This submission template is a convenient document for you to provide your work and your answers for Assignment 6. This submission template is intended to be used in conjunction with the Assignment 6 Instructions document. The instructions document illustrates how to correctly derive the answers, explains important theoretical and practical details, and contains the complete set of instructions for this lab.

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Date:

2019/12/9

**Section One – Foundational Routing Concepts**

If you choose to perform portions of the assignment in different sittings, it is important to *commit* your data at the end of each session. This way, you will be sure to make permanent any data changes you have made in your curent session, so that you can resume working without issue in your next session. To do so, simply issue this command:

COMMIT;

We will learn more about committing data in future weeks. For now, it is sufficient to know that data changes in one session will only be visible in that session, unless they are committed, which makes the changes permanent in the database.

**SAVING YOUR DATA**

**Scenario 1**

1. Identify which adapter(s) would receive a data-link layer broadcast transmitted by Computer B and which would not (if any). Provide an explanation of why *each adapter present in the preceding figure* would or would not receive the broadcast.

Computer A and Computer B are configured on adjacent network. If Computer B transmits a data-link layer broadcast, network adapter B and network adapter R2 will receive the data-link layer broadcast address, because they are present in the same broadcast domain as Computer B. While network adapter R1 and network adapter A are lying in the different broadcast domain and they are part of different network also.

2. Can Computer B directly address Computer A at the data-link layer? Explain why or why not.

As computer B and computer A are on the different networks, so computer B can’t directly address computer A at the data-link layer. Computer B would forward the data-link layer frame to the router’s network adapter R2 which is connected with network B. And the router creates a new data-link layer frame with the destination host’s MAC address as the destination address.

3. Imagine that Computer B successfully transmits an IPv4 packet to Computer A, that there are no errors on any frame or packet, and that the ARP cache on all computers and the router is already fully populated. Identify any data-link layer frame(s) that are created for this transmission. For each frame, identify the adapter it originates from and the adapter it is addressed to, explain why it was created, and provide its source and destination MAC address and source and destination IPv4 address.

First frame: created by Computer B which is destined for the router. Because Computer B wants to transmit a packet to Computer A, but computer B doesn’t have the MAC address of computer A. So it create a ARP to request the address, and the ARP can only broadcast in the network B. And the router receives the ARP request, it responds with the network adapter R2’s MAC address. So computer B can send the IPv4 packet to the router. Destination MAC address: FA-AF-93-28-7C-31, source MAC address: C4-04-32-81-A2-98; Destination IPv4 address: 90.118.32.132/24, source IPv4 address: 15.152.13.98/25

Second frame: created by router which is destined for the computer A. Router receives the packet that we talk above, and it removes the data-link header and check the destination IPv4 address. And create a new frame with the packet, but change the destination MAC address with the MAC address of the computer A. Destination MAC address: 3C-22-39-A1-1A-32, source MAC address: 93-0B-05-B4-2E-59; destination IPv4 address: 90.118.32.132/24, source IPv4 address: 15.152.13.98/25

4. What function does the router serve for the transmission in #3?

The router plays a role as route the right way from computer B to computer A. First, the computer B doesn’t have the MAC address of the computer A, so it needs to send the frame which encapsulate the IPv4 packet to the router. Then the router opens the frame and check the destination IPv4 address. And it found the destination, then create a new frame which destination MAC address is the computer A’s MAC address.

**Scenario 2**

5. Imagine that Computer C successfully sends an IPv4 packet to Computer A, that there are no errors on any frame or packet during the transmission, and that the ARP cache on all computers and routers has been fully populated before the packet is sent. Identify any data-link layer frame(s) that are created in this scenario. For each frame, identify the adapter it originates from and the adapter it is addressed to, explain why it was created, and provide its source and destination MAC address and source and destination IPv4 address.

1. First frame: from network adapter C to network adapter BC2(computer C-> router BC). When the computer C wants to send an IPv4 packet to computer A, it creates a frame encapsulates the packet. And it heads to network adapter BC2 of router BC which connect to network C.

