NETWORKING ESSENTIALS

Chapter 3.

LAN Switching

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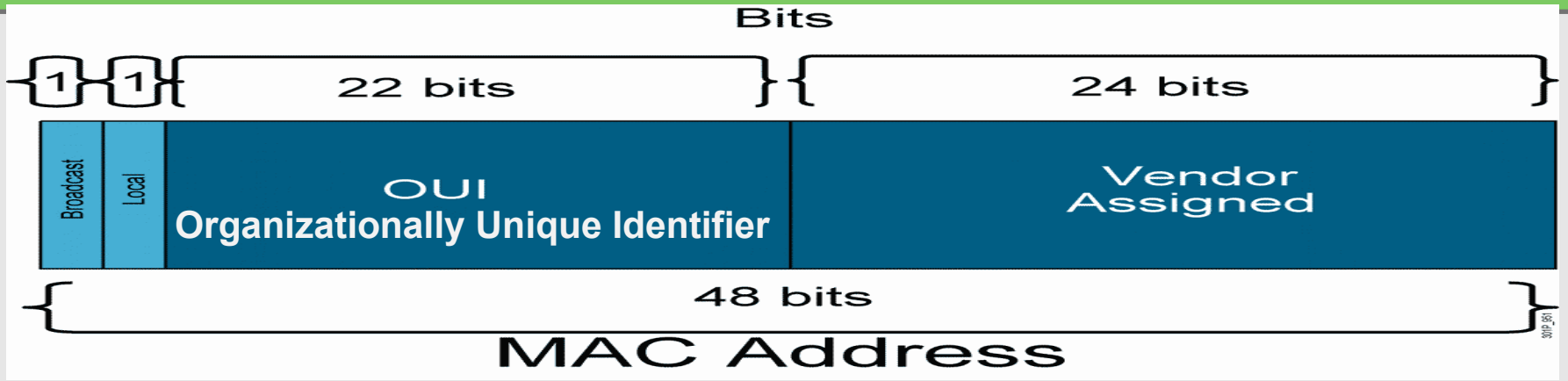
I. Understanding the challenges with Switched LAN Technology

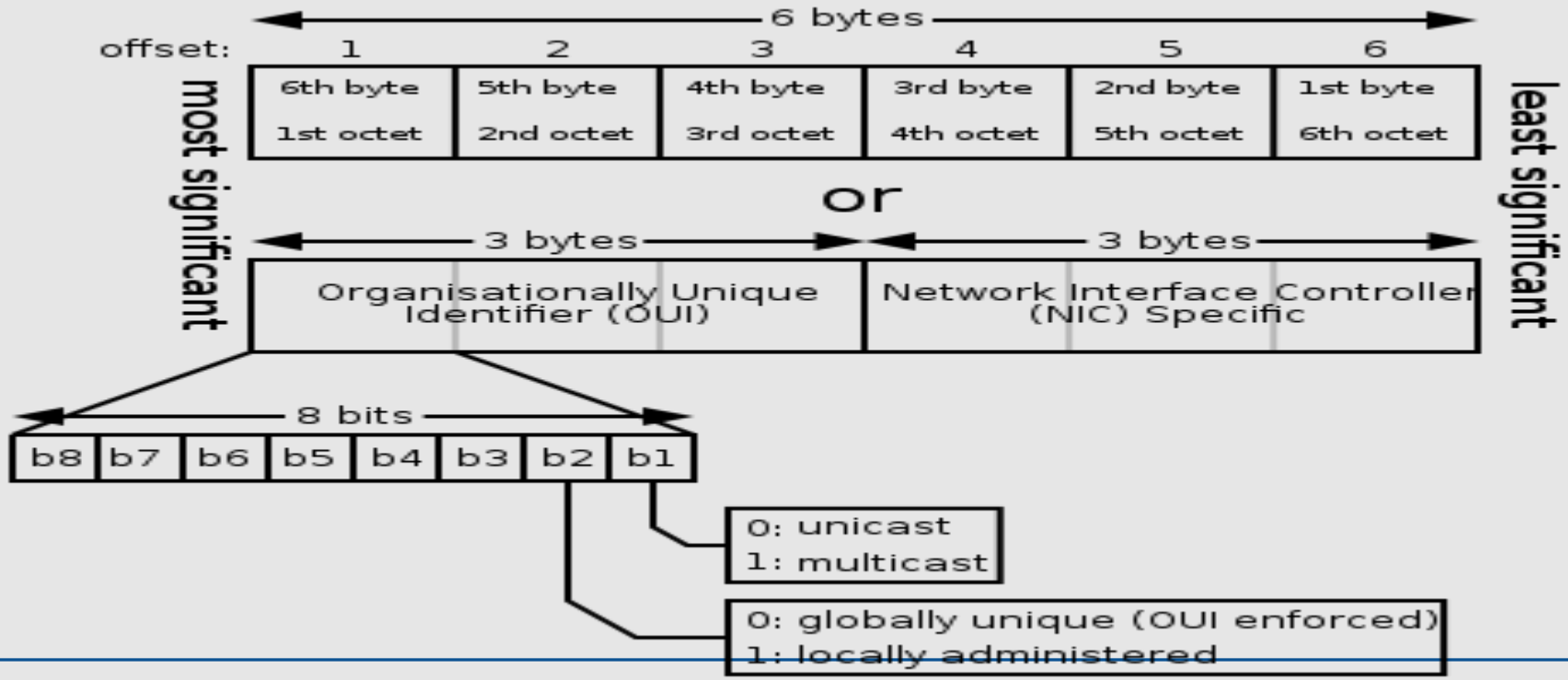
II. Exploring the packet Delivery Process 1 (layer 1)

III. Exploring the packet Delivery Process 2 (layer 2)

IV. Exploring the packet Delivery Process 3 (layer 3)

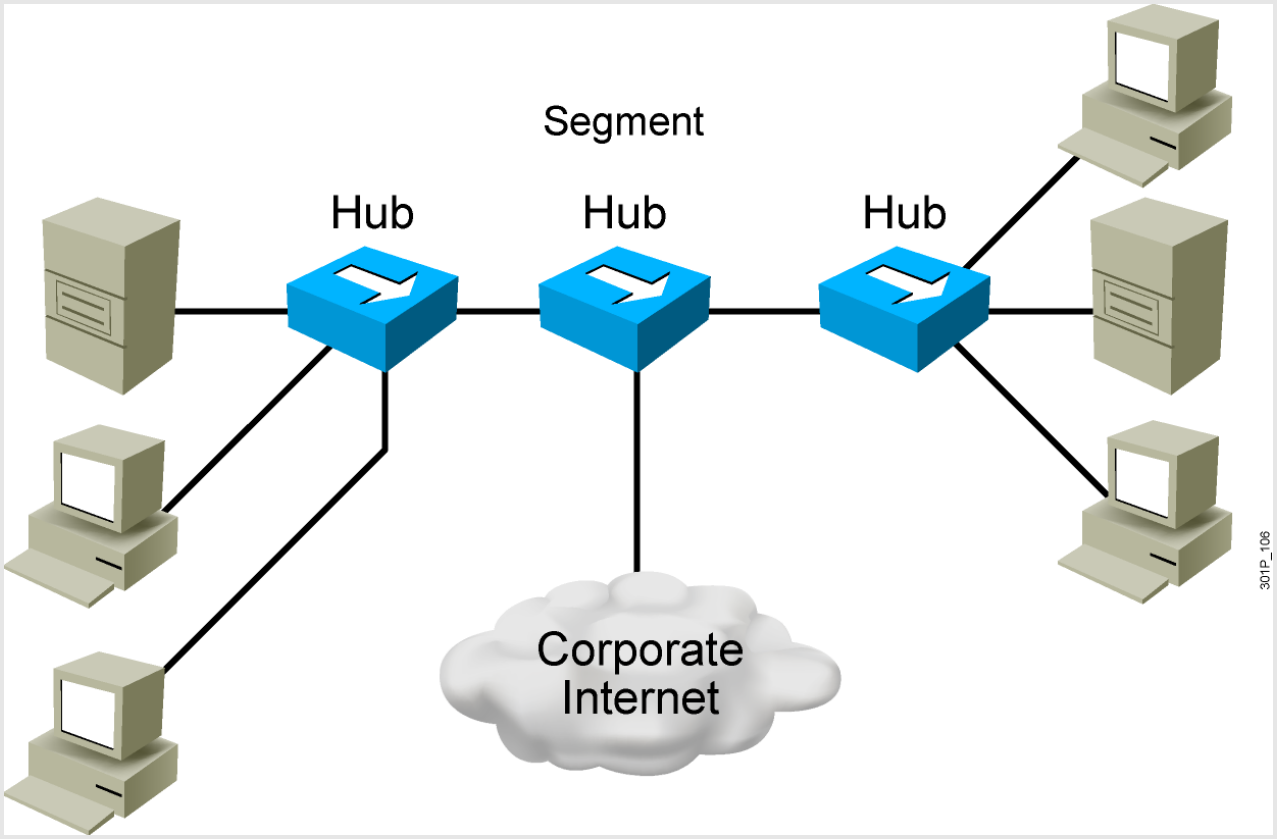
MAC Address Components





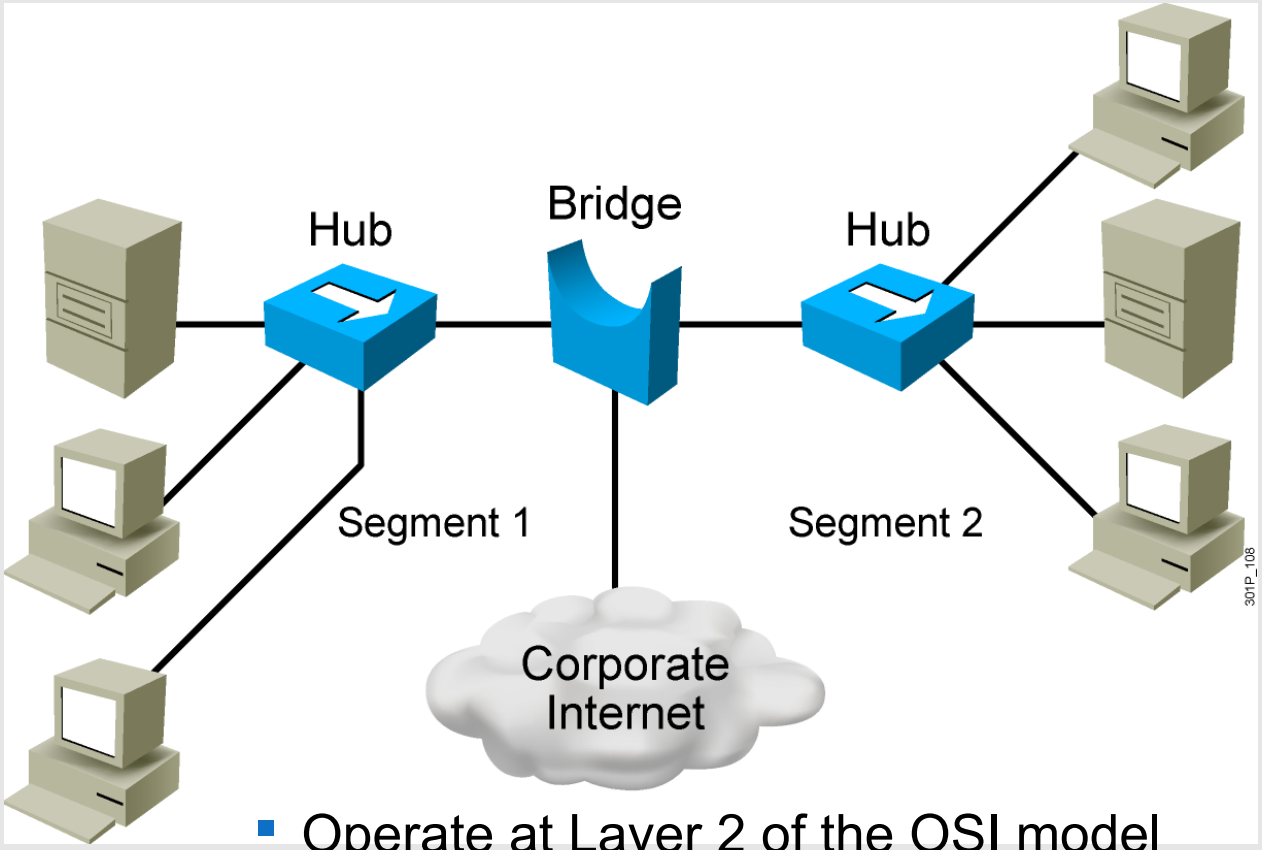
II. Understanding the challenges with Switched LAN Technology

Network Congestion



- High-performance PCs
- More networked data
- Bandwidth-intensive applications

Bridges

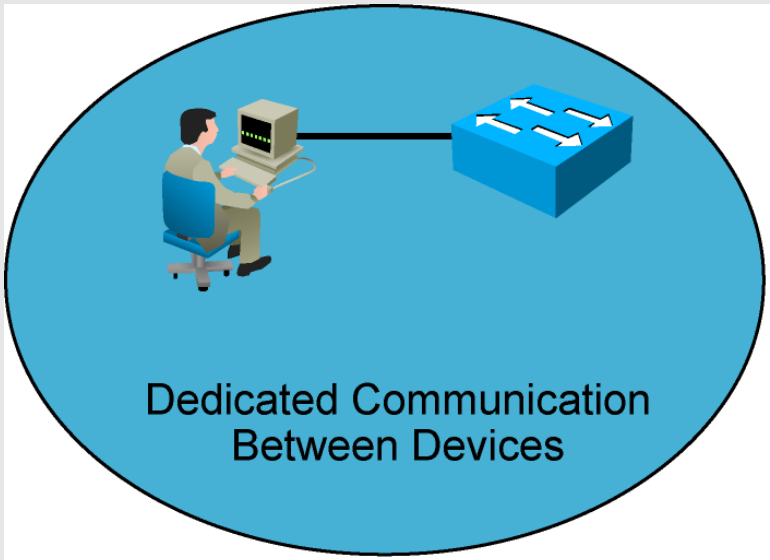


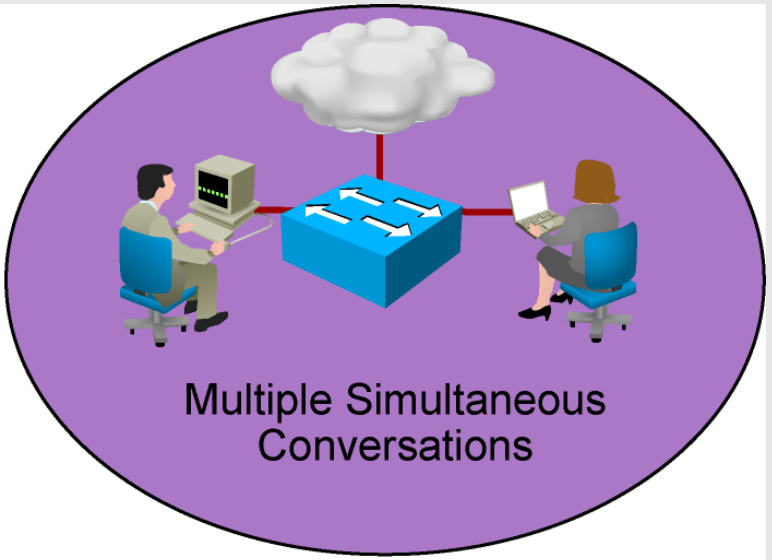
- Operate at Layer 2 of the OSI model
- Forward, filter, or flood frames
- Have few ports
- Are slow

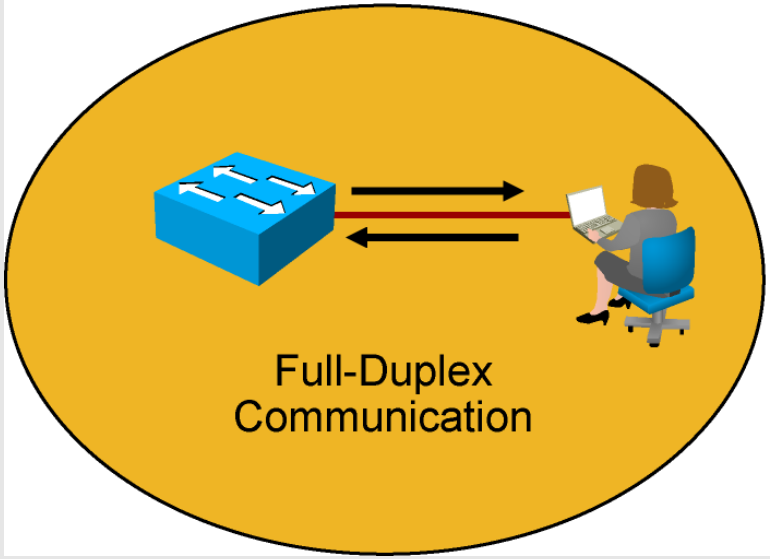
LAN Switch

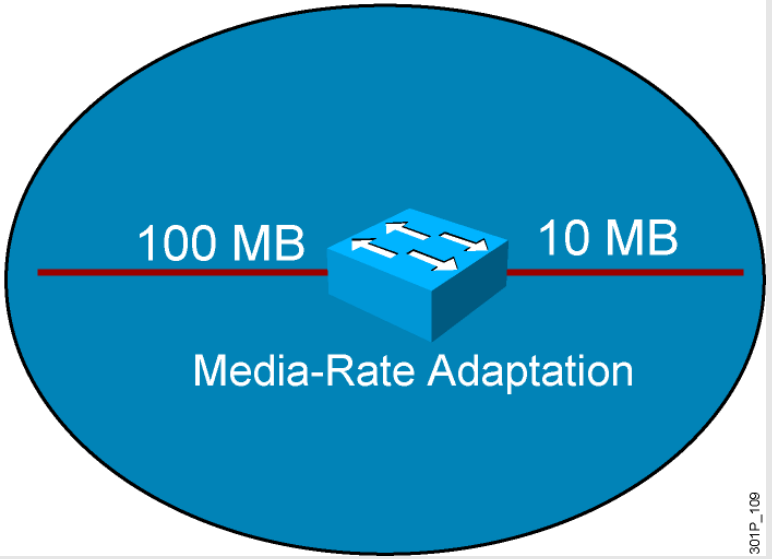
- High port density
- Large frame buffers
- Mixture of port speeds
- Fast internal switching
- Switching modes:
  - Cut-through
  - Store-and-forward
  - Fragment-free

LAN Switch Features









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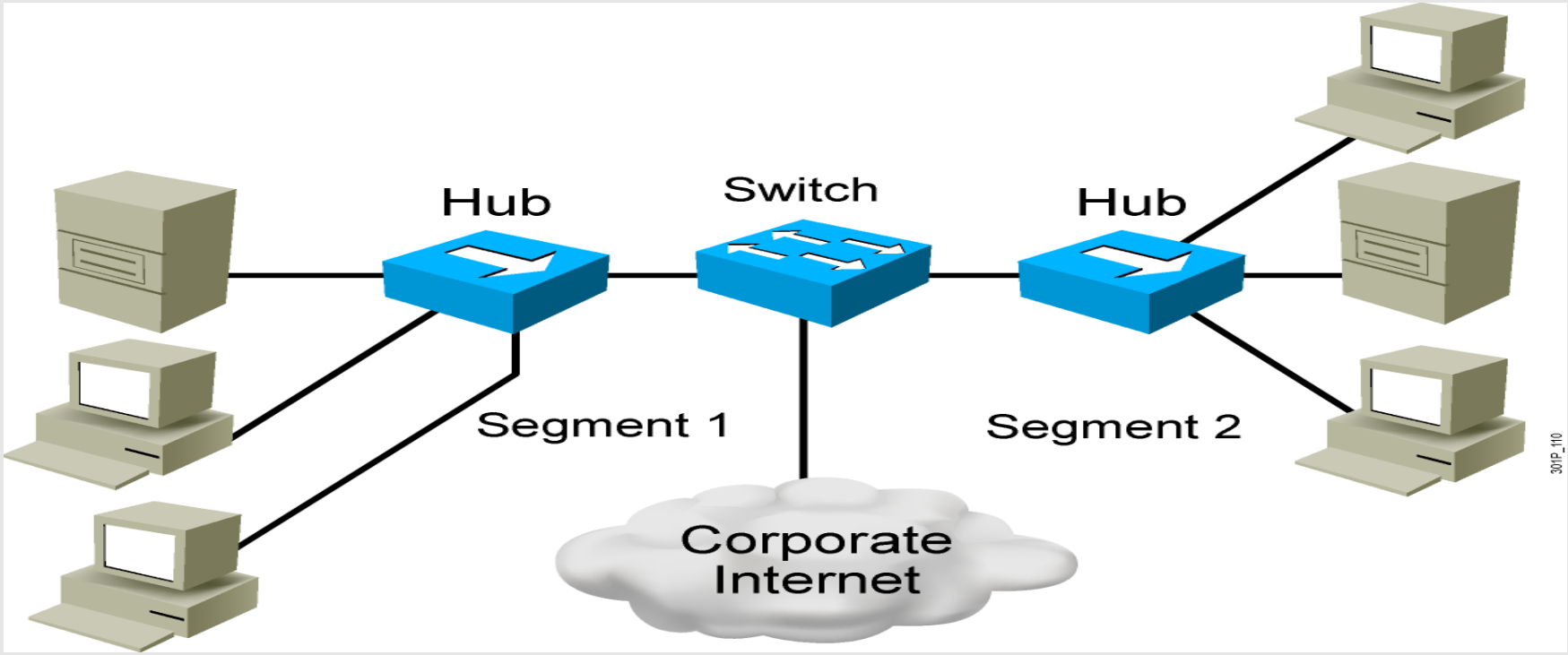
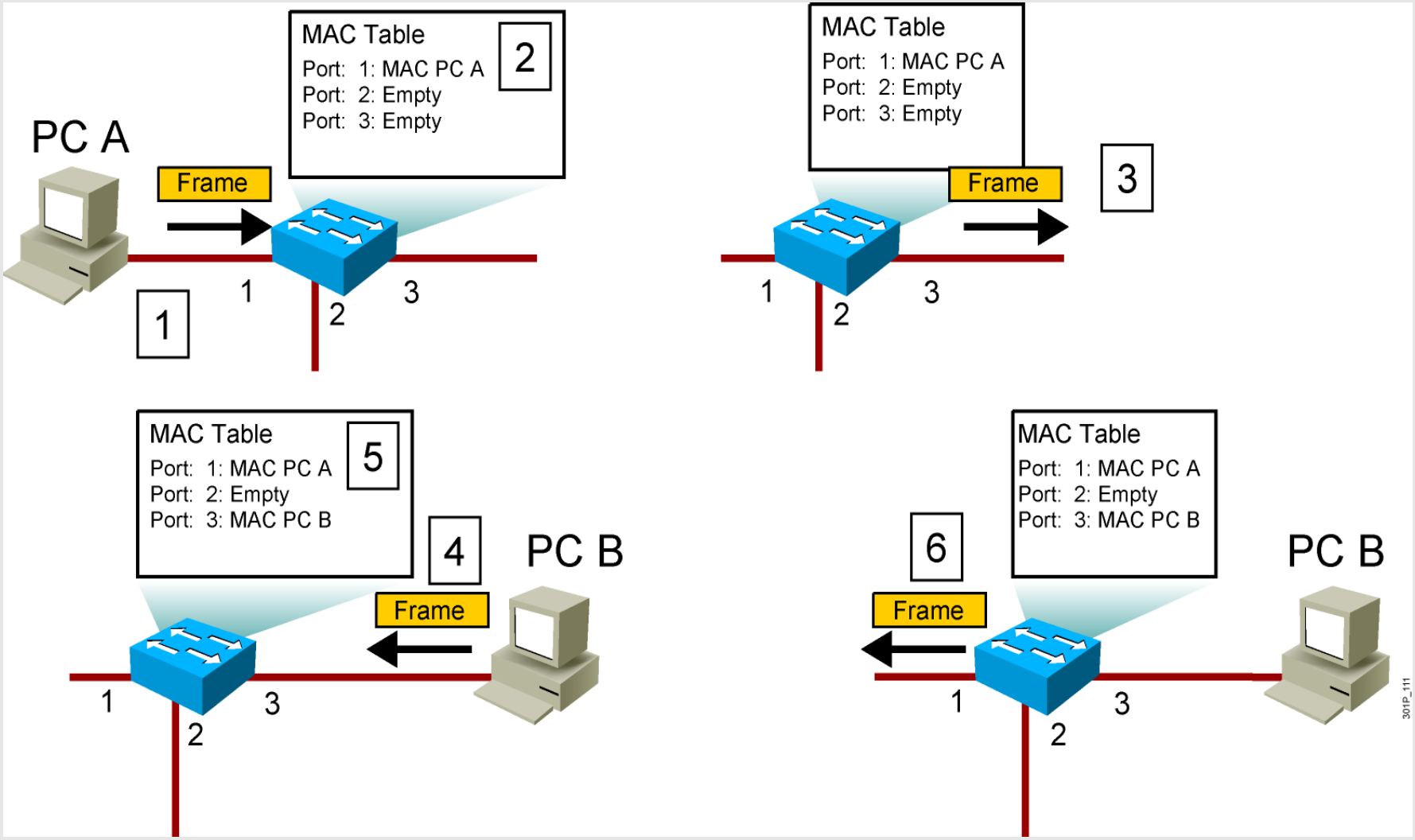
Switches Supersede Bridges

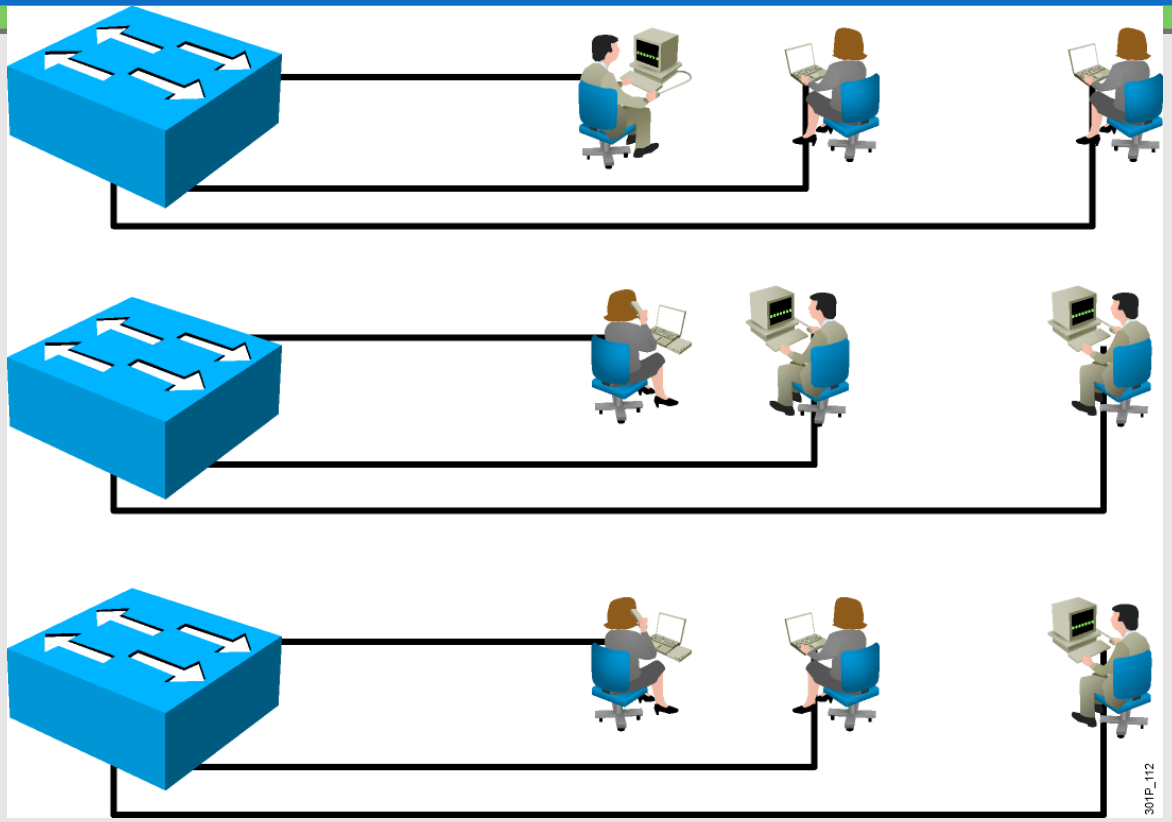


- Operate at Layer 2 of the OSI model
- Forward, filter, or flood frames
- Have many ports
- Are fast

Switching Frames



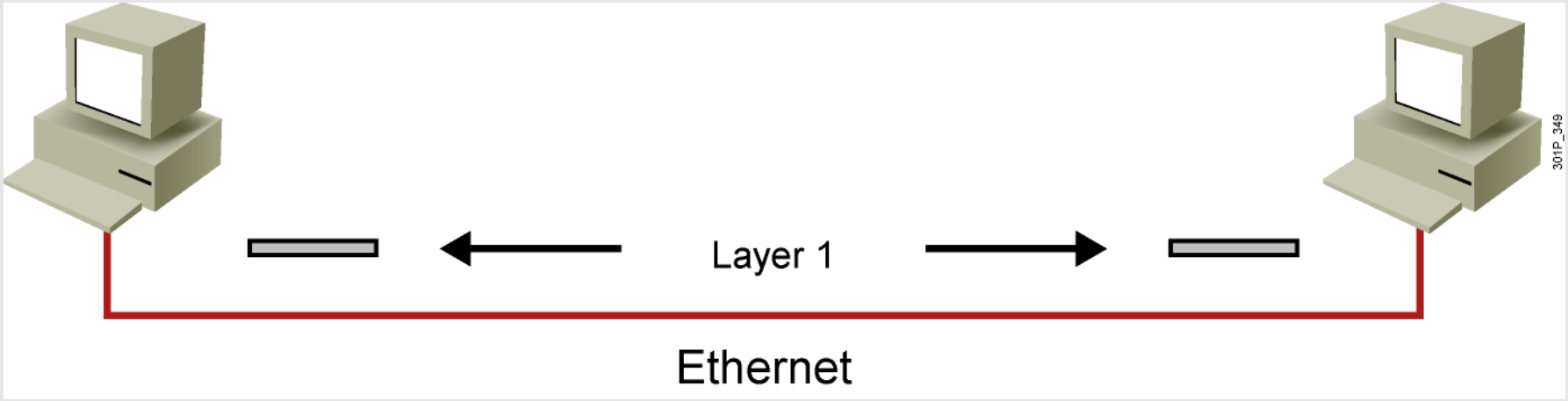
LANs Today



- Users grouped by physical location
- More switches added to networks
- Switches connected by high-speed links

