x0006
Flags: 0x0100 Standard query
0... .... .... .... = Response: Message is a query
.000 0... .... .... = Opcode: Standard query (0)
.... ..0. .... .... = Truncated: Message is not truncated
.... ...1 .... .... = Recursion desired: Do query recursively
.... .... .0.. .... = Z: reserved (0)
.... .... ...0 .... = Non-authenticated data: Unacceptable
Questions: 1
Answer RRs: 0
Authority RRs: 0
Additional RRs: 0
www.mit.edu: type A, class IN
Name: www.mit.edu
[Name Length: 11]
[Label Count: 3]
Type: A (Host Address) (1)
Class: IN (0x0001)
```

2. DNS响应

```
Domain Name System (response)
Transaction ID: 0x0006
Flags: 0x8180 Standard query response, No error
1... .... .... .... = Response: Message is a response
.000 0... .... .... = Opcode: Standard query (0)
.... .0.. .... .... = Authoritative: Server is not an authority for domain
.... ..0. .... .... = Truncated: Message is not truncated
.... ...1 .... .... = Recursion desired: Do query recursively
.... .... 1... .... = Recursion available: Server can do recursive queries
.... .... .0.. .... = Z: reserved (0)
.... .... ..0. .... = Answer authenticated: Answer/authority portion was not authenticated by the server
.... .... ...0 .... = Non-authenticated data: Unacceptable
.... .... .... 0000 = Reply code: No error (0)
Questions: 1
Answer RRs: 3
Authority RRs: 0
Additional RRs: 0
www.mit.edu: type A, class IN
Name: www.mit.edu
[Name Length: 11]
[Label Count: 3]
Type: A (Host Address) (1)
Class: IN (0x0001)
www.mit.edu: type CNAME, class IN, cname www.mit.edu.edgekey.net
www.mit.edu.edgekey.net: type CNAME, class IN, cname e9566.dscb.akamaiedge.net
```

```
26  e9566.dscb.akamaiedge.net: type A, class IN, addr
    23.57.56.98
```

8. 阅读分组具体内容，对实验问题的回答如下

    11. DNS查询消息的目标端口和响应消息的源端口均为`53`

    12. DNS请求送往`202.38.64.56`，这是本地的DNS服务器

    13. 由内容`Type: A (Host Address) (1)`可知，类别为`A`；由内容`Answer RRs: 0`可知，查询消息不包含任何回答

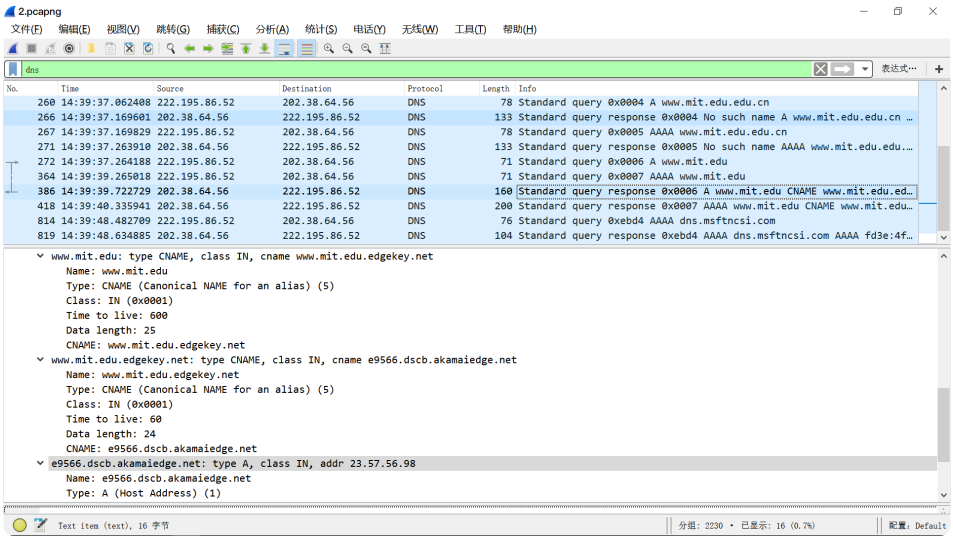
    14. 由内容`Answer RRs: 3`可知，响应消息提供了3个回答，分别包括了如下两个主机别名和主机IP地址的信息

