

Séance 5 : Couche liaison de données

Exercice 1 (IPv6)

Identifier les mécanismes à l'œuvre dans la trace suivante.

Frame 1319: 102 bytes on wire (816 bits), 102 bytes captured (816 bits) on interface 0
Ethernet II, Src: Vmware_9d:2a:f5 (00:50:56:9d:2a:f5), Dst: IPv6mcast_01 (33:33:00:00:00:01)
Internet Protocol Version 6, Src: fe80::250:56ff:fe9d:2af5, Dst: ff02::1
Internet Control Message Protocol v6
 Type: Router Advertisement (134)
 Code: 0
 Checksum: 0x46e7 [correct]
 Cur hop limit: 64
 Flags: 0x00
 Router lifetime (s): 1800
 Reachable time (ms): 0
 Retrans timer (ms): 0
 ICMPv6 Option (Prefix information : 2001:6a8:3900:20::/64)
 Type: Prefix information (3)
 Length: 4 (32 bytes)
 Prefix Length: 64
 Flag: 0xc0
 Valid Lifetime: 2592000
 Preferred Lifetime: 604800
 Reserved
 Prefix: 2001:6a8:3900:20::

Frame 1416: 86 bytes on wire (688 bits), 86 bytes captured (688 bits) on interface 0
Ethernet II, Src: Dell_ff:24:ce (d4:be:d9:ff:24:ce), Dst: Vmware_9d:2a:f5 (00:50:56:9d:2a:f5)
Internet Protocol Version 6, Src: fe80::d6be:d9ff:feff:24ce, Dst: 2001:6a8:3900:20::1
Internet Control Message Protocol v6
 Type: Neighbor Solicitation (135)
 Code: 0
 Checksum: 0x1175 [correct]
 Reserved: 00000000
 Target Address: 2001:6a8:3900:20::1
 ICMPv6 Option (Source link-layer address : d4:be:d9:ff:24:ce)
 Type: Source link-layer address (1)
 Length: 1 (8 bytes)
 Link-layer address: Dell_ff:24:ce (d4:be:d9:ff:24:ce)

Frame 1417: 78 bytes on wire (624 bits), 78 bytes captured (624 bits) on interface 0
Ethernet II, Src: Vmware_9d:2a:f5 (00:50:56:9d:2a:f5), Dst: Dell_ff:24:ce (d4:be:d9:ff:24:ce)
Internet Protocol Version 6, Src: 2001:6a8:3900:20::1, Dst: fe80::d6be:d9ff:feff:24ce
Internet Control Message Protocol v6
 Type: Neighbor Advertisement (136)

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Code: 0
Checksum: 0x250a [correct]
Flags: 0xc0000000
Target Address: 2001:6a8:3900:20::1

Frame 1422: 86 bytes on wire (688 bits), 86 bytes captured (688 bits) on interface 0
Ethernet II, Src: Vmware_9d:2a:f5 (00:50:56:9d:2a:f5), Dst: Dell_ff:24:ce (d4:be:d9:ff:24:ce)
Internet Protocol Version 6, Src: fe80::250:56ff:fe9d:2af5, Dst: 2001:6a8:3900:20:226::2a
Internet Control Message Protocol v6
  Type: Neighbor Solicitation (135)
  Code: 0
  Checksum: 0xb02b [correct]
  Reserved: 00000000
  Target Address: 2001:6a8:3900:20:226::2a
  ICMPv6 Option (Source link-layer address : 00:50:56:9d:2a:f5)
    Type: Source link-layer address (1)
    Length: 1 (8 bytes)
    Link-layer address: Vmware_9d:2a:f5 (00:50:56:9d:2a:f5)

Frame 1423: 78 bytes on wire (624 bits), 78 bytes captured (624 bits) on interface 0
Ethernet II, Src: Dell_ff:24:ce (d4:be:d9:ff:24:ce), Dst: Vmware_9d:2a:f5 (00:50:56:9d:2a:f5)
Internet Protocol Version 6, Src: 2001:6a8:3900:20:226::2a, Dst: fe80::250:56ff:fe9d:2af5
Internet Control Message Protocol v6
  Type: Neighbor Advertisement (136)
  Code: 0
  Checksum: 0x7216 [correct]
  Flags: 0xc0000000
  Target Address: 2001:6a8:3900:20:226::2a

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Exercice 2 (IPv4)

Identifier les mécanismes à l'oeuvre dans la trace suivante.

