Address Resolution Protocol

Foreword

Ogni volta che debbono essere trasmessi dei dati attraverso Ethernet, questi debbono essere incapsulati in un frame. Il frame non può essere completato se non sono noti gli indirizzi fisici del mittente e del destinatario.

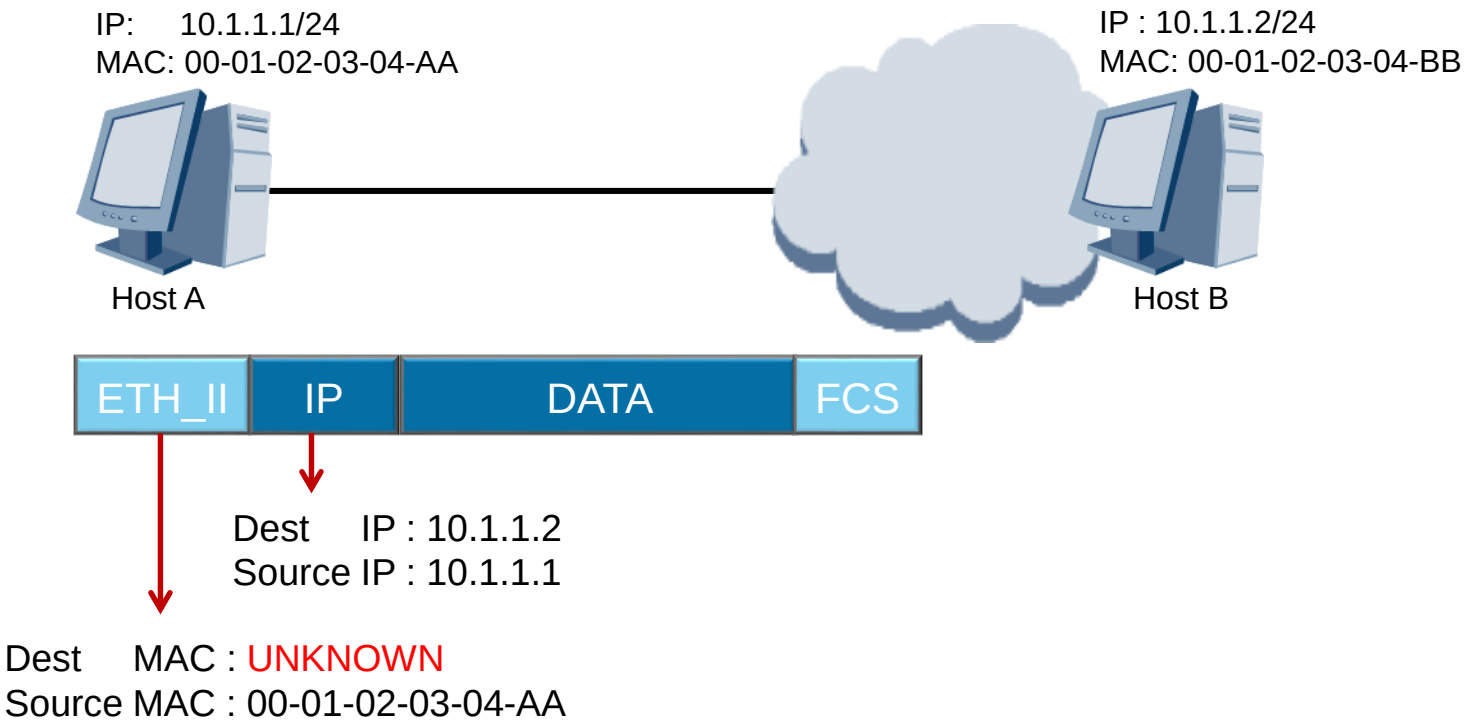
ARP è il protocollo che consente di apprendere dinamicamente il MAC ADDRESS di un dispositivo di rete che si trova sulla nostra stessa LAN.

Objectives

Upon completion of this section, trainees will be able to:

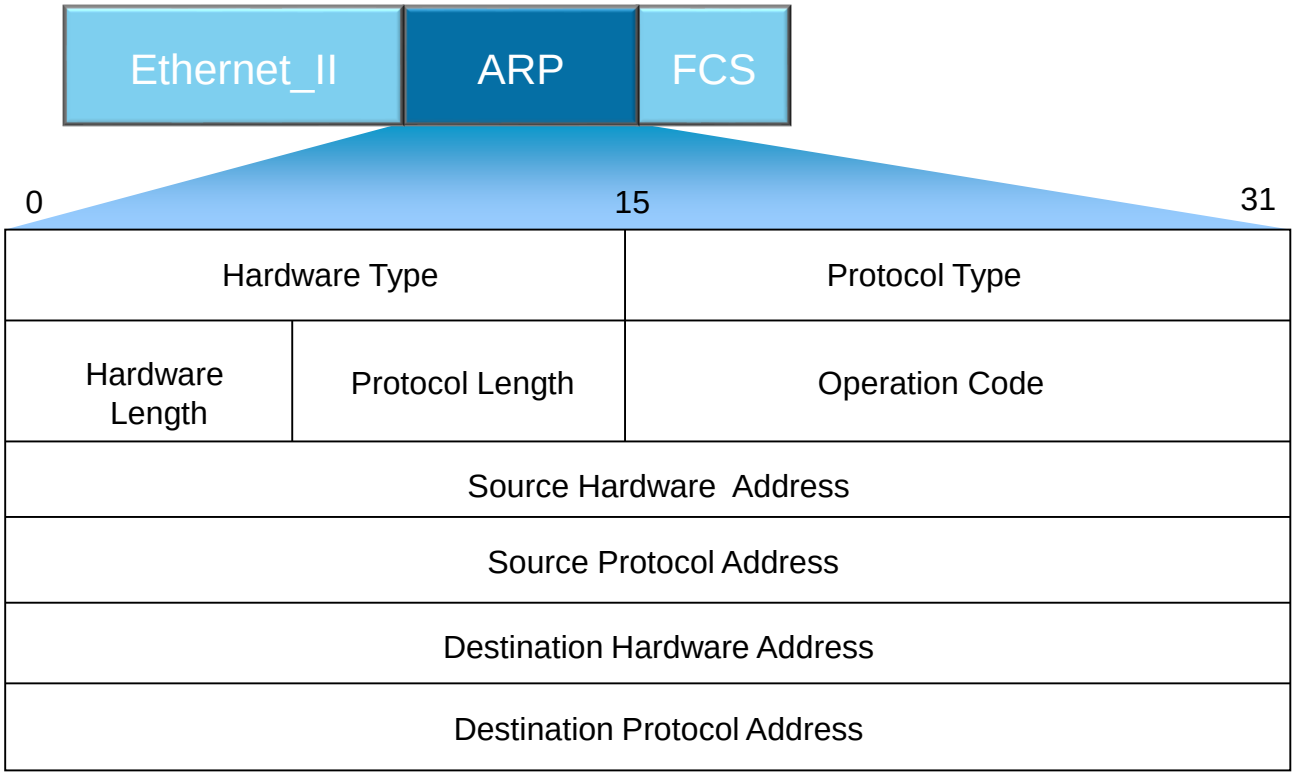
- Explain how the MAC address is resolved using ARP.
- Explain the function of the ARP cache table.

