Challenge 1.1

Identify the ARP and Ping packets captured by Wireshark. Briefly explain the flow of the ARP and Ping packets that have been sent and received as an effect of the ping-command:

No.	Time	Source	Destination	Protocol	Info
1	0.000000	10.0.0.1	10.0.0.2	ICMP	Echo (ping) request
2	0.000086	00:00:00_00:00:07	Broadcast	ARP	Who has 10.0.0.1? Tell 10.0.0.2
3	0.000205	00:00:00_00:00:05	00:00:00_00:00:07	ARP	10.0.0.1 is at 00:00:00:00:00:05
4	0.000246	10.0.0.2	10.0.0.1	ICMP	Echo (ping) reply
5	1.017784	10.0.0.1	10.0.0.2	ICMP	Echo (ping) request
6	1.018272	10.0.0.2	10.0.0.1	ICMP	Echo (ping) reply
7	2.028057	10.0.0.1	10.0.0.2	ICMP	Echo (ping) request
8	2.028281	10.0.0.2	10.0.0.1	ICMP	Echo (ping) reply
9	3.028456	10.0.0.1	10.0.0.2	ICMP	Echo (ping) request
10	3.028813	10.0.0.2	10.0.0.1	ICMP	Echo (ping) reply
11	4.028655	10.0.0.1	10.0.0.2	ICMP	Echo (ping) request
12	4.028711	10.0.0.2	10.0.0.1	ICMP	Echo (ping) reply

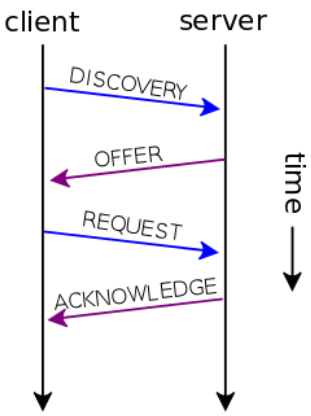
10.0.0.1 er routerens adresse og 10.0.0.2 er node1s adresse. ARP-protokollen bliver taget i brug for at klargøre og identificere routeren som sendte ping requesten. Så snart det er på plads og node1 har fået svar på dens broadcast begynder selve ping-interaktionen: Routeren pinger(ICMP) node1 og node1 sender herefter et svar tilbage. Dette forekommer 5 gange indtil at man ud fra dette kan se statistik på packet-loss mm.

Challenge 1.2

Identify the DHCP packets, and briefly explain the exchange of DHCP packets. What IPv4 address has been assigned to "Node 2"?

2	2.581779	fe80::200:ff:fe00:5	ff02::16	ICMPv6	Multicast Listener Report Message v2
3	40.797634	0.0.0.0	255.255.255.255	DHCP	DHCP Discover - Transaction ID 0xc497e24a
4	40.803222	::	ff02::16	ICMPv6	Multicast Listener Report Message v2
5	40.810481	00:00:00_00:00:05	Broadcast	ARP	Who has 10.0.0.3? Tell 10.0.0.1
6	41.644051	10.0.0.1	10.0.0.3	DHCP	DHCP Offer - Transaction ID 0xc497e24a
7	41.644482	0.0.0.0	255.255.255.255	DHCP	DHCP Request - Transaction ID 0xc497e24a
8	41.654650	10.0.0.1	10.0.0.3	DHCP	DHCP ACK - Transaction ID 0xc497e24a
9	41.800185	00:00:00_00:00:05	Broadcast	ARP	Who has 10.0.0.3? Tell 10.0.0.1
10	41.800313	00:00:00_00:00:06	00:00:00_00:00:05	ARP	10.0.0.3 is at 00:00:00:00:00:06
11	41.800472	10.0.0.1	10.0.0.3	ICMP	Echo (ping) request
12	41.800668	10.0.0.3	10.0.0.1	ICMP	Echo (ping) reply
13	46.808911	00:00:00_00:00:06	00:00:00_00:00:05	ARP	Who has 10.0.0.1? Tell 10.0.0.3
14	46.809070	00:00:00_00:00:05	00:00:00_00:00:06	ARP	10.0.0.1 is at 00:00:00:00:00:05
15	50.485647	fe80::200:ff:fe00:6	ff02::16	ICMPv6	Multicast Listener Report Message v2

På linje 2 “Discover” vores client DCHP fra serveren. Hvorefter på linje 6 bliver vores client tilbudt en IPv4 adresse. På linje 7 laver vores client et ”request” til serven. Og til sidst på linje 8 slutter serveren af med at returnere et ACK. Dermed er vores client blevet tildelt en IPv4 adresse, som er 10.0.03. Forløbet med DHCP-packet kan også følges på sekvensdiagram lige nedenfor.



