

EL5373

INTERNET ARCHITECTURE AND PROTOCOLS

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49/50

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Workstation: APAH Othello_I

MAC: f8:0f:41:c4:7f:aa

Lab Report 3

Due Oct 7, 2014

The default IP address of the router interface is 128.238.64.3
Gratuitous ARP sent by the router.

The image shows the Wireshark network protocol analyzer interface. The title bar indicates it is capturing from the 'eth0' interface on a 'Wireshark 1.10.6 (v1.10.6 from master-1.10)' system. The top toolbar contains various icons for file operations, packet list, packet details, packet bytes, and network statistics. Below the toolbar is a filter bar with a text input field and buttons for 'Expression...', 'Clear', 'Apply', and 'Save'. The main display area shows a list of 15 captured packets. The first packet is a standard query (0x0000 PTR ipps.tcp.local) from 128.238.63.7 to 224.0.0.251. The subsequent packets are ARP requests and replies, and CDP/VTP/DTP/PagP/UDLD messages. The packet list is color-coded: red for ARP and CDP/VTP/DTP/PagP/UDLD, and orange for Broadcast.

No.	Time	Source	Destination	Protocol	Length	Info
1	0.000000000	128.238.63.7	224.0.0.251	MDNS	87	Standard query 0x0000 PTR ipps.tcp.local
2	47.731192000	Cisco_bf:45:a1	Broadcast	ARP	60	Gratuitous ARP for 128.238.64.3 (Reply)
3	47.797752000	Cisco_bf:45:a1	Broadcast	ARP	60	Gratuitous ARP for 128.238.64.3 (Reply)
4	48.239534000	Cisco_bf:45:a1	CDP/VTP/DTP/PagP/UDLD	CDP	367	Device ID: router3 Port ID: FastEthernet0/1
5	48.590315000	Cisco_bf:45:a1	Broadcast	ARP	60	Gratuitous ARP for 128.238.64.3 (Reply)
6	49.239815000	Cisco_bf:45:a1	CDP/VTP/DTP/PagP/UDLD	CDP	367	Device ID: router3 Port ID: FastEthernet0/1
7	50.241486000	Cisco_bf:45:a1	CDP/VTP/DTP/PagP/UDLD	CDP	367	Device ID: router3 Port ID: FastEthernet0/1
8	54.351201000	Cisco_bf:45:a1	Cisco_bf:45:a1	LOOP	60	Reply
9	64.351825000	Cisco_bf:45:a1	Cisco_bf:45:a1	LOOP	60	Reply
10	213.224925000	Cisco_bf:45:a1	Broadcast	ARP	60	Gratuitous ARP for 128.238.64.3 (Reply)
11	213.291487000	Cisco_bf:45:a1	Broadcast	ARP	60	Gratuitous ARP for 128.238.64.3 (Reply)
12	213.732903000	Cisco_bf:45:a1	CDP/VTP/DTP/PagP/UDLD	CDP	367	Device ID: router3 Port ID: FastEthernet0/1
13	214.083692000	Cisco_bf:45:a1	Broadcast	ARP	60	Gratuitous ARP for 128.238.64.3 (Reply)
14	214.733327000	Cisco_bf:45:a1	CDP/VTP/DTP/PagP/UDLD	CDP	367	Device ID: router3 Port ID: FastEthernet0/1
15	215.735925000	Cisco_bf:45:a1	CDP/VTP/DTP/PagP/UDLD	CDP	367	Device ID: router3 Port ID: FastEthernet0/1

▼ Frame 11: 60 bytes on wire (480 bits), 60 bytes captured (480 bits) on interface 0

```
Interface id: 0
Encapsulation type: Ethernet (1)
Arrival Time: Sep 30, 2014 18:51:28.755452000 EDT
[Time shift for this packet: 0.000000000 seconds]
Epoch Time: 1412117488.755452000 seconds
[Time delta from previous captured frame: 0.066562000 seconds]
[Time delta from previous displayed frame: 0.066562000 seconds]
[Time since reference or first frame: 213.291487000 seconds]
Frame Number: 11
Frame Length: 60 bytes (480 bits)
Capture Length: 60 bytes (480 bits)
[Frame is marked: False]
[Frame is ignored: False]
[Protocols in frame: eth:arp]
[Coloring Rule Name: ARP]
[Coloring Rule String: arp]
```

```
▼ Ethernet II, Src: Cisco bf:45:a1 (00:05:9b:bf:45:a1), Dst: Broadcast (ff:ff:ff:ff:ff:ff)
```

```
Destination: Broadcast (ff:ff:ff:ff:ff:ff)
```

```
Source: Cisco bf:45:a1 (00:05:9b:bf:45:a1)
```