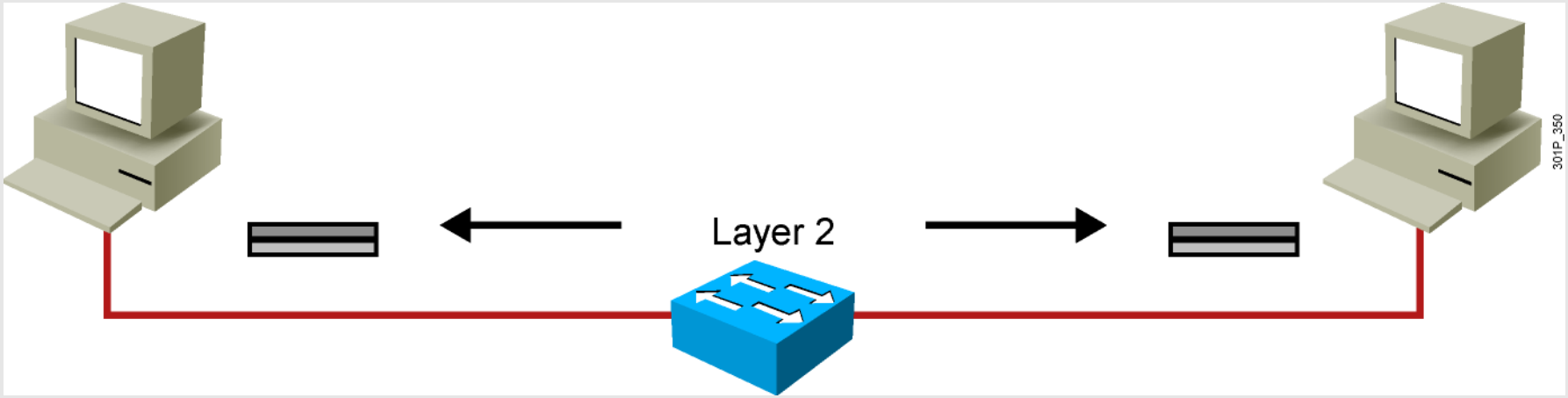
III. Exploring the packet Delivery Process 1 (layer 1)

Layer 1 Devices



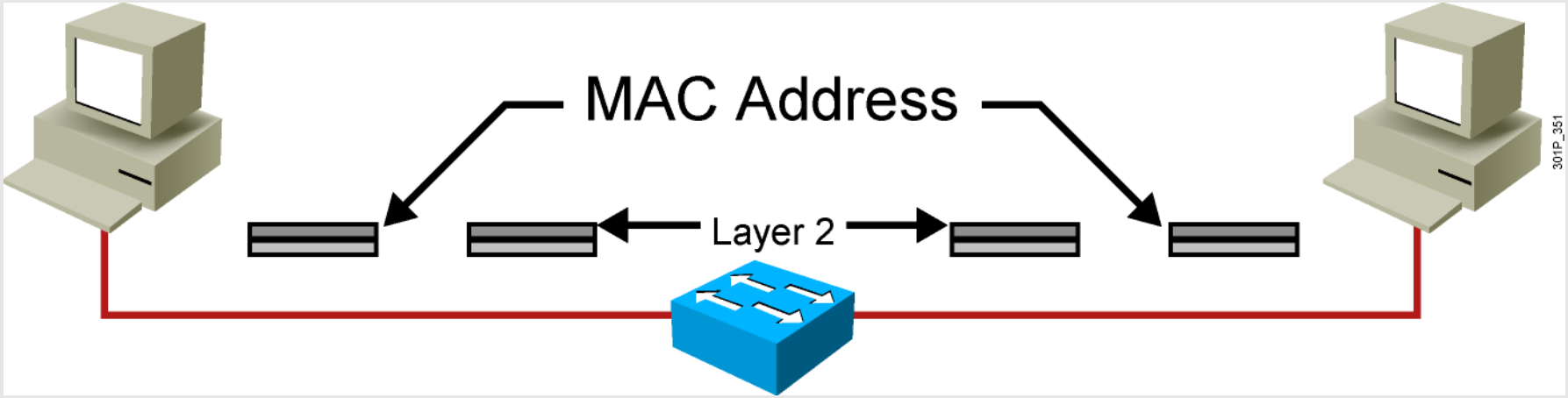
- Layer 1 provides the physical media and its encoding.
- Examples:
  - Ethernet
  - Serial
  - Repeater
  - Physical interface of the NIC

Layer 2 Devices



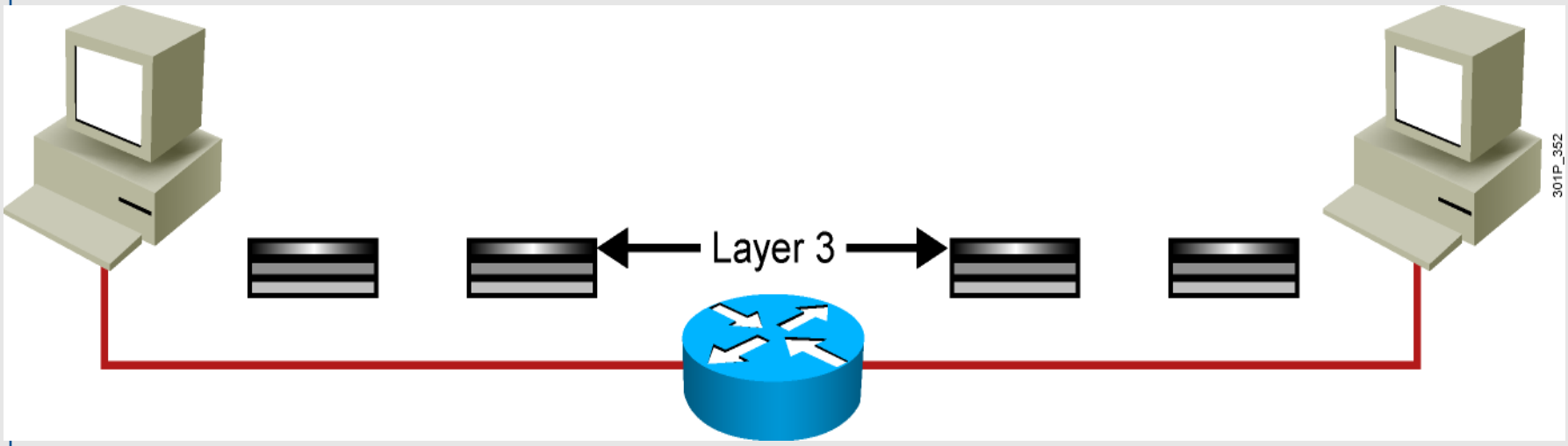
- Layer 2 devices provide an interface with the physical media.
- Examples:
  - NIC
  - Bridge
  - Switch

Layer 2 Addressing



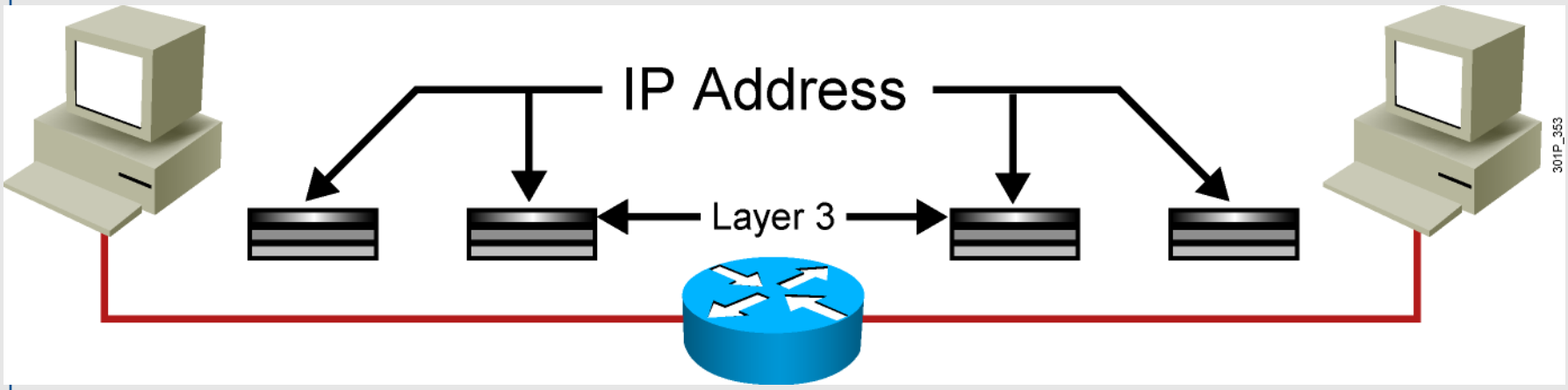
- MAC address
- Assigned to end devices

Layer 3 Devices and Their Function



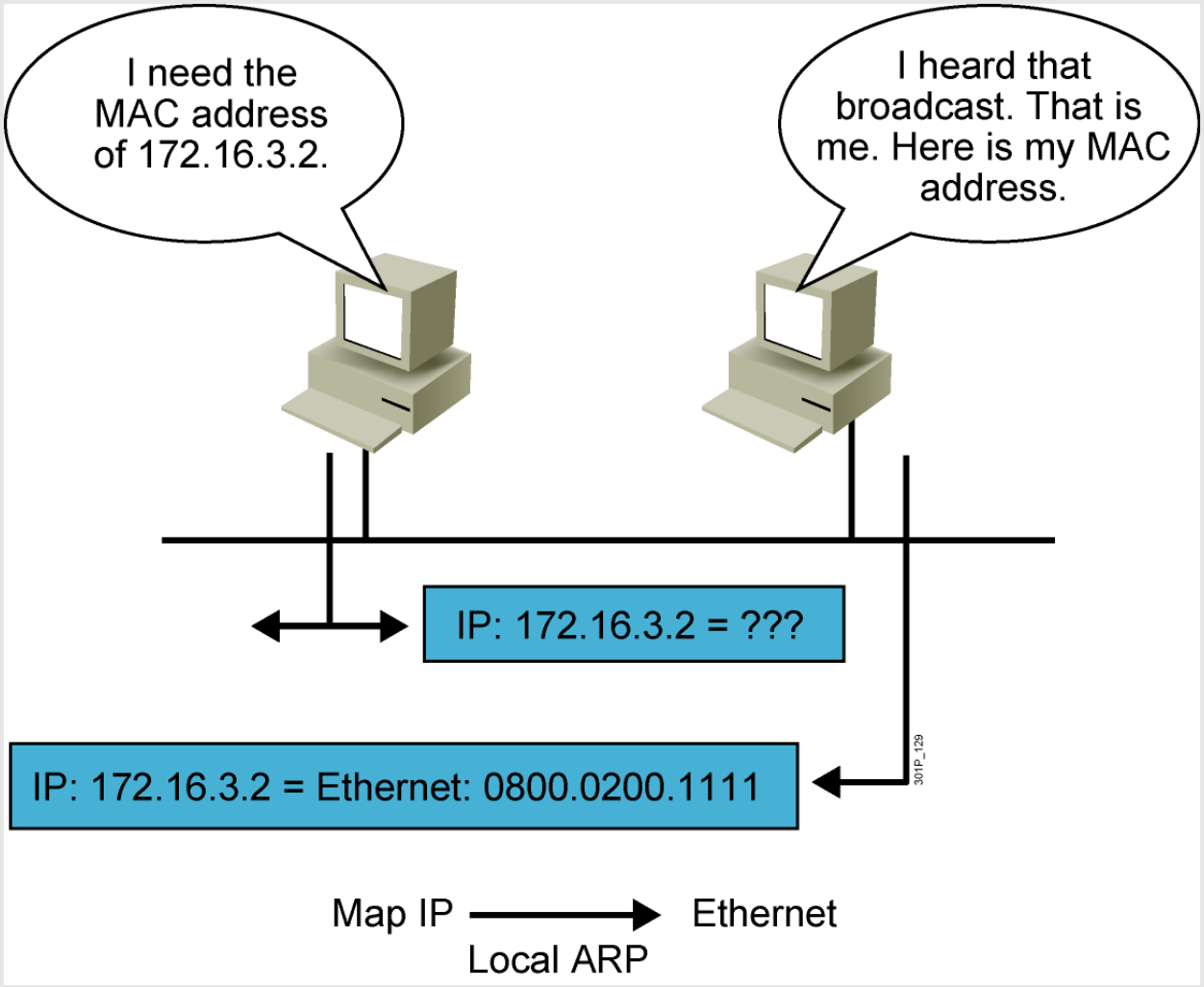
- The network layer provides connectivity and path selection between two host systems.
- In the host, this is the path between the data link layer and the upper layers of the Network Operating System(NOS).
- In the router, it is the actual path across the network.

Layer 3 Addressing

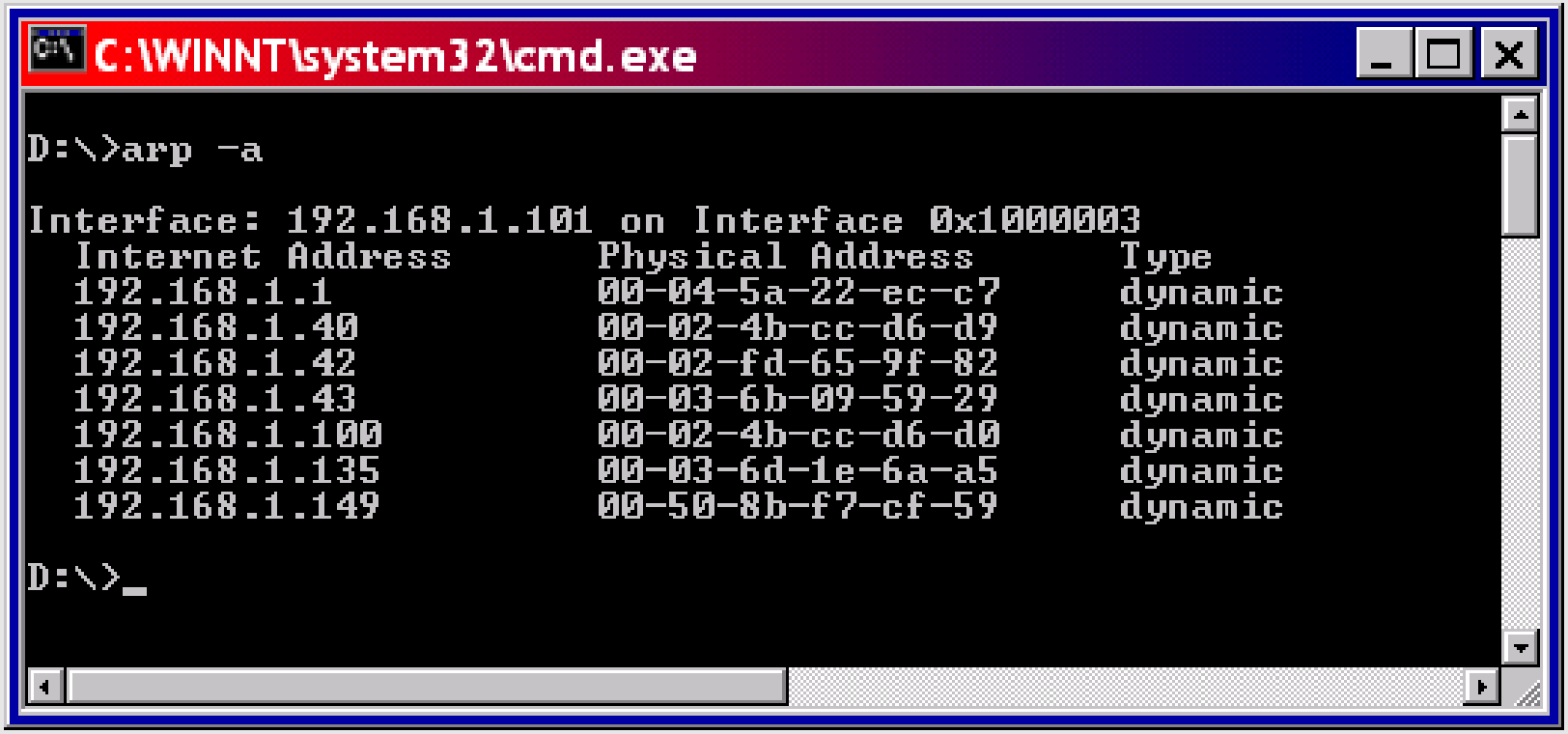


- Each NOS has its own Layer 3 address format.
- OSI uses an Network Service Access Point.
- TCP/IP uses IP.

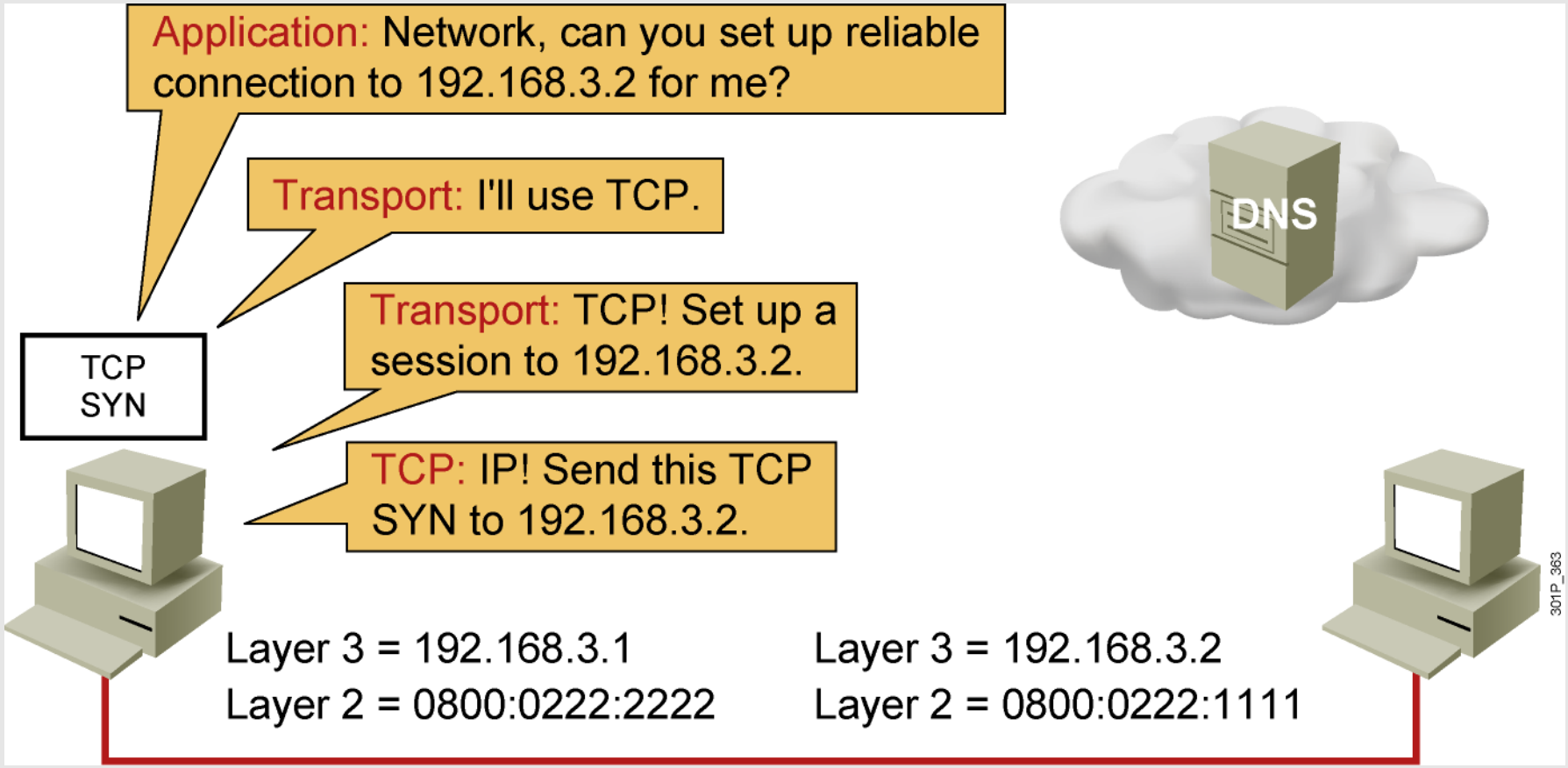
ARP


I need the MAC address of 172.16.3.2.
I heard that broadcast. That is me. Here is my MAC address.
IP: 172.16.3.2 = ???
IP: 172.16.3.2 = Ethernet: 0800.0200.1111
301P_129
Map IP
Ethernet
Local ARP

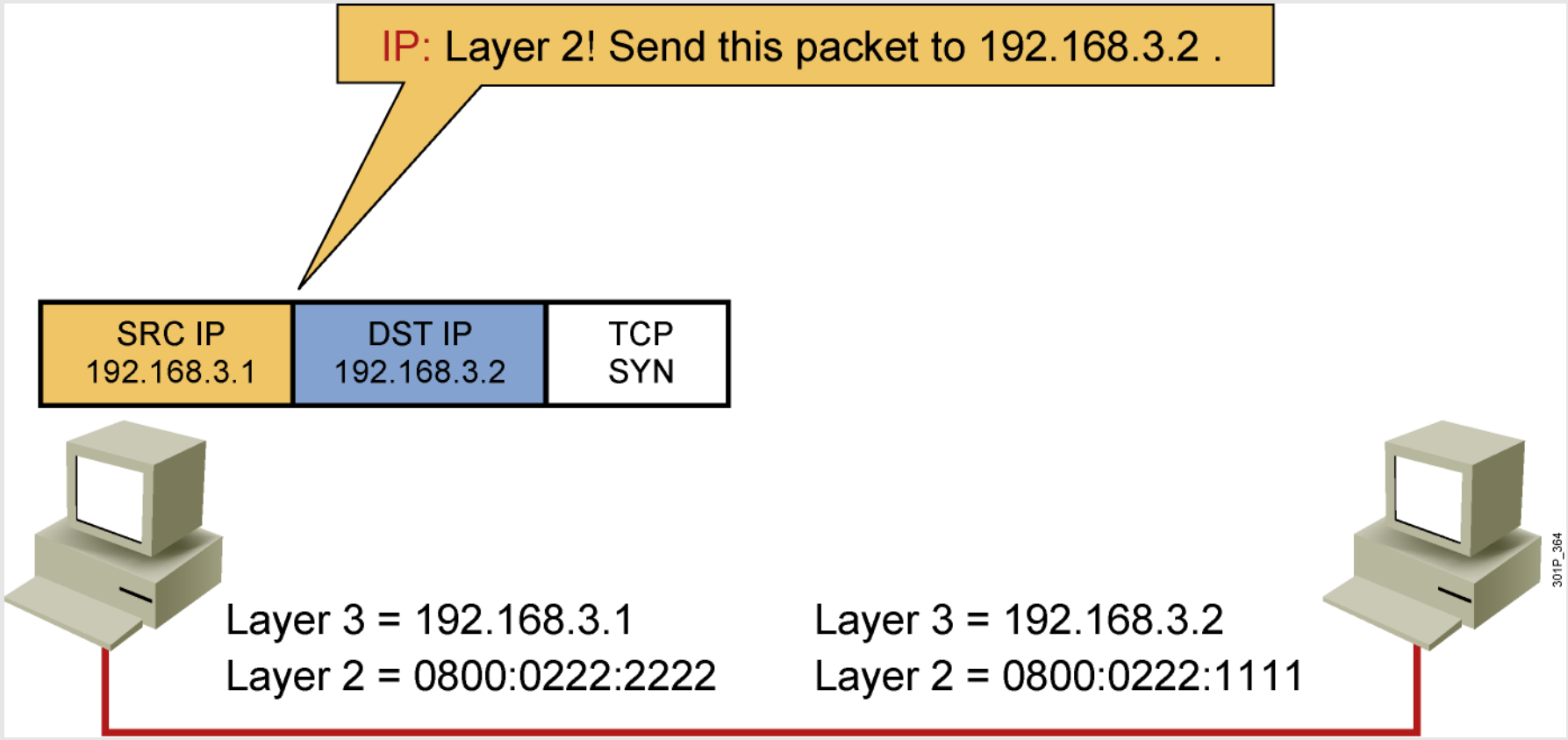
ARP Table


C:\WINNT\system32\cmd.exe
D:\>arp -a
Interface: 192.168.1.101 on Interface 0x1000003
Internet Address Physical Address Type
192.168.1.1 00-04-5a-22-ec-c7 dynamic
192.168.1.40 00-02-4b-cc-d6-d9 dynamic
192.168.1.42 00-02-fd-65-9f-82 dynamic
192.168.1.43 00-03-6b-09-59-29 dynamic
192.168.1.100 00-02-4b-cc-d6-d0 dynamic
192.168.1.135 00-03-6d-1e-6a-a5 dynamic
192.168.1.149 00-50-8b-f7-cf-59 dynamic
D:\>

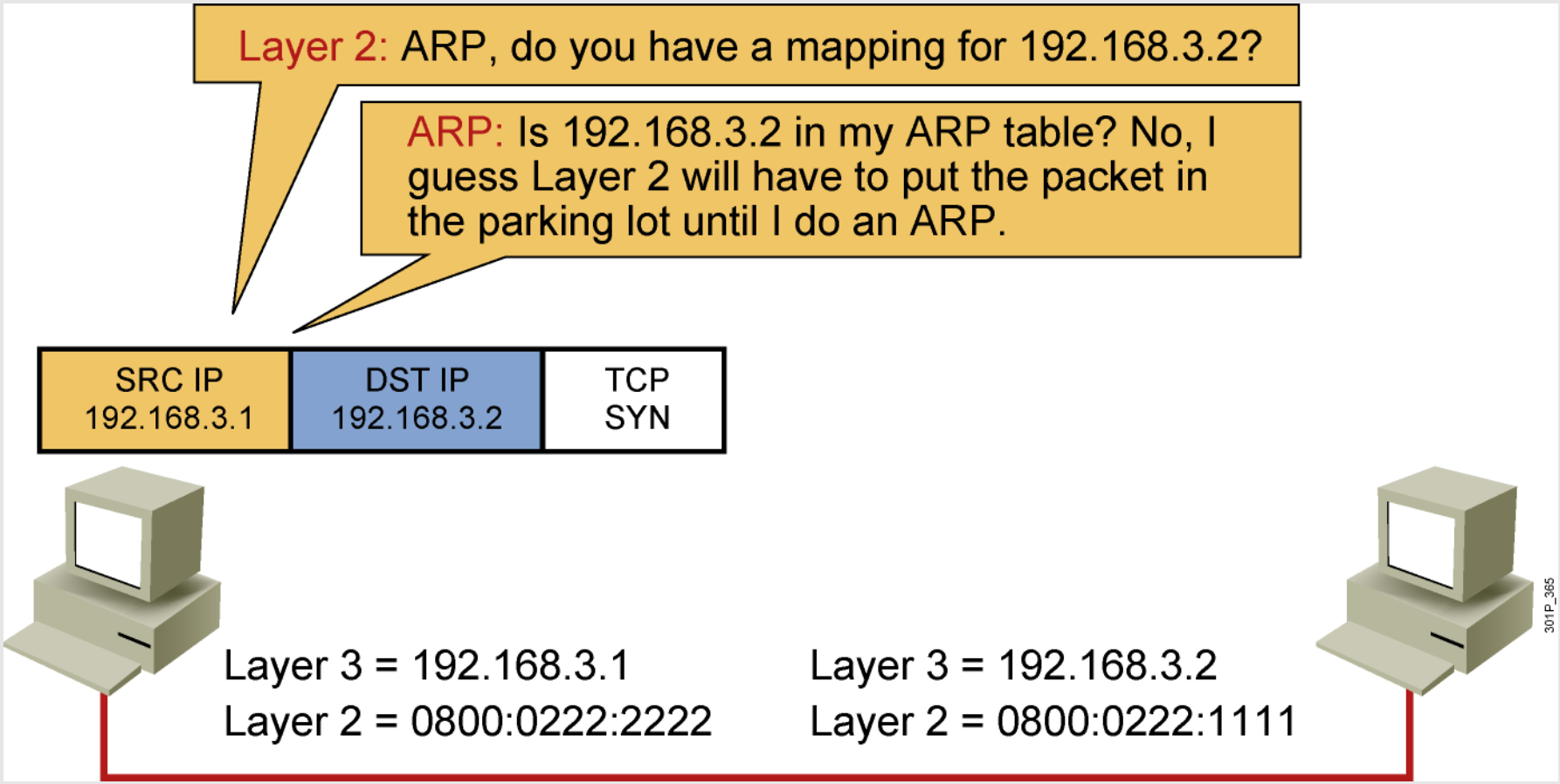
Host-to-Host Packet Delivery (1 of 22)



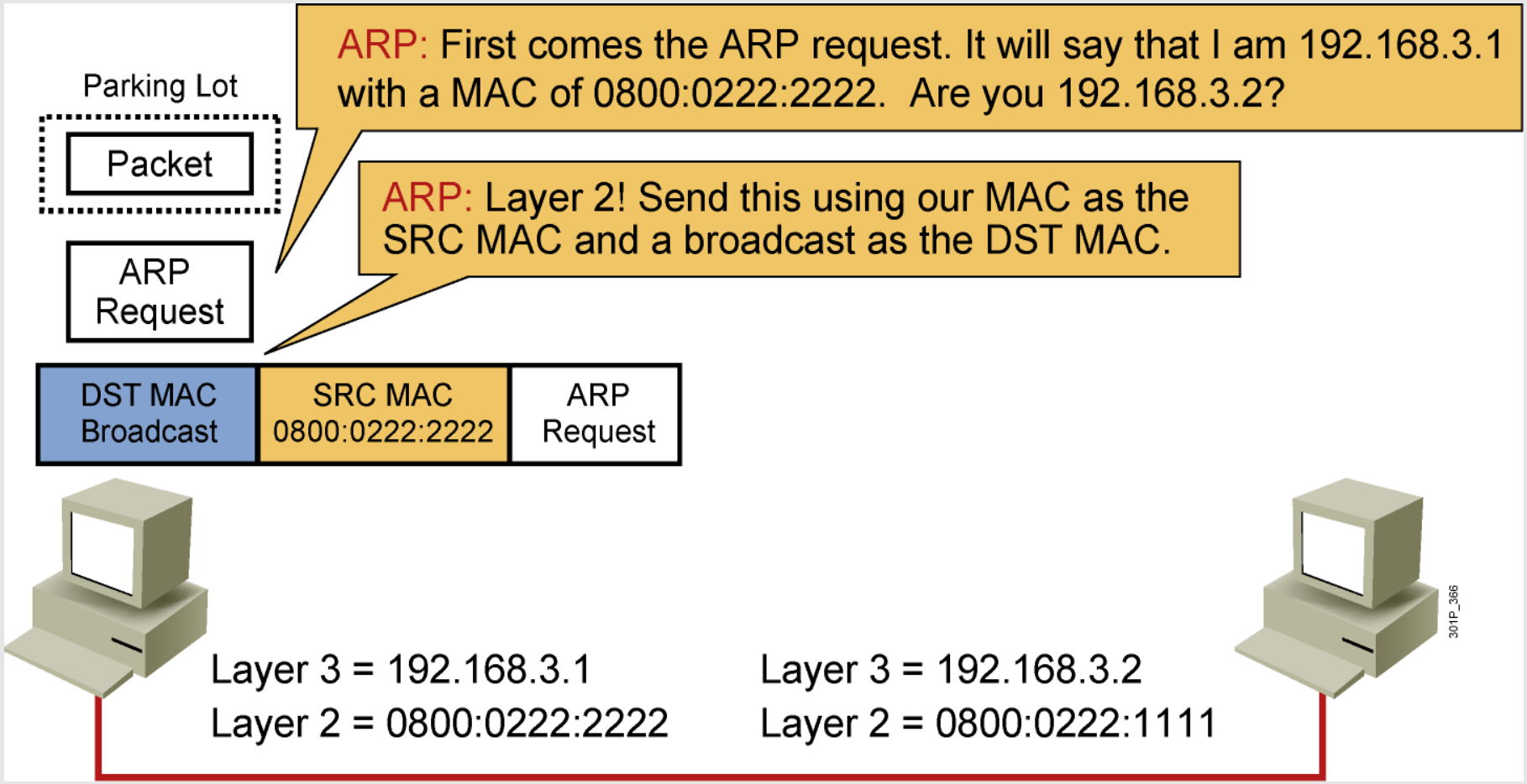
Host-to-Host Packet Delivery (2 of 22)



