

Lab 9: Wireshark --- ARP, DHCP, and ICMP

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1. DHCP protocol

- Use `dhcpcd` command to send DHCP requests

```
dhcpcd -r          # release the current lease
dhcpcd             # get new lease
```

```
vscode → /workspaces/Lab (main x) $ sudo dhcpcd -r
sudo: unable to resolve host bravo: Temporary failure in name resolution
Removed stale PID file

"systemd" is not running in this container due to its overhead.
Use the "service" command to start services instead. e.g.:

service --status-all
vscode → /workspaces/Lab (main x) $ sudo dhcpcd
sudo: unable to resolve host bravo: Temporary failure in name resolution

"systemd" is not running in this container due to its overhead.
Use the "service" command to start services instead. e.g.:

service --status-all

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Use the "service" command to start services instead. e.g.:

service --status-all
```

a. DHCP Request, Reply, and ACK messages

Packet Number 2554, 2555, 2556, 2561 correspond to DHCP Discover, Offer, Request, ACK respectively.

dhcp						
No.	Time	Source	Destination	Protocol	Length	Info
2273	35.012995	10.4.19.148	10.1.1.3	DHCP	342	DHCP Release - Transaction ID 0x660a212d
2554	40.057016	0.0.0.0	255.255.255.255	DHCP	342	DHCP Discover - Transaction ID 0x77ee4633
2555	40.064220	10.4.18.1	10.4.19.148	DHCP	369	DHCP Offer - Transaction ID 0x77ee4633
2556	40.064825	0.0.0.0	255.255.255.255	DHCP	342	DHCP Request - Transaction ID 0x77ee4633
2557	40.064889	10.4.18.1	10.4.18.52	DHCP	369	DHCP Offer - Transaction ID 0x77ee4633
2561	40.174449	10.4.18.1	10.4.19.148	DHCP	369	DHCP ACK - Transaction ID 0x77ee4633

b. IP addresses of the DHCP server and client

After DHCP ACK

- Client IP: 10.4.19.148
- DHCP Server IP: 10.4.18.1

dhcp							
No.	Time	Source	Destination	Protocol ▾	Length	Info	
2273	35.012995	10.4.19.148	10.1.1.3	DHCP	342	DHCP Release	- Transaction ID 0x660a212d
2554	40.057016	0.0.0.0	255.255.255....	DHCP	342	DHCP Discover	- Transaction ID 0x77ee4633
2555	40.064220	10.4.18.1	10.4.19.148	DHCP	369	DHCP Offer	- Transaction ID 0x77ee4633
2556	40.064825	0.0.0.0	255.255.255....	DHCP	342	DHCP Request	- Transaction ID 0x77ee4633
2557	40.064889	10.4.18.1	10.4.18.52	DHCP	369	DHCP Offer	- Transaction ID 0x77ee4633
2561	40.174449	10.4.18.1	10.4.19.148	DHCP	369	DHCP ACK	- Transaction ID 0x77ee4633

▶ Flags: 0x0000 Fragment offset: 0 Time to live: 255 Protocol: UDP (17) Header checksum: 0xe2eb [validation disabled] [Header checksum status: Unverified] Source: 10.4.18.1 Destination: 10.4.19.148

▶ User Datagram Protocol, Src Port: 67, Dst Port: 68 ▶ Dynamic Host Configuration Protocol (ACK)

2. ARP protocol

- use `arping` to send ARP requests

```
vscode → /workspaces/Lab (main x) $ sudo arping -c 5 10.4.19.22
sudo: unable to resolve host bravo: Temporary failure in name resolution
ARPING 10.4.19.22
Timeout
Timeout
Timeout
Timeout
Timeout

--- 10.4.19.22 statistics ---
5 packets transmitted, 0 packets received, 100% unanswered (0 extra)

vscode → /workspaces/Lab (main x) $ sudo arping -c 5 10.4.18.1
sudo: unable to resolve host bravo: Temporary failure in name resolution
ARPING 10.4.18.1
60 bytes from 28:6f:7f:5a:ab:40 (10.4.18.1): index=0 time=4.780 msec
60 bytes from 28:6f:7f:5a:ab:40 (10.4.18.1): index=1 time=5.373 msec
60 bytes from 28:6f:7f:5a:ab:40 (10.4.18.1): index=2 time=4.131 msec
60 bytes from 28:6f:7f:5a:ab:40 (10.4.18.1): index=3 time=4.797 msec
60 bytes from 28:6f:7f:5a:ab:40 (10.4.18.1): index=4 time=8.477 msec

--- 10.4.18.1 statistics ---
5 packets transmitted, 5 packets received, 0% unanswered (0 extra)
rtt min/avg/max/std-dev = 4.131/5.511/8.477/1.534 ms
vscode → /workspaces/Lab (main x) $
```