Type: ARP (0x0806)

```
Padding: 8080808080808080808080808080808080808080
```

▼ Address Resolution Protocol (reply/gratuitous ARP)

Hardware type: Ethernet (1)

Protocol type: IP (0x0800)

Hardware size: 6

Protocol size: 4

```
Opcode: reply (2)
[Is gratuitous: True]
```

```
Sender MAC address: Cisco bf:45:a1 (00:05:9b:bf:45:a1)
```

Sender IP address: 128.238.64.3 (128.238.64.3)

Target MAC address: Broadcast (ff:ff:ff:ff:ff:ff)

Target IP address: 128.238.64.3 (128.238.64.3)

Exercise 2

Change the IP address of my workstation to be the same subnet as the router 3 and telnet the router 3 (default ip address 128.238.63.4).

Show Version

Version 12.3(20) Release Software (fc2)

```
guest@othello1: ~  
% Invalid input detected at '^' marker.  
  
router3>show version  
Cisco Internetwork Operating System Software  
IOS (tm) C2600 Software (C2600-I-M), Version 12.3(20), RELEASE SOFTWARE (fc2)  
Technical Support: http://www.cisco.com/techsupport  
Copyright (c) 1986-2006 by cisco Systems, Inc.  
Compiled Tue 08-Aug-06 20:50 by kesnyder  
Image text-base: 0x80008098, data-base: 0x80CE7FC4  
  
ROM: System Bootstrap, Version 12.1(3r)T2, RELEASE SOFTWARE (fc1)  
ROM: C2600 Software (C2600-I-M), Version 12.3(20), RELEASE SOFTWARE (fc2)  
  
router3 uptime is 23 minutes  
System returned to ROM by power-on  
System image file is "flash:c2600-i-mz.123-20.bin"  
  
cisco 2651 (MPC860P) processor (revision 0x200) with 61440K/4096K bytes of memory.  
Processor board ID JAB05240A08 (2969173941)  
M860 processor: part number 5, mask 2  
Bridging software.  
X.25 software, Version 3.0.0.  
2 FastEthernet/IEEE 802.3 interface(s)
```

Exercise 3

In order to finish this part, we change router interface IP address as Figure 3.7.

Router 3	eth0 (123.238.63.3)	eth1 (128.238.63.4)
Host	Partner(eth0) (128.238.63.100)	Me(eth1) (128.238.63.115)

What are the IP and MAC addresses of a packet that went from your machine to the bridge?

IP 128.238.63.100 MAC f8:0f:41:c4:7f:a8

What are the IP and MAC addresses of a packet that went from the router to your partner's machine?

IP 128.238.63.100 MAC f8:0f:41:c4:7f:a8

What are the IP and MAC addresses of a packet that went from partner's machine to the bridge?

IP 128.238.63.115 MAC f8:0f:41:c4:7f:aa

What are the IP and MAC addresses of a packet that went from the router to your machine?

IP 128.238.63.115 MAC f8:0f:41:c4:7f:aa

Using the tcpdump outputs from both machines, calculate the average delay that a packet experienced in the bridge.

For this question, we can capture some completed ICMP request/reply to calculate the delay. When I ping my partner, my machine sends ICMP request, and then partner's machine receive the request, send ICMP reply to my machine. So we can calculate round trip delay from tcpdump output.

368	511.07312406	128.238.63.115	128.238.63.100	ICMP	42 Echo (ping) request	id=0x1be7, seq=2/512, ttl=64 (reply in 369)
369	511.07435406	128.238.63.100	128.238.63.115	ICMP	60 Echo (ping) reply	id=0x1be7, seq=2/512, ttl=64 (request in 368)
370	512.07446306	128.238.63.115	128.238.63.100	ICMP	42 Echo (ping) request	id=0x1be7, seq=3/768, ttl=64 (reply in 371)
371	512.07570706	128.238.63.100	128.238.63.115	ICMP	60 Echo (ping) reply	id=0x1be7, seq=3/768, ttl=64 (request in 370)
372	512.57492506	Cisco_bf:45:a1	Spanning-tree-(for-br)STP		60 Conf. Root = 32768/0/00:05:9b:bf:45:a6 Cost = 6 Port = 0x8003	
373	512.96896906	Cisco_bf:45:a1	CDP/VTP/DTP/PAGP/UDLD	CDP	376 Device ID: router3 Port ID: FastEthernet0/1	
374	513.07587906	128.238.63.115	128.238.63.100	ICMP	42 Echo (ping) request	id=0x1be7, seq=4/1024, ttl=64 (reply in 375)
375	513.07719506	128.238.63.100	128.238.63.115	ICMP	60 Echo (ping) reply	id=0x1be7, seq=4/1024, ttl=64 (request in 374)
376	514.07668306	128.238.63.115	128.238.63.100	ICMP	42 Echo (ping) request	id=0x1be7, seq=5/1280, ttl=64
377	514.07792306	128.238.63.100	128.238.63.115	ICMP	60 Echo (ping) reply	id=0x1be7, seq=5/1280, ttl=64 (request in 376)