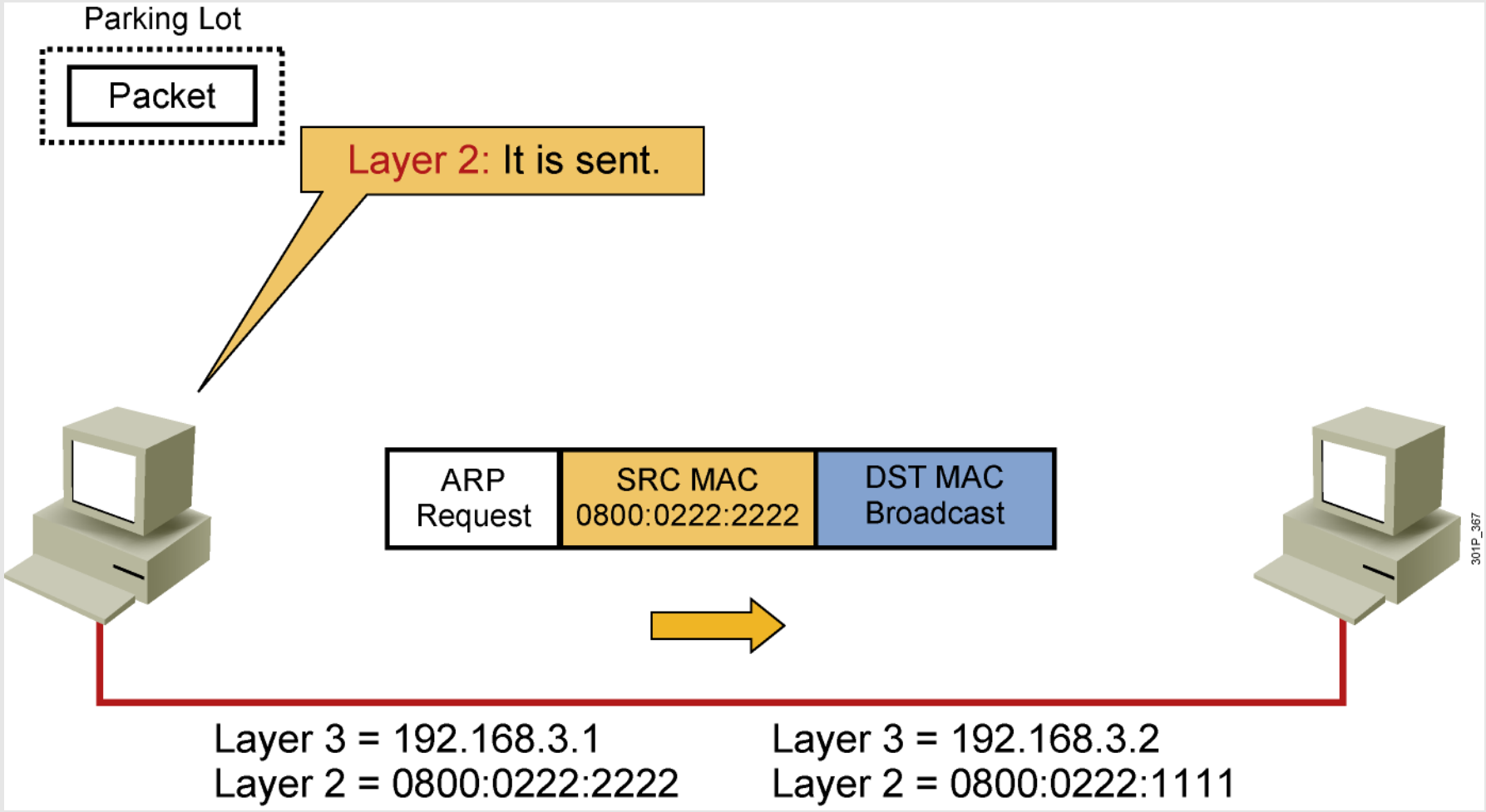
Host-to-Host Packet Delivery (3 of 22)



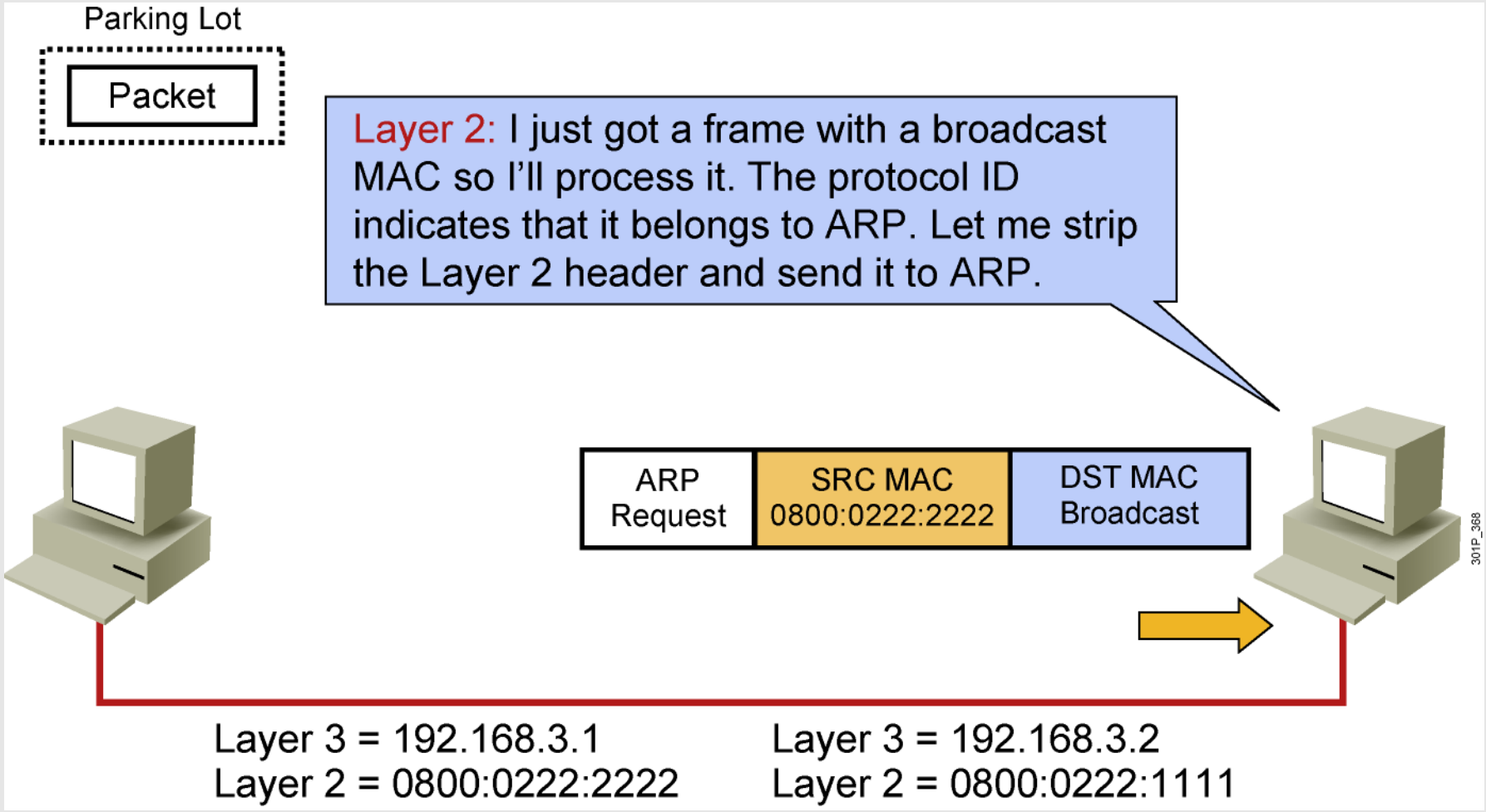
Host-to-Host Packet Delivery (4 of 22)



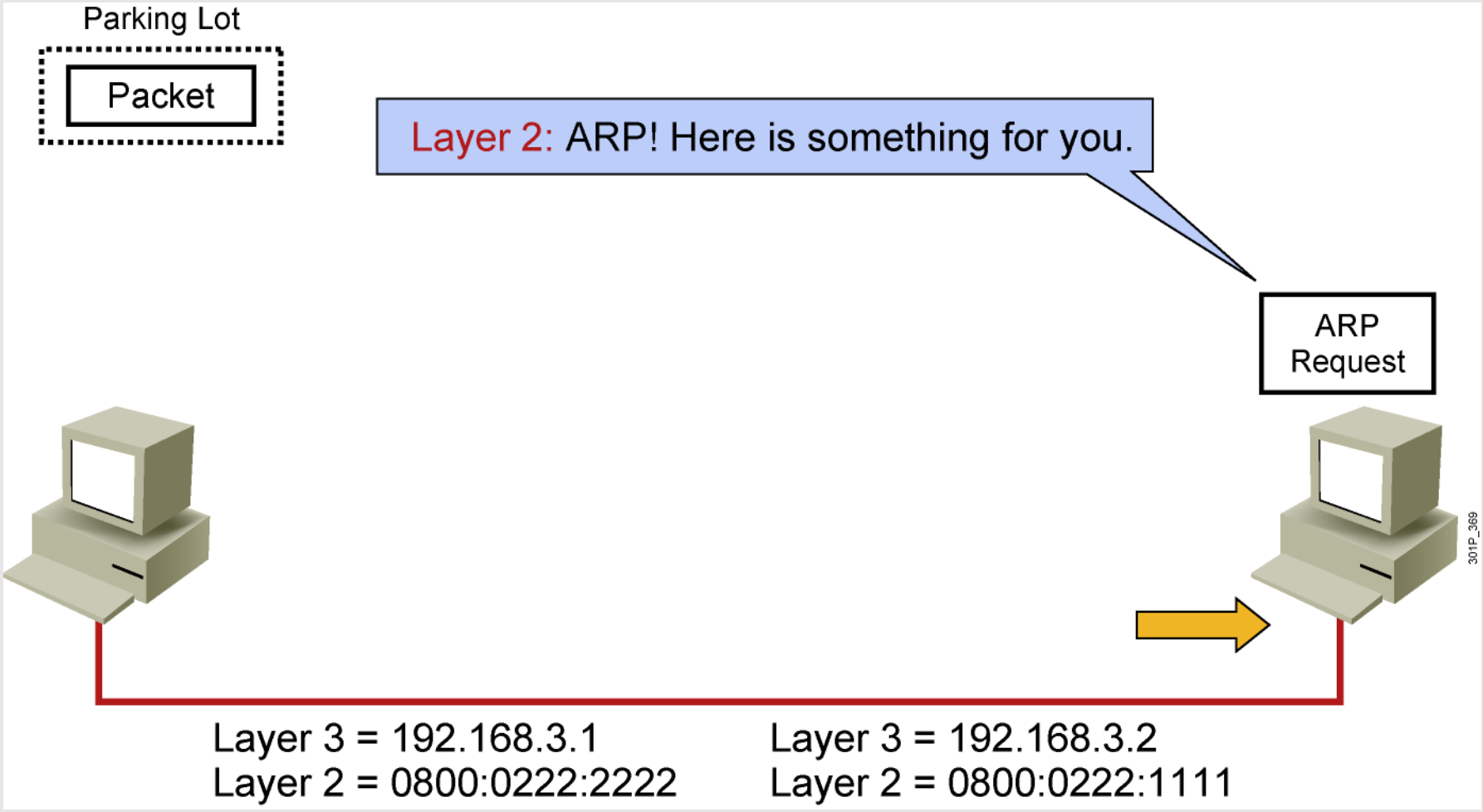
Host-to-Host Packet Delivery (5 of 22)



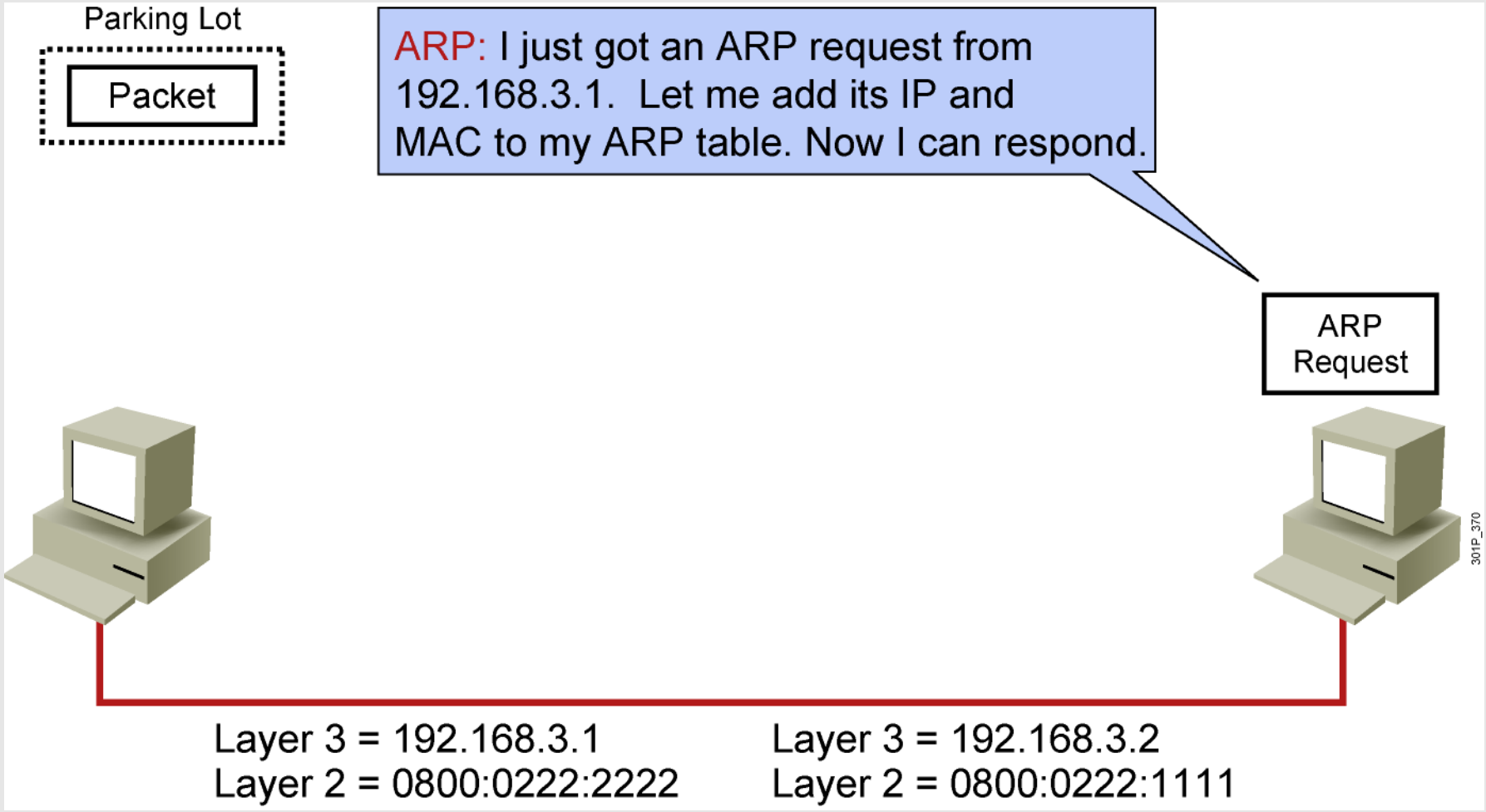
Host-to-Host Packet Delivery (6 of 22)



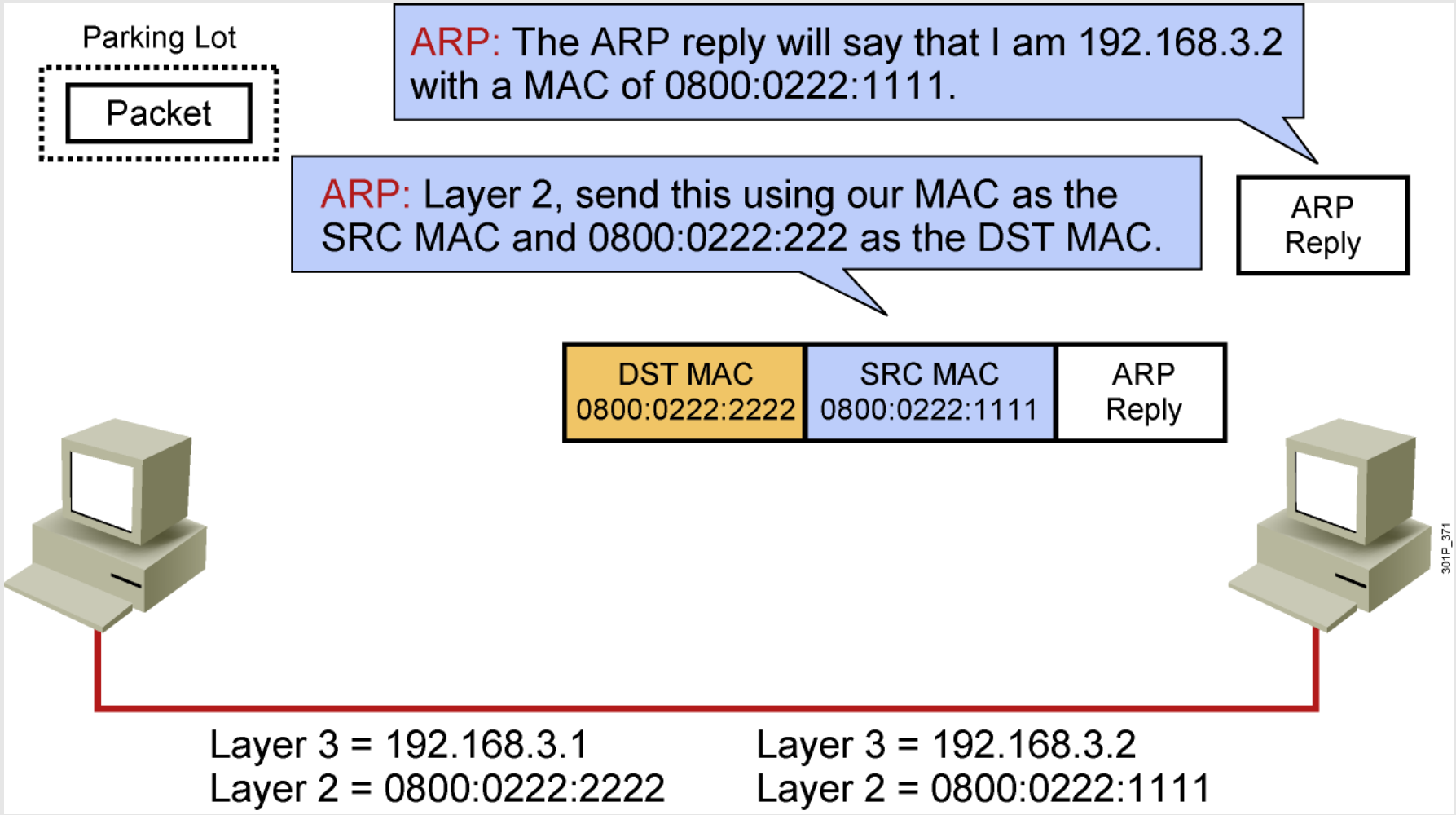
Host-to-Host Packet Delivery (7 of 22)



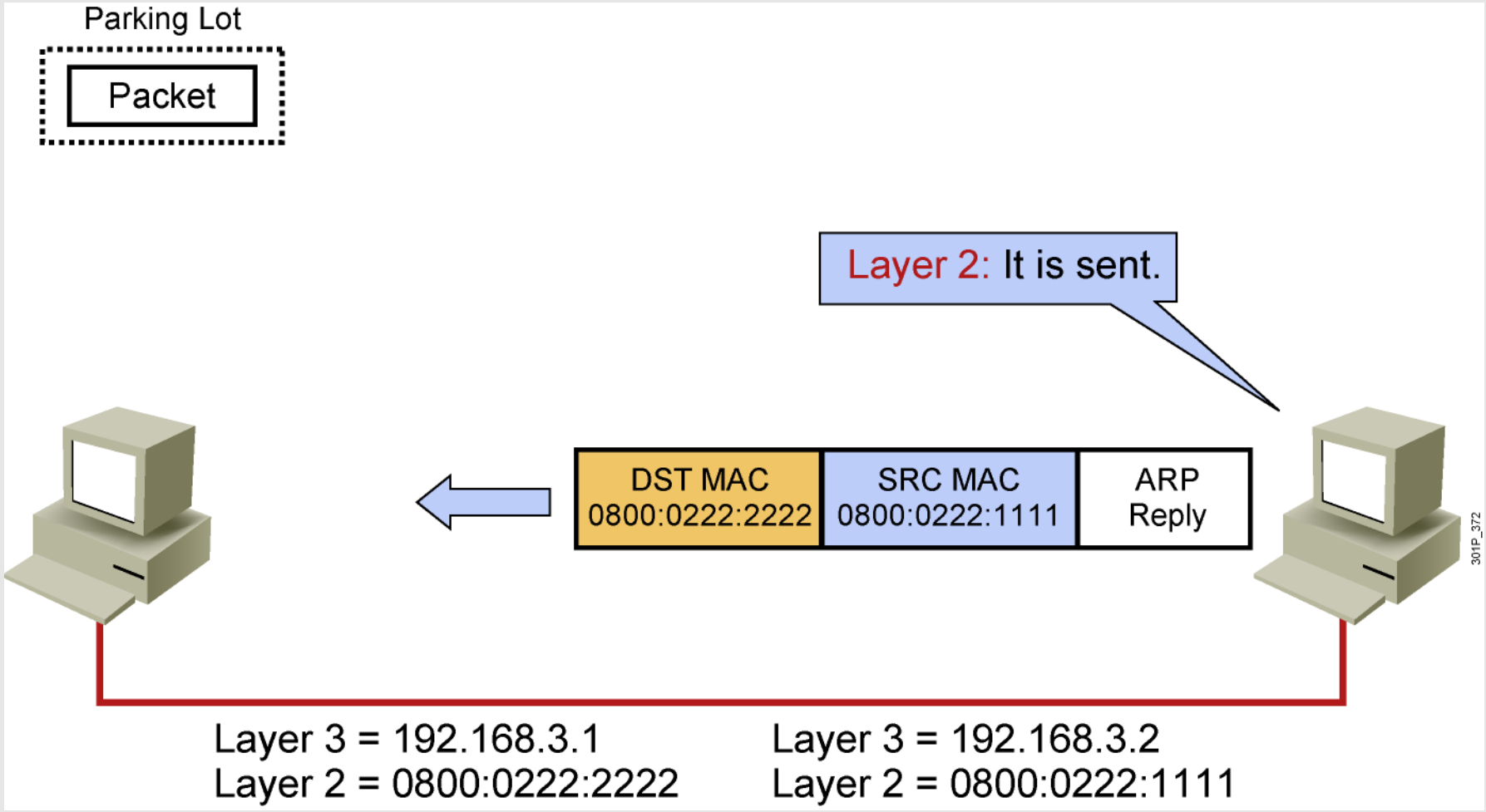
Host-to-Host Packet Delivery (8 of 22)



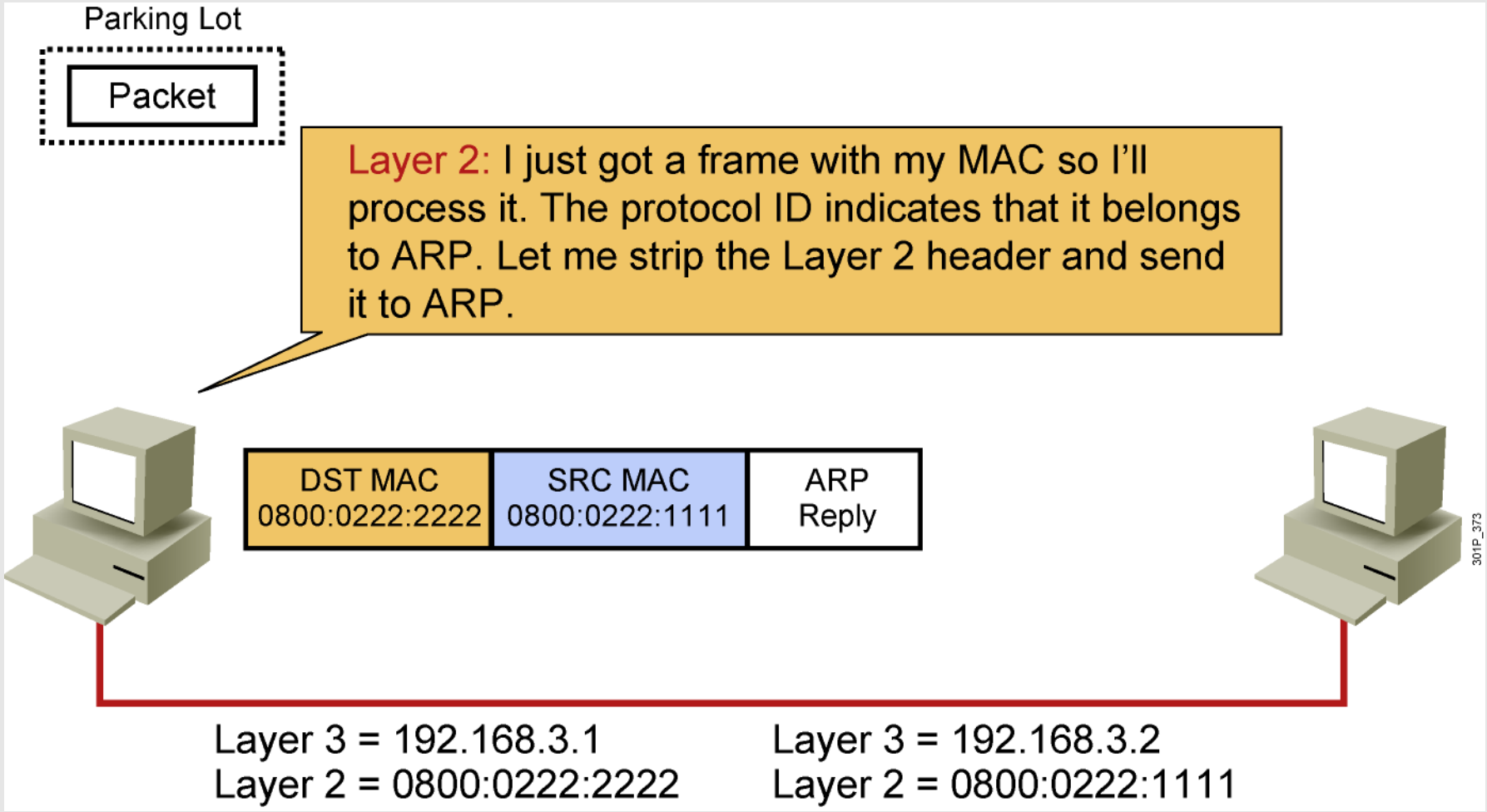
Host-to-Host Packet Delivery (9 of 22)



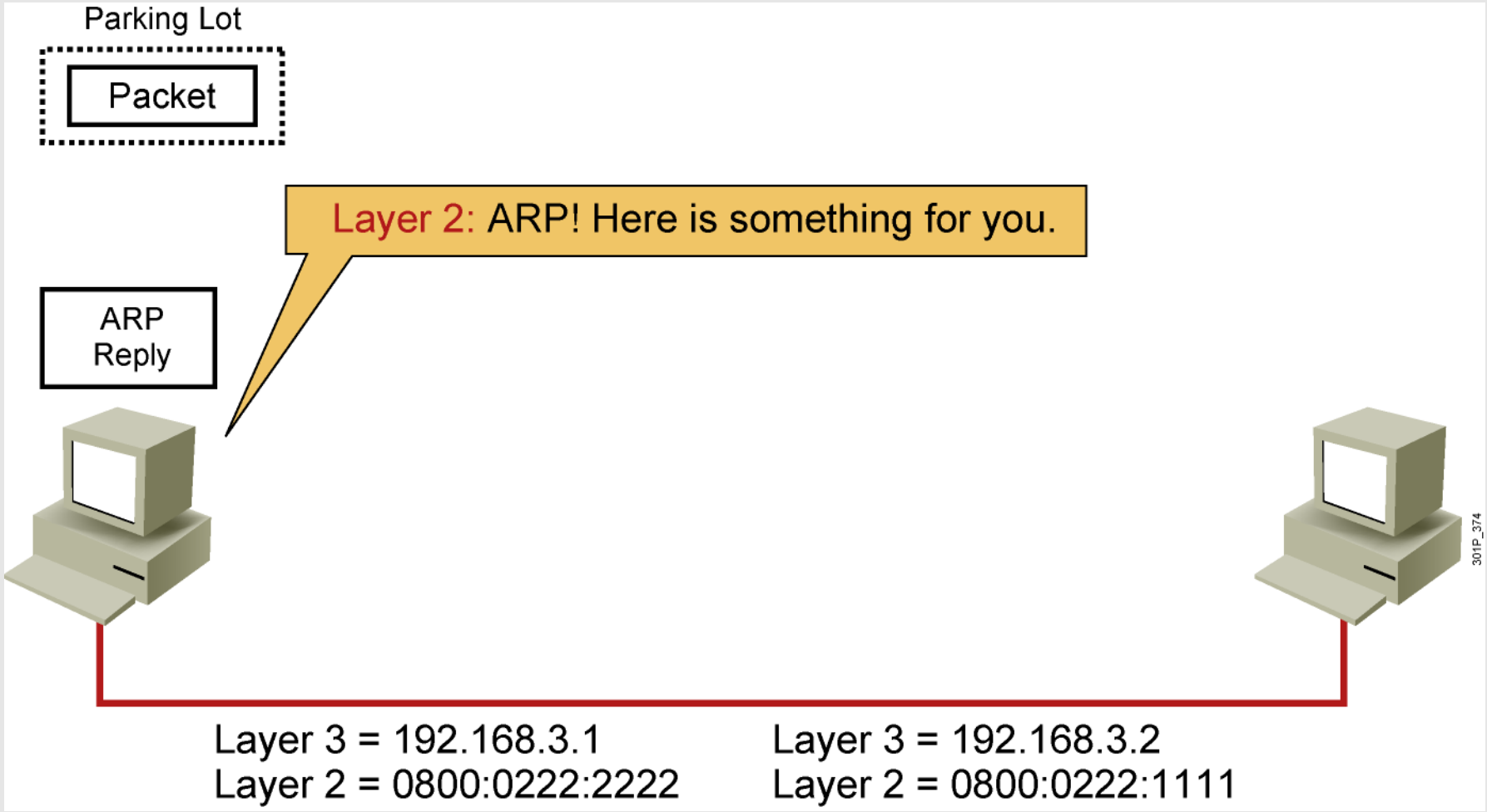
Host-to-Host Packet Delivery (10 of 22)



