

네트워크프로그래밍-3주 수업 자료

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3주 수업 내용

- ▶ 과제 확인 - 네트워크 구성도
- ▶ Wireshark Capturing 복습/Q&A
 - ARP, IP, TCP, UDP/DNS
- ▶ Mongoose Web Server 추가 실습
 - PC/Mobile < WiFi > Web Server
 - Mobile < 4G/5G > Web Server
- ▶ 3주 강의 요약
 - Socket API
 - Socket Programming 실습 - Time Client/Server

과제확인 - 네트워크 구성도

- ▶ 5가지 예가 아닌 경우
 - HP을 Hot Spot 으로 공유기로 사용하는 예
- ▶ `tracert -d` 에서 * 로 나오는 경우 설명
 - 첫번째 router 를 확인하지 못하는 경우
 - KT 공유기 환경과 같은 경우
 - 172.30.1.254 다음 Router가 *로 안보이는 경우가 있다
 - IPTIME 공유기의 경우
 - 192.168.0.1 다음 Router가 *로 안보이는 경우가 있다

Wireshark Capturing

- ▶ Wireshark 문제
 - Loopback이 안보인다
 - Interface 모두 안보인다
 - Network 이 안된다.
 - 해결방법 : npcap 을 재설치 (제거/reboot/설치)
 - <https://nmap.org/npcap/dist/npcap-0.9997.exe>

Network Data 구조

▶ ARP

Ethernet Header Type = 0x0806	ARP Header + Data
14	42 ~ 60

▶ IP

Ethernet Header	IP Header Protocol ?	TCP/UDP Header	DATA (HTTP, FTP, DNS, RTP, ...)
14	20	20/8	0 ~ 1472

▶ ICMP

Ethernet Header Type = 0x0800	IP Header Protocol 1	ICMP Header + Data
14	20	0 ~ 1480

▶ TCP

Ethernet Header Type = 0x0800	IP Header Protocol 6	TCP Header	DATA (HTTP, FTP, Telnet, ..)
14	20	20	0 ~ 1460

▶ UDP

Ethernet Header Type = 0x0800	IP Header Protocol 17	UDP Header	DATA (DNS, RTP, ...)
14	20	8	0 ~ 1472

ARP Request

The image shows a Wireshark packet capture window titled "이더넷". The filter bar shows "arp". The packet list shows two packets:

No.	Time	Source	Destination	Protocol	Length	Info
144	0.865206	ASUSTekC_79:ce:90	Broadcast	ARP	42	Who has 172.30.1.254? Tell 172.30.1.33
145	0.865670	Allradio_9c:45:33	ASUSTekC_79:ce:90	ARP	60	172.30.1.254 is at 00:07:89:9c:45:33

The packet details pane shows the selected packet (144) expanded:

- Ethernet II, Src: ASUSTekC_79:ce:90 (ac:22:0b:79:ce:90), Dst: Broadcast (ff:ff:ff:ff:ff:ff)
 - Destination: Broadcast (ff:ff:ff:ff:ff:ff)
 - Source: ASUSTekC_79:ce:90 (ac:22:0b:79:ce:90)
 - Type: ARP (0x0806)
- Address Resolution Protocol (request)
 - Hardware type: Ethernet (1)
 - Protocol type: IPv4 (0x0800)
 - Hardware size: 6
 - Protocol size: 4
 - Opcode: request (1)
 - Sender MAC address: ASUSTekC_79:ce:90 (ac:22:0b:79:ce:90)
 - Sender IP address: 172.30.1.33
 - Target MAC address: 00:00:00_00:00:00 (00:00:00:00:00:00)
 - Target IP address: 172.30.1.254

The packet bytes pane shows the raw data:

```
0000  ff ff ff ff ff ff ac 22 0b 79 ce 90 08 06 00 01  .....".y....
0010  08 00 06 04 00 01 ac 22 0b 79 ce 90 ac 1e 01 21  .....".y.....!
0020  00 00 00 00 00 00 ac 1e 01 fe  ..... ..
```

The status bar at the bottom indicates: Address Resolution Protocol (arp), 28 byte(s) | Packets: 171 · Displayed: 2 (1,2%) · Dropped: 0 (0,0%) | Profile: Default

ARP Reply

The image shows a Wireshark packet capture window titled "이더넷". The packet list shows two ARP packets. Packet 145 is an ARP Reply from Allradio_9c:45:33 to ASUSTekC_79:ce:90. The packet details pane shows the Ethernet II header, the ARP type, and the Address Resolution Protocol (reply) section. The packet bytes pane shows the raw data in hexadecimal and ASCII.