When I ping my partner, from these 4 complete ICMP process, we have 4 round trip delay time, **0.001316, 0.00123, 0.00124, 0.00124 seconds.**

So the average transmission delay in bridge is half round trip delay, **0.000628 (6.28E-4) seconds.**

Capturing from eth0 [Wireshark 1.10.6 (v1.10.6 from master-1.10)]

Filter: Expression... Clear Apply Save

No.	Time	Source	Destination	Protocol	Length	Info
1	0.000000000	Cisco bf:45:a1	Spanning-tree-(for-bri STP	60	Conf. Root = 32768/0/00:05:9b:bf:45:a0 Cost = 0 Port = 0x8003	
2	2.003370000	Cisco bf:45:a1	Spanning-tree-(for-bri STP	60	Conf. Root = 32768/0/00:05:9b:bf:45:a0 Cost = 0 Port = 0x8003	
3	4.006673000	Cisco bf:45:a1	Spanning-tree-(for-bri STP	60	Conf. Root = 32768/0/00:05:9b:bf:45:a0 Cost = 0 Port = 0x8003	
4	6.009991000	Cisco bf:45:a1	Spanning-tree-(for-bri STP	60	Conf. Root = 32768/0/00:05:9b:bf:45:a0 Cost = 0 Port = 0x8003	
5	7.047592000	Cisco bf:45:a1	Cisco bf:45:a1	LOOP	60	Reply
6	8.013372000	Cisco bf:45:a1	Spanning-tree-(for-bri STP	60	Conf. Root = 32768/0/00:05:9b:bf:45:a0 Cost = 0 Port = 0x8003	
7	10.016631000	Cisco bf:45:a1	Spanning-tree-(for-bri STP	60	Conf. Root = 32768/0/00:05:9b:bf:45:a0 Cost = 0 Port = 0x8003	
8	12.019965000	Cisco bf:45:a1	Spanning-tree-(for-bri STP	60	Conf. Root = 32768/0/00:05:9b:bf:45:a0 Cost = 0 Port = 0x8003	
9	14.019332000	Cisco bf:45:a1	Spanning-tree-(for-bri STP	60	Conf. Root = 32768/0/00:05:9b:bf:45:a0 Cost = 0 Port = 0x8003	
10	16.022673000	Cisco bf:45:a1	Spanning-tree-(for-bri STP	60	Conf. Root = 32768/0/00:05:9b:bf:45:a0 Cost = 0 Port = 0x8003	
11	17.048231000	Cisco bf:45:a1	Cisco bf:45:a1	LOOP	60	Reply
12	17.285540000	WistronI c4:7f:a8	Broadcast	ARP	60	Who has 128.238.63.115? Tell 128.238.63.100
13	17.285563000	WistronI c4:7f:aa	WistronI c4:7f:a8	ARP	42	128.238.63.115 is at f8:0f:41:c4:7f:aa
14	17.287345000	128.238.63.100	128.238.63.115	ICMP	98	Echo (ping) request id=0x13d7, seq=1/256, ttl=64 (reply in 15)
15	17.287381000	128.238.63.115	128.238.63.100	ICMP	98	Echo (ping) reply id=0x13d7, seq=1/256, ttl=64 (request in 14)
16	18.026005000	Cisco bf:45:a1	Spanning-tree-(for-bri STP	60	Conf. Root = 32768/0/00:05:9b:bf:45:a0 Cost = 0 Port = 0x8003	
17	18.206992000	128.238.63.100	128.238.63.115	ICMP	98	Echo (ping) request id=0x13d7, seq=2/512, ttl=64 (reply in 18)
18	18.207040000	128.238.63.115	128.238.63.100	ICMP	98	Echo (ping) reply id=0x13d7, seq=2/512, ttl=64 (request in 17)
19	19.208761000	128.238.63.100	128.238.63.115	ICMP	98	Echo (ping) request id=0x13d7, seq=3/768, ttl=64 (reply in 20)
20	19.208810000	128.238.63.115	128.238.63.100	ICMP	98	Echo (ping) reply id=0x13d7, seq=3/768, ttl=64 (request in 19)
21	20.029347000	Cisco bf:45:a1	Spanning-tree-(for-bri STP	60	Conf. Root = 32768/0/00:05:9b:bf:45:a0 Cost = 0 Port = 0x8003	
22	20.290022000	128.238.63.100	128.238.63.115	ICMP	98	Echo (ping) request id=0x13d7, seq=4/1024, ttl=64 (reply in 23)
23	20.290079000	128.238.63.115	128.238.63.100	ICMP	98	Echo (ping) reply id=0x13d7, seq=4/1024, ttl=64 (request in 22)
24	21.291715000	128.238.63.100	128.238.63.115	ICMP	98	Echo (ping) request id=0x13d7, seq=5/1280, ttl=64 (reply in 25)
25	21.291764000	128.238.63.115	128.238.63.100	ICMP	98	Echo (ping) reply id=0x13d7, seq=5/1280, ttl=64 (request in 24)