Challenge 1.3

What IPv6 addresses are configured for the interface prior to autoconfiguration?

```
eth0      Link encap:Ethernet  HWaddr 00:00:00:00:00:07
          inet6 addr: fe80::200:ff:fe00:7/64 Scope:Link
          UP BROADCAST RUNNING MULTICAST  MTU:1500  Metric:1
          RX packets:15 errors:0 dropped:0 overruns:0 frame:0
          TX packets:4 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:1000
          RX bytes:2735 (2.7 KB)  TX bytes:360 (360.0 B)
          Interrupt:5
```

Her får node1, inden autokonfigurationen, tildelt en IPv6 adresse, som kan ses under ”inet6 addr:”

Challenge 1.4

What IPv6 addresses are configured for eth0?

No. .	Time	Source	Destination	Protocol	Info
1	0.000000	::	ff02::16	ICMPv6	Multicast Listener Report Message v2
2	0.359189	::	ff02::1:ff00:6	ICMPv6	Neighbor solicitation
3	0.449928	::	ff02::16	ICMPv6	Multicast Listener Report Message v2
4	1.360033	fe80::200:ff:fe00:6	ff02::2	ICMPv6	Router solicitation
5	1.361167	fe80::200:ff:fe00:5	ff02::1	ICMPv6	Router advertisement
6	1.559802	::	ff02::1:ff00:6	ICMPv6	Neighbor solicitation

```
eth0      Link encap:Ethernet  HWaddr 00:00:00:00:00:06
          inet6 addr: 2001:16d8:dd92:1001:200:ff:fe00:6/64 Scope:Global
          inet6 addr: fe80::200:ff:fe00:6/64 Scope:Link
          UP BROADCAST RUNNING MULTICAST  MTU:1500  Metric:1
          RX packets:12 errors:0 dropped:0 overruns:0 frame:0
          TX packets:5 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:1000
          RX bytes:2447 (2.4 KB)  TX bytes:406 (406.0 B)
          Interrupt:5

lo        Link encap:Local Loopback
          inet addr:127.0.0.1  Mask:255.0.0.0
          inet6 addr: ::1/128 Scope:Host
          UP LOOPBACK RUNNING  MTU:16436  Metric:1
          RX packets:0 errors:0 dropped:0 overruns:0 frame:0
          TX packets:0 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:0
          RX bytes:0 (0.0 B)  TX bytes:0 (0.0 B)
```

Node 2 er nu blevet autokonfigureret og har fået tildelt en lokal IPv6 adresse og en global IPv6 og globalt.

Challenge 1.5

What is the IPv6-network address used, and how can you tell?

I challenge 1.4 fik vi tildelt en global netværk adresse 2001:16db:dd92:1001:200:ff:fe00:6/64. Denne globale adresse er vores IPv6-network adresse.

Challenge 1.6

Briefly explain the ICMPv6 packets capture by Wireshark. You can ignore packets destined for ff02::16.

No.	Time	Source	Destination	Protocol	Info
1	0.000000	::	ff02::16	ICMPv6	Multicast Listener Report Message v2
2	0.359189	::	ff02::1:ff00:6	ICMPv6	Neighbor solicitation
3	0.449928	::	ff02::16	ICMPv6	Multicast Listener Report Message v2
4	1.360033	fe80::200:ff:fe00:6	ff02::2	ICMPv6	Router solicitation
5	1.361167	fe80::200:ff:fe00:5	ff02::1	ICMPv6	Router advertisement
6	1.559802	::	ff02::1:ff00:6	ICMPv6	Neighbor solicitation

- Neighbor solicitation:
  - Bestemmelse af link layer adressen til noder på det lokale netværk
- Router solicitation:
  - Efterspørgsel på en router, hvilket generer en Router advertisement på routeren med det samme denmodtager denne.
- Router advertisement:
  - Routeren fortæller at den er til stede og er operativ – ofte som svar til en Router Solicitation request.