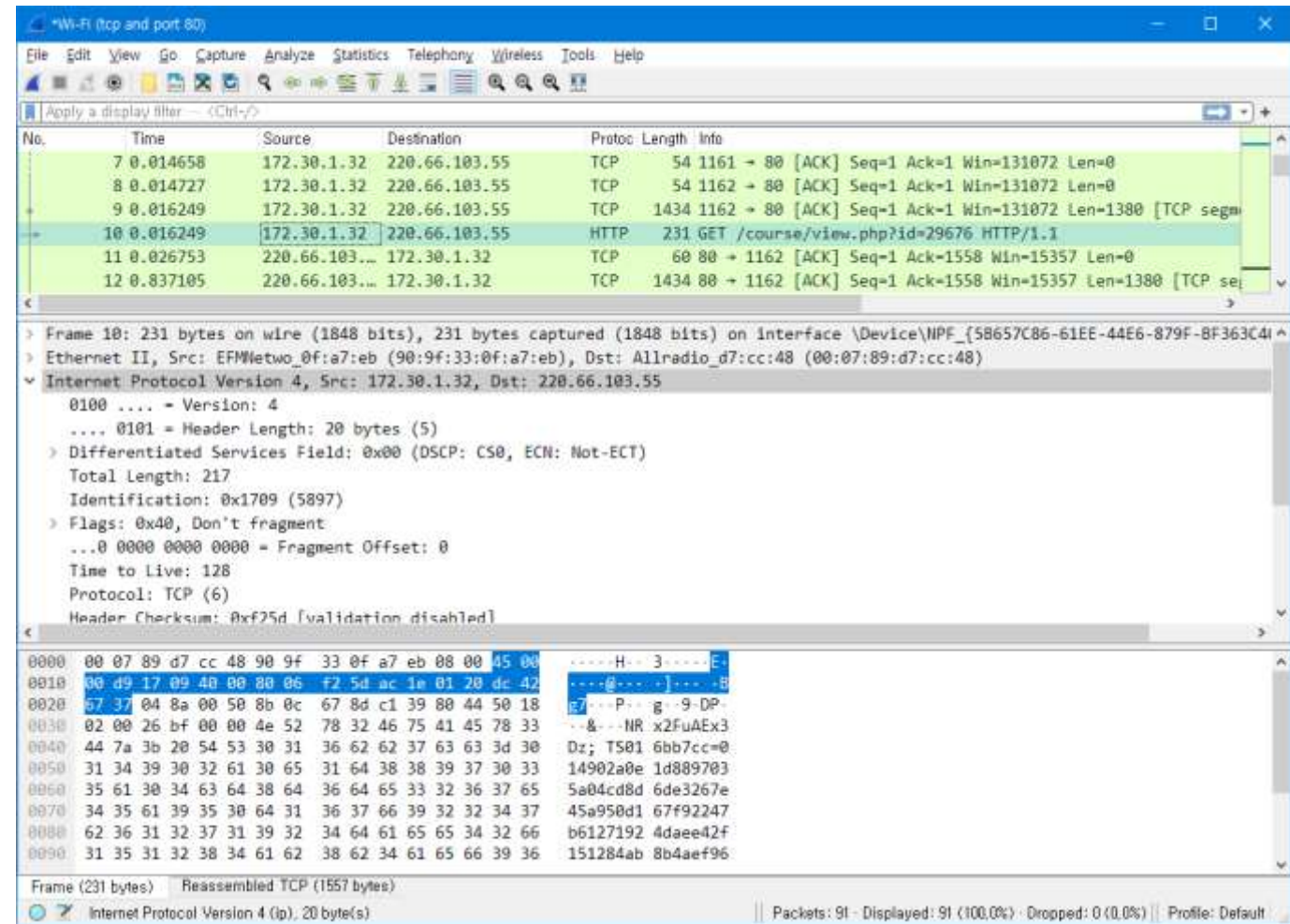
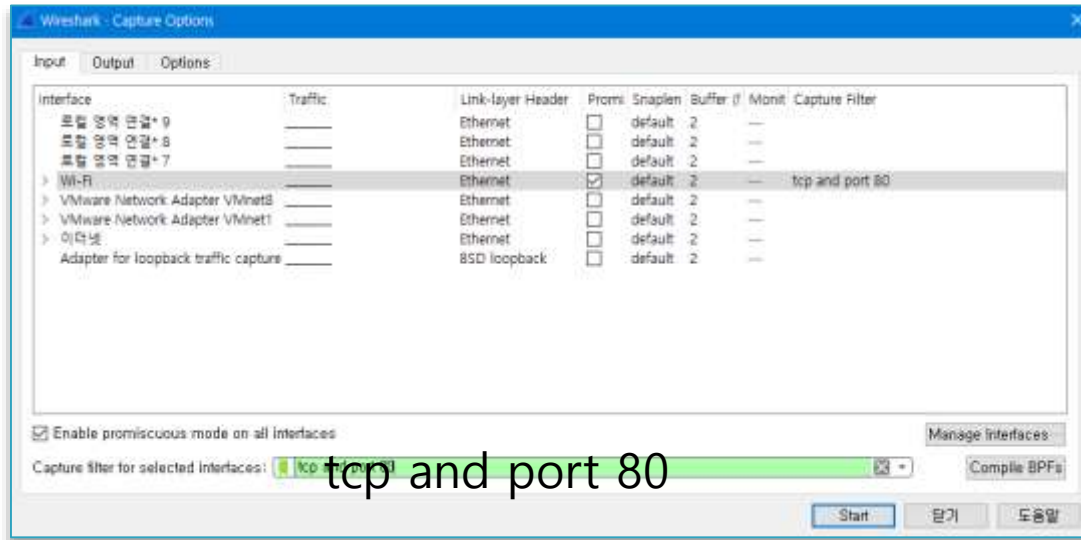
No.	Time	Source	Destination	Protocol	Length	Info
144	0.865206	ASUSTekC_79:ce:90	Broadcast	ARP	42	Who has 172.30.1.254? Tell 172.30.1.33
145	0.865670	Allradio_9c:45:33	ASUSTekC_79:ce:90	ARP	60	172.30.1.254 is at 00:07:89:9c:45:33