ARP



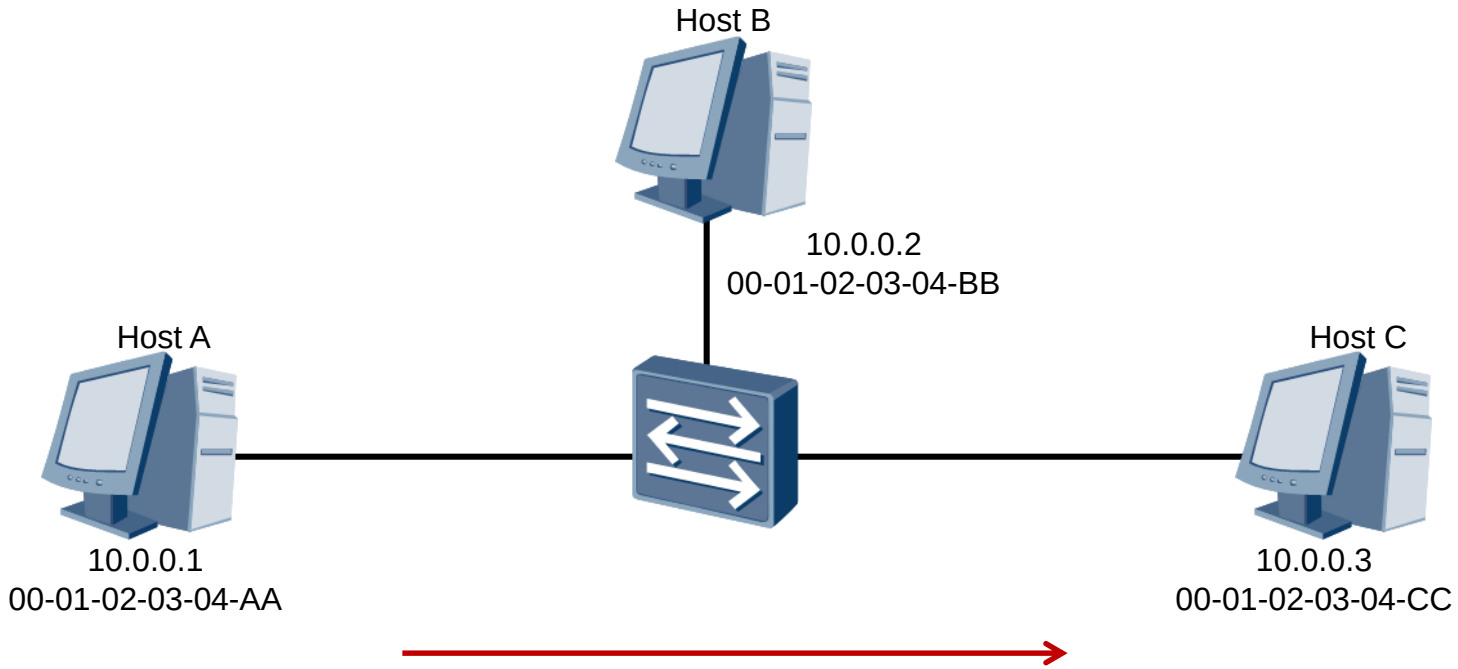
- Data link forwarding relies on knowledge of the MAC address of the data link layer destination.