Frame 1: 60 bytes on wire (480 bits), 60 bytes captured (480 bits) on interface 0

IEEE 802.3 Ethernet

Logical-Link Control

Spanning Tree Protocol

Exercise 4

A bridge sends its BPDUs every 2 seconds.

*Priority level always :32768

<p>Othello_1</p> <p>Root ID: 00:05:9b:bf:45:a0</p> <p>Root path cost: 0</p> <p>Bridge ID: 00:05:9b:bf:45:a0</p> <p>Port ID: 0x8003</p>	<p>Desdemona_1</p> <p>Root ID: 00:05:9b:bf:45:a0</p> <p>Root path cost: 0</p> <p>Bridge ID: 00:05:9b:bf:45:a0</p> <p>Port ID: 0x8002</p>
<p>Katherina_1</p> <p>Root ID: 00:05:9b:bf:4a:80</p> <p>Root path cost: 0</p> <p>Bridge ID: 00:05:9b:bf:4a:80</p> <p>Port ID: 0x8003</p>	<p>Petruchio_1</p> <p>Root ID: 00:05:9b:bf:4a:80</p> <p>Root path cost: 0</p> <p>Bridge ID: 00:05:9b:bf:4a:80</p> <p>Port ID: 0x8004</p>
<p>Romeo_1</p> <p>Root ID: 00:09:e8:d9:93:60</p> <p>Root path cost: 0</p> <p>Bridge ID: 00:09:e8:d9:93:60</p> <p>Port ID: 0x8004</p>	<p>Juliet_1</p> <p>Root ID: 00:09:e8:d9:93:60</p> <p>Root path cost: 0</p> <p>Bridge ID: 00:09:e8:d9:93:60</p> <p>Port ID: 0x8003</p>
<p>Ophelia_1</p> <p>Root ID: 00:05:9b:bf:44:80</p> <p>Root path cost: 0</p> <p>Bridge ID: 00:05:9b:bf:44:80</p>	<p>Hamlet_1</p> <p>Root ID: 00:05:9b:bf:44:80</p> <p>Root path cost: 0</p> <p>Bridge ID: 00:05:9b:bf:44:80</p>

Port ID: 0x8003

Port ID: 0x8004

Exercise 5

Form show bridge

Bridge 4 eth1 is blocked.

Bridge 3 eth0 and **Bridge 1 eth1** are in forwarding state to each bridge.

Bridge 1

```
guest@othello1: ~
User Access Verification

Password:
router1>enable
Password:
router1#show bridge

Total of 300 station blocks, 290 free
Codes: P - permanent, S - self

Bridge Group 1:

  Address      Action  Interface    Age    RX count  TX count
f80f.41c3.8683 forward FastEthernet0/0 0        1         0
f80f.41c4.8091 forward FastEthernet0/1 1         35         0
f80f.41c4.7c38 forward FastEthernet0/1 0        396        394
f80f.41c4.c8b6 forward FastEthernet0/1 2        241        304
f80f.41c3.880d forward FastEthernet0/1 0         5         0
0005.9bbf.4480 forward FastEthernet0/1 0         86         17
0005.9bbf.4a80 forward FastEthernet0/1 0         91         0
0005.9bbf.4a81 forward FastEthernet0/0 0        790        550
f80f.41c4.7faa forward FastEthernet0/1 4         3         0
0005.9bbf.45a0 forward FastEthernet0/1 1        161         0
router1#
```