> Frame 145: 60 bytes on wire (480 bits), 60 bytes captured (480 bits) on interface \Device\NPF_{ACA27A13-66BA-4DA1-AA9A-20DE41ED0C4A}, id
v Ethernet II, Src: Allradio_9c:45:33 (00:07:89:9c:45:33), Dst: ASUSTekC_79:ce:90 (ac:22:0b:79:ce:90)
v Destination: ASUSTekC_79:ce:90 (ac:22:0b:79:ce:90)
v Source: Allradio_9c:45:33 (00:07:89:9c:45:33)
Type: ARP (0x0806)
Padding: 00000000000000000000000000000000
v Address Resolution Protocol (reply)
Hardware type: Ethernet (1)
Protocol type: IPv4 (0x0800)
Hardware size: 6
Protocol size: 4
Opcode: reply (2)
Sender MAC address: Allradio_9c:45:33 (00:07:89:9c:45:33)
Sender IP address: 172.30.1.254
Target MAC address: ASUSTekC_79:ce:90 (ac:22:0b:79:ce:90)
Target IP address: 172.30.1.33

0000 ac 22 0b 79 ce 90 00 07 89 9c 45 33 08 06 00 01 .".y.... ..E3...
0010 08 00 06 04 00 02 00 07 89 9c 45 33 ac 1e 01 feE3...
0020 ac 22 0b 79 ce 90 ac 1e 01 21 00 00 00 00 00 00 .".y.... ..!
0030 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00

Sender IP address (arp.src.proto_ipv4), 4 byte(s) | Packets: 171 · Displayed: 2 (1,2%) · Dropped: 0 (0,0%) | Profile: Default

IP Packet 예 (172.30.1.32 <-> learn.hansung.ac.kr 220.66.103.55)



TCP Packet 예 (172.30.1.32 <-> learn.hansung.ac.kr 220.66.103.55)

The image shows a Wireshark packet capture window titled "*Wi-Fi (tcp and port 80)". The packet list on the left shows several packets, with packet 10 selected. The packet details pane on the right shows the structure of the selected packet, and the packet bytes pane at the bottom shows the raw data in hexadecimal and ASCII.