ARP Format



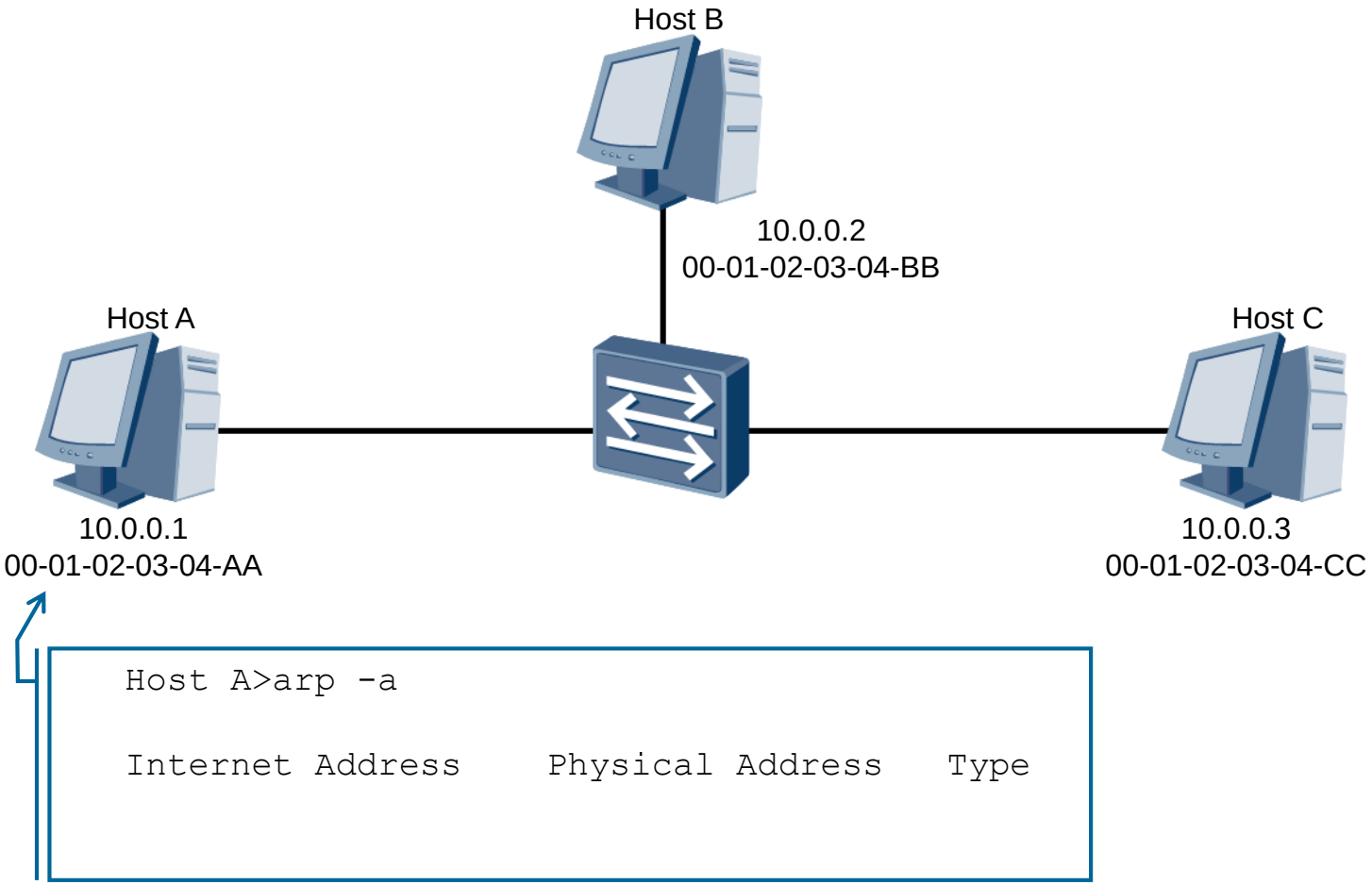
- The ARP packet operates within the boundaries of the data link layer, as can be understood by the absence of an IP header.

ARP Process

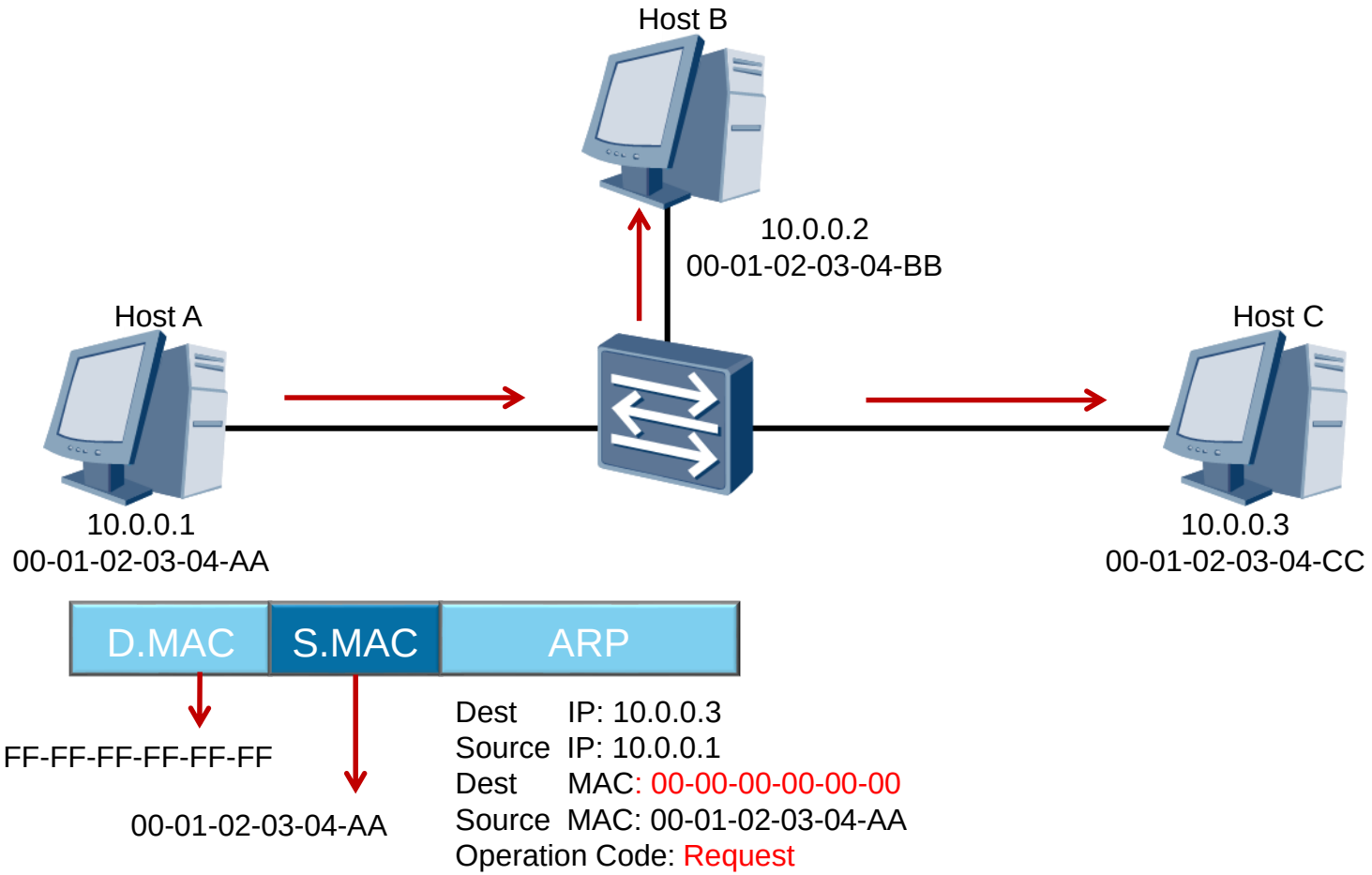


- Host A wishes to forward data to Host C, but must identify whether it is able to reach the destination at the data link layer.