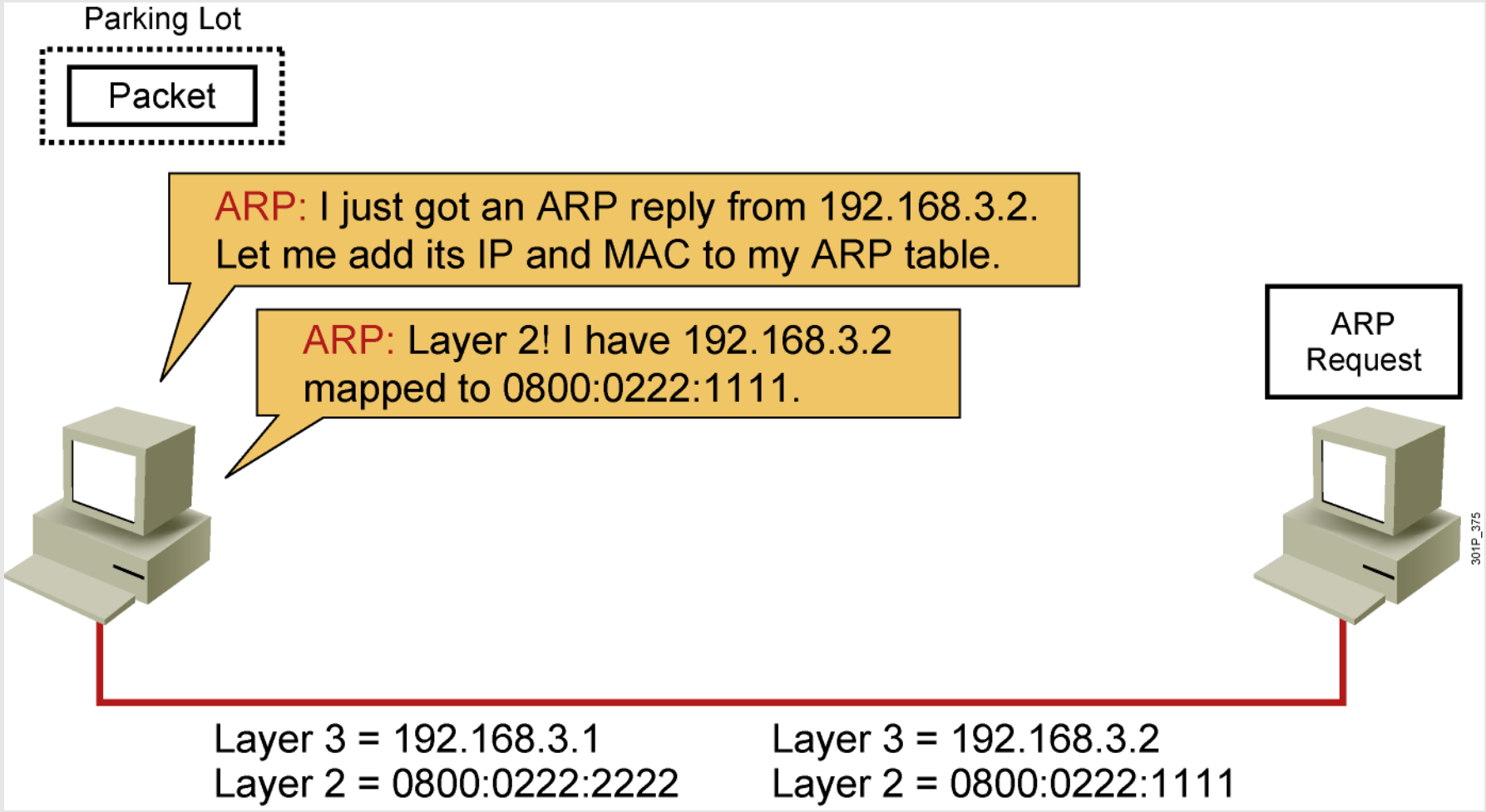
Host-to-Host Packet Delivery (11 of 22)



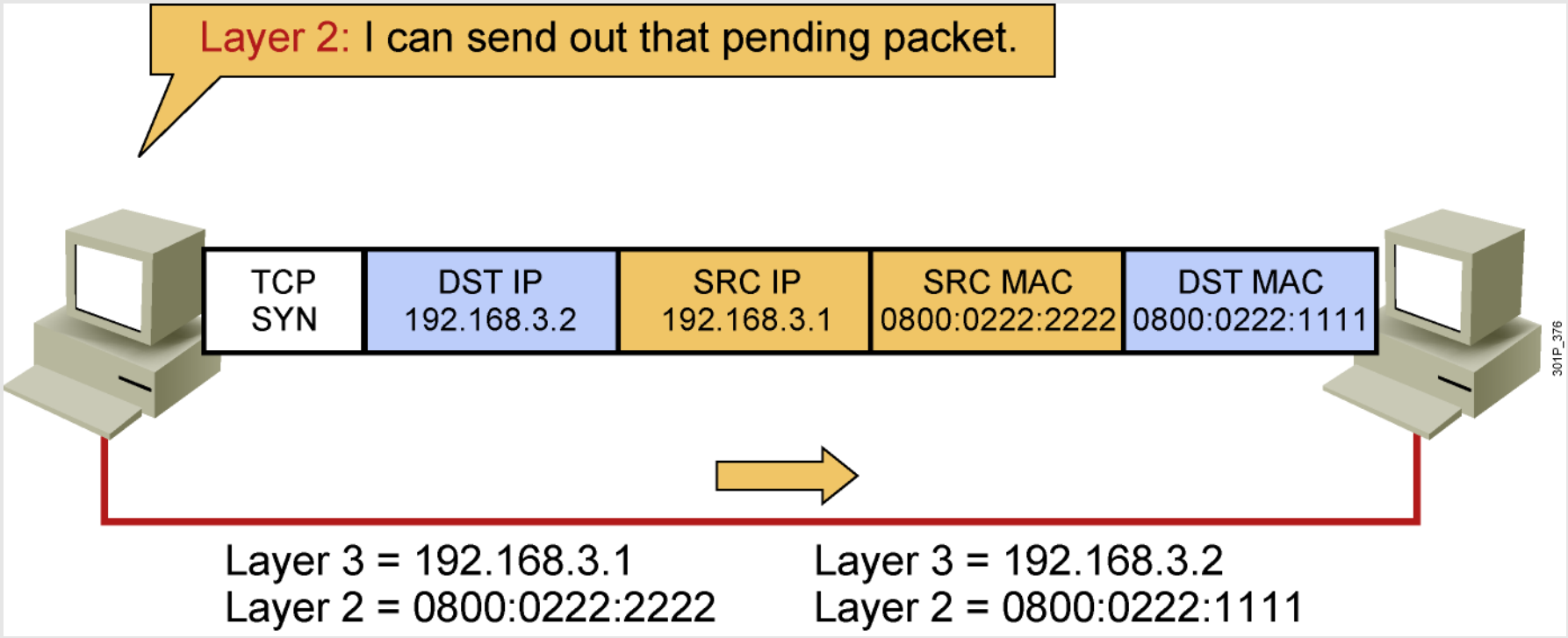
Host-to-Host Packet Delivery (12 of 22)



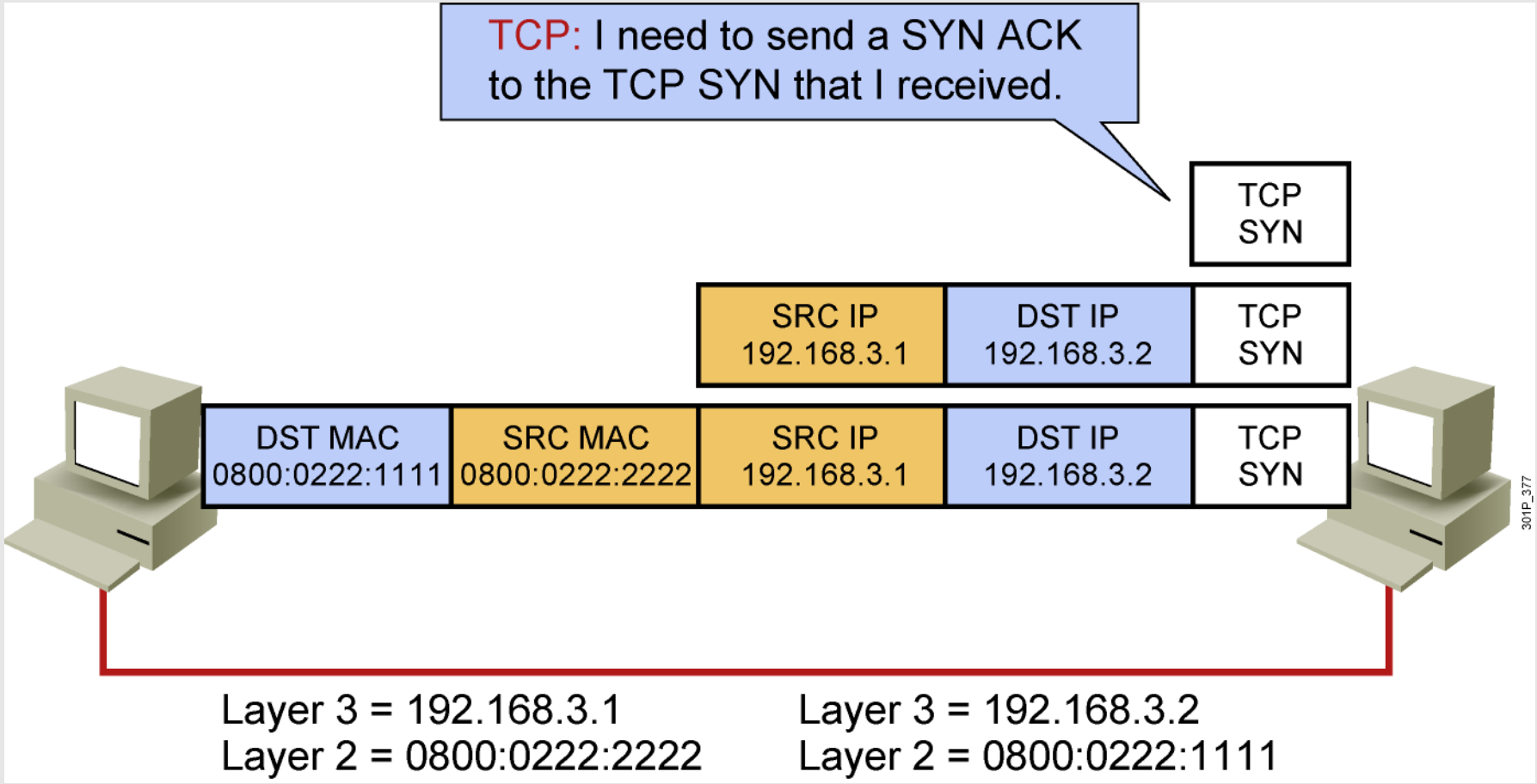
Host-to-Host Packet Delivery (13 of 22)



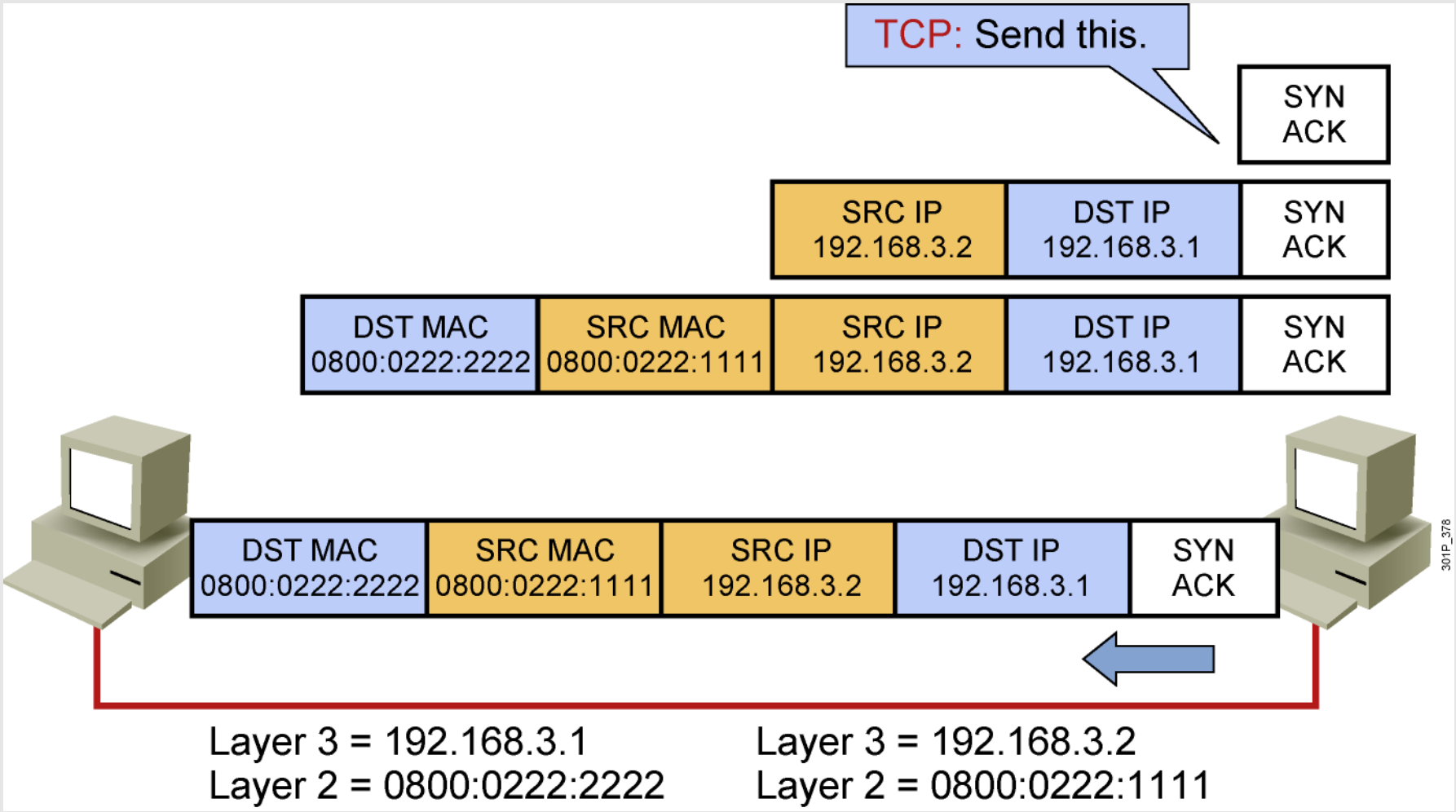
Host-to-Host Packet Delivery (14 of 22)



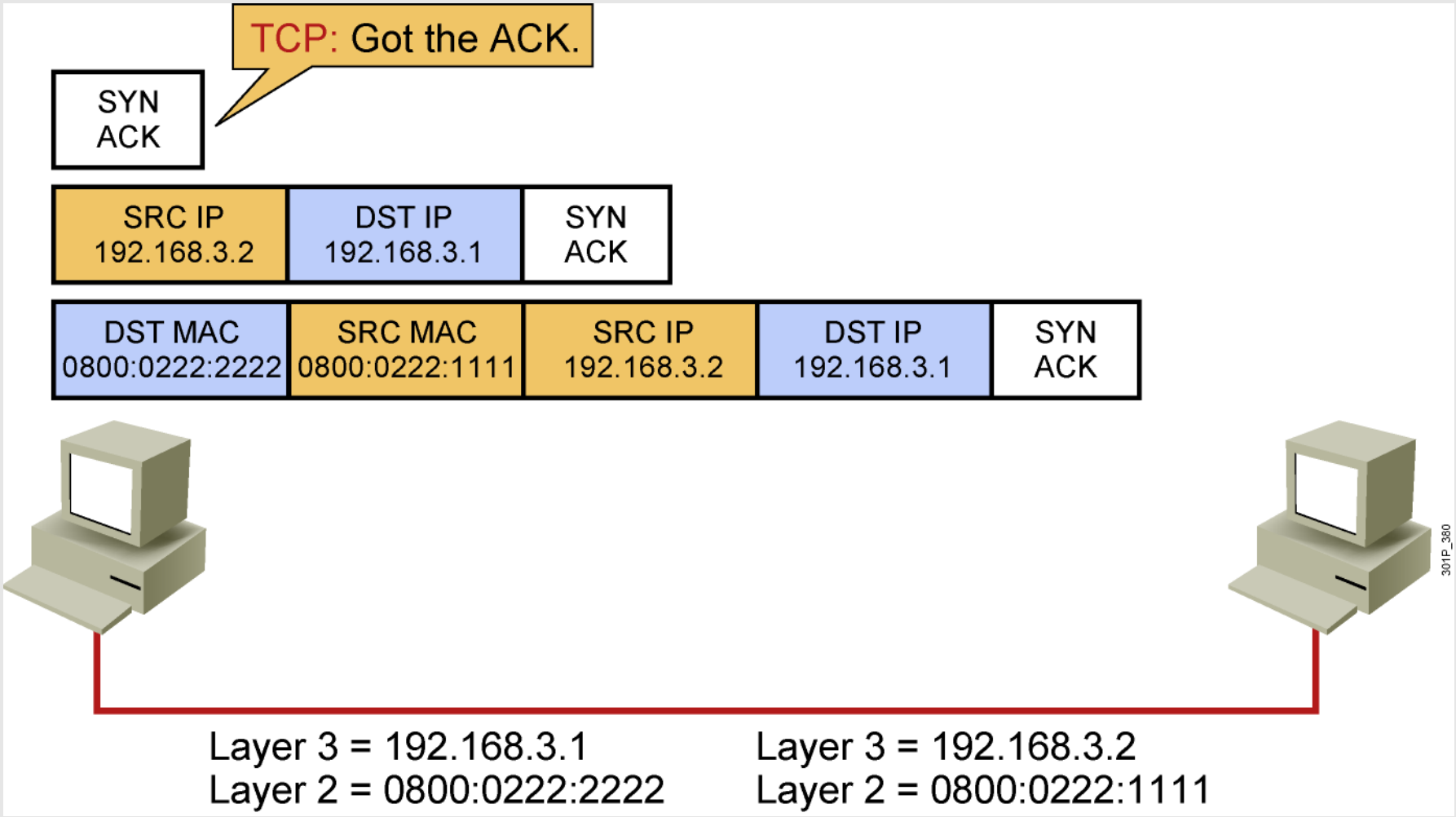
Host-to-Host Packet Delivery (15 of 22)



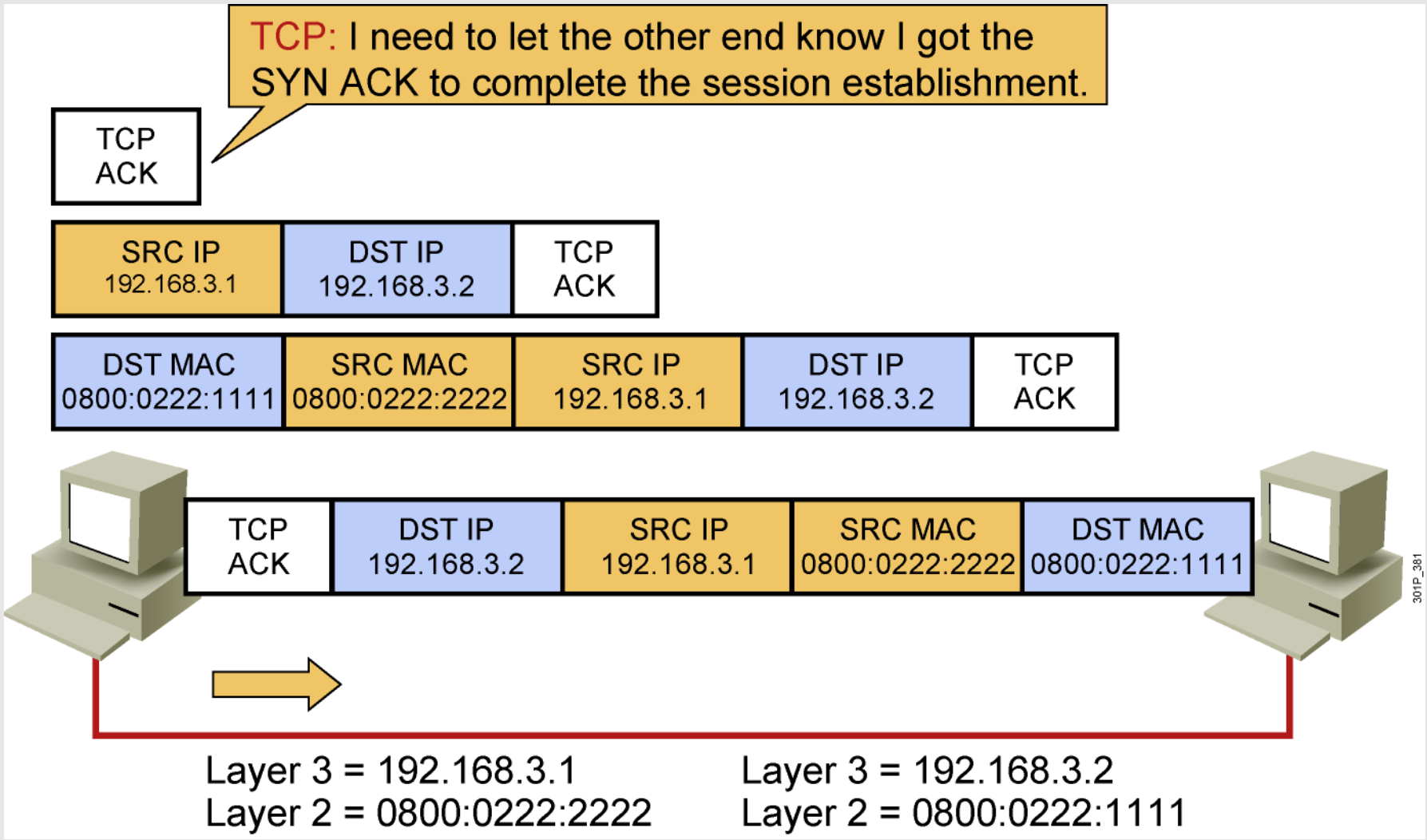
Host-to-Host Packet Delivery (16 of 22)



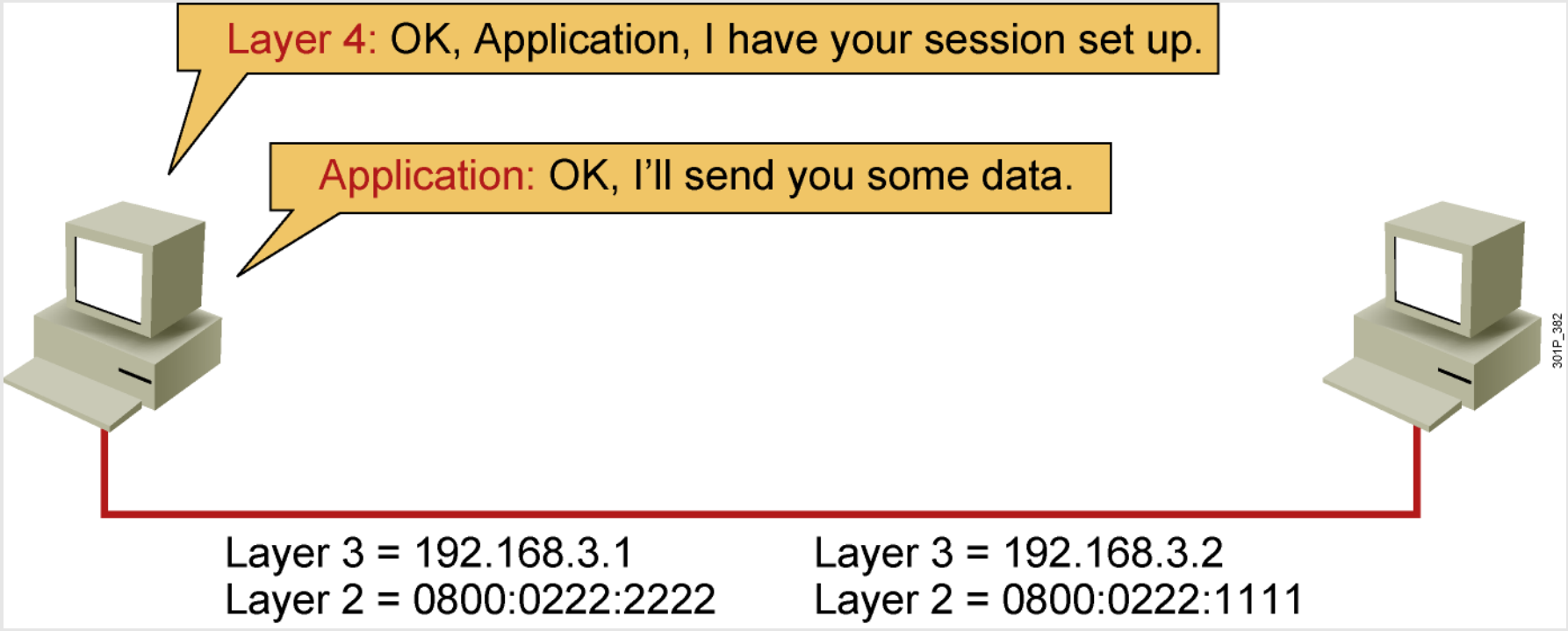
Host-to-Host Packet Delivery (17 of 22)



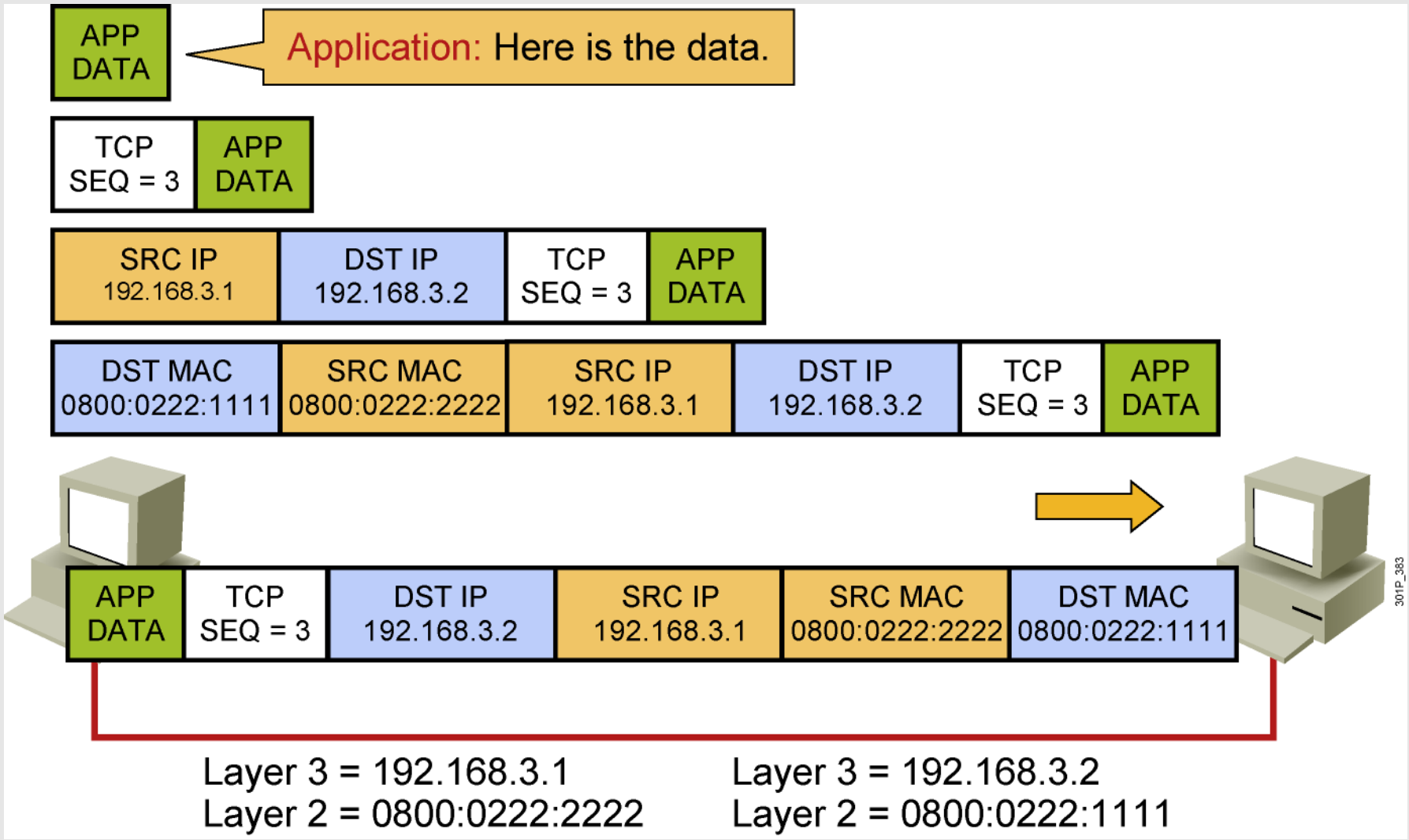
Host-to-Host Packet Delivery (18 of 22)



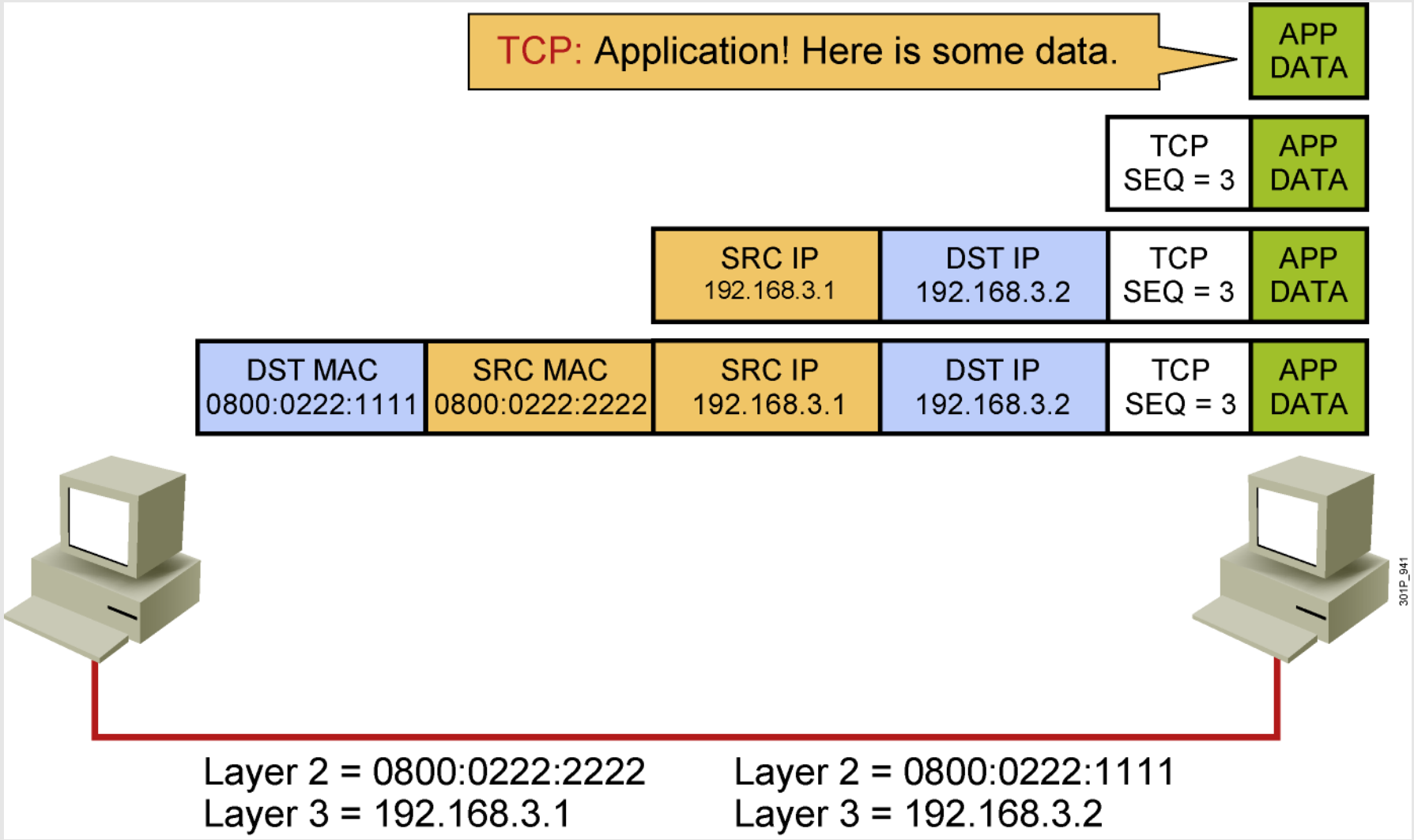
Host-to-Host Packet Delivery (19 of 22)