Packet List:

No.	Time	Source	Destination	Protoc	Length	Info
7	0.014658	172.30.1.32	220.66.103.55	TCP	54	1161 → 80 [ACK] Seq=1 Ack=1 Win=131072 Len=0
8	0.014727	172.30.1.32	220.66.103.55	TCP	54	1162 → 80 [ACK] Seq=1 Ack=1 Win=131072 Len=0
9	0.016249	172.30.1.32	220.66.103.55	TCP	1434	1162 → 80 [ACK] Seq=1 Ack=1 Win=131072 Len=1380 [TCP segment...]
10	0.016249	172.30.1.32	220.66.103.55	HTTP	231	GET /course/view.php?id=29676 HTTP/1.1
11	0.026753	220.66.103.55	172.30.1.32	TCP	60	80 → 1162 [ACK] Seq=1 Ack=1558 Win=15357 Len=0
12	0.837105	220.66.103.55	172.30.1.32	TCP	1434	80 → 1162 [ACK] Seq=1 Ack=1558 Win=15357 Len=1380 [TCP segment...]

Packet 10 Details:

- Frame 10: 231 bytes on wire (1848 bits), 231 bytes captured (1848 bits) on interface \Device\NPF_{5B657C86-61EE-44E6-879F-BF363C4...}
- Ethernet II, Src: EFMNetwo_0f:a7:eb (90:9f:33:0f:a7:eb), Dst: Allradio_d7:cc:48 (00:07:89:d7:cc:48)
- Internet Protocol Version 4, Src: 172.30.1.32, Dst: 220.66.103.55
- Transmission Control Protocol, Src Port: 1162, Dst Port: 80, Seq: 1381, Ack: 1, Len: 177
 - Source Port: 1162
 - Destination Port: 80
 - [Stream index: 2]
 - [Conversation completeness: Complete, WITH_DATA (31)]
 - [TCP Segment Len: 177]
 - Sequence Number: 1381 (relative sequence number)
 - Sequence Number (raw): 2332845965
 - [Next Sequence Number: 1558 (relative sequence number)]
 - Acknowledgment Number: 1 (relative ack number)
 - Acknowledgment number (raw): 3241771076
 - 0101 = Header Length: 20 bytes (5)
 - Flags: 0x018 (PSH, ACK)

Packet Bytes:

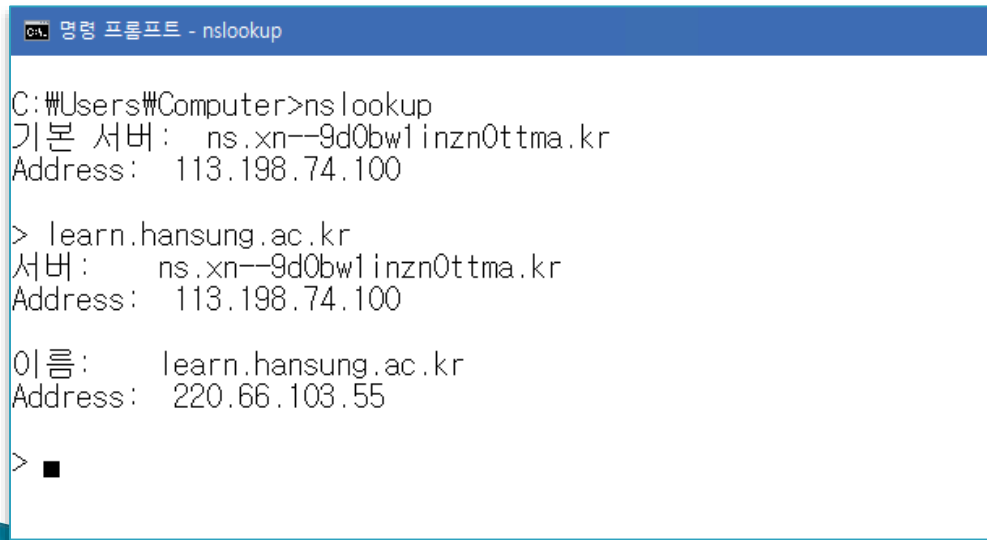
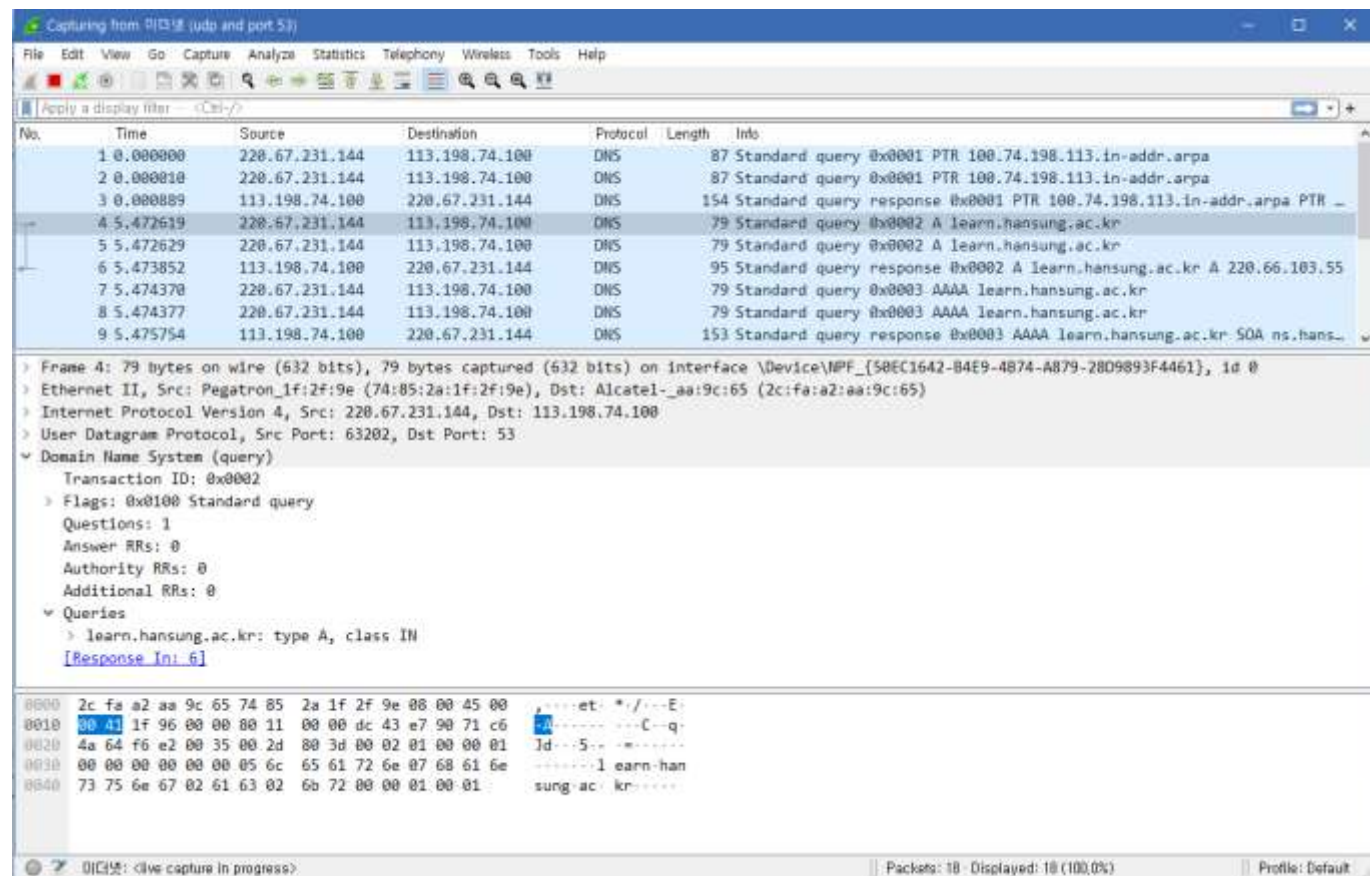
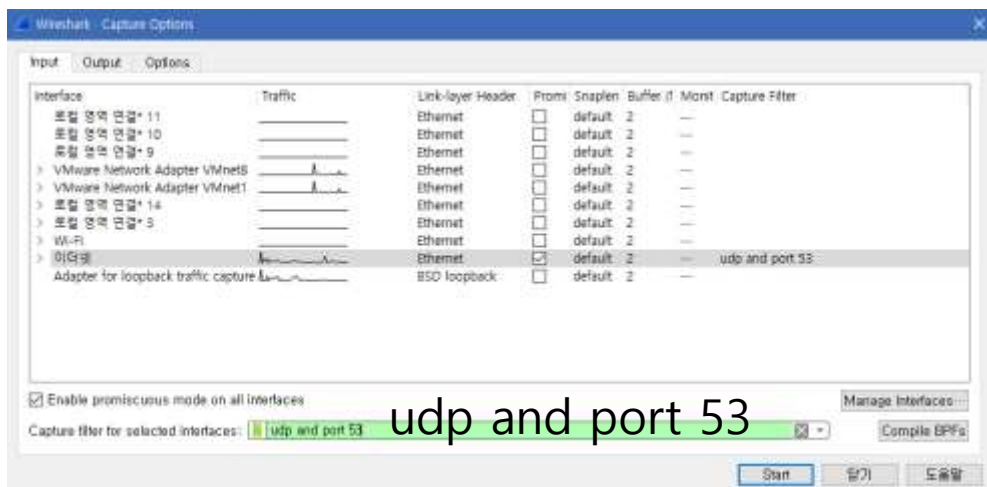
Offset	Hex	ASCII
0020	67 37 04 8a 00 50 8b 0c 67 8d c1 39 80 44 50 18	g7...P...g...DP...
0030	02 00 26 bf 00 00 4e 52 78 32 46 75 41 45 78 33	...&...NR x2FuAEx3
0040	44 7a 3b 20 54 53 30 31 36 62 62 37 63 63 3d 30	Dz; TS01 6bb7cc=0
0050	31 34 39 30 32 61 30 65 31 64 38 38 39 37 30 33	14902a0e 1d889703
0060	35 61 30 34 63 64 38 64 36 64 65 33 32 36 37 65	5a04cd8d 6de3267e
0070	34 35 61 39 35 30 64 31 36 37 66 39 32 32 34 37	45a950d1 67f92247