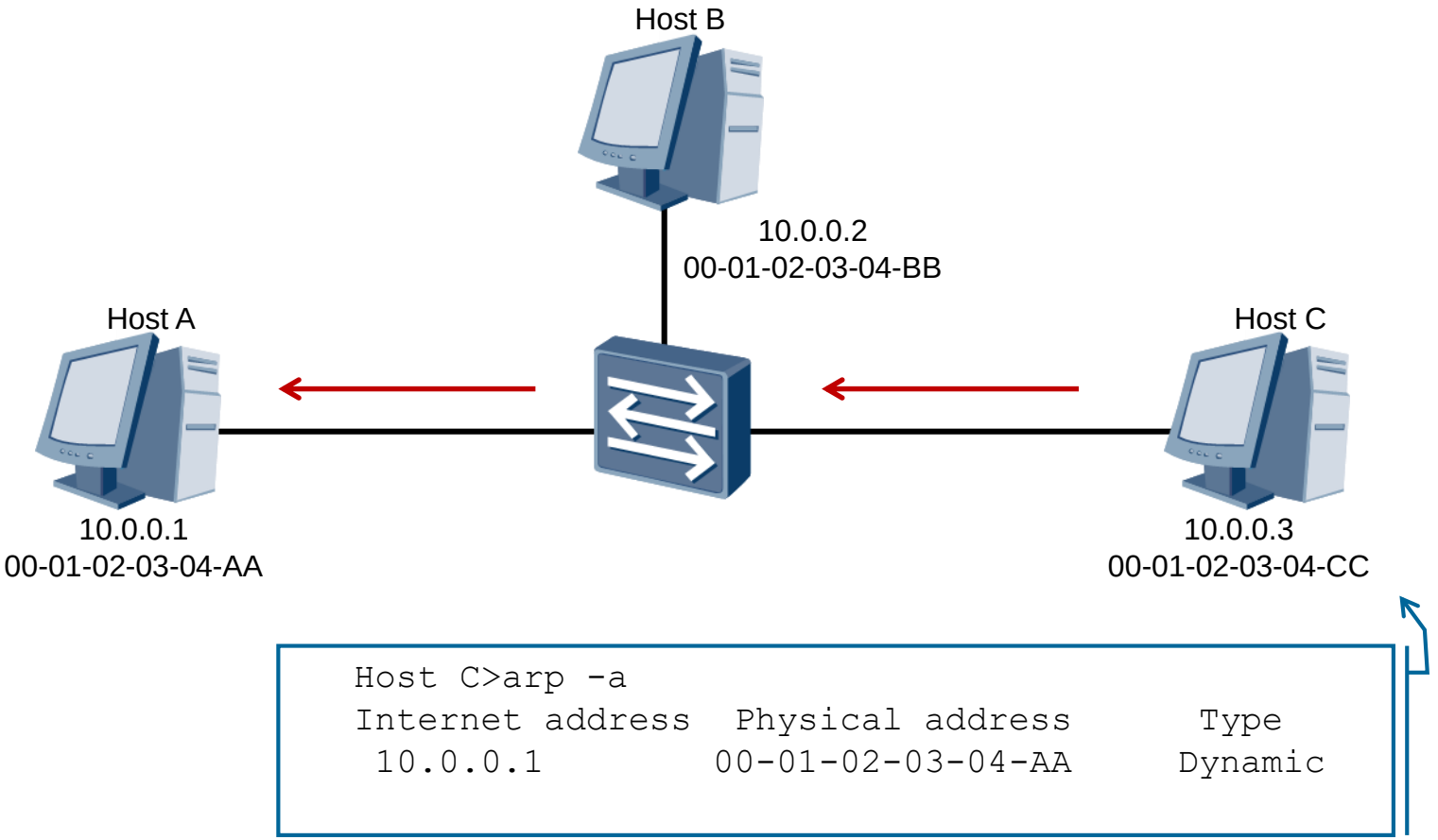
ARP Cache Lookup



ARP Request Process



ARP Reply Process



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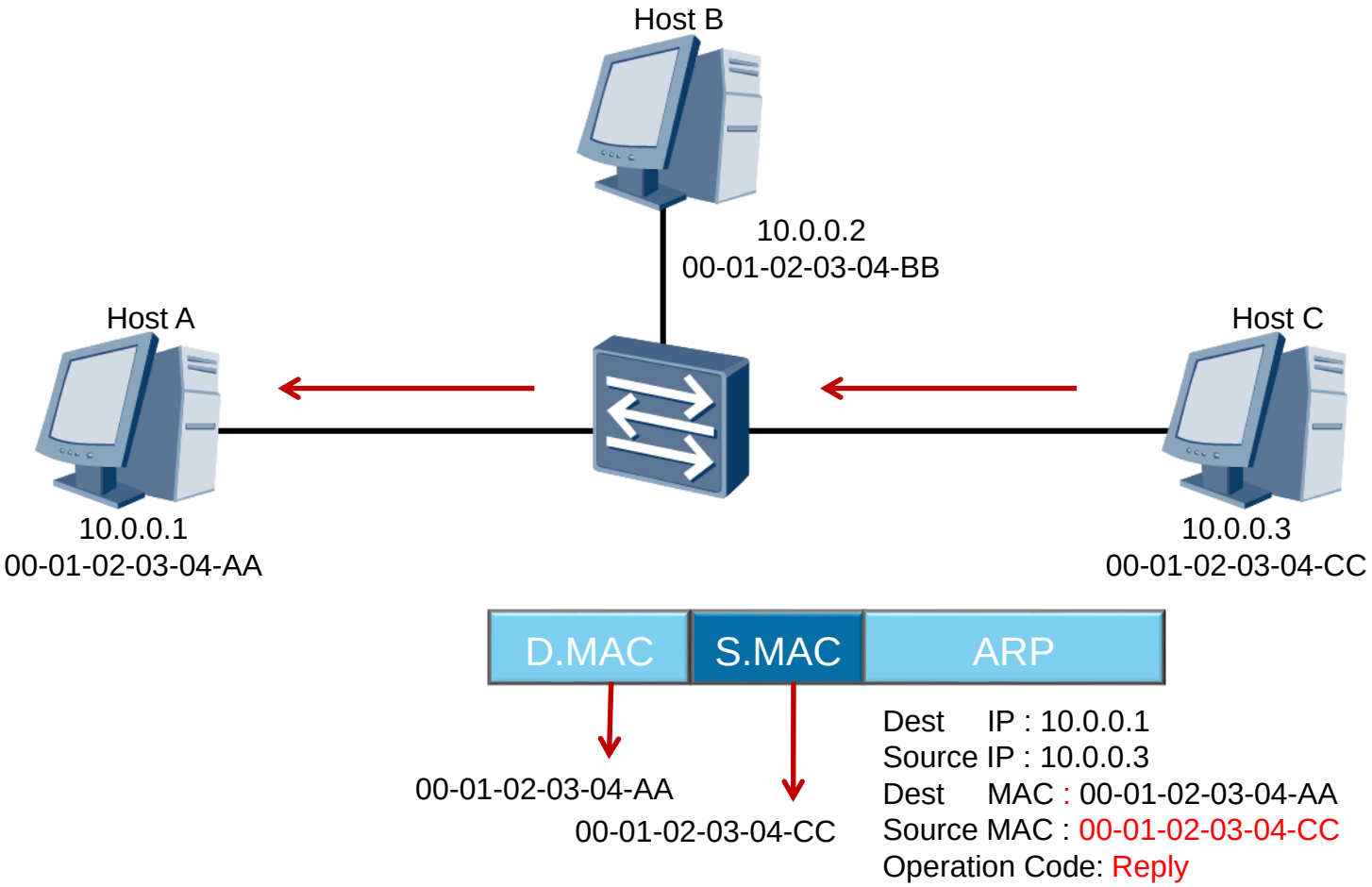
ARP Reply Process