a. ARP Request and Reply messages

- Packet number 10117 is APR Request
- Packet number 10118 is APR Response

No.	Time	Source	Destination	Protocol	Length	Info
10097	171.2131...	Cisco 5a:a...	LCFCHeFe 65:d3...	ARP	60	Who has 10.4.19.168? Tell 10.4.18.1
10117	171.3071...	RealtekS_3...	Broadcast	ARP	58	Who has 10.4.18.1? Tell 10.4.19.148
10118	171.3118...	Cisco 5a:a...	RealtekS 31:6b...	ARP	60	10.4.18.1 is at 28:6f:7f:5a:ab:40
10119	171.3134...	D-LinkIn 4...	Broadcast	ARP	60	Who has 10.4.19.78? Tell 192.168.0.182
10120	171.3141...	D-linkIn 4...	Broadcast	ARP	60	Who has 10.4.19.78? Tell 192.168.0.182

b. MAC address of the the replier

MAC address of the the replier is 28:6f:7f:5a:ab:40

10117	171.3071...	RealtekS 3...	Broadcast	ARP	58 Who has 10.4.18.1? Tell 10.4.19.148
10118	171.3118...	Cisco 5a:a...	RealtekS 31:6b...	ARP	60 10.4.18.1 is at 28:6f:7f:5a:ab:40
10119	171.3134...	D-LinkIn 4...	Broadcast	ARP	60 Who has 10.4.19.78? Tell 192.168.0.182
10120	171.3141...	D-LinkIn 4...	Broadcast	ARP	60 Who has 10.4.19.78? Tell 192.168.0.182

▶ Frame 10118: 60 bytes on wire (480 bits), 60 bytes captured (480 bits)
 ▶ Ethernet II, Src: Cisco_5a:ab:40 (28:6f:7f:5a:ab:40), Dst: RealtekS_31:6b:09 (00:e0:4c:31:6b:09)
 ▼ Address Resolution Protocol (reply)
 Hardware type: Ethernet (1)
 Protocol type: IPv4 (0x0800)
 Hardware size: 6
 Protocol size: 4
 Opcode: reply (2)
 Sender MAC address: Cisco 5a:ab:40 (28:6f:7f:5a:ab:40)
 Sender IP address: 10.4.18.1
 Target MAC address: RealtekS_31:6b:09 (00:e0:4c:31:6b:09)
 Target IP address: 10.4.19.148

3. traceroute for dns.google

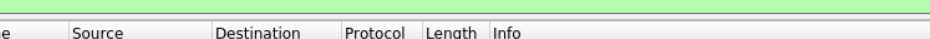
```
tracert -i icmp dns.google
# OR
tracert -i icmp 8.8.8.8
```

```
vscode → /workspaces/Lab (main x) $ traceroute --icmp 8.8.8.8
traceroute to 8.8.8.8 (8.8.8.8), 30 hops max, 60 byte packets
 1  10.4.18.1 (10.4.18.1)  0.867 ms  0.809 ms  0.768 ms
 2  campnet.bits-go.a.in (10.1.0.10)  0.741 ms  0.726 ms  0.707 ms
 3  103-210-49-129.rev.expl.in (103.210.49.129)  1.179 ms * *
 4  * * 103.123.50.37 (103.123.50.37)  1.660 ms
 5  45-116-0-133.rev.expl.in (45.116.0.133)  2.366 ms  2.362 ms  2.344 ms
 6  45-116-0-245.rev.expl.in (45.116.0.245)  31.676 ms  31.381 ms  31.325 ms
 7  72.14.198.241 (72.14.198.241)  31.303 ms  31.296 ms  31.288 ms
 8  108.170.248.177 (108.170.248.177)  23.733 ms  23.818 ms  23.697 ms
 9  72.14.237.139 (72.14.237.139)  32.216 ms  32.203 ms  32.187 ms
10  dns.google (8.8.8.8)  22.938 ms  22.920 ms  22.908 ms
```

a. IP address of your host and the destination

Host IP: 10.4.19.148

Destination IP: 8.8.8.8



The screenshot shows a Wireshark packet capture of ICMP Echo (ping) requests. The packet list pane displays four packets, all of which are Echo (ping) requests from 10.4.19.148 to 8.8.8.8. The packet details pane shows the ICMP header information for the selected packet, including the protocol (ICMP), header checksum (0x6ca9), status (Unverified), source (10.4.19.148), and destination (8.8.8.8). The packet bytes pane shows the raw data of the packet, which is the ICMP Echo request.