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Frame 45: 73 bytes on wire (584 bits), 73 bytes captured (584 bits) on interface 0
Ethernet II, Src: Dell_ff:24:ce (d4:be:d9:ff:24:ce), Dst: HewlettP_63:6d:2d (b8:af:67:63:6d:2d)
Internet Protocol Version 4, Src: 138.48.32.150, Dst: 138.48.4.10
User Datagram Protocol, Src Port: 56559 (56559), Dst Port: domain (53)
Domain Name System (query): Standard query 0xd203 A www.unamur.be

Frame 47: 246 bytes on wire (1968 bits), 246 bytes captured (1968 bits) on interface 0
Ethernet II, Src: HewlettP_63:6d:2d (b8:af:67:63:6d:2d), Dst: Dell_ff:24:ce (d4:be:d9:ff:24:ce)
Internet Protocol Version 4, Src: 138.48.4.10, Dst: 138.48.32.150
User Datagram Protocol, Src Port: domain (53), Dst Port: 56559 (56559)
Domain Name System (response): Standard query response 0xd203 A www.unamur.be A 138.48.4.201 NS ns2.belnet.be
ns6.unamur.be NS ns1.belnet.be NS ns1.unamur.be A 138.48.2.17 A 138.48.2.18 AAAA 2001:6a8:3900:30::7e:2a

Frame 49: 98 bytes on wire (784 bits), 98 bytes captured (784 bits) on interface 0
Ethernet II, Src: Dell_ff:24:ce (d4:be:d9:ff:24:ce), Dst: HewlettP_63:6d:2d (b8:af:67:63:6d:2d)
Internet Protocol Version 4, Src: 138.48.32.150, Dst: 138.48.4.201
Internet Control Message Protocol
  Type: 8 (Echo (ping) request)
  Code: 0
  Checksum: 0xb507 [correct]
  Identifier (BE): 32607 (0x7f5f)
  Identifier (LE): 24447 (0x5f7f)
  Sequence number (BE): 1 (0x0001)
  Sequence number (LE): 256 (0x0100)
  Timestamp from icmp data: Dec 12, 2016 09:17:49.000000000 CET

```

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Frame 50: 98 bytes on wire (784 bits), 98 bytes captured (784 bits) on interface 0
Ethernet II, Src: HewlettP_63:6d:2d (b8:af:67:63:6d:2d), Dst: Dell_ff:24:ce (d4:be:d9:ff:24:ce)
Internet Protocol Version 4, Src: 138.48.4.201, Dst: 138.48.32.150
Internet Control Message Protocol
  Type: 0 (Echo (ping) reply)
  Code: 0
  Checksum: 0xbd07 [correct]
  Identifier (BE): 32607 (0x7f5f)
  Identifier (LE): 24447 (0x5f7f)
  Sequence number (BE): 1 (0x0001)
  Sequence number (LE): 256 (0x0100)
  Timestamp from icmp data: Dec 12, 2016 09:17:49.000000000 CET
  Data (48 bytes)

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Exercice 3 (ARP)

1. Quelles sont les principales différences entre les listings (sous forme de paquets) 1, 2 et 3, sachant que la station émettrice se trouve dans le sous-réseau 138.48.32.0/23 ?

Listing 1

```

1  0.000000 00:50:04:8c:83:70 -> ff:ff:ff:ff:ff:ff ARP Who has 138.48.32.54? Tell 138.48.33.200
2  0.000000 00:c0:f0:3c:68:91 -> 00:50:04:8c:83:70 ARP 138.48.32.54 is at 00:c0:f0:3c:68:91
3  0.000000 138.48.33.200 -> 138.48.32.54 ICMP Echo (ping) request
4  0.000000 138.48.32.54 -> 138.48.33.200 ICMP Echo (ping) reply
5  1.000000 138.48.33.200 -> 138.48.32.54 ICMP Echo (ping) request
6  1.000000 138.48.32.54 -> 138.48.33.200 ICMP Echo (ping) reply

```

Listing 2

```

1  0.000000 00:50:04:8c:83:70 -> ff:ff:ff:ff:ff:ff ARP Who has 138.48.32.1? Tell 138.48.33.200
2  0.000000 00:50:bd:d0:e0:00 -> 00:50:04:8c:83:70 ARP 138.48.32.1 is at 00:50:bd:d0:e0:00
3  0.000000 138.48.33.200 -> 138.48.4.4 ICMP Echo (ping) request
4  0.000000 138.48.4.4 -> 138.48.33.200 ICMP Echo (ping) reply
5  1.000000 138.48.33.200 -> 138.48.4.4 ICMP Echo (ping) request
6  1.000000 138.48.4.4 -> 138.48.33.200 ICMP Echo (ping) reply

```

Listing 3

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1  0.000000 138.48.33.200 -> 138.48.32.92 DNS Standard query A alouette.info.fundp.ac.be
2  0.000000 138.48.32.92 -> 138.48.33.200 DNS Standard query response A 138.48.32.54
3  0.000000 00:50:04:8c:83:70 -> ff:ff:ff:ff:ff:ff ARP Who has 138.48.32.54? Tell 138.48.33.200
4  0.000000 00:c0:f0:3c:68:91 -> 00:50:04:8c:83:70 ARP 138.48.32.54 is at 00:c0:f0:3c:68:91
5  0.000000 138.48.33.200 -> 138.48.32.54 ICMP Echo (ping) request
6  0.000000 138.48.32.54 -> 138.48.33.200 ICMP Echo (ping) reply
7  1.000000 138.48.33.200 -> 138.48.32.54 ICMP Echo (ping) request
8  1.000000 138.48.32.54 -> 138.48.33.200 ICMP Echo (ping) reply