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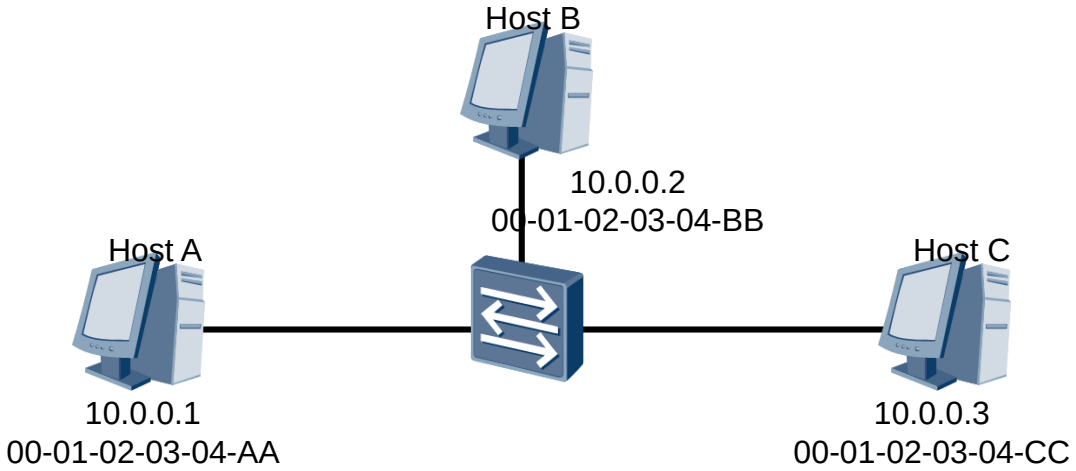
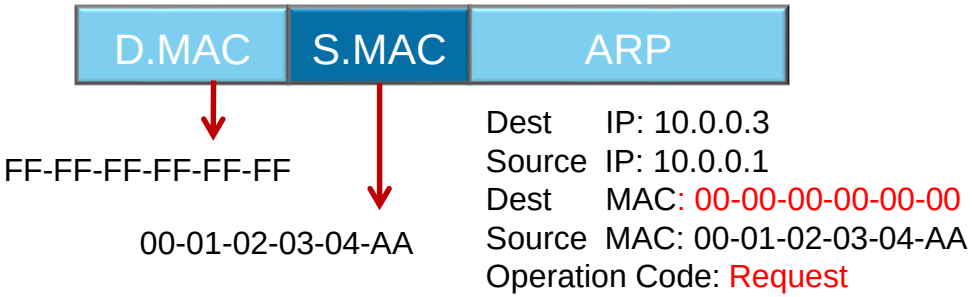
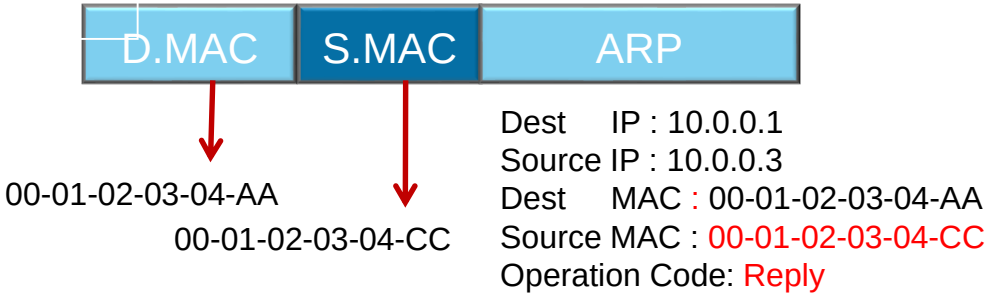
ARP Reply and Request Process







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ARP Process - request

Source	Destination	Protocol	Length	Info
HuaweiTe_2a:02:56	Broadcast	ARP	60	Who has 192.168.1.2? Tell 192.168.1.1
HuaweiTe_a8:3c:e3	HuaweiTe_2a:02:56	ARP	60	192.168.1.2 is at 54:89:98:a8:3c:e3

