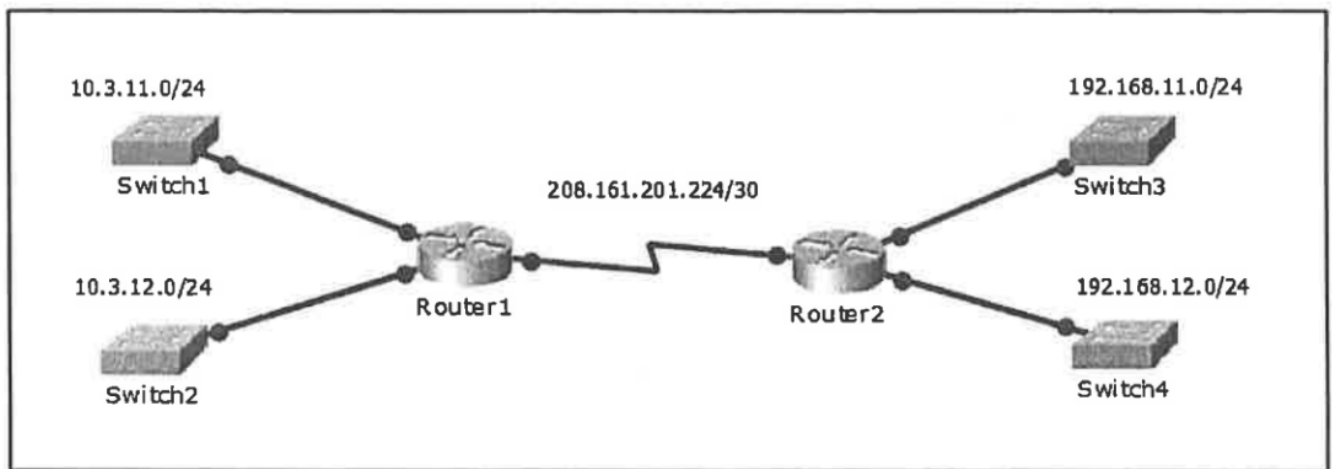


# FCN FYE Apr-19

January 28, 2020

## 1. Question 1

- (a) Examine FOUR (4) basic processes utilized in the network layer to accomplish end-to-end communication. (12 marks)
- Addressing.** Addresses packets with IP addresses of the destination. Configures end devices with unique IP address for identification on the network.
  - Encapsulation.** Receives a protocol data unit (PDU) from the transport layer. The network layer then adds IP header information, such as the IP address of source & destination hosts. The PDU now is called a packet.
  - Routing.** Routes the packet to the correct destination. Intermediary devices such as routers help to select paths and direct packets to destination host in a process known as routing.
  - Decapsulation.** When the packet arrives at the destination host, the host checks the IP header of the packet and verifies that it matches its own IP address. The host decapsulates packets and pass it to the upper layers for further interpretation at the destination end device.
- (b) Explain TWO (2) limitations of Internet Protocol version 4 (IPv4). (4 marks)
- Limited addressing space. IPv4 can only accomodate  $2^{32}$  addresses, which is not enough for all the devices available globally.
  - Lack of end-to-end connectivity. Due to IPv4 public address exhaustion, many devices share a single public IP address through NAT (network address translation). This causes issues for end-to-end connectivity as not all devices has a public IP address.
- (c) Router is a networking device that used to forward data packets between computer networks. Identify any TWO (2) types of memory found in a router and explain their roles. (4 marks)
- RAM. Store running OS, configuration files, routing, ARP tables, and packet buffer
  - Flash. Used to store OS, and system files.
- (d) Based on the diagram illustrated in Figure 1-1, locate the directly connected routes and remote routes for Router 2.



i.

|              | Directly-connected routes | Remote routes |
|--------------|---------------------------|---------------|
| ii. Router 2 | 208.161.201.224/30        | 10.3.11.0/24  |
|              | 192.168.11.0/24           | 10.3.12.0/24  |
|              | 192.168.12.0/24           |               |

## 2. Question 2

- (a) State THREE (3) types of Internet Protocol version 6 (IPv6) addresses. (3 marks)
- Unicast address
  - Multicast address
  - Loopback address