```
1  www.mit.edu: type CNAME, class IN, cname
   www.mit.edu.edgekey.net
2  Name: www.mit.edu
3  Type: CNAME (Canonical NAME for an alias) (5)
4  Class: IN (0x0001)
5  Time to live: 600
6  Data length: 25
7  CNAME: www.mit.edu.edgekey.net
```

```
1  www.mit.edu.edgekey.net: type CNAME, class IN, cname
   e9566.dscb.akamaiedge.net
2  Name: www.mit.edu.edgekey.net
3  Type: CNAME (Canonical NAME for an alias) (5)
4  Class: IN (0x0001)
5  Time to live: 60
6  Data length: 24
7  CNAME: e9566.dscb.akamaiedge.net
```

```
1  e9566.dscb.akamaiedge.net: type A, class IN, addr
   23.57.56.98
2  Name: e9566.dscb.akamaiedge.net
3  Type: A (Host Address) (1)
4  Class: IN (0x0001)
5  Time to live: 20
6  Data length: 4
7  Address: 23.57.56.98
```

    15. 屏幕截图如下



9. 运行指令

```
nslookup -type=NS mit.edu
```

以确定麻省理工学院(mit.edu)的DNS服务器

```
C:\Users\瞳木水杉>nslookup -type=NS mit.edu
Server:  mx.ustc.edu.cn
Address:  202.38.64.56

Non-authoritative answer:
mit.edu nameserver = eur5.akam.net
mit.edu nameserver = ns1-37.akam.net
mit.edu nameserver = asia1.akam.net
mit.edu nameserver = usw2.akam.net
mit.edu nameserver = use2.akam.net
mit.edu nameserver = asia2.akam.net
mit.edu nameserver = ns1-173.akam.net
mit.edu nameserver = use5.akam.net
```

10. 捕获如下分组

    1. DNS请求

```
Domain Name System (query)
Transaction ID: 0x0004
0... .... .... .... = Response: Message is a query
.000 0... .... .... = Opcode: Standard query (0)
.... ..0. .... .... = Truncated: Message is not truncated
.... ...1 .... .... = Recursion desired: Do query
recursively
.... .... .0.. .... = Z: reserved (0)
.... .... ...0 .... = Non-authenticated data: Unacceptable
Questions: 1
Answer RRs: 0
Authority RRs: 0
Additional RRs: 0
mit.edu: type NS, class IN
Name: mit.edu
[Name Length: 7]
[Label Count: 2]
Type: NS (authoritative Name Server) (2)
Class: IN (0x0001)
```

2. DNS响应

```
Domain Name System (response)
Transaction ID: 0x0004
1... .... .... .... = Response: Message is a response
.000 0... .... .... = Opcode: Standard query (0)
.... .0.. .... .... = Authoritative: Server is not an authority for domain
.... ..0. .... .... = Truncated: Message is not truncated
.... ...1 .... .... = Recursion desired: Do query recursively
.... .... 1... .... = Recursion available: Server can do recursive queries
.... .... .0.. .... = Z: reserved (0)
.... .... ..0. .... = Answer authenticated: Answer/authority portion was not authenticated by the server
.... .... ...0 .... = Non-authenticated data: Unacceptable
.... .... .... 0000 = Reply code: No error (0)
Questions: 1
Answer RRs: 8
Authority RRs: 0
Additional RRs: 0
mit.edu: type NS, class IN
Name: mit.edu
[Name Length: 7]
[Label Count: 2]
Type: NS (authoritative Name Server) (2)
Class: IN (0x0001)
mit.edu: type NS, class IN, ns eur5.akam.net
mit.edu: type NS, class IN, ns ns1-37.akam.net
mit.edu: type NS, class IN, ns asia1.akam.net
mit.edu: type NS, class IN, ns usw2.akam.net
mit.edu: type NS, class IN, ns use2.akam.net
mit.edu: type NS, class IN, ns asia2.akam.net
mit.edu: type NS, class IN, ns ns1-173.akam.net
mit.edu: type NS, class IN, ns use5.akam.net
Name: mit.edu
Type: NS (authoritative Name Server) (2)
Class: IN (0x0001)
Time to live: 450
Data length: 7
Name Server: use5.akam.net
```

11. 阅读分组具体内容，对实验问题的回答如下

    16. DNS请求送往`202.38.64.56`，这是本地的DNS服务器

    17. 由内容`Type: NS (authoritative Name Server) (2)`可知，类别为`NS`；由内容`Answer RRs: 0`可知，查询消息不包含任何回答

    18. 由内容`Answer RRs: 8`可知，响应消息提供了8个回答，分别包含了如下内容