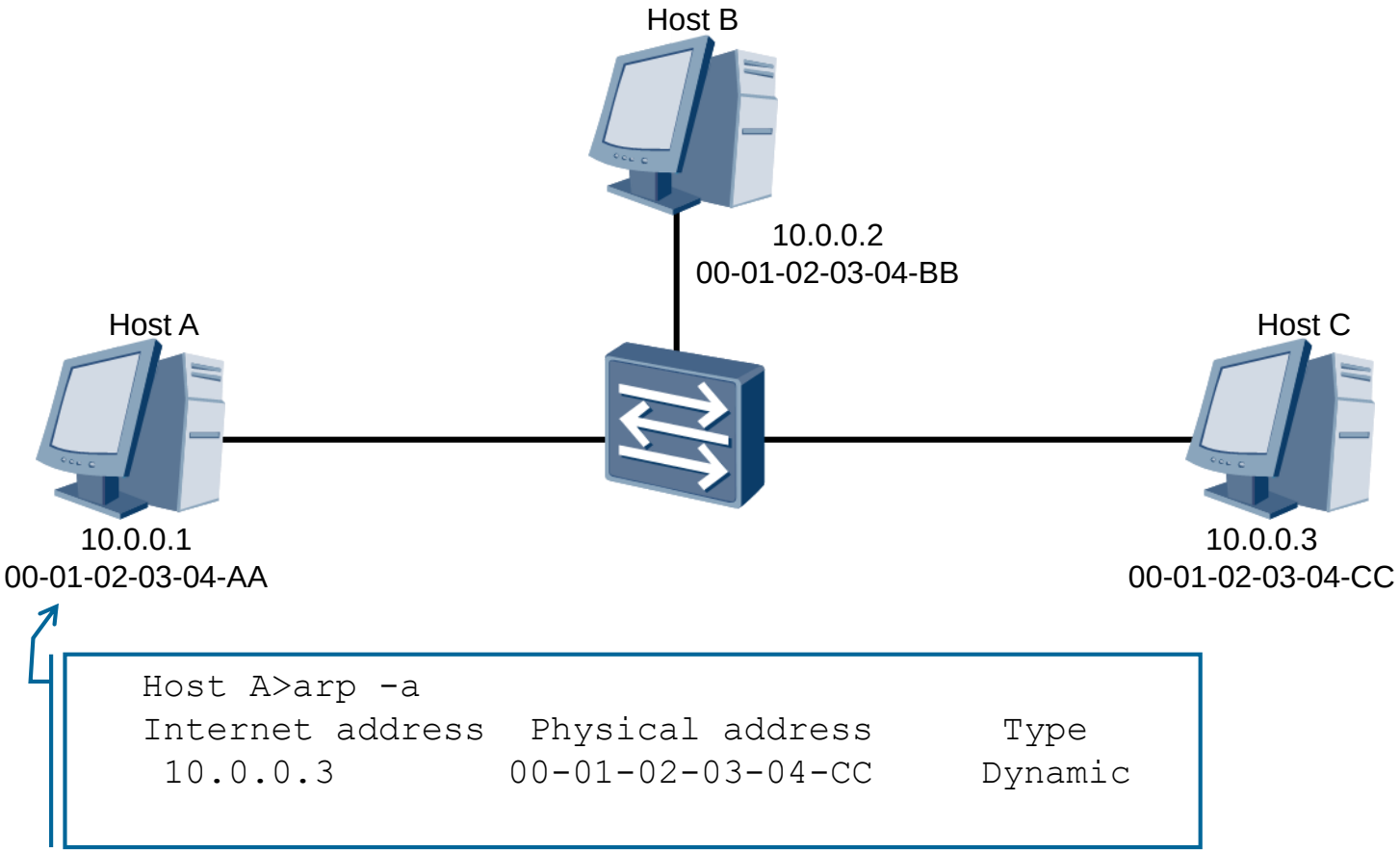
```
> Frame 1: 60 bytes on wire (480 bits), 60 bytes captured (480 bits) on interface 0
v Ethernet II, Src: HuaweiTe_2a:02:56 (54:89:98:2a:02:56), Dst: Broadcast (ff:ff:ff:ff:ff:ff)
  > Destination: Broadcast (ff:ff:ff:ff:ff:ff)
  > Source: HuaweiTe_2a:02:56 (54:89:98:2a:02:56)
    Type: ARP (0x0806)
    Padding: 000000000000000000000000000000000000
v Address Resolution Protocol (request)
    Hardware type: Ethernet (1)
    Protocol type: IPv4 (0x0800)
    Hardware size: 6
    Protocol size: 4
    Opcode: request (1)
    Sender MAC address: HuaweiTe_2a:02:56 (54:89:98:2a:02:56)
    Sender IP address: 192.168.1.1
    Target MAC address: Broadcast (ff:ff:ff:ff:ff:ff)
    Target IP address: 192.168.1.2
```

ARP Process - reply

Source	Destination	Protocol	Length	Info
HuaweiTe_2a:02:56	Broadcast	ARP	60	Who has 192.168.1.2? Tell 192.168.1.1
HuaweiTe_a8:3c:e3	HuaweiTe_2a:02:56	ARP	60	192.168.1.2 is at 54:89:98:a8:3c:e3

```
> Frame 2: 60 bytes on wire (480 bits), 60 bytes captured (480 bits) on interface 0
v Ethernet II, Src: HuaweiTe_a8:3c:e3 (54:89:98:a8:3c:e3), Dst: HuaweiTe_2a:02:56 (54:89:98:2a:02:56)
  > Destination: HuaweiTe_2a:02:56 (54:89:98:2a:02:56)
  > Source: HuaweiTe_a8:3c:e3 (54:89:98:a8:3c:e3)
    Type: ARP (0x0806)
    Padding: 000000000000000000000000000000000000
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: HuaweiTe_a8:3c:e3 (54:89:98:a8:3c:e3)
    Sender IP address: 192.168.1.2
    Target MAC address: HuaweiTe_2a:02:56 (54:89:98:2a:02:56)
    Target IP address: 192.168.1.1
```