No.	Time	Source	Destination	Protocol	Length	Info
15774	269.166070	10.4.19.148	8.8.8.8	ICMP	74	Echo (ping) request id=0x0008, seq=1/256, ttl=1 (no response yet)
15775	269.166127	10.4.19.148	8.8.8.8	ICMP	74	Echo (ping) request id=0x0008, seq=2/512, ttl=1 (no response yet)
15776	269.166151	10.4.19.148	8.8.8.8	ICMP	74	Echo (ping) request id=0x0008, seq=3/768, ttl=1 (no response yet)
15777	269.166170	10.4.19.148	8.8.8.8	ICMP	74	Echo (ping) request id=0x0008, seq=4/1024, ttl=2 (no response yet)

Protocol: ICMP (1)
Header checksum: 0x6ca9 [validation disabled]
[Header checksum status: Unverified]
Source: 10.4.19.148
Destination: 8.8.8.8
Internet Control Message Protocol

b. raw bytes of the ICMP echo packet

icmp

No.	Time	Source	Destination	Protocol	Length	Info
15774	269.166070	10.4.19.148	8.8.8.8	ICMP	74	Echo (ping) request
15775	269.166127	10.4.19.148	8.8.8.8	ICMP	74	Echo (ping) request
15776	269.166151	10.4.19.148	8.8.8.8	ICMP	74	Echo (ping) request
15777	269.166170	10.4.19.148	8.8.8.8	ICMP	74	Echo (ping) request
15778	269.166191	10.4.19.148	8.8.8.8	ICMP	74	Echo (ping) request
15779	269.166206	10.4.19.148	8.8.8.8	ICMP	74	Echo (ping) request
15780	269.166220	10.4.19.148	8.8.8.8	ICMP	74	Echo (ping) request

Frame 15774: 74 bytes on wire (592 bits), 74 bytes captured (592 bits)

Ethernet II, Src: RealtekS_31:6b:09 (00:e0:4c:31:6b:09), Dst: Cisco_5a:ab:40 (28:6f:7f:5a:ab:40)

Internet Protocol Version 4, Src: 10.4.19.148, Dst: 8.8.8.8

Internet Control Message Protocol

```

0000  28 6f 7f 5a ab 40 00 e0  4c 31 6b 09 08 00 45 00  (o.Z.@.. L1k...E.
0010  00 3c 1f 71 00 00 01 01  6c a9 0a 04 13 94 08 08  .<.q.... l.....
0020  08 08 08 00 82 71 00 08  00 01 48 49 4a 4b 4c 4d  ...q... ..HIJKLM
0030  4e 4f 50 51 52 53 54 55  56 57 58 59 5a 5b 5c 5d  NOPQRSTU VWXYZ[\]
0040  5e 5f 60 61 62 63 64 65  66 67                    ^_abcde fg
  
```

- type 0x08

Frame 15774: 74 bytes on wire (592 bits), 74 bytes captured (592 bits)

Ethernet II, Src: RealtekS_31:6b:09 (00:e0:4c:31:6b:09), Dst: Cisco_5a:ab:40 (28:6f:7f:5a:ab:40)

Internet Protocol Version 4, Src: 10.4.19.148, Dst: 8.8.8.8

Internet Control Message Protocol

Type: 8 (Echo (ping) request)

Code: 0

Checksum: 0x8271 [correct]

[Checksum Status: Good]

Identifier (ID): 8 (0x0008)

```

0000  28 6f 7f 5a ab 40 00 e0  4c 31 6b 09 08 00 45 00  (o.Z.@.. L1k...E.
0010  00 3c 1f 71 00 00 01 01  6c a9 0a 04 13 94 08 08  .<.q.... l.....
0020  08 08 08 00 82 71 00 08  00 01 48 49 4a 4b 4c 4d  ...q... ..HIJKLM
0030  4e 4f 50 51 52 53 54 55  56 57 58 59 5a 5b 5c 5d  NOPQRSTU VWXYZ[\]
0040  5e 5f 60 61 62 63 64 65  66 67                    ^_abcde fg
  