Bridge 2

```
guest@othello1: ~
User Access Verification

Password:
router2>enable
Password:
router2#show bridge

Total of 300 station blocks, 290 free
Codes: P - permanent, S - self

Bridge Group 1:

  Address      Action  Interface    Age    RX count  TX count
f80f.41c4.8091 forward FastEthernet0/0 1         38         0
f80f.41c4.7c38 forward FastEthernet0/1 1        400        389
f80f.41c4.c8b6 forward FastEthernet0/1 1        245        304
f80f.41c3.880d forward FastEthernet0/0 2        115         0
0005.9bbf.4a80 forward FastEthernet0/1 0        116         0
0005.9bbf.4a81 forward FastEthernet0/0 0        785        550
f80f.41c4.7faa forward FastEthernet0/1 0         33         0
f80f.41c4.7fa8 forward FastEthernet0/1 0         60         28
0005.9bbf.45a0 forward FastEthernet0/1 0        267         0
0009.e8d9.9361 forward FastEthernet0/0 0         34         32
router2#
```

Bridge 3

```
guest@othello1: ~  
0005.9bbf.4a80 forward FastEthernet0/1 0 121 20  
0005.9bbf.4a81 forward FastEthernet0/0 0 494 550  
f80f.41c4.7faa forward FastEthernet0/0 0 57 0  
f80f.41c4.7fa8 forward FastEthernet0/0 0 56 20  
0009.e8d9.9361 forward FastEthernet0/0 2 5 0  
router3#show bridge  
  
Total of 300 station blocks, 290 free  
Codes: P - permanent, S - self  
  
Bridge Group 1:  


| Address        | Action  | Interface       | Age | RX count | TX count |
|----------------|---------|-----------------|-----|----------|----------|
| f80f.41c4.8091 | forward | FastEthernet0/0 | 0   | 37       | 0        |
| f80f.41c4.7c38 | forward | FastEthernet0/1 | 0   | 400      | 214      |
| f80f.41c4.c8b6 | forward | FastEthernet0/1 | 0   | 273      | 204      |
| f80f.41c3.880d | forward | FastEthernet0/0 | 2   | 113      | 0        |
| 0005.9bbf.4481 | forward | FastEthernet0/0 | 0   | 86       | 0        |
| 0005.9bbf.4a80 | forward | FastEthernet0/1 | 0   | 122      | 20       |
| 0005.9bbf.4a81 | forward | FastEthernet0/0 | 0   | 495      | 550      |
| f80f.41c4.7faa | forward | FastEthernet0/0 | 0   | 57       | 0        |
| f80f.41c4.7fa8 | forward | FastEthernet0/0 | 0   | 56       | 20       |
| 0009.e8d9.9361 | forward | FastEthernet0/0 | 2   | 5        | 0        |

  
router3#
```

Bridge 4

```
guest@othello1: ~  
Trying 128.238.61.40...  
Connected to 128.238.61.40.  
Escape character is '^]'.  
  
User Access Verification  
  
Password:  
router4>enable  
Password:  
router4#show bridge  
  
Total of 300 station blocks, 295 free  
Codes: P - permanent, S - self  
  
Bridge Group 1:  


| Address        | Action  | Interface       | Age | RX count | TX count |
|----------------|---------|-----------------|-----|----------|----------|
| f80f.41c4.8091 | forward | FastEthernet0/0 | 0   | 1        | 0        |
| f80f.41c4.7c38 | forward | FastEthernet0/0 | 0   | 1        | 0        |
| f80f.41c4.c8b6 | forward | FastEthernet0/0 | 0   | 1        | 0        |
| f80f.41c3.880d | forward | FastEthernet0/0 | 0   | 1        | 0        |
| 0005.9bbf.4a81 | forward | FastEthernet0/0 | 0   | 20       | 0        |

  
router4#
```

Exercise 6

Final BPDU Messages collected

*Priority level always :32768

Bridge 1 Root ID: 00:05:9b:bf:44:80 Root path cost: 100 Bridge ID: 00:09:e8:d9:93:60 Port ID: 0x8003	Bridge 2 Root ID: 00:05:9b:bf:44:80 Root path cost: 0 Bridge ID: 00:05:9b:bf:44:80 Port ID: 0x8003
Bridge 3 Root ID: 00:05:9b:bf:44:80 Root path cost: 100 Bridge ID: 00:05:9b:bf:45:a0 Port ID: 0x8003	Bridge 4 Root ID: 00:05:9b:bf:44:80 Root path cost: 200 Bridge ID: 00:05:9b:Bf:4a:80 Port ID: 0x8003