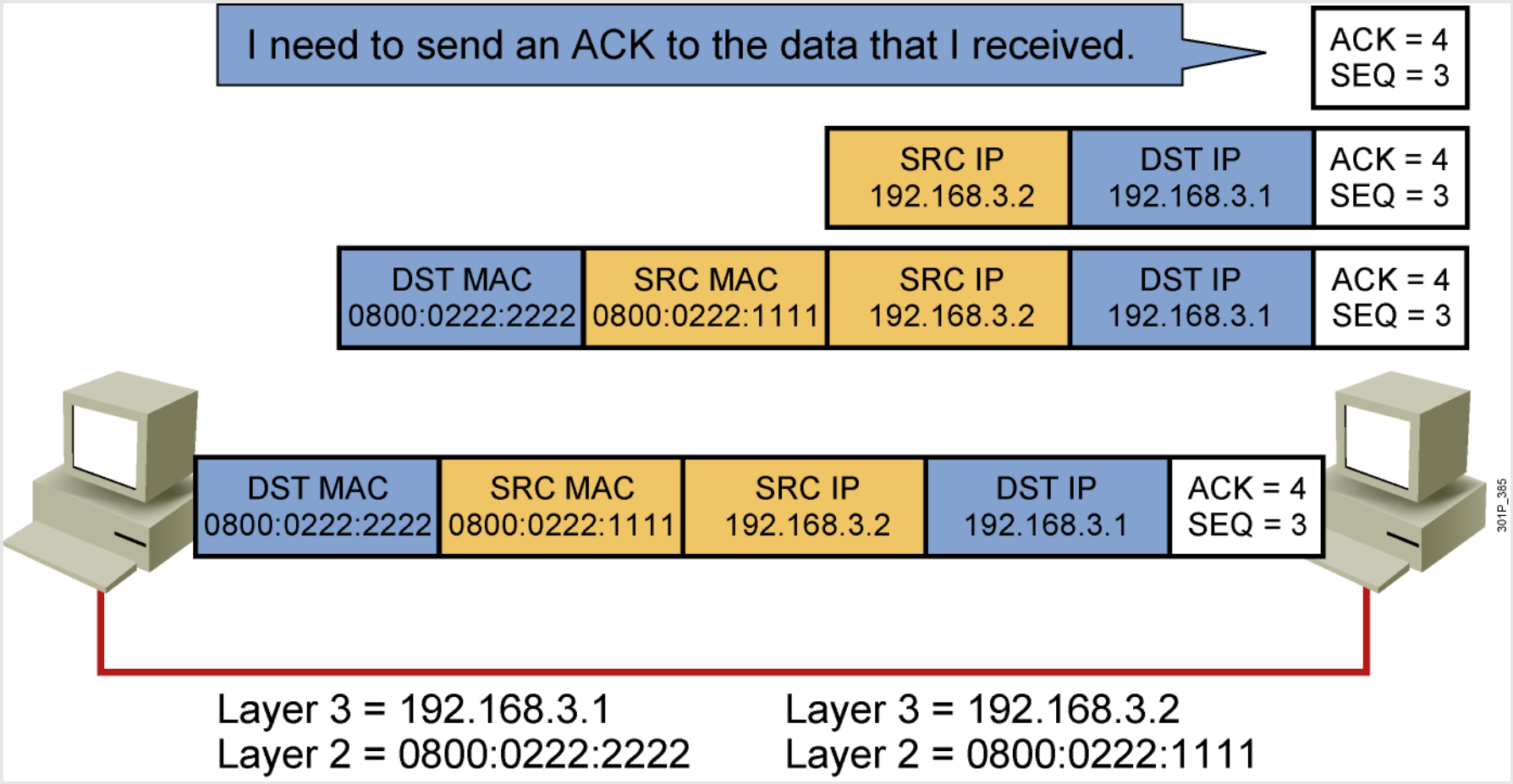
Host-to-Host Packet Delivery (20 of 22)



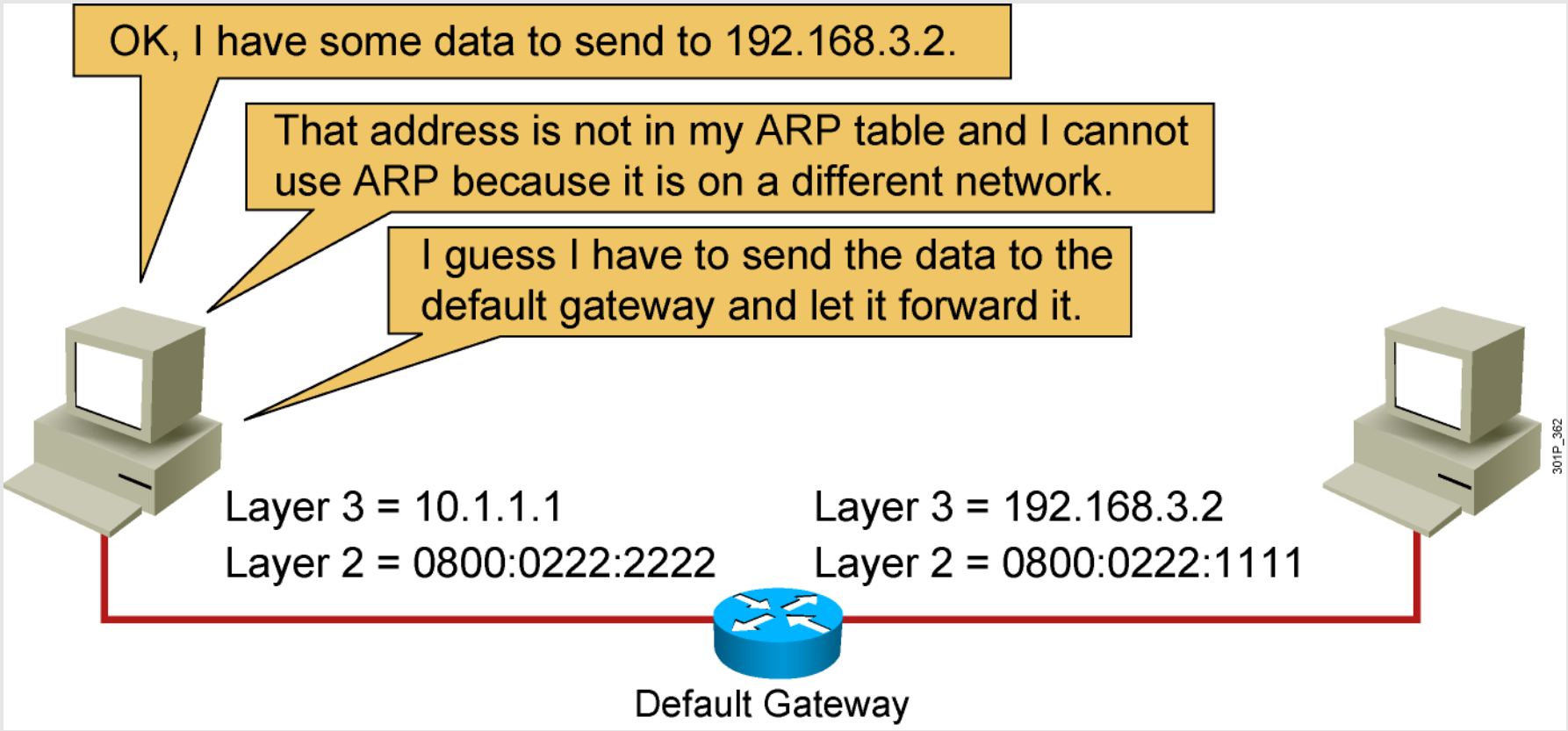
Host-to-Host Packet Delivery (21 of 22)



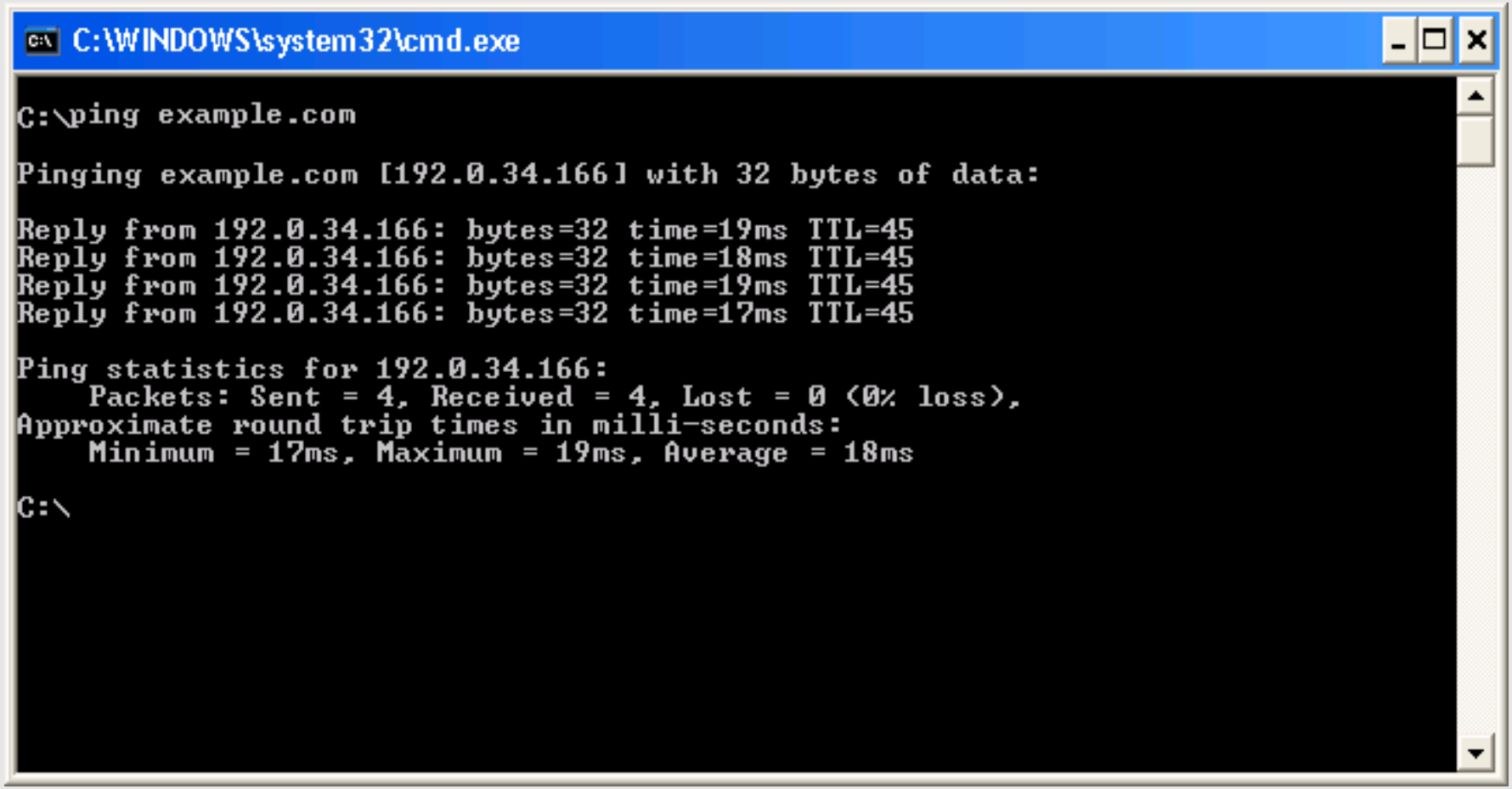
Host-to-Host Packet Delivery (22 of 22)



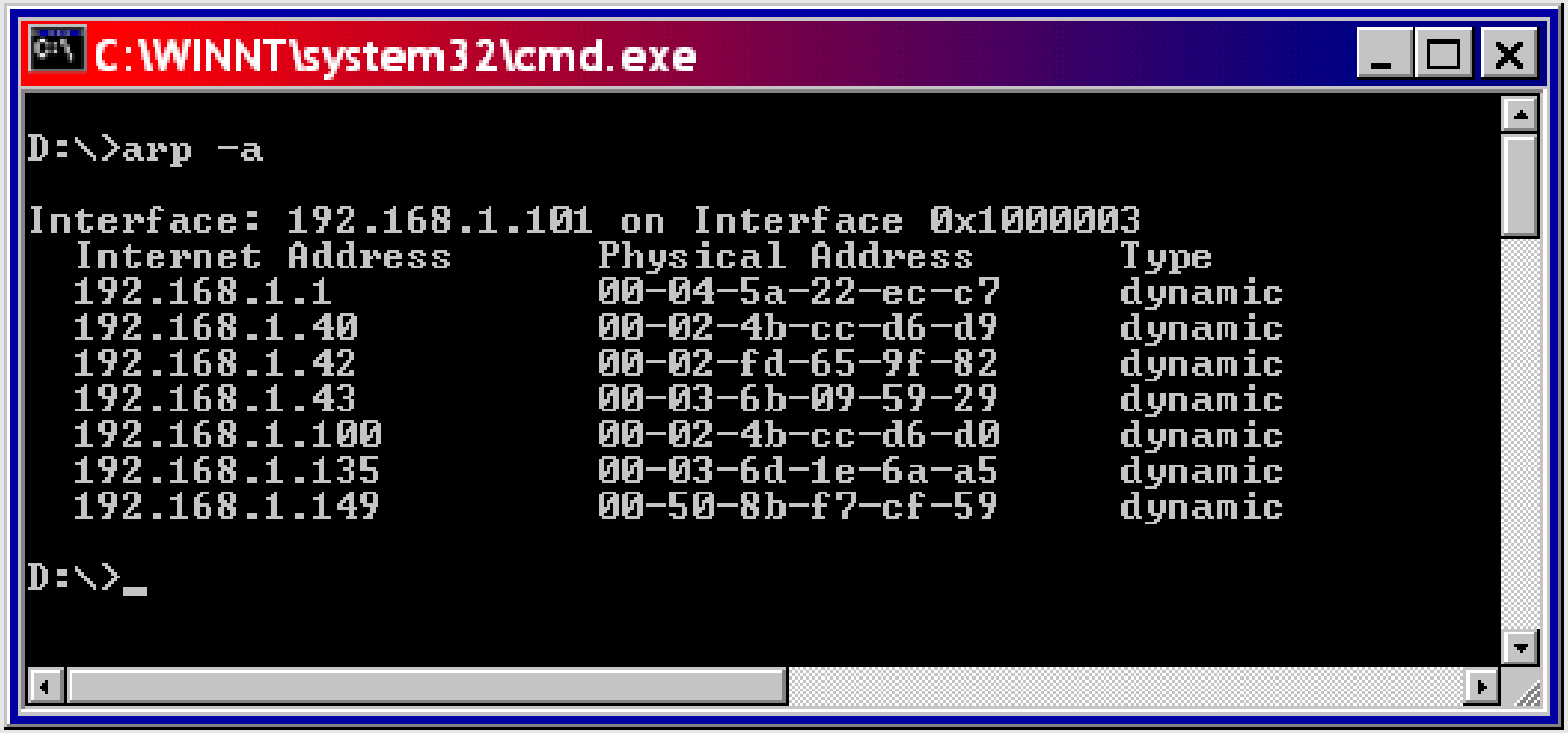
Default Gateway



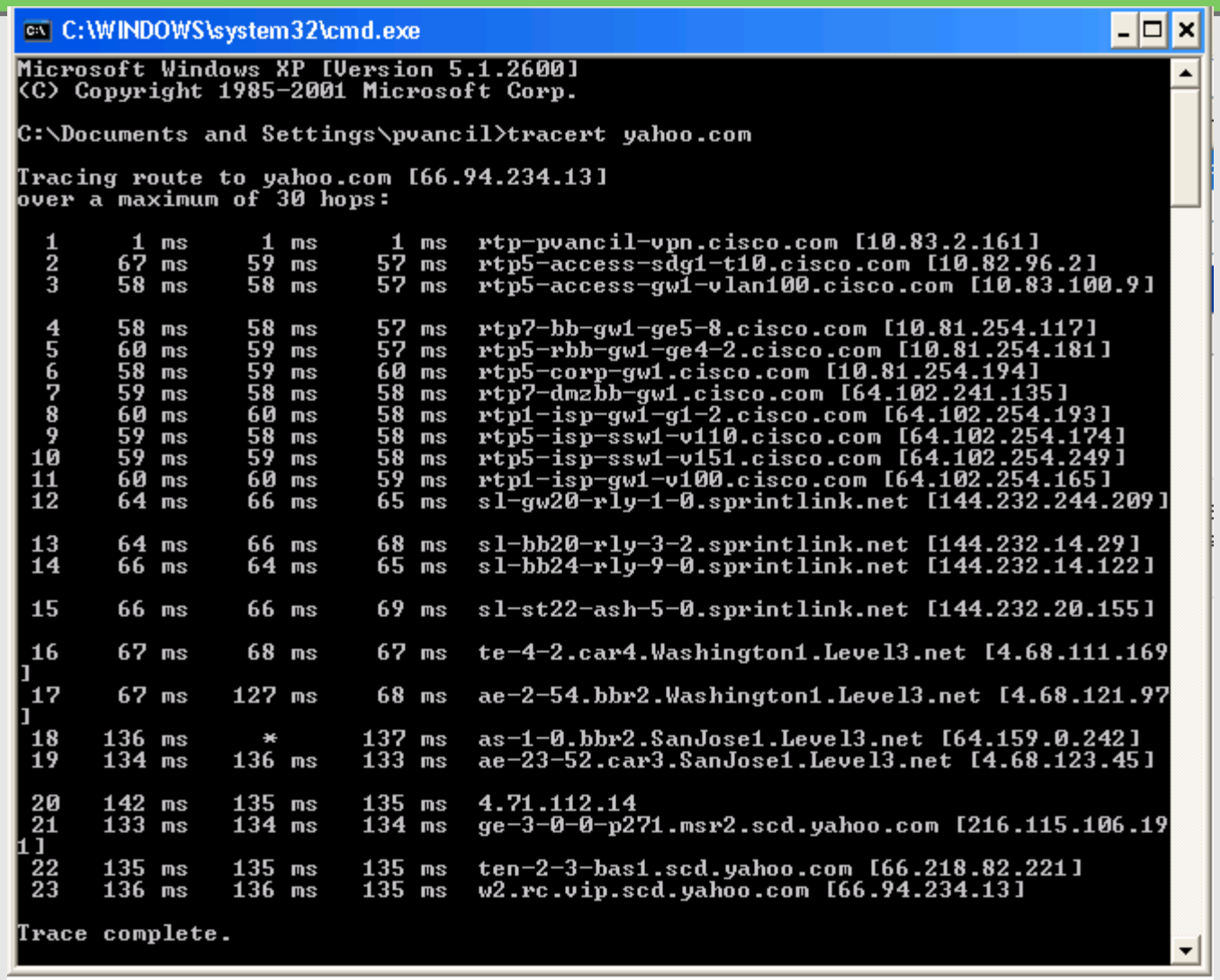
Host-Based Tools: ping



Host-Based Tools: Table

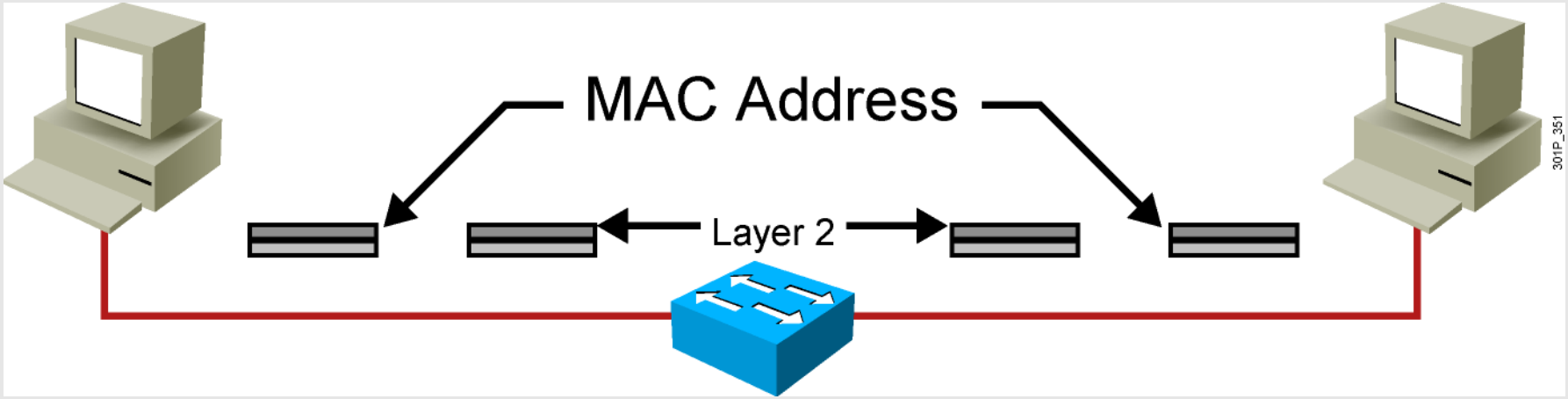


Host-Based Tools: tracert



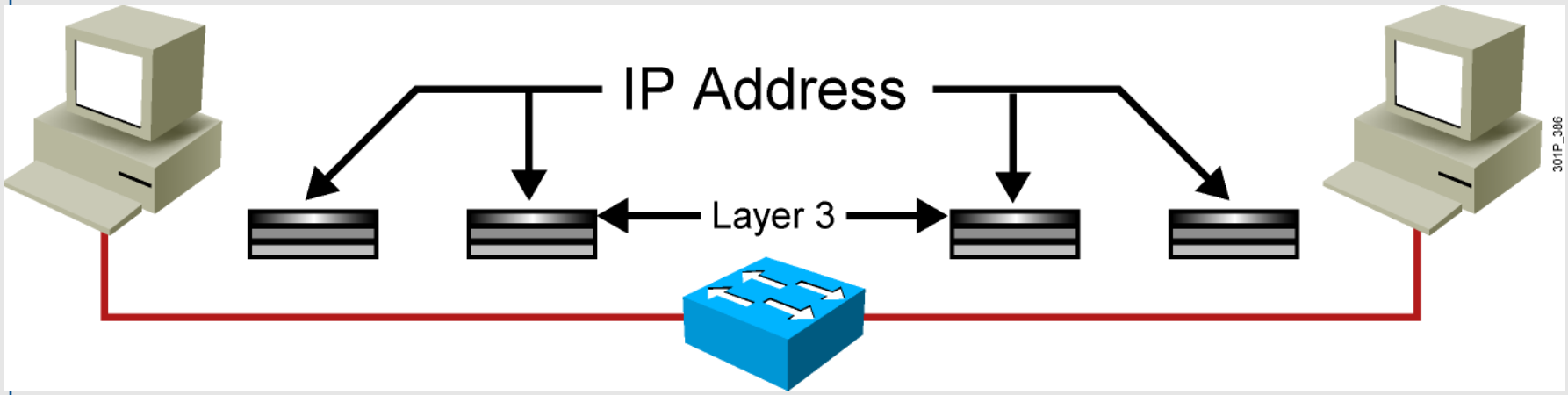
IV. Exploring the packet Delivery Process 2 (layer 2)

Layer 2 Addressing



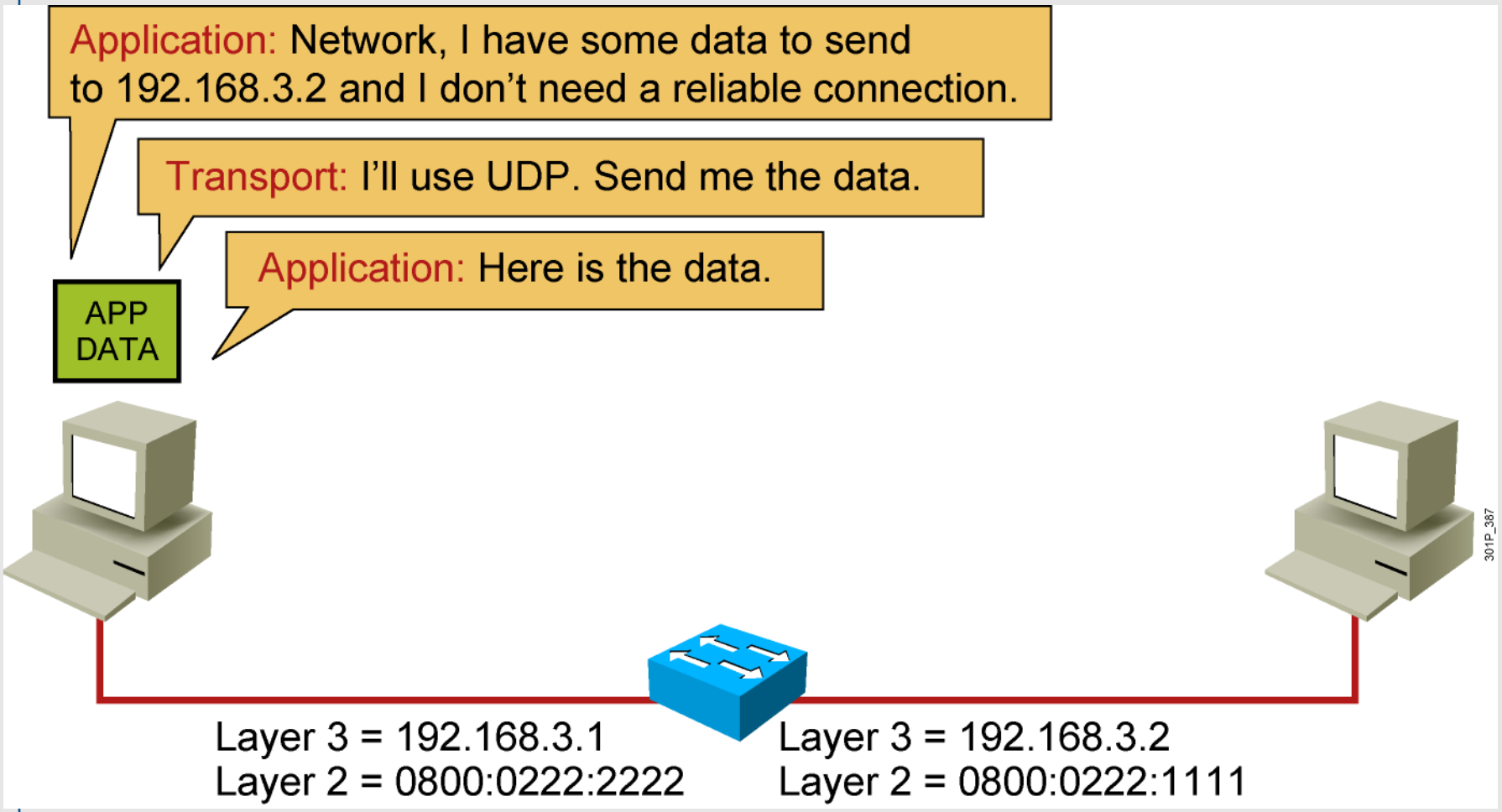
- Uses MAC address
- Assigned to end devices

Layer 3 Addressing

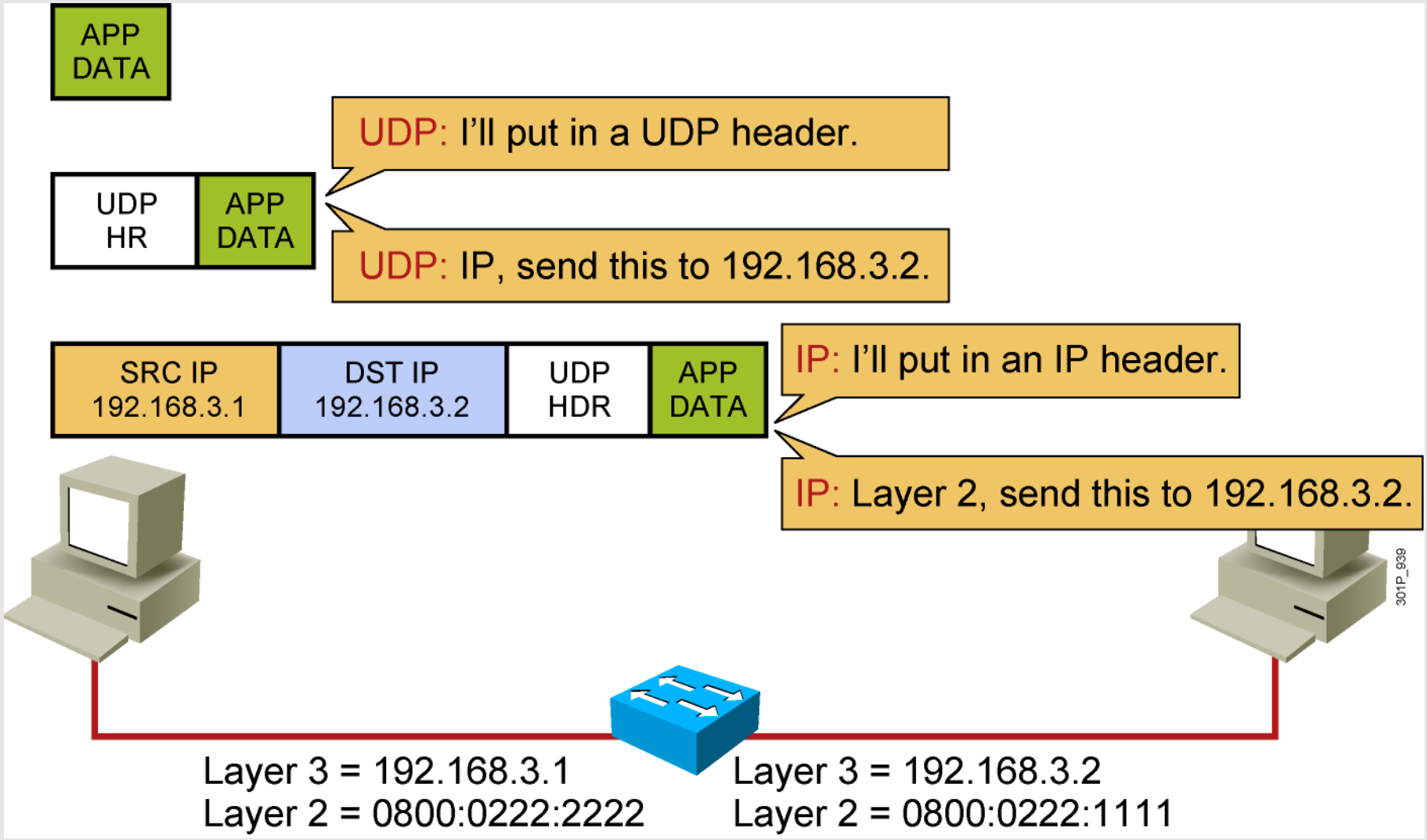


- Each NOS has its own Layer 3 address format.
- OSI uses NSAP.
- TCP/IP uses IP.

Host-to-Host Packet Delivery (1 of 10)



Host-to-Host Packet Delivery (2 of 10)

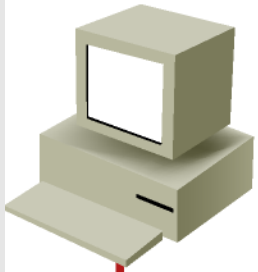


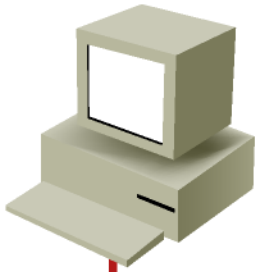
Host-to-Host Packet Delivery (3 of 10)

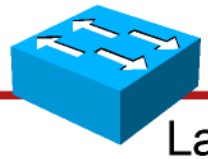
Layer 2: ARP, do you have a mapping for 192.168.3.2 ?