```

- code 0x00

Frame 15774: 74 bytes on wire (592 bits), 74 bytes captured (592 bits)

Ethernet II, Src: RealtekS_31:6b:09 (00:e0:4c:31:6b:09), Dst: Cisco_5a:ab:40 (28:6f:7f:5a:ab:40)

Internet Protocol Version 4, Src: 10.4.19.148, Dst: 8.8.8.8

Internet Control Message Protocol

Type: 8 (Echo (ping) request)

Code: 0

Checksum: 0x8271 [correct]

[Checksum Status: Good]

Identifier (ID): 8 (0x0008)

```

0000  28 6f 7f 5a ab 40 00 e0  4c 31 6b 09 08 00 45 00  (o.Z.@.. L1k...E.
0010  00 3c 1f 71 00 00 01 01  6c a9 0a 04 13 94 08 08  .<.q.... l.....
0020  08 08 08 00 82 71 00 08  00 01 48 49 4a 4b 4c 4d  ...q... ..HIJKLM
0030  4e 4f 50 51 52 53 54 55  56 57 58 59 5a 5b 5c 5d  NOPQRSTU VWXYZ[\]
0040  5e 5f 60 61 62 63 64 65  66 67                    ^_abcde fg
  
```

c. raw bytes of the ICMP error packet

icmp						
No.	Time	Source	Destination	Protocol	Length	Info
15787	269.166315	10.4.19.148	8.8.8.8	ICMP	74	Echo (ping) request id=0x0008, seq=14/3584, ttl=5 (no res
15788	269.166324	10.4.19.148	8.8.8.8	ICMP	74	Echo (ping) request id=0x0008, seq=15/3840, ttl=5 (no res
15789	269.166332	10.4.19.148	8.8.8.8	ICMP	74	Echo (ping) request id=0x0008, seq=16/4096, ttl=6 (no res
15790	269.166905	10.1.0.10	10.4.19.148	ICMP	102	Time-to-live exceeded (Time to live exceeded in transit)
15791	269.166905	10.4.18.1	10.4.19.148	ICMP	70	Time-to-live exceeded (Time to live exceeded in transit)
15792	269.166905	10.1.0.10	10.4.19.148	ICMP	102	Time-to-live exceeded (Time to live exceeded in transit)
15793	269.166906	10.4.18.1	10.4.19.148	ICMP	70	Time-to-live exceeded (Time to live exceeded in transit)
15794	269.166906	10.1.0.10	10.4.19.148	ICMP	102	Time-to-live exceeded (Time to live exceeded in transit)
▶ Frame 15790: 102 bytes on wire (816 bits), 102 bytes captured (816 bits) ▶ Ethernet II, Src: Cisco_5a:ab:40 (28:6f:7f:5a:ab:40), Dst: RealtekS_31:6b:09 (00:e0:4c:31:6b:09) ▶ Internet Protocol Version 4, Src: 10.1.0.10, Dst: 10.4.19.148 ▶ Internet Control Message Protocol						
0000	00 e0 4c 31 6b 09 28 6f 7f 5a ab 40 08 00 45 c0	..L1k.(o .Z.@.E.				
0010	00 58 1c 6e 00 00 3f 01 36 d5 0a 01 00 0a 0a 04	.X.n..?. 6.....				
0020	13 94 0b 00 f4 ff 00 00 00 00 45 00 00 3c 1f 74	...[....E.<.t				
0030	00 00 01 01 6c a6 0a 04 13 94 08 08 08 08 08 00l... ..				
0040	82 6e 00 08 00 04 48 49 4a 4b 4c 4d 4e 4f 50 51	.n....HI JKLMNOPQ				
0050	52 53 54 55 56 57 58 59 5a 5b 5c 5d 5e 5f 60 61	RSTUVWXY Z[\]^_`a				
0060	62 63 64 65 66 67	bcdefg				