Frame (231 bytes) Reassembled TCP (1557 bytes)

Transmission Control Protocol (tcp), 20 byte(s)

Packets: 91 · Displayed: 91 (100,0%) · Dropped: 0 (0,0%) | Profile: Default

DNS Query (learn.hansung.ac.kr ?)



DNS Response (learn.hansung.ac.kr ?)

The image shows a Wireshark packet capture window titled "Capturing from 이더넷 (udp and port 53)". The packet list on the left shows a series of DNS queries and responses. Packet 6 is selected, showing a DNS response from 113.198.74.100 to 220.67.231.144. The packet details pane on the right shows the structure of the DNS response, including the transaction ID (0x0002), flags (0x8580), and a single query for learn.hansung.ac.kr. The answers section shows the IP address 220.66.103.55. The packet bytes pane at the bottom shows the raw data in hexadecimal and ASCII.

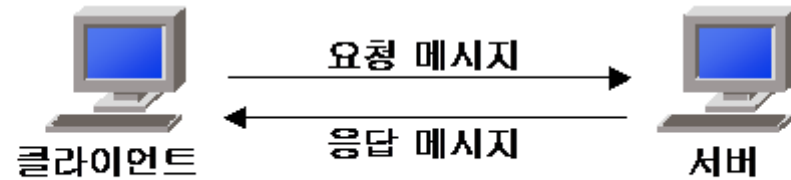
No.	Time	Source	Destination	Protocol	Length	Info
1	0.000000	220.67.231.144	113.198.74.100	DNS	87	Standard query 0x0001 PTR 100.74.198.113.in-addr.arpa
2	0.000010	220.67.231.144	113.198.74.100	DNS	87	Standard query 0x0001 PTR 100.74.198.113.in-addr.arpa
3	0.000889	113.198.74.100	220.67.231.144	DNS	154	Standard query response 0x0001 PTR 100.74.198.113.in-addr.arpa PTR ...
4	5.472619	220.67.231.144	113.198.74.100	DNS	79	Standard query 0x0002 A learn.hansung.ac.kr
5	5.472629	220.67.231.144	113.198.74.100	DNS	79	Standard query 0x0002 A learn.hansung.ac.kr
6	5.473852	113.198.74.100	220.67.231.144	DNS	95	Standard query response 0x0002 A learn.hansung.ac.kr A 220.66.103.55
7	5.474370	220.67.231.144	113.198.74.100	DNS	79	Standard query 0x0003 AAAA learn.hansung.ac.kr
8	5.474377	220.67.231.144	113.198.74.100	DNS	79	Standard query 0x0003 AAAA learn.hansung.ac.kr
9	5.475754	113.198.74.100	220.67.231.144	DNS	153	Standard query response 0x0003 AAAA learn.hansung.ac.kr SOA ns.hans...

Internet Protocol Version 4, Src: 113.198.74.100, Dst: 220.67.231.144
User Datagram Protocol, Src Port: 53, Dst Port: 63202
Domain Name System (response)
Transaction ID: 0x0002
Flags: 0x8580 Standard query response, No error
Questions: 1
Answer RRs: 1
Authority RRs: 0
Additional RRs: 0
Queries
learn.hansung.ac.kr: type A, class IN
Answers
learn.hansung.ac.kr: type A, class IN, addr 220.66.103.55
[Request In: 4]
[Time: 0.001233000 seconds]

0000 74 85 2a 1f 2f 9e 2c fa a2 aa 9c 65 08 00 45 00 t.*./.,. .e..E.
0010 00 51 84 bb 00 00 3e 11 77 e2 71 c6 4a 64 dc 43 .Q....> w.q.Jd.C
0020 e7 90 00 35 f6 e2 00 3d f9 be 00 02 85 80 00 01 ...5...=
0030 00 01 00 00 00 00 05 6c 65 61 72 6e 07 68 61 6el earn-han
0040 73 75 6e 67 02 61 63 02 6b 72 00 00 01 00 01 c0 sung-ac-kr.....
0050 0c 00 01 00 01 00 01 51 80 00 04 dc 42 67 37QBg7

Text item (text), 16 byte(s) | Packets: 42 · Displayed: 42 (100.0%) | Profile: Default

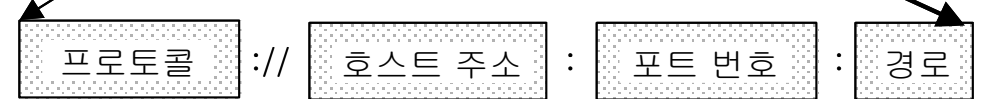
HTTP 프로토콜 분석



요청 라인
헤더 (일반헤더 요청헤더 엔터티헤더)
공백 라인
본 문 (요청 메시지)

상태 라인
헤더 (일반헤더 요청헤더 엔터티헤더)
공백 라인
본 문 (응답 메시지)

메소드(요청타입)	S P	URL	S P	HTTP 버전	C R F
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HTTP 버전	S P	상태코드	S P	상태설명	C R F
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Mongoose Webserver 실습

- ▶ Mongoose 설치 : c:\Mongoose
- ▶ Local to Local : 127.0.0.1, tcp and port 80
 - 실습 PC, Notebook 주소창 127.0.0.1
- ▶ 실습실 환경 실습 (PC/노트북/Mobile \leftrightarrow Web Server)
 - 실습 PC1~45 \rightarrow HUB \rightarrow 강사 PC (Mongoose Web Server)
 - 학생 노트북 \rightarrow WiFi \rightarrow 강사 PC (Mongoose Web Server)
 - Mobile \rightarrow 4G/5G \rightarrow 강사 PC (Mongoose Web Server)

Mobile < 4G/5G > 실습실 Web Server