```
mit.edu: type NS, class IN, ns eur5.akam.net
Name: mit.edu
Type: NS (authoritative Name Server) (2)
Class: IN (0x0001)
Time to live: 450
Data length: 15
Name Server: eur5.akam.net
```

```
mit.edu: type NS, class IN, ns ns1-37.akam.net
Name: mit.edu
Type: NS (authoritative Name Server) (2)
Class: IN (0x0001)
Time to live: 450
Data length: 9
Name Server: ns1-37.akam.net
```

```
mit.edu: type NS, class IN, ns asia1.akam.net
Name: mit.edu
Type: NS (authoritative Name Server) (2)
Class: IN (0x0001)
Time to live: 450
Data length: 8
Name Server: asia1.akam.net
```

```
mit.edu: type NS, class IN, ns usw2.akam.net
Name: mit.edu
Type: NS (authoritative Name Server) (2)
Class: IN (0x0001)
Time to live: 450
Data length: 7
Name Server: usw2.akam.net
```

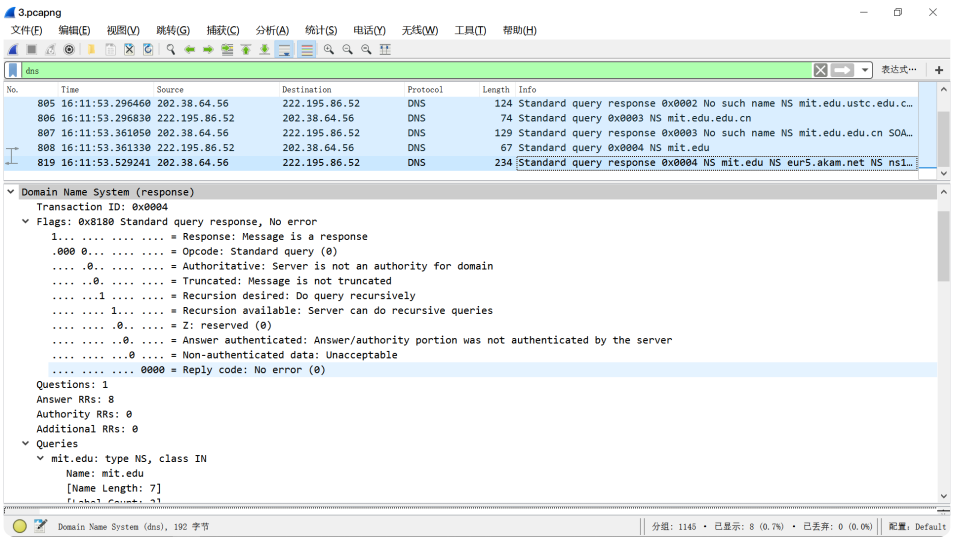
```
mit.edu: type NS, class IN, ns use2.akam.net
Name: mit.edu
Type: NS (authoritative Name Server) (2)
Class: IN (0x0001)
Time to live: 450
Data length: 7
Name Server: use2.akam.net
```

```
mit.edu: type NS, class IN, ns asia2.akam.net
Name: mit.edu
Type: NS (authoritative Name Server) (2)
Class: IN (0x0001)
Time to live: 450
Data length: 8
Name Server: asia2.akam.net
```

```
mit.edu: type NS, class IN, ns ns1-173.akam.net
Name: mit.edu
Type: NS (authoritative Name Server) (2)
Class: IN (0x0001)
Time to live: 450
Data length: 10
Name Server: ns1-173.akam.net
```