- type 0x0b

▶ Frame 15790: 102 bytes on wire (816 bits), 102 bytes captured (816 bits) ▶ Ethernet II, Src: Cisco_5a:ab:40 (28:6f:7f:5a:ab:40), Dst: RealtekS_31:6b:09 (00:e0:4c:31:6b:09) ▶ Internet Protocol Version 4, Src: 10.1.0.10, Dst: 10.4.19.148 ▶ Internet Control Message Protocol						
Type: 11 (Time-to-live exceeded)						
Code: 0 (Time to live exceeded in transit)						
Checksum: 0xf4ff [correct]						
[Checksum Status: Good]						
Unused: 00000000						
0000	00 e0 4c 31 6b 09 28 6f 7f 5a ab 40 08 00 45 c0	..L1k.(o .Z.@.E.				
0010	00 58 1c 6e 00 00 3f 01 36 d5 0a 01 00 0a 0a 04	.X.n..?. 6.....				
0020	13 94 0b 00 f4 ff 00 00 00 00 45 00 00 3c 1f 74	...[....E.<.t				
0030	00 00 01 01 6c a6 0a 04 13 94 08 08 08 08 08 00l... ..				
0040	82 6e 00 08 00 04 48 49 4a 4b 4c 4d 4e 4f 50 51	.n....HI JKLMNOPQ				
0050	52 53 54 55 56 57 58 59 5a 5b 5c 5d 5e 5f 60 61	RSTUVWXY Z[\]^_`a				
0060	62 63 64 65 66 67	bcdefg				

- code 0x00

▶ Frame 15790: 102 bytes on wire (816 bits), 102 bytes captured (816 bits) ▶ Ethernet II, Src: Cisco_5a:ab:40 (28:6f:7f:5a:ab:40), Dst: RealtekS_31:6b:09 (00:e0:4c:31:6b:09) ▶ Internet Protocol Version 4, Src: 10.1.0.10, Dst: 10.4.19.148 ▶ Internet Control Message Protocol						
Type: 11 (Time-to-live exceeded)						
Code: 0 (Time to live exceeded in transit)						
Checksum: 0xf4ff [correct]						
[Checksum Status: Good]						
Unused: 00000000						
0000	00 e0 4c 31 6b 09 28 6f 7f 5a ab 40 08 00 45 c0	..L1k.(o .Z.@.E.				
0010	00 58 1c 6e 00 00 3f 01 36 d5 0a 01 00 0a 0a 04	.X.n..?. 6.....				
0020	13 94 0b 00 f4 ff 00 00 00 00 45 00 00 3c 1f 74	...[....E.<.t				
0030	00 00 01 01 6c a6 0a 04 13 94 08 08 08 08 08 00l... ..				
0040	82 6e 00 08 00 04 48 49 4a 4b 4c 4d 4e 4f 50 51	.n....HI JKLMNOPQ				
0050	52 53 54 55 56 57 58 59 5a 5b 5c 5d 5e 5f 60 61	RSTUVWXY Z[\]^_`a				
0060	62 63 64 65 66 67	bcdefg				

d. last three ICMP packets received by the source host

- The last 3 ICMP packets are ICMP Echo reply packets with type `0x00` and code `0x00`.

No.	Time	Source	Destination	Protocol	Length	Info
15894	269.842250	10.4.19.148	8.8.8.8	ICMP	74	Echo (ping) request id=0x0008, seq=34/8704, ttl=12 (reply
15895	269.842278	10.4.19.148	8.8.8.8	ICMP	74	Echo (ping) request id=0x0008, seq=35/8960, ttl=12 (reply
15896	269.842297	10.4.19.148	8.8.8.8	ICMP	74	Echo (ping) request id=0x0008, seq=36/9216, ttl=12 (reply
15897	269.842320	10.4.19.148	8.8.8.8	ICMP	74	Echo (ping) request id=0x0008, seq=37/9472, ttl=13 (reply
15898	269.842338	10.4.19.148	8.8.8.8	ICMP	74	Echo (ping) request id=0x0008, seq=38/9728, ttl=13 (reply
15900	269.865266	8.8.8.8	10.4.19.148	ICMP	74	Echo (ping) reply id=0x0008, seq=32/8192, ttl=117 (requ
15901	269.865267	8.8.8.8	10.4.19.148	ICMP	74	Echo (ping) reply id=0x0008, seq=33/8448, ttl=117 (requ
15902	269.865267	8.8.8.8	10.4.19.148	ICMP	74	Echo (ping) reply id=0x0008, seq=34/8704, ttl=117 (requ
15903	269.865267	8.8.8.8	10.4.19.148	ICMP	74	Echo (ping) reply id=0x0008, seq=35/8960, ttl=117 (requ
15904	269.865267	8.8.8.8	10.4.19.148	ICMP	74	Echo (ping) reply id=0x0008, seq=36/9216, ttl=117 (requ
15905	269.865267	8.8.8.8	10.4.19.148	ICMP	74	Echo (ping) reply id=0x0008, seq=37/9472, ttl=117 (requ
15906	269.865267	8.8.8.8	10.4.19.148	ICMP	74	Echo (ping) reply id=0x0008, seq=38/9728, ttl=117 (requ