* Source MAC address: 12-34-01-9A-FF-FE
* Destination MAC address: 9B-D1-82-13-AB-CD
* Source IPv4 address: 210.99.45.137/24
* Destination IPv4 address: 43.19.238.195/22

1. Second frame: from network adapter BC1 to network adapter AB2 (router BC-> router AB). Router BC receive the frame and remove the data-link header and open the IPv4 packet to check the destination IPv4 address. And use the address to find out the packet should be sent to the router AB using adapter BC1. Then it encapsulates the IPv4 packet into a new frame with the destination MAC address of the network adapter AB2 of router AB.

* Source MAC address: 47-E2-FE-77-11-23
* Destination MAC address: DD-01-23-45-9A-BC
* Source IPv4 address: 210.99.45.137/24
* Destination IPv4 address: 43.19.238.195/22

1. Third frame: from network adapter AB1 to network adapter A (router AB -> computer A). Router AB receive the frame and remove the data-link header and open the IPv4 packet to check the destination IPv4 address. And use the address to find out the packet should be sent to the computer A using adapter A. Then it encapsulates the IPv4 packet into a new frame with the destination MAC address of the computer A. And send it to computer A through network adapter AB1.

* Source MAC address: 94-59-4B-88-00-01
* Destination MAC address: 23-9E-77-10-09-4C
* Source IPv4 address: 210.99.45.137/24
* Destination IPv4 address: 43.19.238.195/22

6. Across all frames in the transmission in #5, contrast the number of different destination IP addresses with the number of different MAC addresses. Why are these numbers different, and what does this tell us about the routing process?

All of the IP addresses are same, but all three MAC addresses are different. Because the IP address is the address of the final destination, but the MAC address is the address of each step. About the routing process, it use the MAC address to set the route to the next router and the router check the IP address to set the route traffic.

**Section Two - Routing Tables**

If you choose to perform portions of the assignment in different sittings, it is important to *commit* your data at the end of each session. This way, you will be sure to make permanent any data changes you have made in your curent session, so that you can resume working without issue in your next session. To do so, simply issue this command:

COMMIT;

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**SAVING YOUR DATA**

**Scenario 3**

7. To get started, calculate the network address and subnet mask of all three networks in this scenario. You will need these values to create rules for the computer’s routing table.

1. Network A:

* Network address: 43.19.236.0
* Subnet mask: 255.255.252.0

1. Network B:

* Network address: 19.107.16.0
* Subnet mask: 255.255.254.0

1. Network C:
   * Network address: 210.99.45.0
   * Subnet mask: 255.255.255.0

8. Create a routing table for Computer C that has no default route, and that supports sending packets to all hosts (directly or indirectly) on Network A, Network B, and Network C. A hint is that this routing table will contain three rules.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Network Destination | Netmask | Gateway | Interface | Metric |
| 210.99.45.0 | 255.255.255.0 | 210.99.45.137 or “on-link” | Adapter C | 10 |
| 19.107.16.0 | 255.255.254.0 | 210.99.45.1 | Adapter C | 20 |
| 43.19.236.0 | 255.255.252.0 | 210.99.45.1 | Adapter C | 30 |

9. Create a routing table for Computer C that has a default route, and that supports sending packets to all hosts (directly or indirectly) on Network A, Network B, and Network C. Make sure to remove redundant routes that are not necessary with the presence of a default route.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Network Destination | Netmask | Gateway | Interface | Metric |
| 0.0.0.0 | 0.0.0.0 | 210.99.45.1 | Adapter C | 10 |
| 210.99.45.0 | 255.255.255.0 | 210.99.45.137 or “on-link” | Adapter C | 10 |

10. Would you recommend using the routing table in #8 or in #9, for Computer C? Explain why.

11. Create a routing table for Router AB which has no default route, which supports communications to all hosts (directly or indirectly) on Network A, Network B, and Network C. A hint is that this routing table will contain three rules.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Network Destination | Netmask | Gateway | Interface | Metric |
| 43.19.236.0 | 255.255.252.0 | 43.19.238.4 or “on-link” | Adapter AB1 | 10 |
| 19.107.16.0 | 255.255.254.0 | 19.107.16.120 or “on-link” | Adapter AB2 | 10 |
| 210.99.45.0 | 255.255.255.0 | 19.107.16.220 | Adapter AB2 | 20 |