ARP: Is 192.168.3.2 in my ARP table? No, I guess Layer 2 will have to hold the packet while I resolve the addressing.

SRC IP 192.168.3.1	DST IP 192.168.3.2	UDP HDR	APP DATA





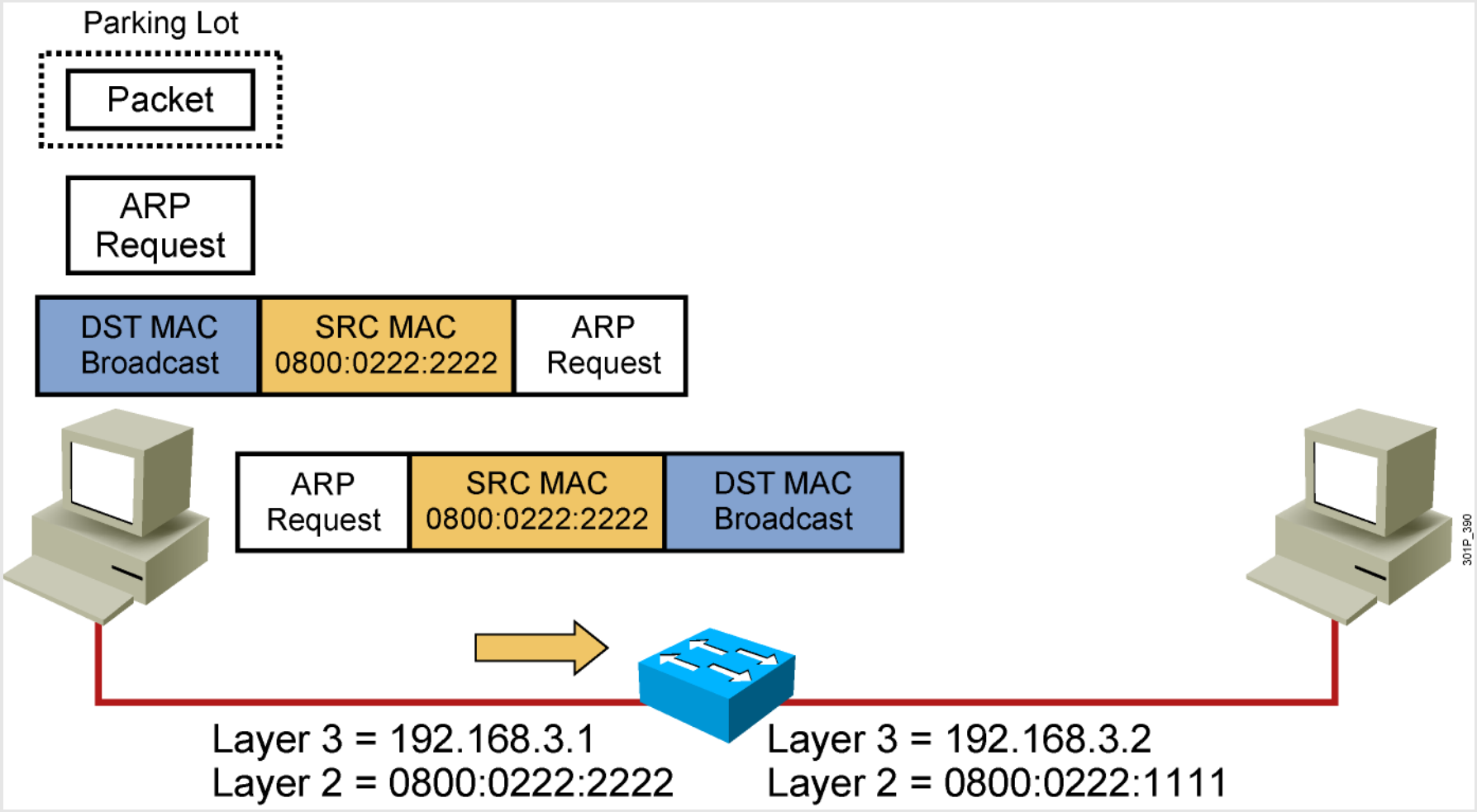


301P_389

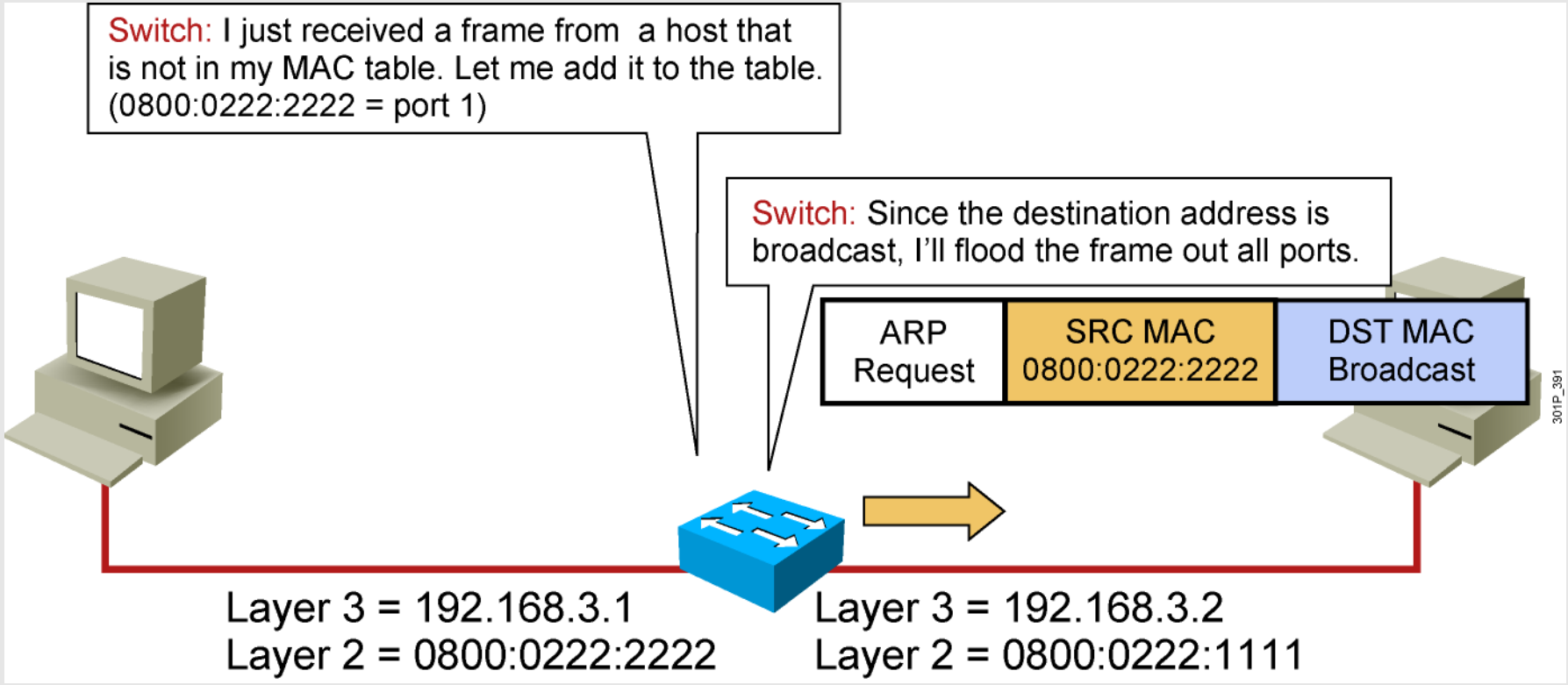
Layer 3 = 192.168.3.1
Layer 2 = 0800:0222:2222

Layer 3 = 192.168.3.2
Layer 2 = 0800:0222:1111

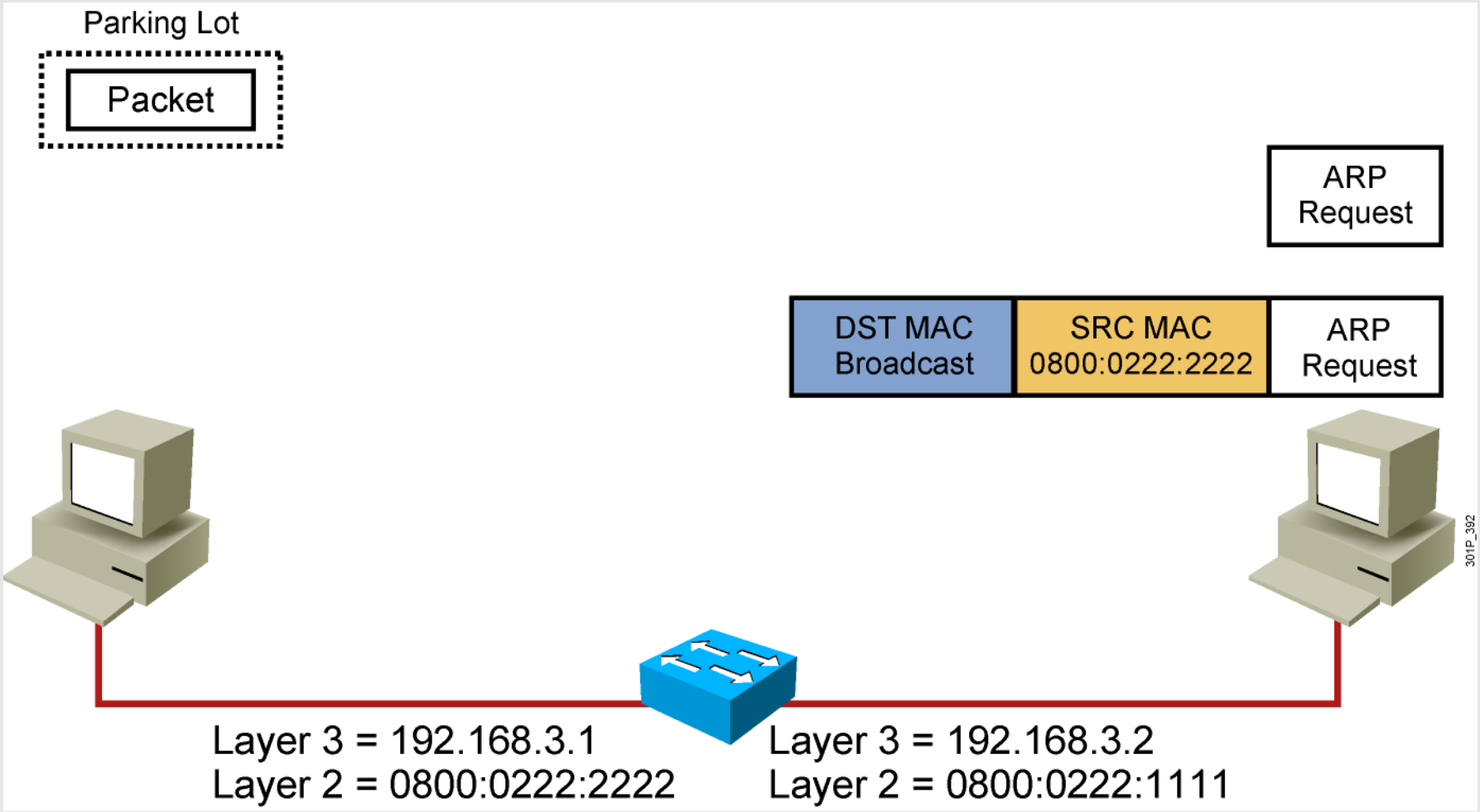
Host-to-Host Packet Delivery (4 of 10)



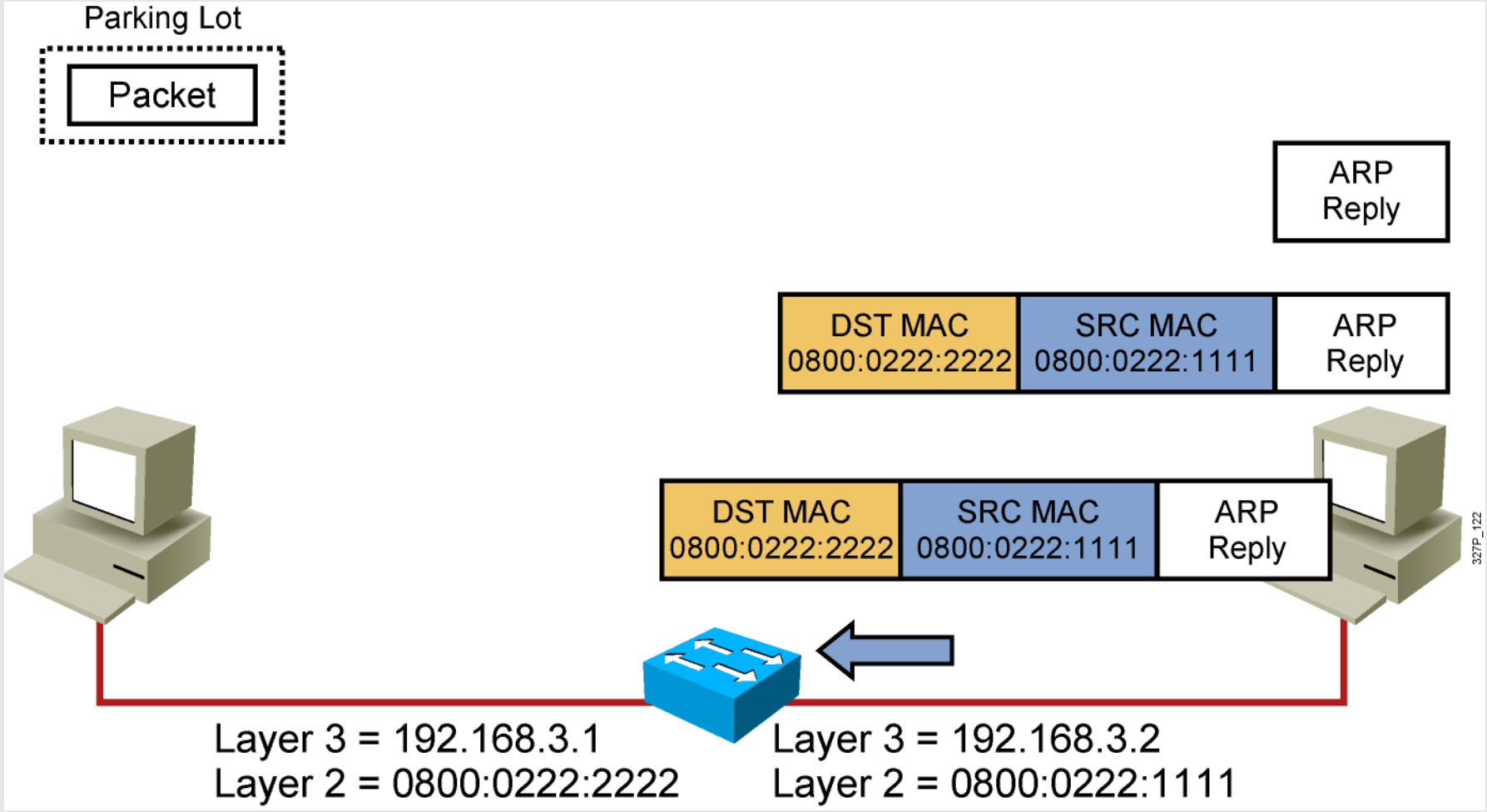
Host-to-Host Packet Delivery (5 of 10)



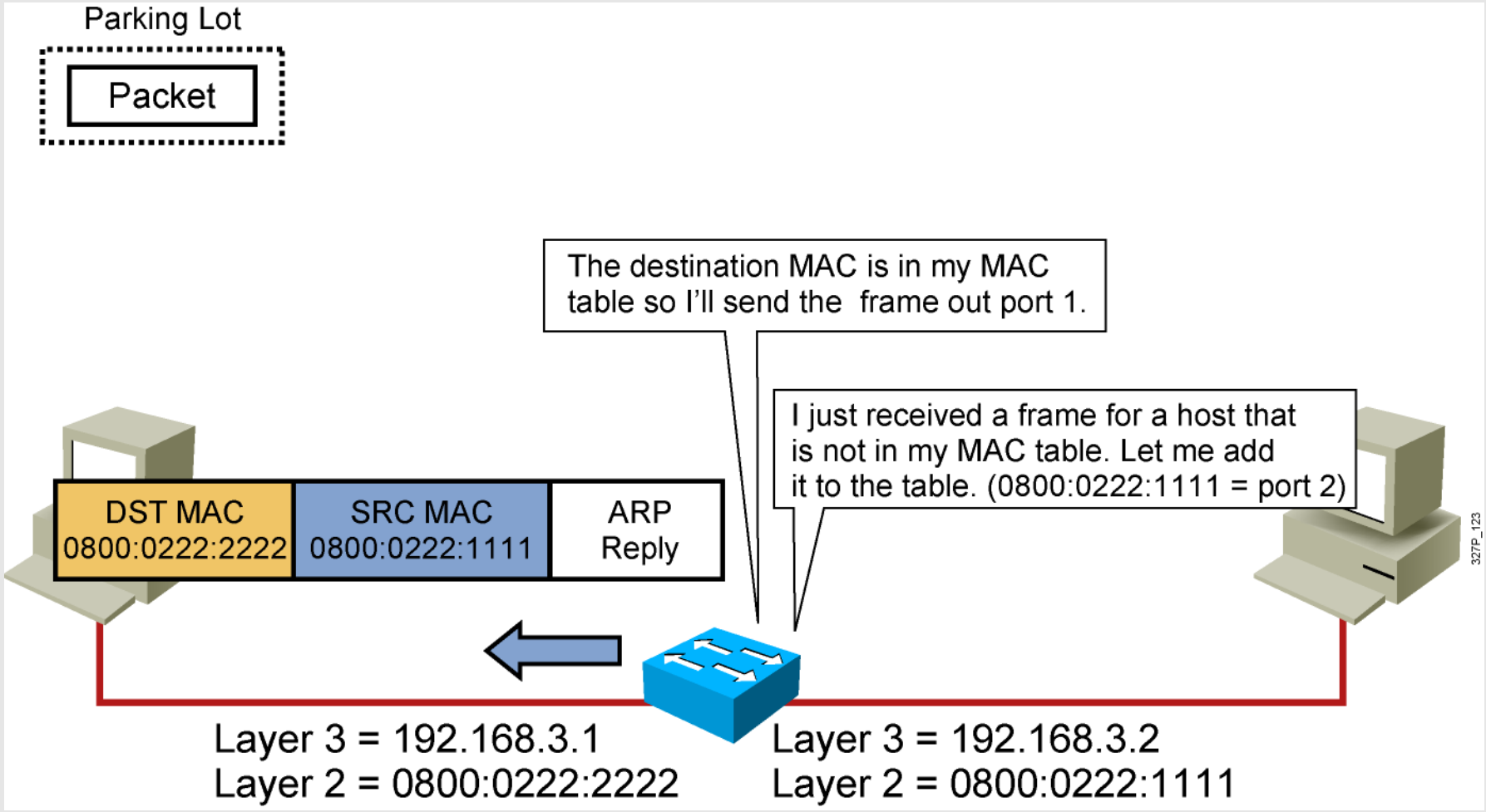
Host-to-Host Packet Delivery (6 of 10)



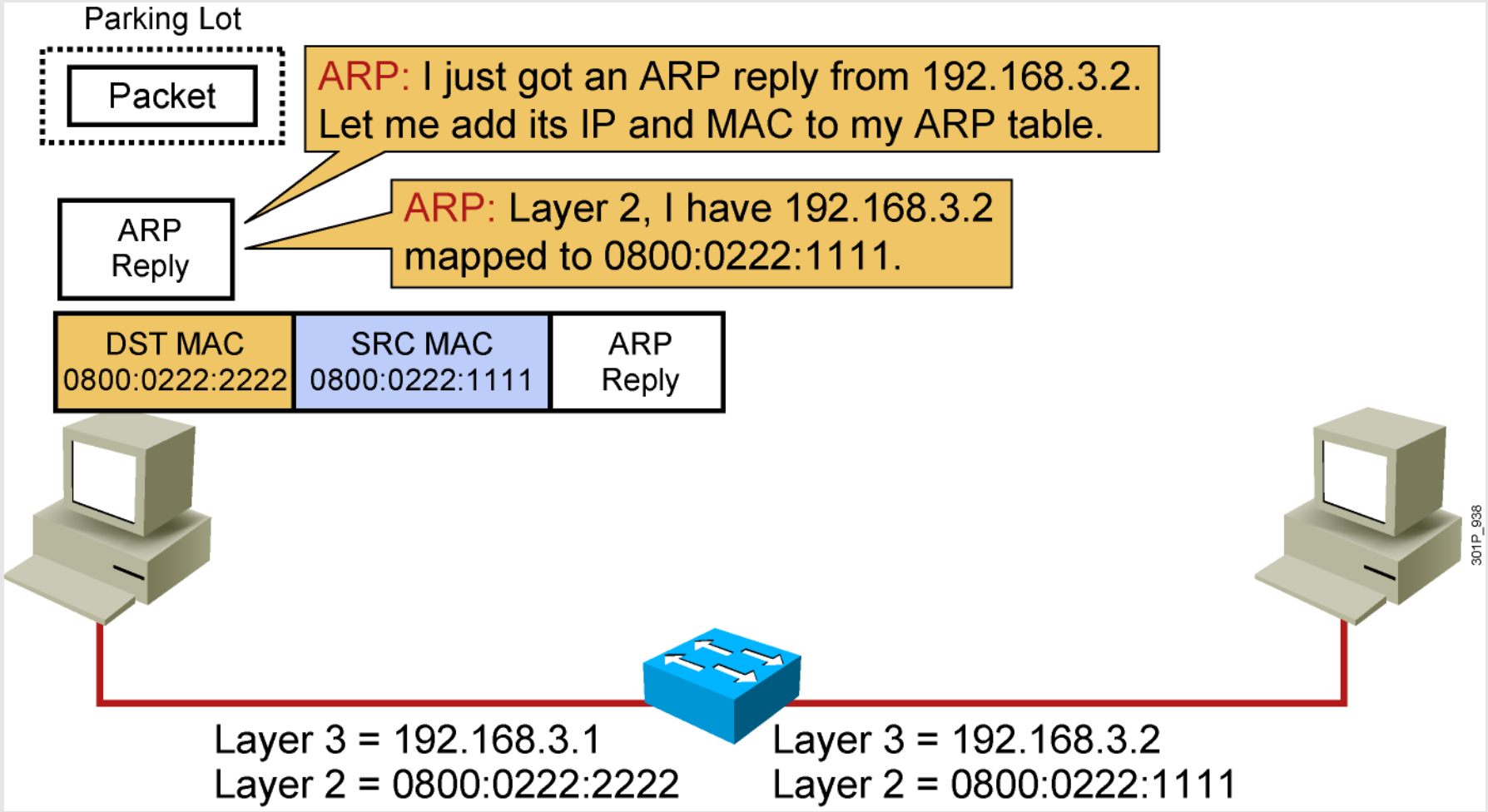
Host-to-Host Packet Delivery (7 of 10)



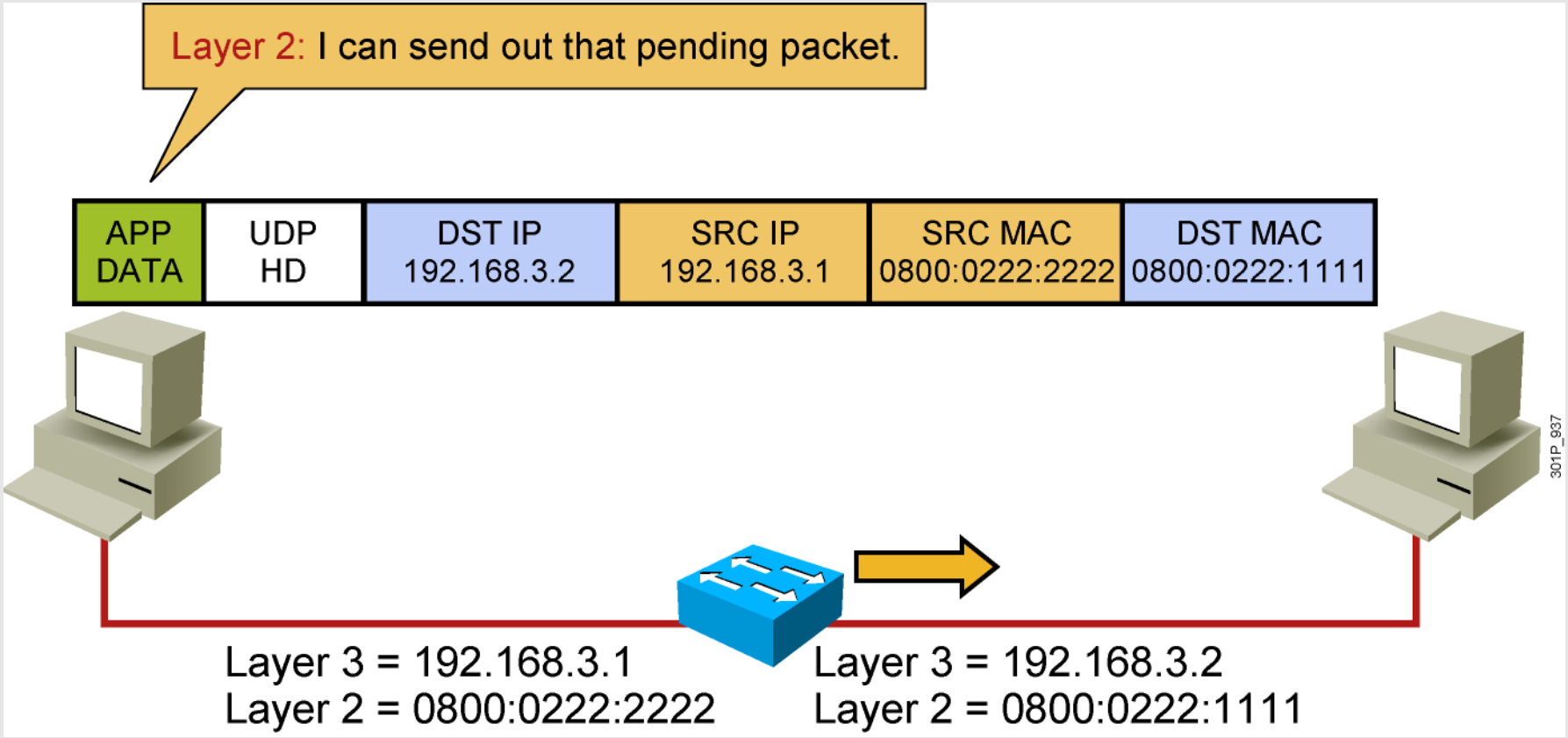
Host-to-Host Packet Delivery (8 of 10)



Host-to-Host Packet Delivery (9 of 10)

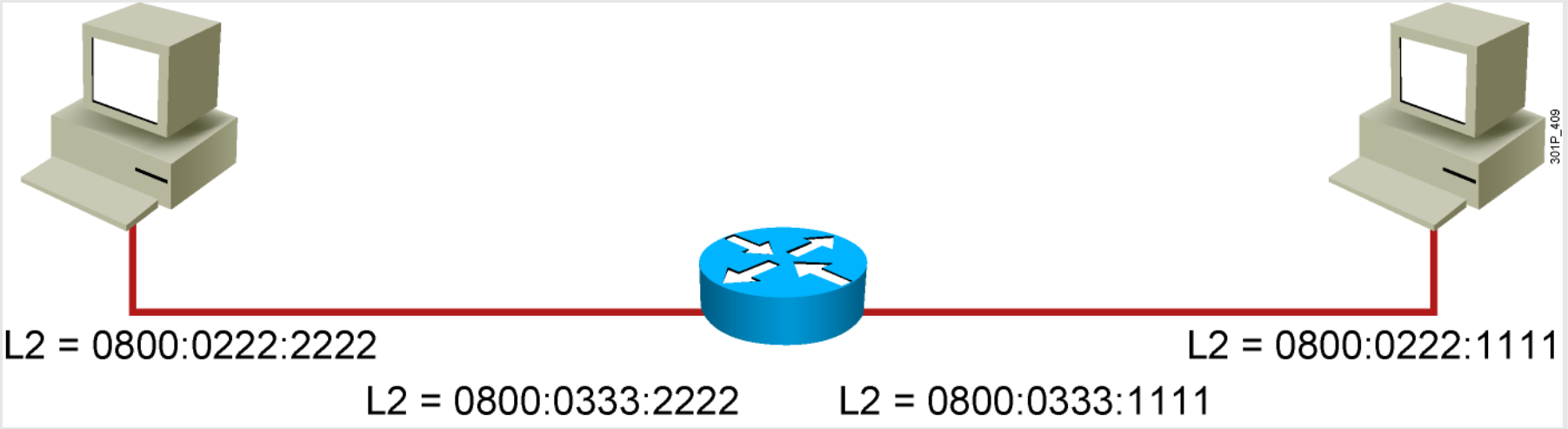


Host-to-Host Packet Delivery (10 of 10)