ARP Cache



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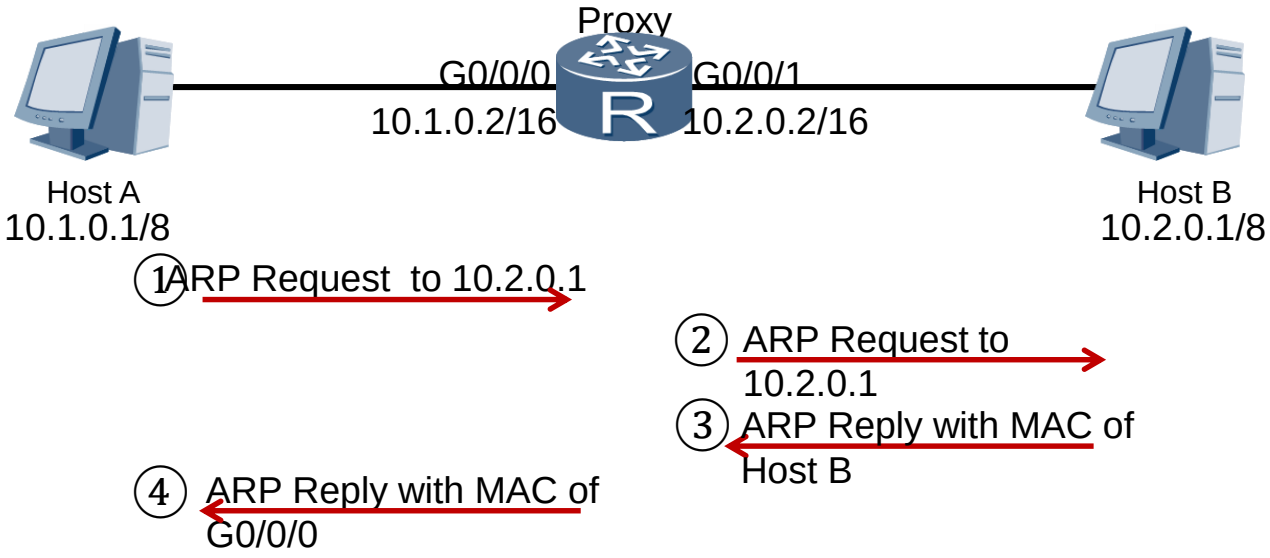
ARP Cache

```
PC>arp -a

Internet Address      Physical Address      Type
192.168.1.2           54-89-98-A8-3C-E3     dynamic

PC>
```

```
Interfaccia: 192.168.81.134 --- 0x1a
  Indirizzo Internet    Indirizzo fisico      Tipo
  192.168.21.137        ac-9b-0a-50-bc-58     dinamico
  192.168.81.9          00-0e-a6-c8-fc-ca     dinamico
  192.168.81.141        00-19-99-cf-ad-de     dinamico
  192.168.81.240        d4-be-d9-c8-67-d7     dinamico
  192.168.81.253        00-13-72-1c-c0-28     dinamico
  192.168.95.254        00-15-e9-f2-33-e7     dinamico
  192.168.95.255        ff-ff-ff-ff-ff-ff     statico
  193.205.130.247       00-16-3e-38-ff-c0     dinamico
  224.0.0.22            01-00-5e-00-00-16     statico
  224.0.0.251           01-00-5e-00-00-fb     statico
  224.0.0.252           01-00-5e-00-00-fc     statico
  239.143.255.250       01-00-5e-0f-ff-fa     statico
  239.255.255.250       01-00-5e-7f-ff-fa     statico
  255.255.255.255       ff-ff-ff-ff-ff-ff     statico

C:\Users\adelmo>
```

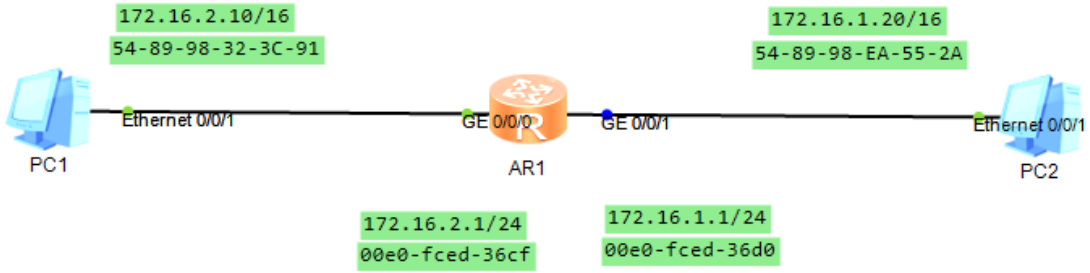
Proxy ARP



- Proxy ARP enables data link discovery between networks.
- Proxy replies with own (G0/0/0) address on behalf of Host B.
- Enables communication among network devices on the same network segment but different physical networks
- Mini-Lab_basic: 03-proxy_arp_01

Proxy ARP – capture gig 0/0/0

- Viene configurator su un dispositivo L3, senza alterare la configurazione degli hosts;

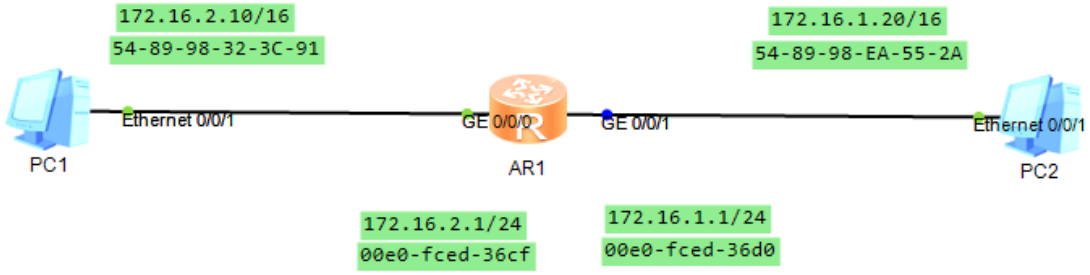



```
⊞ Ethernet II, Src: HuaweiTe_32:3c:91 (54:89:98:32:3c:91), Dst: Broadcast (ff:ff:ff:ff:ff:ff)
⊟ Address Resolution Protocol (request)
    Hardware type: Ethernet (0x0001)
    Protocol type: IP (0x0800)
    Hardware size: 6
    Protocol size: 4
    Opcode: request (0x0001)
    [Is gratuitous: False]
    Sender MAC address: 54:89:98:32:3c:91 (54:89:98:32:3c:91)
    Sender IP address: 172.16.2.10 (172.16.2.10)
    Target MAC address: 00:00:00:00:00:00 (00:00:00:00:00:00)
    Target IP address: 172.16.2.1 (172.16.2.1)
```

```
⊞ Ethernet II, Src: HuaweiTe_ed:36:cf (00:e0:fc:ed:36:cf), Dst: HuaweiTe_32:3c:91 (54:89:98:32:3c:91)
⊟ Address Resolution Protocol (reply)
    Hardware type: Ethernet (0x0001)
    Protocol type: IP (0x0800)
    Hardware size: 6
    Protocol size: 4
    Opcode: reply (0x0002)
    [Is gratuitous: False]
    Sender MAC address: HuaweiTe_ed:36:cf (00:e0:fc:ed:36:cf)
    Sender IP address: 172.16.1.20 (172.16.1.20)
    Target MAC address: HuaweiTe_32:3c:91 (54:89:98:32:3c:91)
    Target IP address: 172.16.2.10 (172.16.2.10)
```