Your assignment will be evaluated according to the following rubric.

|  |  |  |  |
| --- | --- | --- | --- |
|  | **Grade** | **Qualities Demonstrated by the Assignment Submission** | **Grade Assigned** |
| **Content (70%)**  **Measures the quality of the content in the assignment** | A+ 🡺 100 | The content demonstrates exceptional understanding of all relevant subject matter and its inter-relationships. All major relevant issues are thoroughly covered, and all content is very focused and on-topic. There is no known way to improve the content, and there are absolutely no technical or coverage errors present. |  |
| A 🡺 96 | The content demonstrates exceptional understanding of all relevant subject matter and its inter-relationships. All major relevant issues are thoroughly covered, and all content is very focused and on-topic. At most one insignificant technical or coverage error may be present |
| A- 🡺 92 | The content demonstrates deep understanding of all relevant subject matter and its inter-relationships. All major relevant issues are covered, and all content is on-topic. |
| B+ 🡺 88 | The content demonstrates understanding of all relevant subject matter and its inter-relationships. Almost all major relevant issues are covered, and the content is at least reasonably on-topic. |
| B 🡺 85 | The content demonstrates understanding of most relevant subject matter and its inter-relationships. Almost all major relevant issues are covered, and all content is at least reasonably on-topic. |
| B- 🡺 82 | The content demonstrates moderate understanding of much relevant subject matter and its inter-relationships. There is reasonable coverage of major relevant issues, and the content is at least reasonably on-topic. |
| C+ 🡺 78 | The content demonstrates some understanding of relevant subject matter and its inter-relationships. Some major relevant issues are covered, and at least some content is on-topic. |
| C 🡺 75 | The content demonstrates understanding of a small portion of the relevant subject matter and its inter-relationships. Some major relevant issues are covered, and at least a small portion of the content is on-topic. |
| C- 🡺 72 | The content demonstrates little understanding of and insight into the relevant subject matter and its inter-relationships. A small portion of the major relevant issues are covered. The focus of the content may be off topic or on insubstantial or secondary topics |
| D 🡺 67 | The content demonstrates almost no understanding of or insight into the relevant subject matter and its inter-relationships. Almost none of the major relevant issues are covered, and the content may be almost entirely off-topic. |
| F 🡺 0 | The content demonstrates no understanding of or insight into the relevant subject matter and its inter-relationships. No major relevant issues are covered, and the content is entirely off-topic. |
| **Exposition (30%)**  **Measures how well the content is expressed** | A+ 🡺 100 | The presentation of all ideas and designs is exceptionally clear and persuasive; the entire submission is exceptionally organized. There is no known way to improve the clarity or organization of the submission. |  |
| A 🡺 96 | The presentation of all ideas and designs is exceptionally clear and persuasive; the entire submission is exceptionally organized. There may be at most one insignificant way to improve the clarity or organization of the submission. |
| A- 🡺 92 | The presentation of all ideas and designs is very clear and persuasive; the entire submission is very organized. |
| B+ 🡺 88 | The presentation of all ideas and designs is clear and persuasive; the entire submission is organized. |
| B 🡺 85 | The presentation of most ideas and designs is clear and persuasive; most of the submission is organized. |
| B- 🡺 82 | The presentation of most ideas and designs is generally clear; most of the submission is reasonably organized. |
| C+ 🡺 78 | Some parts of the submission are hard to understand; some parts are disorganized. |
| C 🡺 75 | About half of the submission is hard to understand; about half is disorganized. |
| C- 🡺 72 | Most parts of the submission are hard to understand; most parts are disorganized. |
| D 🡺 67 | Almost all of the submission is hard to understand and disorganized. |
| F 🡺 0 | The entire submission is hard to understand and disorganized. |
| **Overall Assignment Grade:** | | | |

Use the **Ask the Teaching Team** discussion boardif you have any questions regarding how to approach this assignment.

Save your assignment as ***lastnameFirstname\_assignment6.doc*** and submit it in the *Assignments* section of the course.

For help uploading files please refer to the *Technical Support* page in the syllabus.