```

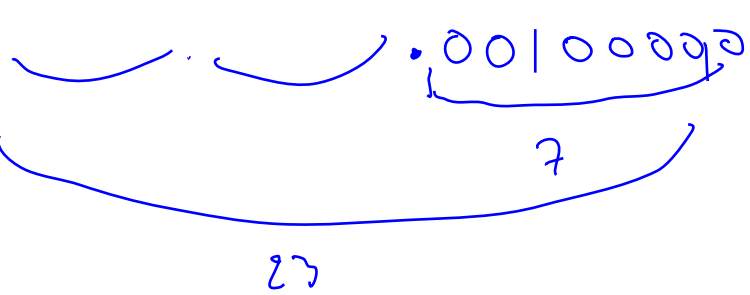
2. Dans la situation de la figure 1, supposons que le terminal 154.112.2.6 veuille émettre un paquet IP vers la machine d'adresse IP 154.112.1.3. On suppose que toutes les caches ARP sont vides. Indiquez quelles sont les trames Ethernet échangées avec, pour chaque trame, les adresses Ethernet source et destination et, pour les trames qui contiennent un paquet IP, les adresses IP source et destination.

Exercice 4 (Exercice de synthèse)

Soit Albert un étudiant qui branche son ordinateur sur l'Ethernet de l'université pour se rendre sur la page d'accueil de Google (www.google.com).

1. Schématiser la situation. Libre à vous d'inventer des adresses IP/Mac quand nécessaire.
2. Décrire, étape par étape et dans l'ordre, ce qui se passe dans les couches applicative (L5), transport (L4), réseaux (L3) et liaison de données (L2), entre le moment où Albert branche son ordinateur et le moment où son navigateur affiche la page d'accueil de Google.

3.

list 1: 
The diagram shows the IP address 138.98.33. The first octet '138' and the second octet '98' are grouped by a bracket underneath with the number '8' below it. The third octet '33' is grouped by a bracket underneath with the number '7' below it. A larger bracket underneath the entire address '138.98.33' has the number '23' below it.

⇒ englobé 138.98.33

⇒ listing 1 : m sous-réseau

listing 3 ; il faut d'abord une requête DNS pour
avoir l'adresse

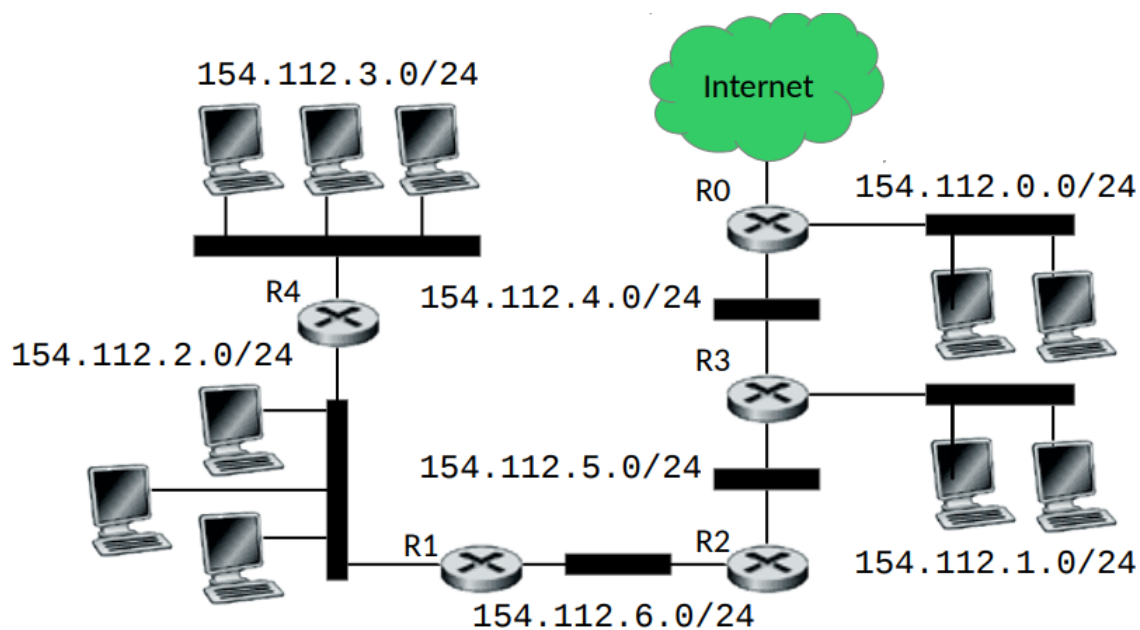


FIGURE 1 – Réseau de l'exercice 3.2