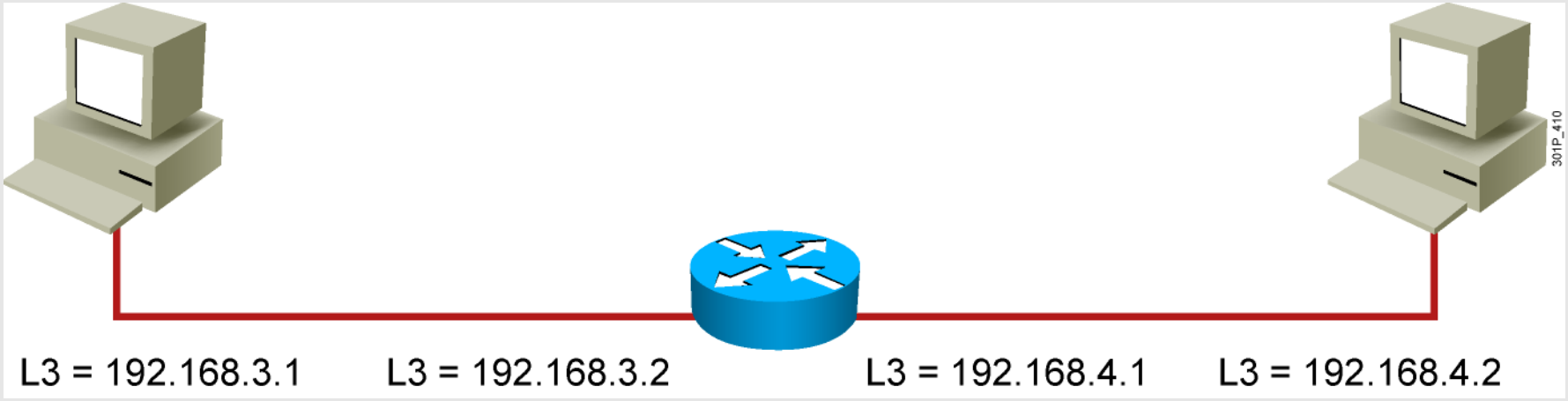


V. Exploring the packet Delivery Process 3 (layer 3)

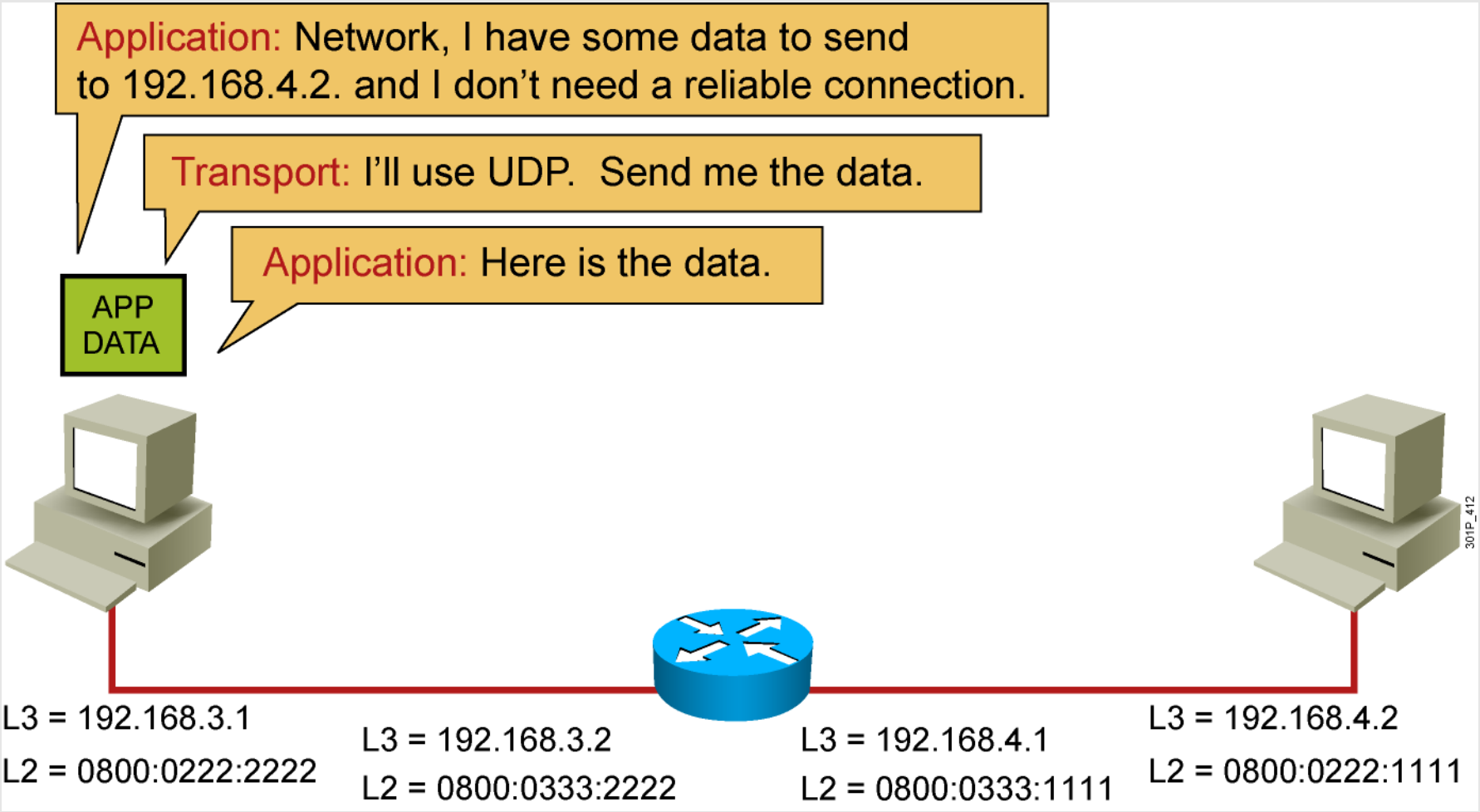
Layer 2 Addressing



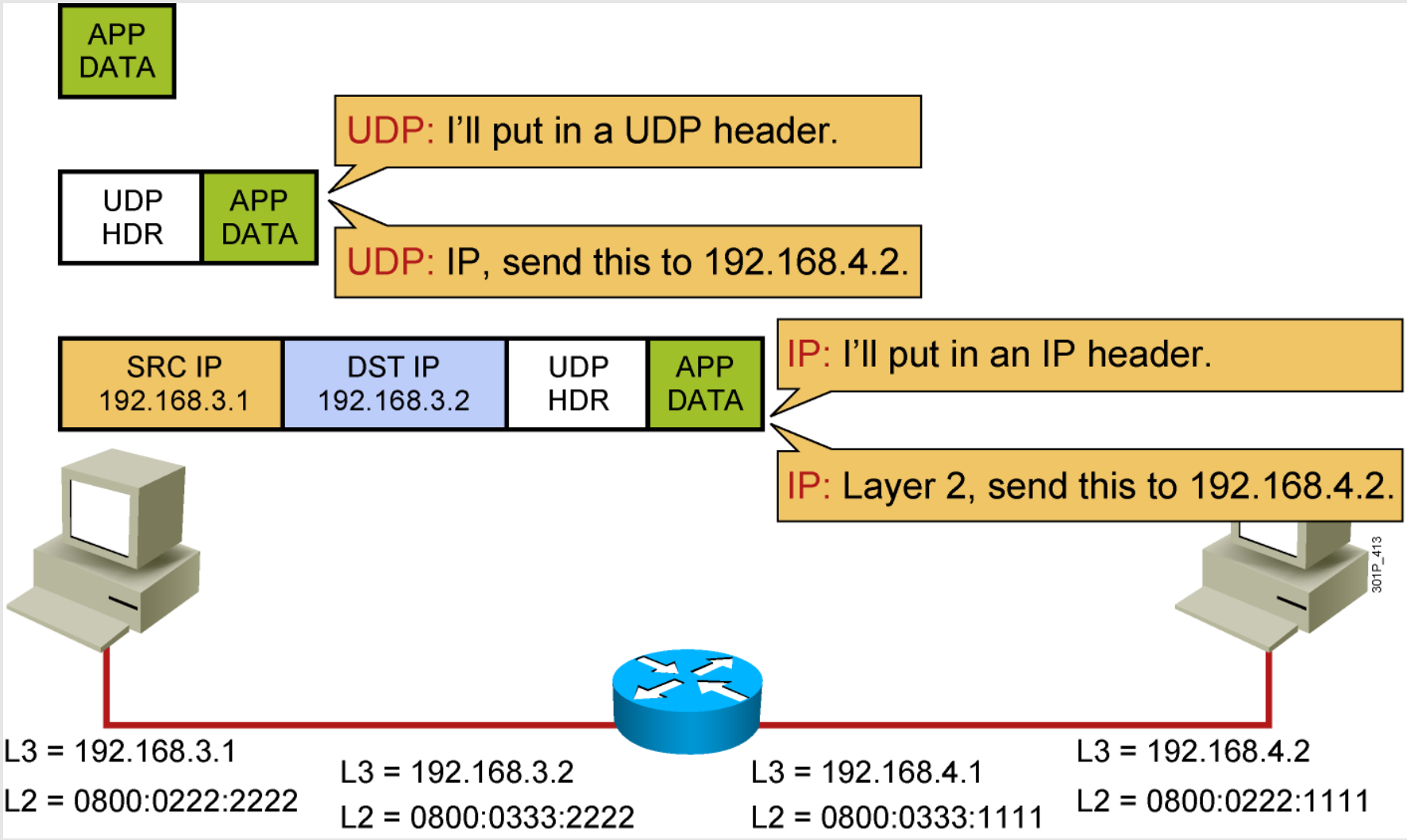
Layer 3 Addressing



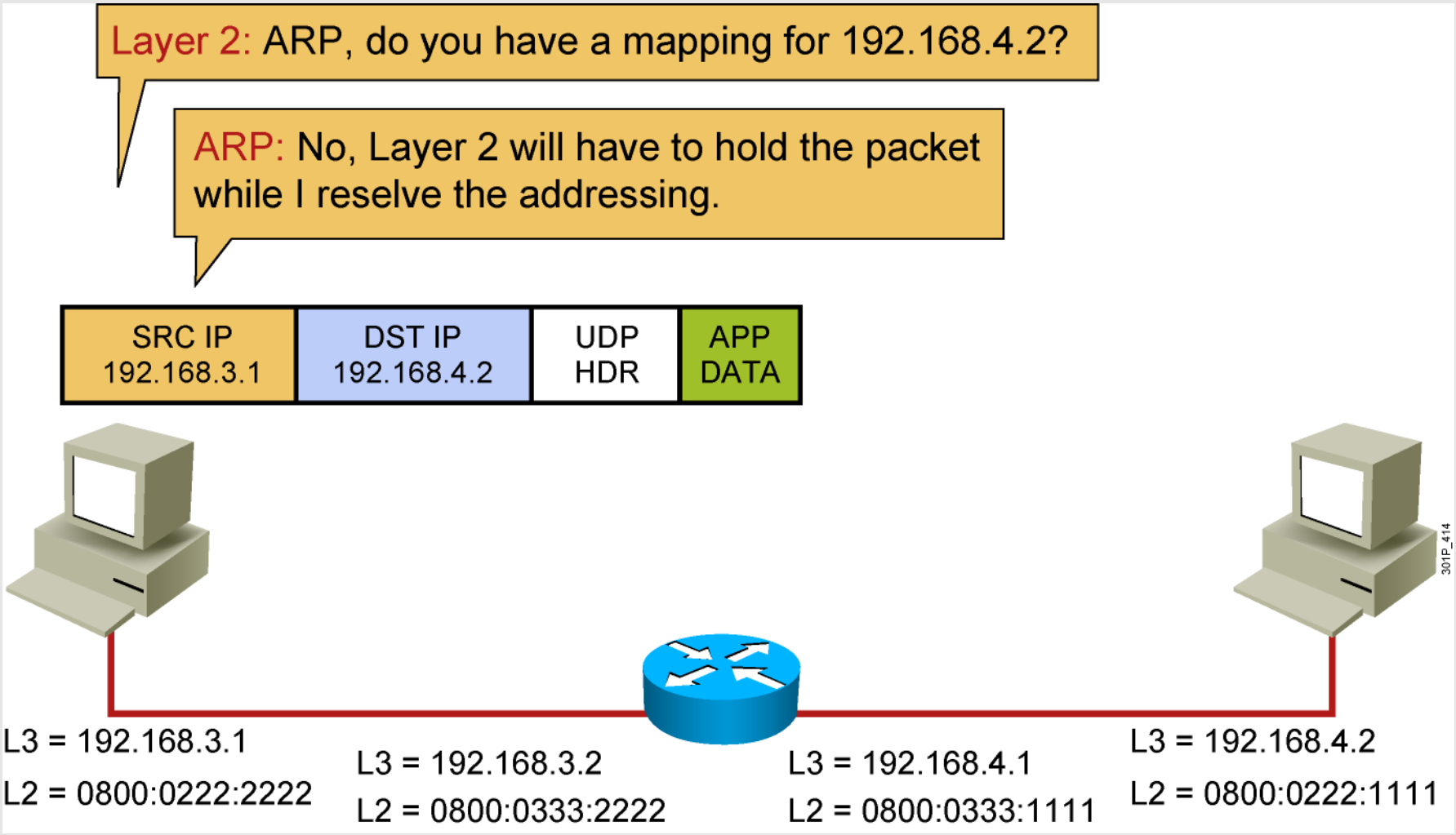
Host-to-Host Packet Delivery (1 of 17)



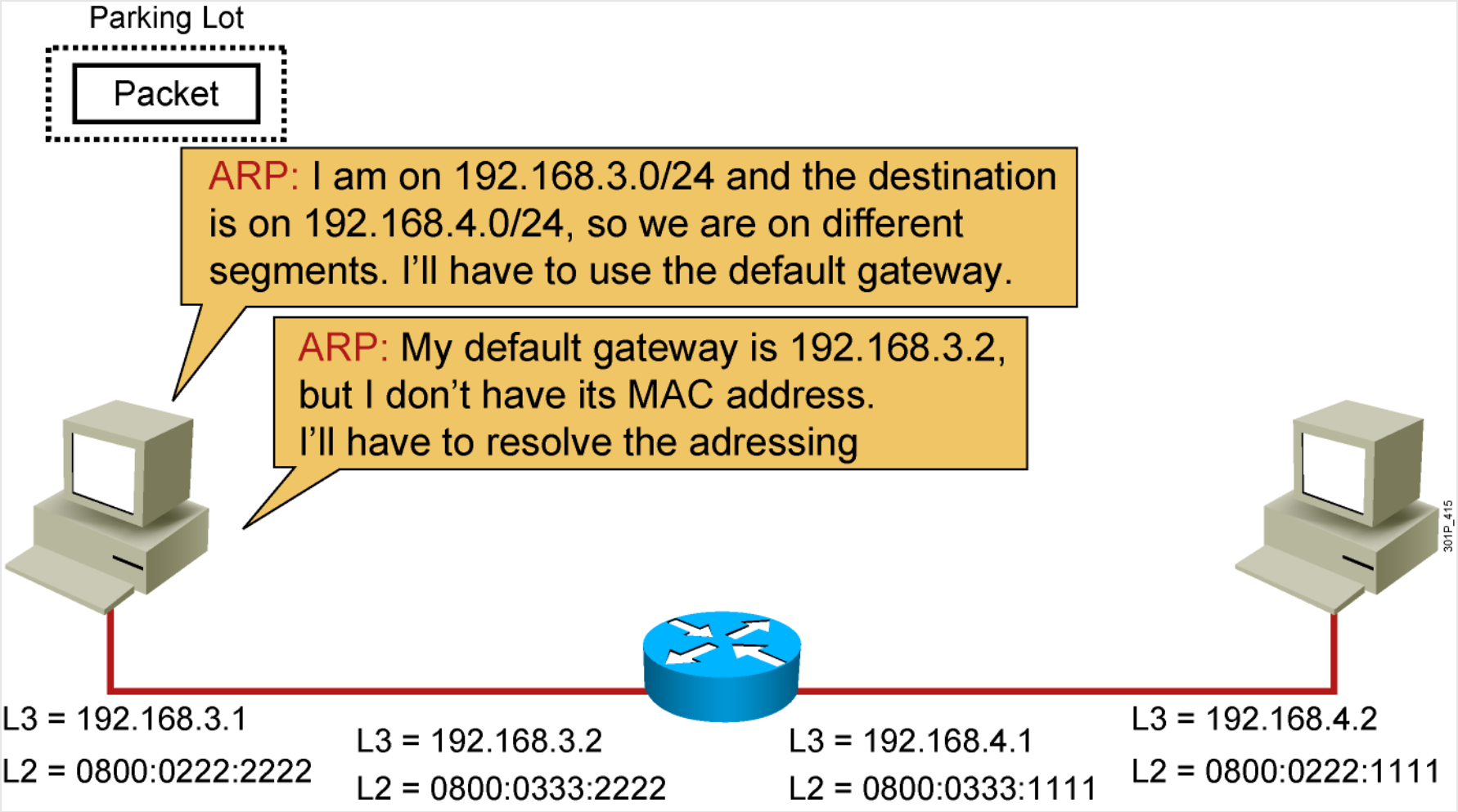
Host-to-Host Packet Delivery (2 of 17)



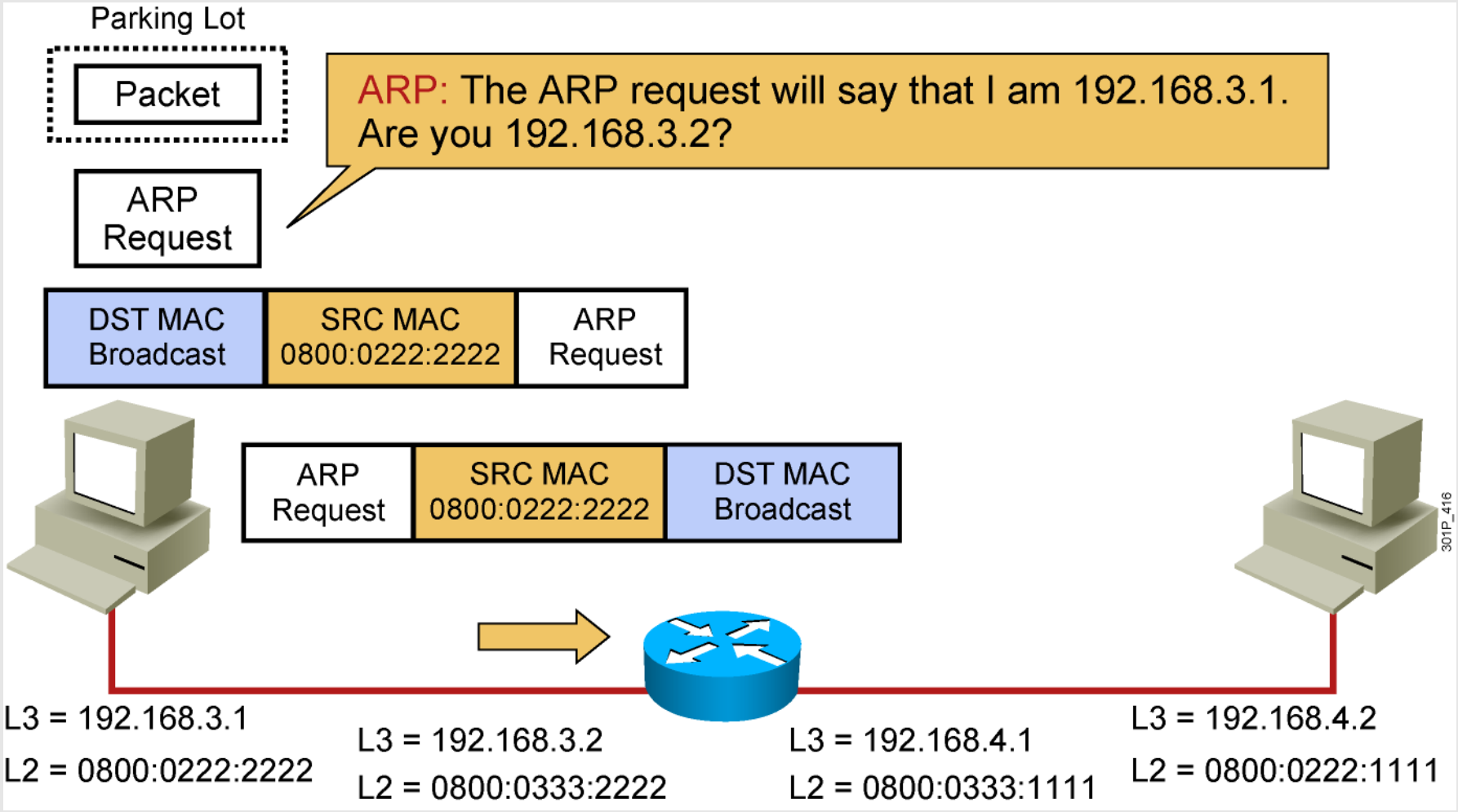
Host-to-Host Packet Delivery (3 of 17)



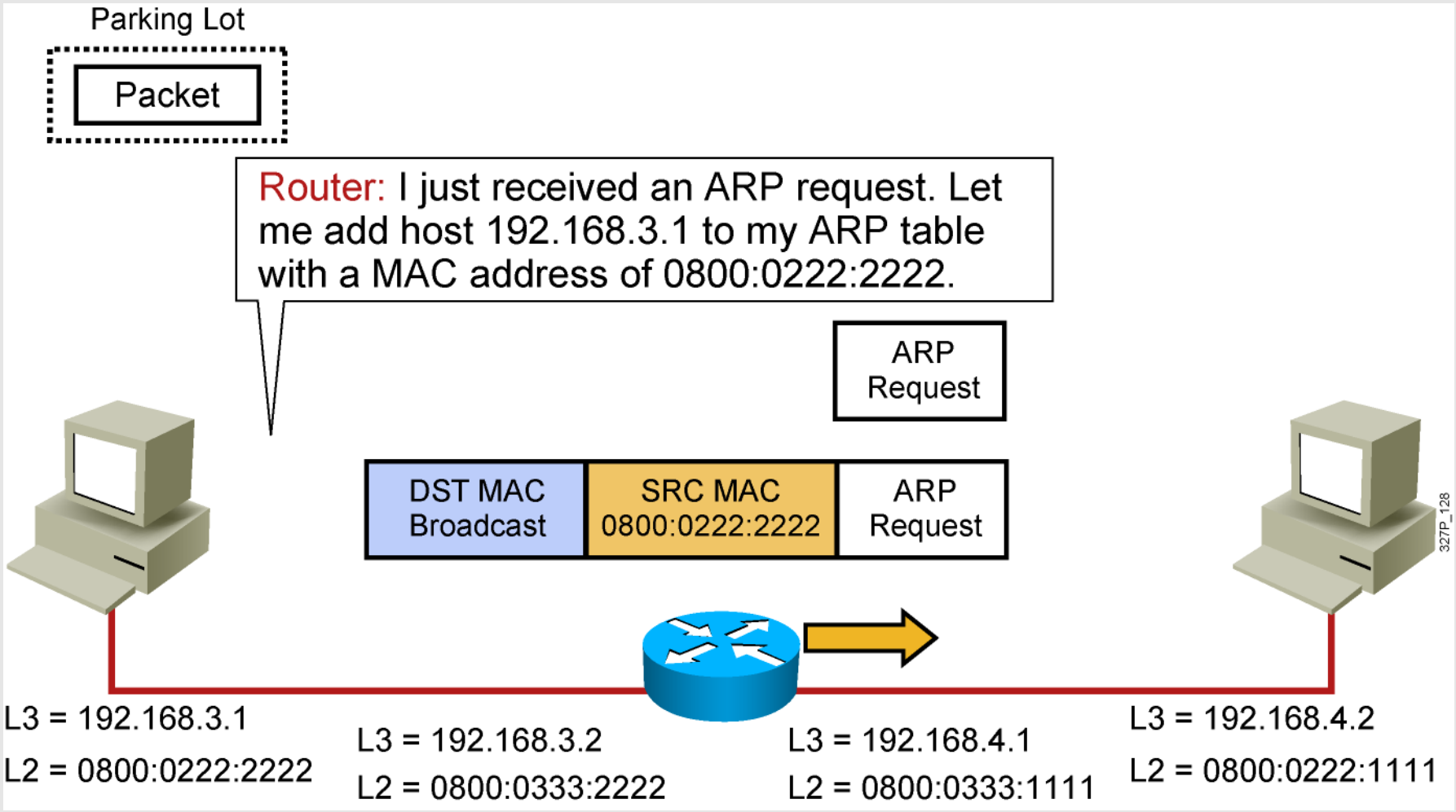
Host-to-Host Packet Delivery (4 of 17)



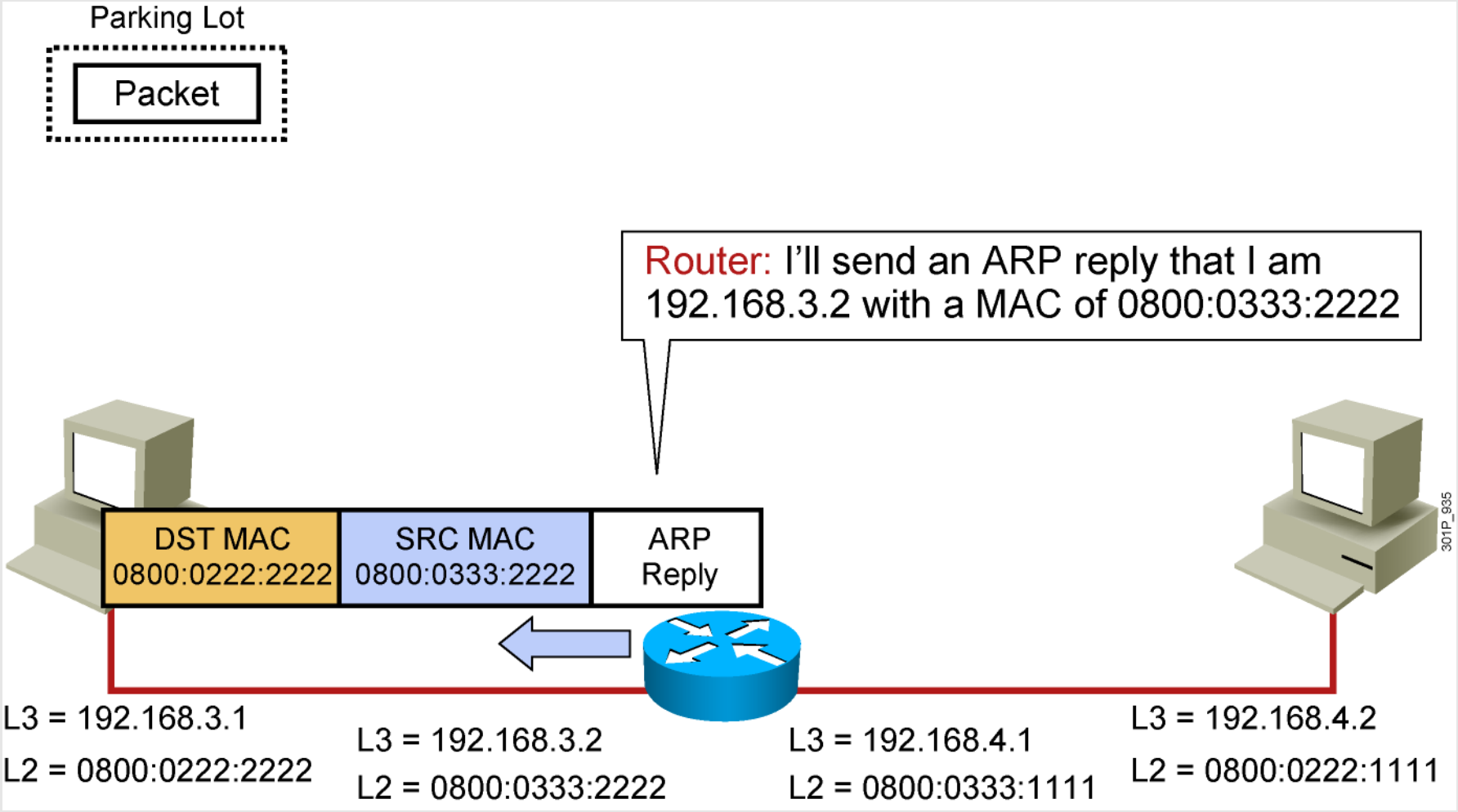
Host-to-Host Packet Delivery (5 of 17)



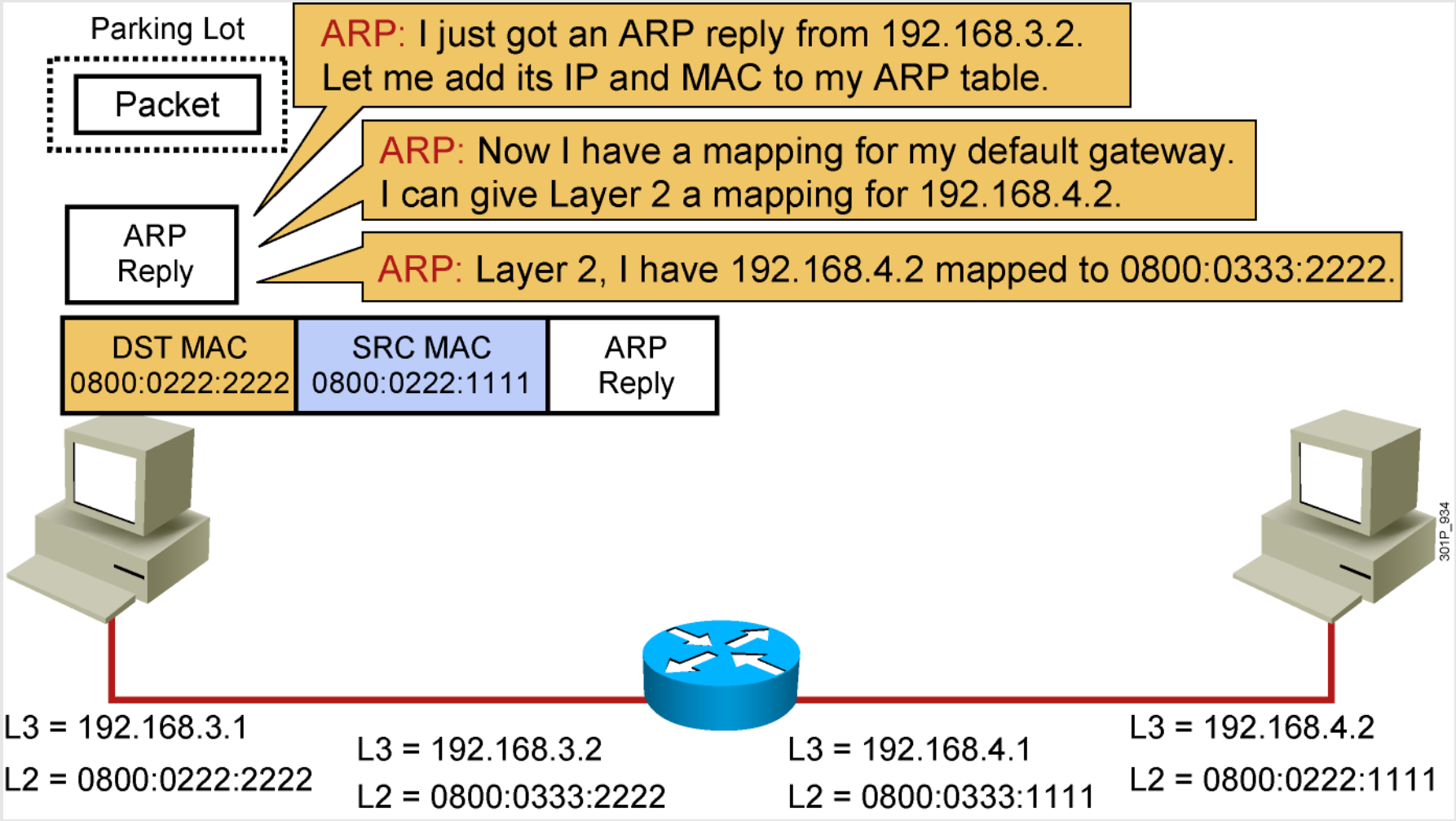
Host-to-Host Packet Delivery (6 of 17)