```
mit.edu: type NS, class IN, ns use5.akam.net
Name: mit.edu
Type: NS (authoritative Name Server) (2)
Class: IN (0x0001)
Time to live: 450
Data length: 7
Name Server: use5.akam.net
```

19. 屏幕截图如下



5. 运行指令

```
nslookup www.aiit.or.kr ns.nju.edu.cn
```

向南京大学DNS服务器(ns.nju.edu.cn)请求解析韩国AIIT机构(www.aiit.or.kr)的IP地址

> 向麻省理工学院的请求会不被接受而超时

```
C:\Users\瞳木水杉>nslookup www.aiit.or.kr bitsy.mit.edu
DNS request timed out.
    timeout was 2 seconds.
Server:  UnKnown
Address:  18.0.72.3

DNS request timed out.
    timeout was 2 seconds.
DNS request timed out.
    timeout was 2 seconds.
DNS request timed out.
    timeout was 2 seconds.
DNS request timed out.
    timeout was 2 seconds.
*** Request to UnKnown timed-out
```

6. 捕获分组：参见第23题答案截图

7. 阅读分组具体内容，对实验问题的回答如下

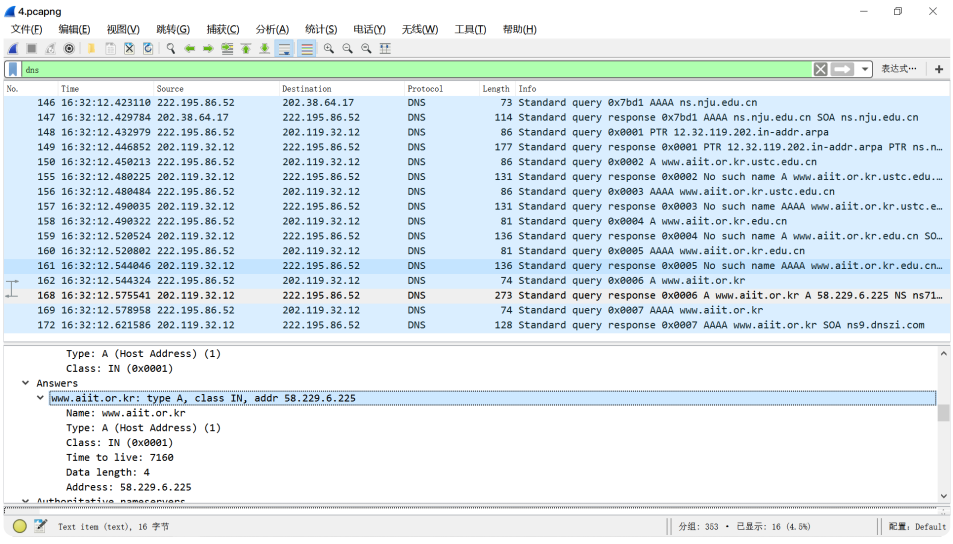
    20. DNS第一次查询消息发送的IP地址是默认的本地域名服务器`202.38.64.17`，查询到ns.nju.edu.cn的IP地址：`202.119.32.12`，之后向这个IP地址发送查询消息

    21. 由内容`Type: A (Host Address) (1)`和`Type: AAAA (IPv6 Address) (28)`可知，类别为`A`或`AAAA`；由内容`Answer RRs: 0`可知，查询消息不包含任何回答

    22. 由内容`Answer RRs: 1`可知，响应消息提供了1个回答，包括了如下主机别名和主机地址的信息

        ```
        www.aiit.or.kr: type A, class IN, addr 58.229.6.225
        Name: www.aiit.or.kr
        Type: A (Host Address) (1)
        Class: IN (0x0001)
        Time to live: 7160
        Data length: 4
        Address: 58.229.6.225
        ```

    23. 屏幕截图如下



实验总结

本次实验主要研究了DNS协议，通过学习nslookup与ipconfig等命令工具，结合Wireshark捕获并分析DNS请求响应的具体内容，深入理解了DNS功能的具体实现以及消息特征，为之后向下学习网络结构提供了知识背景和基础。

附

本报告中出现的捕获分组文件以及相关截图可见GitHub@lyc0930