- ICMP reply packets have type `0x00`. ICMP request packets have type `0x08`. Other type values are used for errors; eg. TTL exceed error corresponds to type `0x0b`. This type indicates how the following bytes are to be interpreted.

No.	Time	Source	Destination	Protocol	Length	Info
15894	269.842250	10.4.19.148	8.8.8.8	ICMP	74	Echo (ping) request id=0x0008, seq=34/8704, ttl=12 (reply
15895	269.842278	10.4.19.148	8.8.8.8	ICMP	74	Echo (ping) request id=0x0008, seq=35/8960, ttl=12 (reply
15896	269.842297	10.4.19.148	8.8.8.8	ICMP	74	Echo (ping) request id=0x0008, seq=36/9216, ttl=12 (reply
15897	269.842320	10.4.19.148	8.8.8.8	ICMP	74	Echo (ping) request id=0x0008, seq=37/9472, ttl=13 (reply
15898	269.842338	10.4.19.148	8.8.8.8	ICMP	74	Echo (ping) request id=0x0008, seq=38/9728, ttl=13 (reply
15900	269.865266	8.8.8.8	10.4.19.148	ICMP	74	Echo (ping) reply id=0x0008, seq=32/8192, ttl=117 (requ
15901	269.865267	8.8.8.8	10.4.19.148	ICMP	74	Echo (ping) reply id=0x0008, seq=33/8448, ttl=117 (requ
15902	269.865267	8.8.8.8	10.4.19.148	ICMP	74	Echo (ping) reply id=0x0008, seq=34/8704, ttl=117 (requ
15903	269.865267	8.8.8.8	10.4.19.148	ICMP	74	Echo (ping) reply id=0x0008, seq=35/8960, ttl=117 (requ
15904	269.865267	8.8.8.8	10.4.19.148	ICMP	74	Echo (ping) reply id=0x0008, seq=36/9216, ttl=117 (requ
15905	269.865267	8.8.8.8	10.4.19.148	ICMP	74	Echo (ping) reply id=0x0008, seq=37/9472, ttl=117 (requ
15906	269.865267	8.8.8.8	10.4.19.148	ICMP	74	Echo (ping) reply id=0x0008, seq=38/9728, ttl=117 (requ

▶ Frame 15906: 74 bytes on wire (592 bits), 74 bytes captured (592 bits)
▶ Ethernet II, Src: Cisco_5a:ab:40 (28:6f:7f:5a:ab:40), Dst: RealtekS_31:6b:09 (00:e0:4c:31:6b:09)
▶ Internet Protocol Version 4, Src: 8.8.8.8, Dst: 10.4.19.148
▼ Internet Control Message Protocol
Type: 0 (Echo (ping) reply)
Code: 0
Checksum: 0x8a4c [correct]
[Checksum Status: Good]
Identifier (BE): 8 (0x0008)
Identifier (LE): 2048 (0x0800)
Sequence number (BE): 38 (0x0026)
Sequence number (LE): 9728 (0x2600)
[Request frame: 15898]
[Response time: 22.929 ms]
▶ Data (32 bytes)

0000	00 e0 4c 31 6b 09 28 6f 7f 5a ab 40 08 00 45 b4	..Llk.(o.Z.@..E.
0010	00 3c 00 00 00 00 75 01 17 66 08 08 08 0a 04	<.....u..f.....
0020	13 94 00 00 8a 4c 00 08 00 26 48 49 4a 4b 4c 4d	..L...&HIJKLM
0030	4e 4f 50 51 52 53 54 55 56 57 58 59 5a 5b 5c 5d	NOPQRSTU VWXYZ[\]
0040	5e 5f 60 61 62 63 64 65 66 67	^_abcde fg