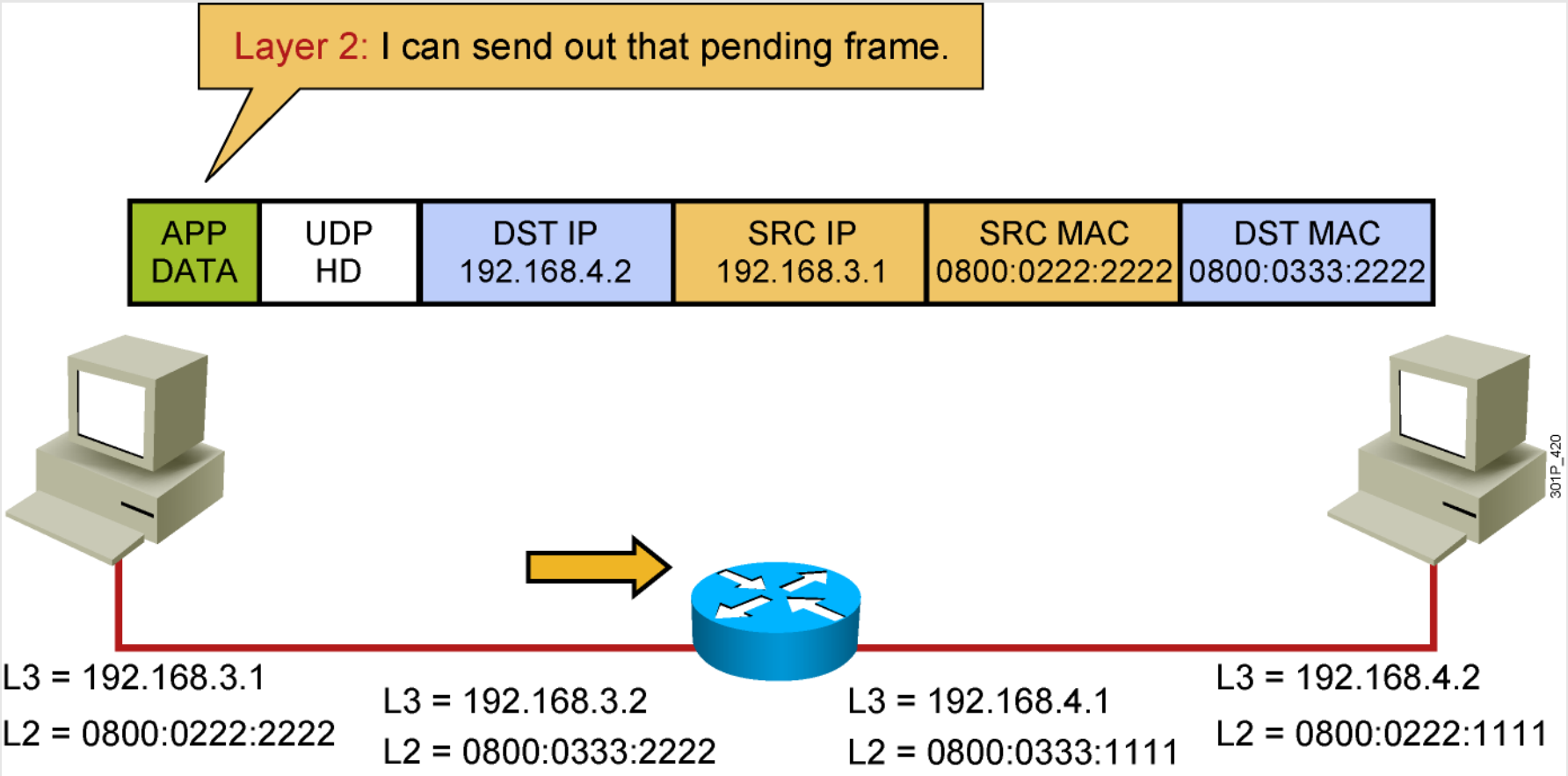
Host-to-Host Packet Delivery (7 of 17)



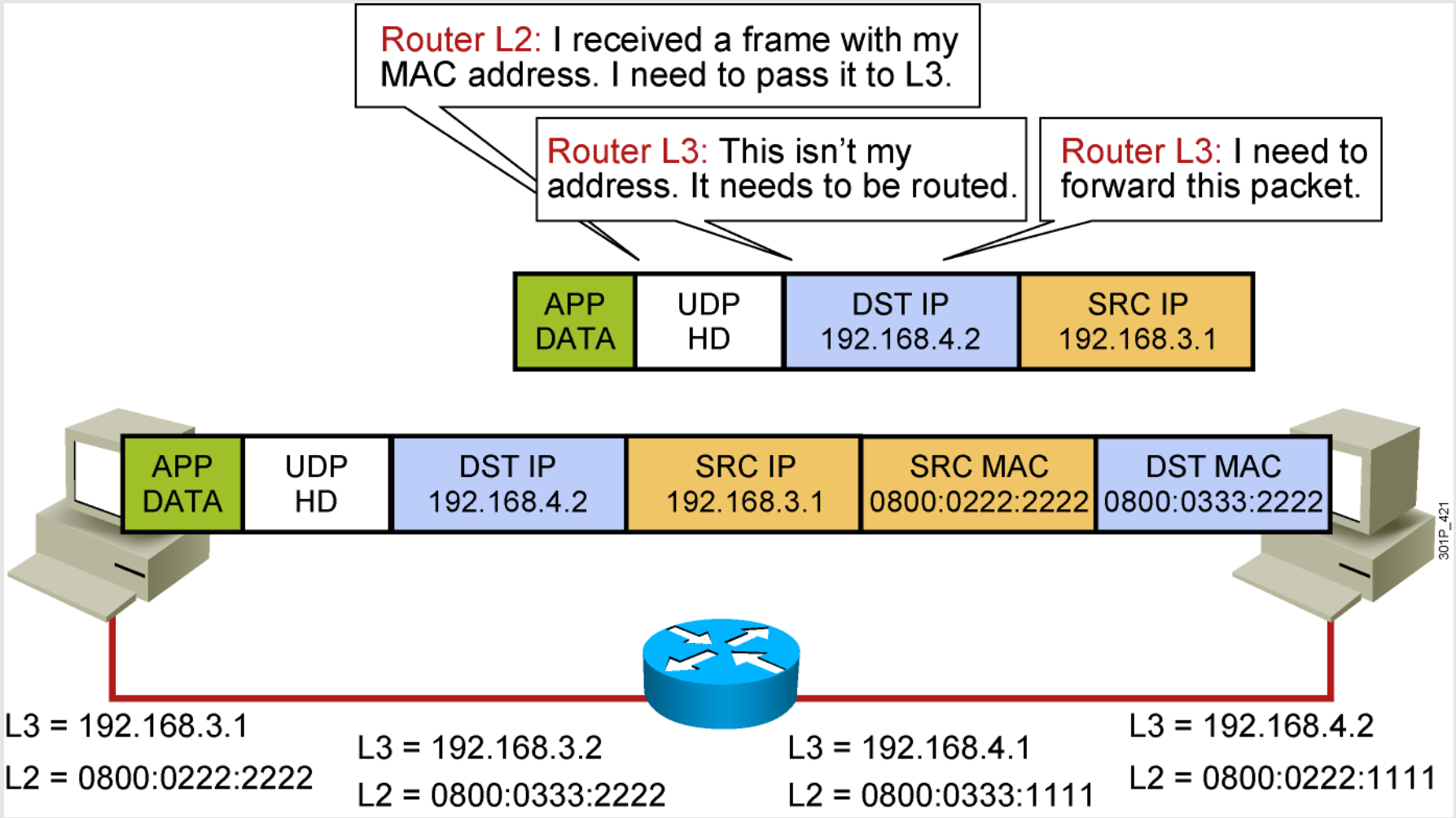
Host-to-Host Packet Delivery (8 of 17)



Host-to-Host Packet Delivery (9 of 17)

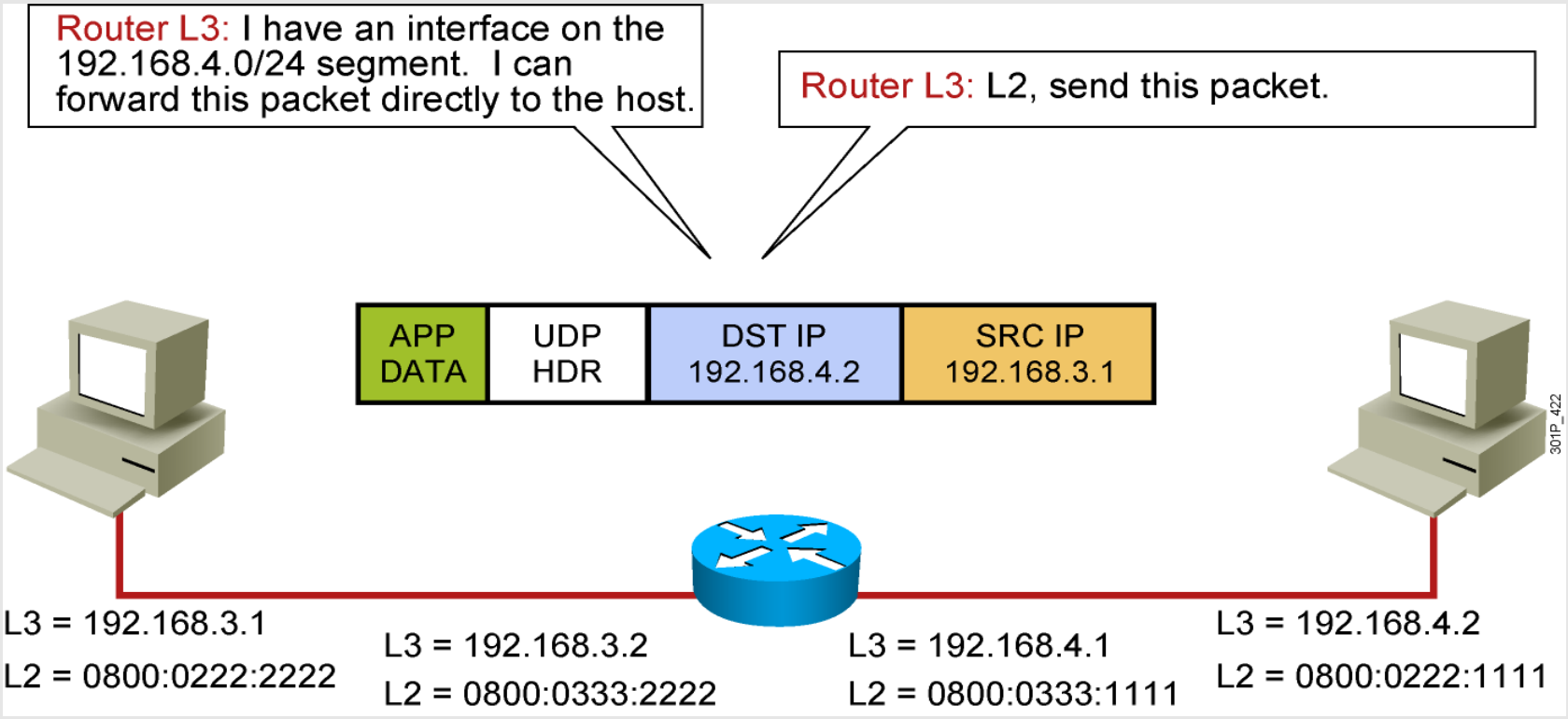


Host-to-Host Packet Delivery (10 of 17)

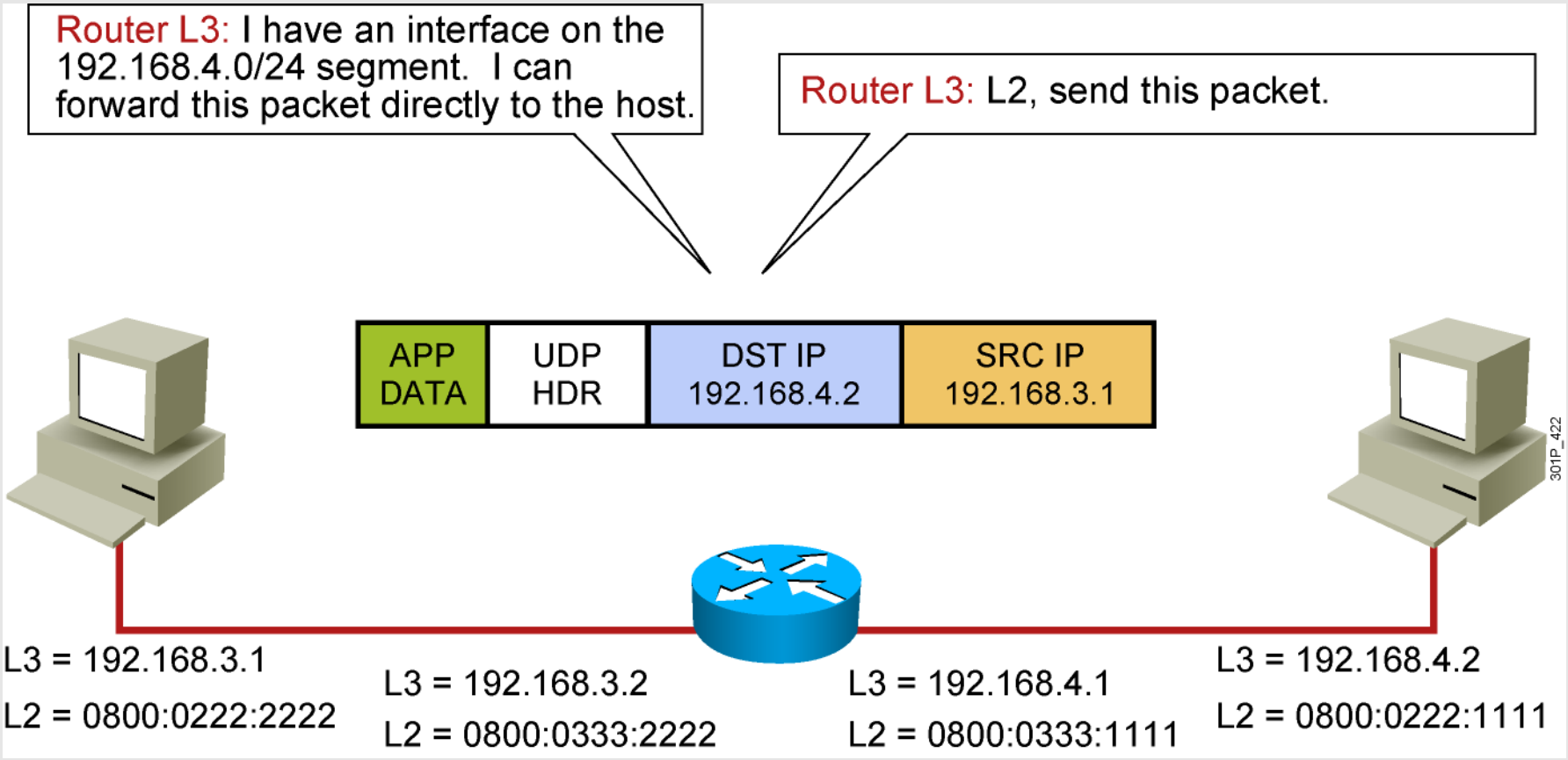


Host-to-Host Packet Delivery (11 of 17)

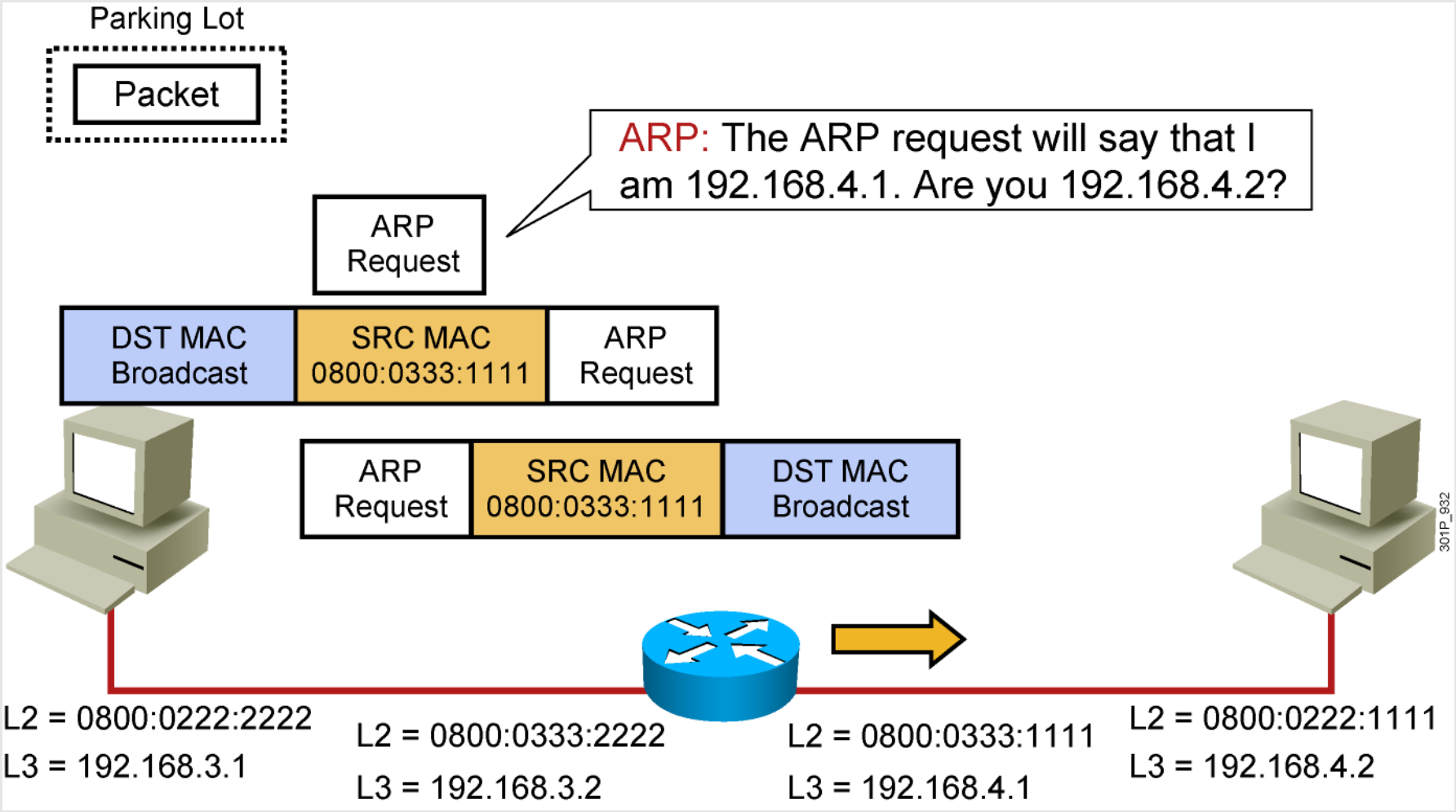
Destination	Next Hop	Interface
192.168.3.0/24	Connected	fa 0/0
192.168.4.0/24	Connected	fa 0/1



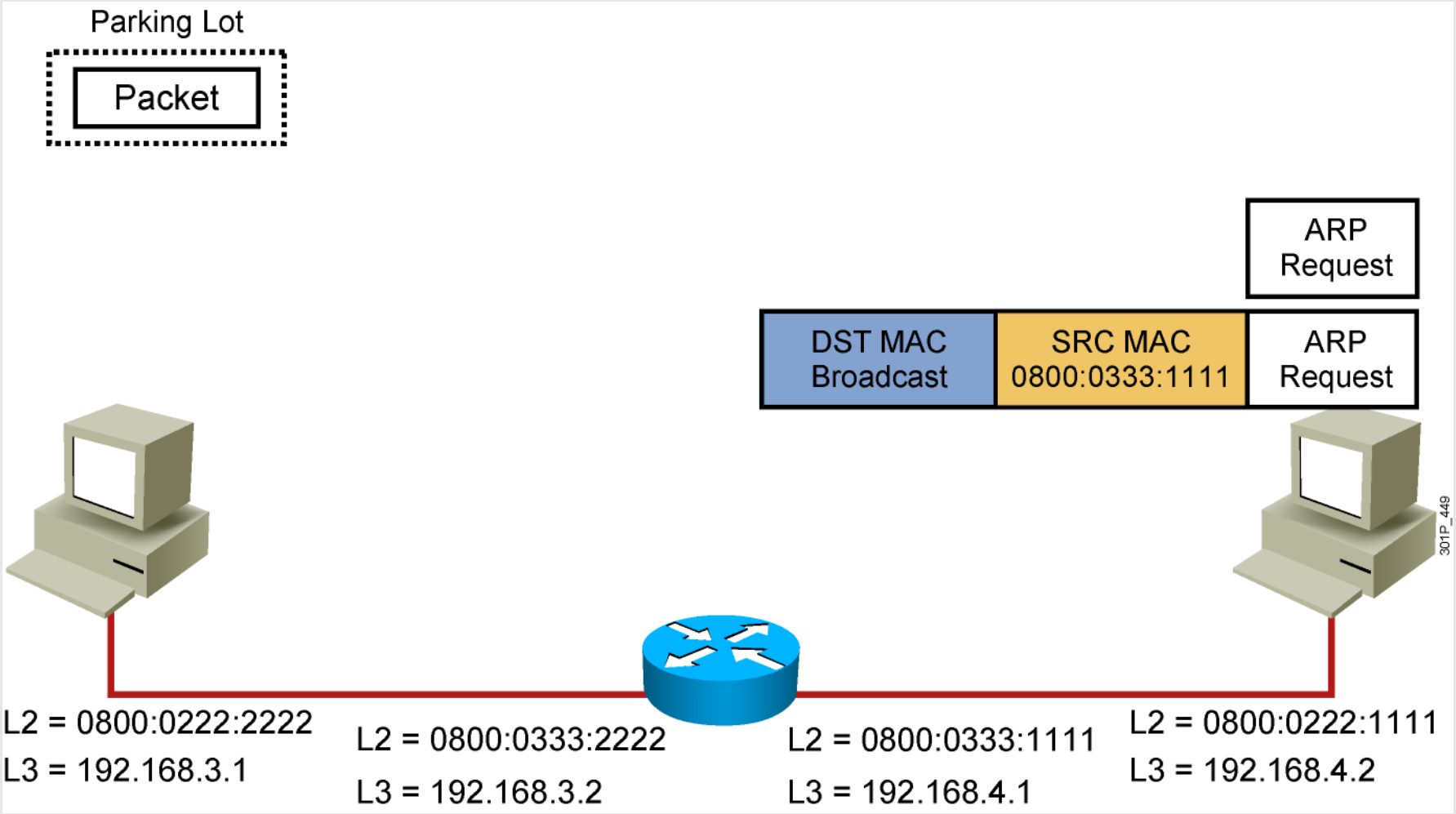
Host-to-Host Packet Delivery (12 of 17)



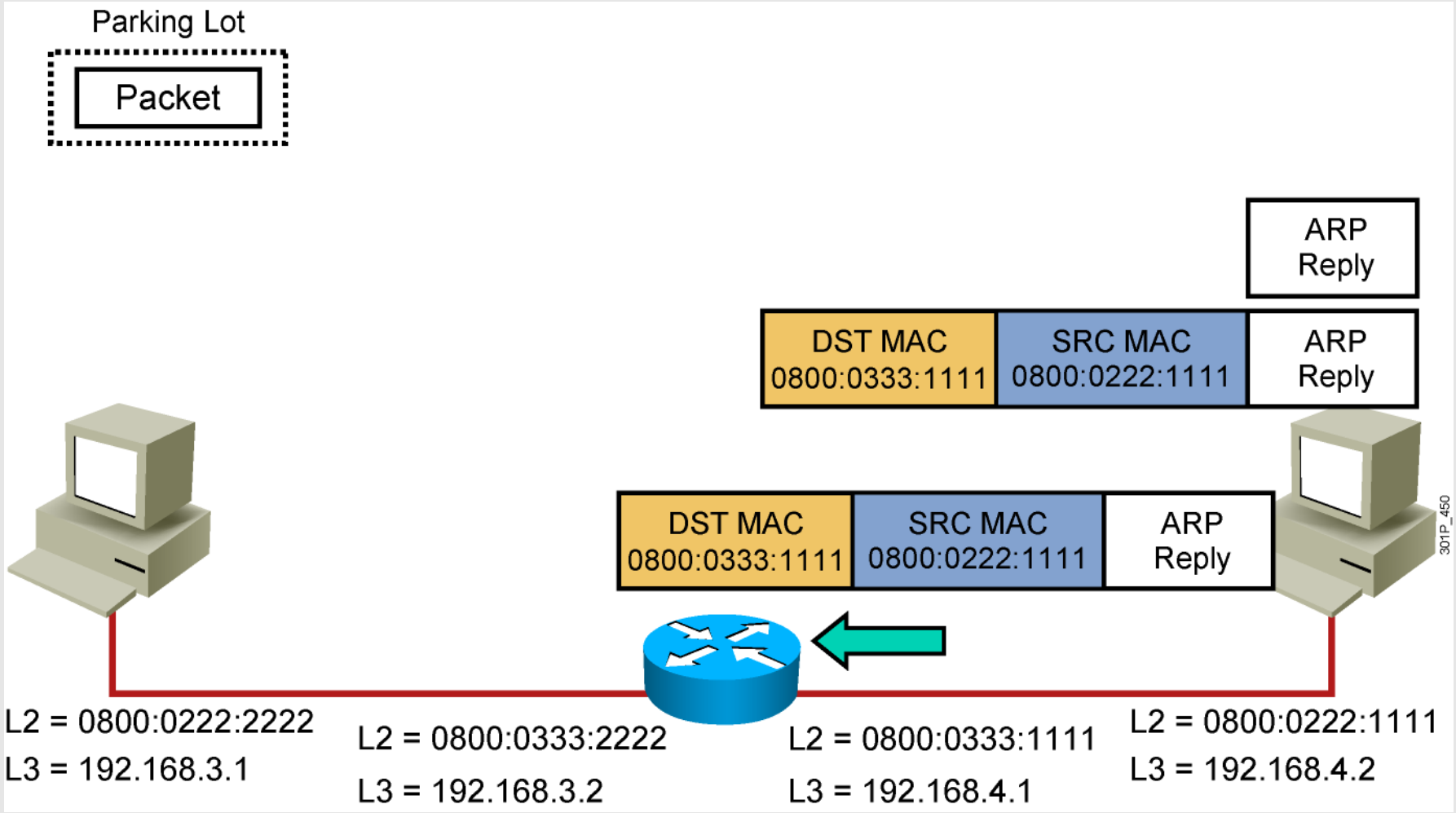
Host-to-Host Packet Delivery (13 of 17)



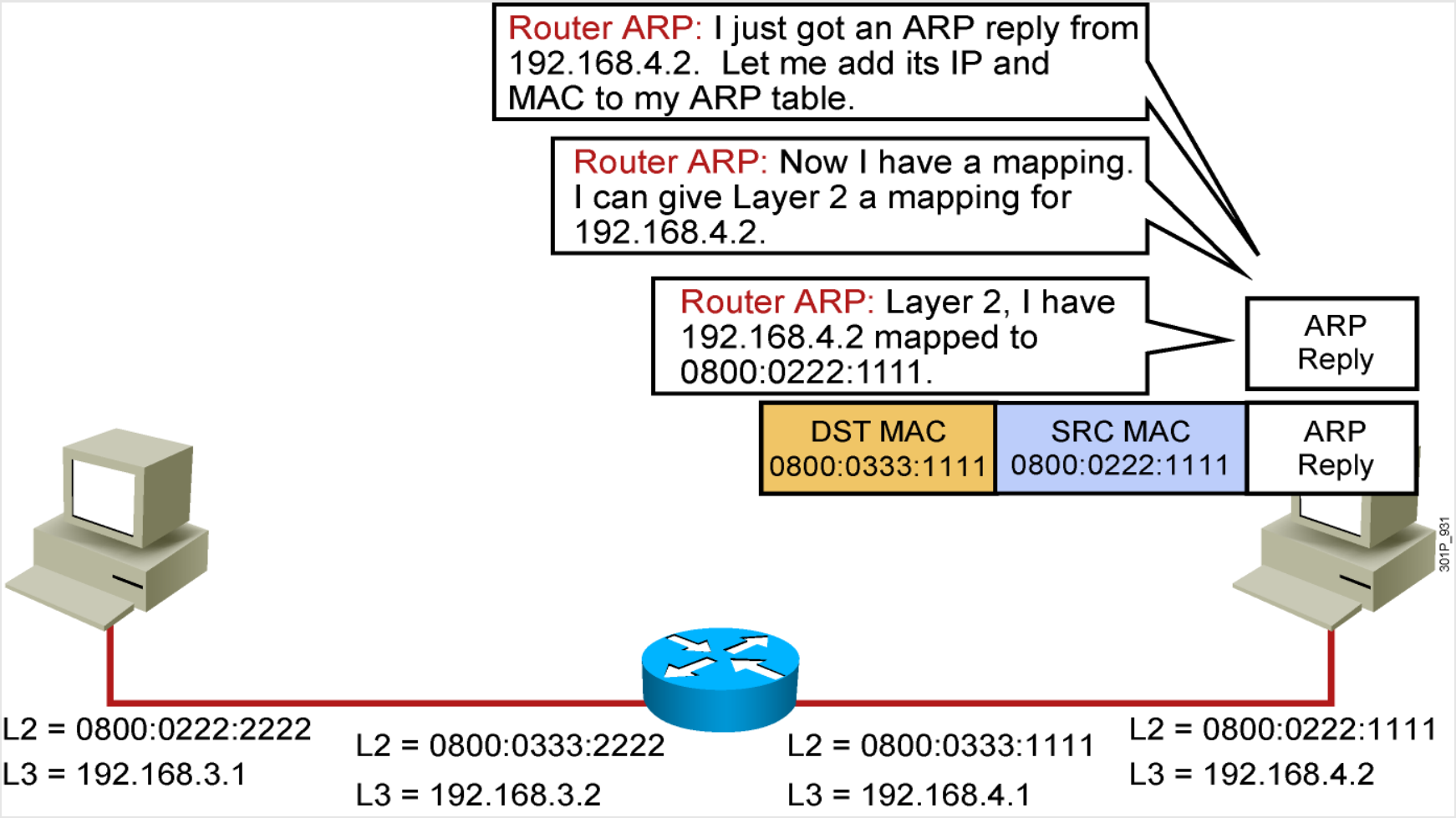
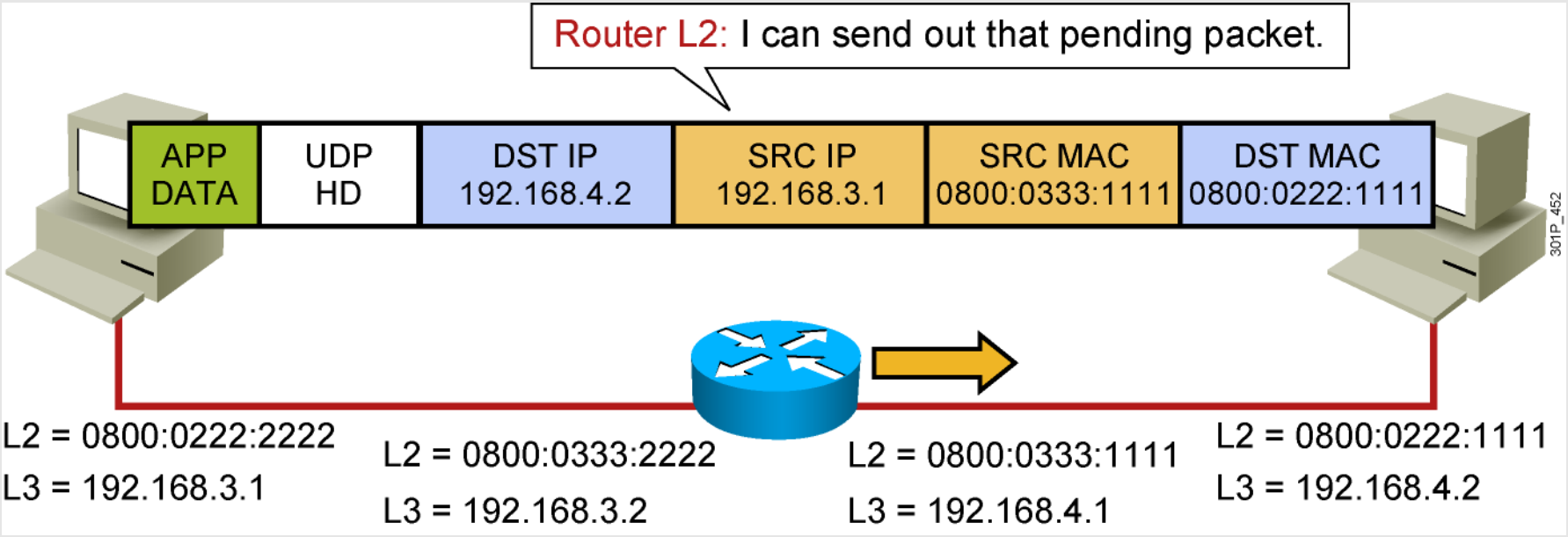
Host-to-Host Packet Delivery (14 of 17)



Host-to-Host Packet Delivery (15 of 17)



Host-to-Host Packet Delivery (16 of 17)



Host-to-Host Packet Delivery (17 of 17)