Proxy ARP – capture gig 0/0/1

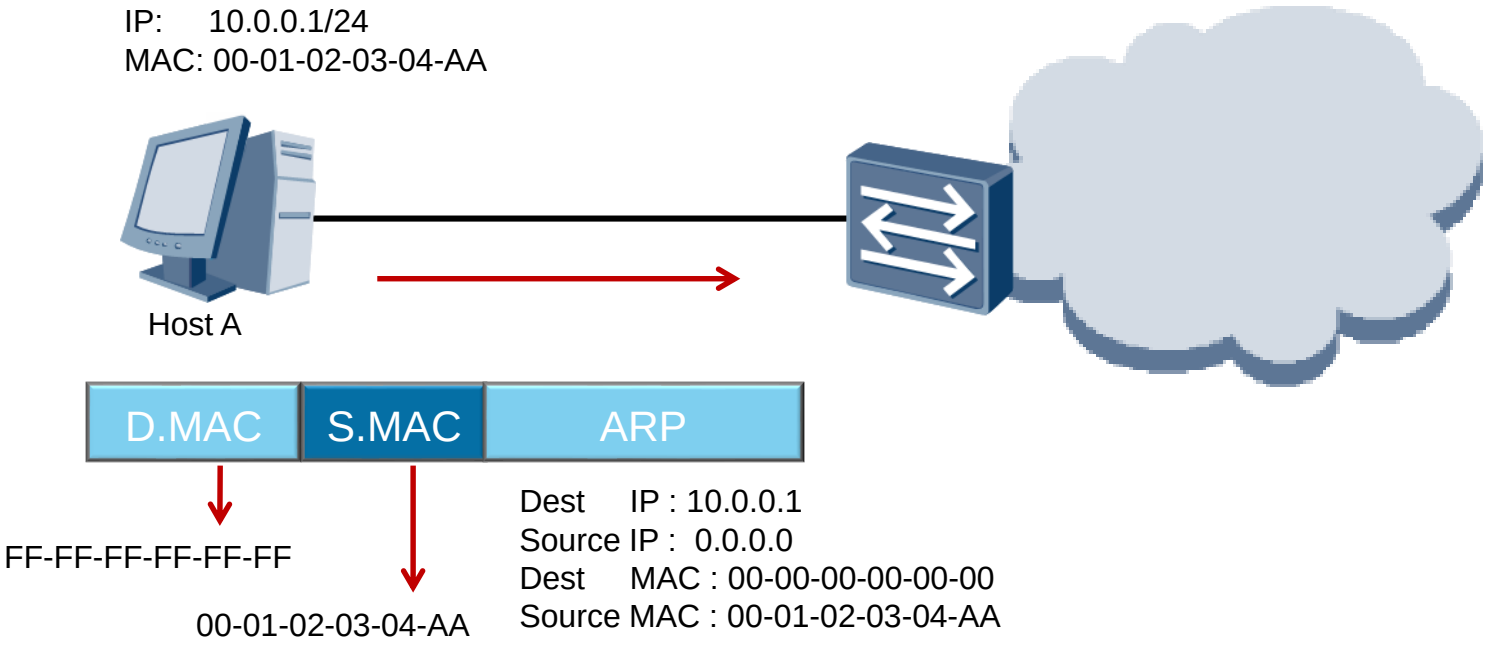
- Viene configurator su un dispositivo L3, senza alterare la configurazione degli hosts;




```
⊞ Frame 11: 60 bytes on wire (480 bits), 60 bytes captured (480 bits)
⊞ Ethernet II, Src: HuaweiTe_ed:36:d0 (00:e0:fc:ed:36:d0), Dst: Broadcast (ff:ff:ff:ff:ff:ff)
⊟ Address Resolution Protocol (request)
```

```
⊞ Frame 12: 60 bytes on wire (480 bits), 60 bytes captured (480 bits)
⊞ Ethernet II, Src: HuaweiTe_ea:55:2a (54:89:98:ea:55:2a), Dst: HuaweiTe_ed:36:d0 (00:e0:fc:ed:36:d0)
⊟ Address Resolution Protocol (reply)
    Hardware type: Ethernet (0x0001)
    Protocol type: IP (0x0800)
    Hardware size: 6
    Protocol size: 4
    Opcode: reply (0x0002)
    [Is gratuitous: False]
    Sender MAC address: HuaweiTe_ea:55:2a (54:89:98:ea:55:2a)
    Sender IP address: 172.16.1.20 (172.16.1.20)
    Target MAC address: HuaweiTe_ed:36:d0 (00:e0:fc:ed:36:d0)
    Target IP address: 172.16.1.1 (172.16.1.1)
```

Gratuitous ARP



- Duplicate IP addresses may be assigned in a single IP network.
- ARP can be used to discover IP address conflicts.

Gratuitous ARP

```
> Frame 315: 42 bytes on wire (336 bits), 42 bytes captured (336 bits) on interface 0
v Ethernet II, Src: Dell_45:37:3c (f0:1f:af:45:37:3c), Dst: Broadcast (ff:ff:ff:ff:ff:ff)
  > Destination: Broadcast (ff:ff:ff:ff:ff:ff)
  > Source: Dell_45:37:3c (f0:1f:af:45:37:3c)
    Type: ARP (0x0806)
v Address Resolution Protocol (request)
    Hardware type: Ethernet (1)
    Protocol type: IPv4 (0x0800)
    Hardware size: 6
    Protocol size: 4
    Opcode: request (1)
    Sender MAC address: Dell_45:37:3c (f0:1f:af:45:37:3c)
    Sender IP address: 0.0.0.0
    Target MAC address: 00:00:00_00:00:00 (00:00:00:00:00:00)
    Target IP address: 192.168.81.134
```

Esercizi

Utilizzando il calcolatore a disposizione:

- Visualizzare la tabella ARP;
- Effettuare un ping a www.google.com;
- Compare l’indirizzo fisico di www.google.com?

Summary

- Prior to generating an ARP request, what action must be taken by an end station?
- When are gratuitous ARP messages generated and propagated on the local network?

Thank you

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