Challenge 1.7

Briefly explain the ICMPv6 packets exchanged.

9	627.635030	2001:16d8:dd92:1001:2	ff02::1:ff00:1	ICMPv6	Neighbor solicitation
10	627.635148	2001:16d8:dd92:1001::	2001:16d8:dd92:1001:2	ICMPv6	Neighbor advertisement
11	627.635206	2001:16d8:dd92:1001:2	2001:16d8:dd92:1001::	ICMPv6	Echo request
12	627.635246	2001:16d8:dd92:1001::	2001:16d8:dd92:1001:2	ICMPv6	Echo reply
13	628.641289	2001:16d8:dd92:1001:2	2001:16d8:dd92:1001::	ICMPv6	Echo request
14	628.641549	2001:16d8:dd92:1001::	2001:16d8:dd92:1001:2	ICMPv6	Echo reply
15	629.640236	2001:16d8:dd92:1001:2	2001:16d8:dd92:1001::	ICMPv6	Echo request
16	629.640337	2001:16d8:dd92:1001::	2001:16d8:dd92:1001:2	ICMPv6	Echo reply
17	630.639882	2001:16d8:dd92:1001:2	2001:16d8:dd92:1001::	ICMPv6	Echo request
18	630.640112	2001:16d8:dd92:1001::	2001:16d8:dd92:1001:2	ICMPv6	Echo reply
19	631.639409	2001:16d8:dd92:1001:2	2001:16d8:dd92:1001::	ICMPv6	Echo request
20	631.639627	2001:16d8:dd92:1001::	2001:16d8:dd92:1001:2	ICMPv6	Echo reply
21	632.643169	fe80::200:ff:fe00:5	2001:16d8:dd92:1001:2	ICMPv6	Neighbor solicitation
22	632.643420	2001:16d8:dd92:1001:2	fe80::200:ff:fe00:5	ICMPv6	Neighbor advertisement
23	637.649326	fe80::200:ff:fe00:6	fe80::200:ff:fe00:5	ICMPv6	Neighbor solicitation
24	637.649545	fe80::200:ff:fe00:5	fe80::200:ff:fe00:6	ICMPv6	Neighbor advertisement

- Neighbor solicitation:
  - Bliver brugt af noder til at bestemme link layer adressen af "nabo noden", eller for checke at "nabo noden" stadig kan nås.
- Neighbor advertisement:
  - Bliver brugt af noder til at svare på Neighbor Solicitation beskeder.
- Echo request og reply:
  - Ping request og pakker

Challenge 1.8

Calculate the global unicast IPv6 address from the MAC -address and the prefix which the router is configured for.

```
-bash-4.1# ping6 -c 5 2001:16d8:dd92:1001:0200:00ff:fe00:0007
PING 2001:16d8:dd92:1001:0200:00ff:fe00:0007(2001:16d8:dd92:1001:200:ff:fe00:7)
56 data bytes
64 bytes from 2001:16d8:dd92:1001:200:ff:fe00:7: icmp_seq=1 ttl=255 time=0.015 m
s
64 bytes from 2001:16d8:dd92:1001:200:ff:fe00:7: icmp_seq=2 ttl=255 time=0.017 m
s
64 bytes from 2001:16d8:dd92:1001:200:ff:fe00:7: icmp_seq=3 ttl=255 time=0.031 m
s
64 bytes from 2001:16d8:dd92:1001:200:ff:fe00:7: icmp_seq=4 ttl=255 time=0.053 m
s
64 bytes from 2001:16d8:dd92:1001:200:ff:fe00:7: icmp_seq=5 ttl=255 time=0.052 m
s

--- 2001:16d8:dd92:1001:0200:00ff:fe00:0007 ping statistics ---
5 packets transmitted, 5 received, 0% packet loss, time 3996ms
rtt min/avg/max/mdev = 0.015/0.033/0.053/0.017 ms
```

MAC : 00:00:00:00:00:07

Network Prefix : 2001:16d8:dd92:1001::/64

Modificeret EUI-64 : 02:00:00:FF:FE:00:00:07 (Grundet invetering af den 7. bit)

Global Unicast : 2001:16d8:dd92:1001:0200:00FF:FE00:0007