(b) By applying Rule 1 and Rule 2 of IPv6 addressing, rewrite the following IPv6 addresses:

- i. FE80 : 0000 : 0000: 0365 : 63AB : 0000 : 00CD : B201 (2 marks)
  - A. Rule 1 (Eliminate Leading Zeroes): FE80 : 0 : 0: 365 : 63AB : 0 : CD : B201
  - B. Rule 2 (Eliminate one all zero segment): **FE80 :: 365 : 63AB : 0 : CD : B201**
- ii. 2001: OBD9 : 0000 : 5893: 0000 : 0000: 0000 : 0500 (2 marks)
  - A. Rule 1 (Eliminate Leading Zeroes): 2001: OBD9 : 0 : 5893: 0 : 0: 0 : 500
  - B. Rule 2 (Eliminate one all zero segment): 2001: OBD9 : 0 : 5893:: 500

(c) Sunshine Hospital network is created by using Variable Length Subnet Mask (VLSM). The hospital needs 4 Local Area Networks (LANs): A&E Department 6 hosts, Billing Department 30 hosts, Clinical Ward 48 hosts, Reception Counter 16 hosts as well as 2 Wide Area Networks (WANs): Link #1, Link #2 to support their daily operations. This hospital will be using the class C address 192.168.38.0/24.

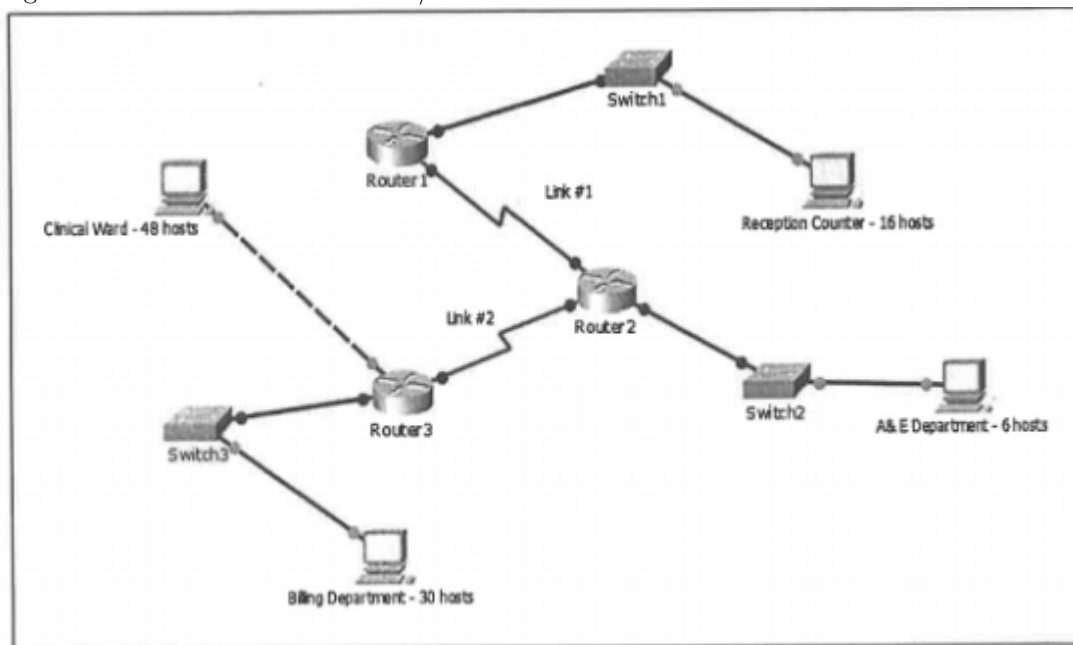


Figure 2-1: Sunshine Hospital Network

|    | Subnet Name        | Required Hosts | Subnet Address | Prefix length /? | First usable address | Last usable address | Broadcast address |
|----|--------------------|----------------|----------------|------------------|----------------------|---------------------|-------------------|
|    | Clinical Ward      | 48             | 192.168.38.0   | /26              | 192.168.38.1         | 192.168.38.62       | 192.168.38.63     |
|    | Billing Department | 30             | 192.168.38.64  | /27              | 192.168.38.65        | 192.168.38.94       | 192.168.38.95     |
| i. | Reception Counter  | 16             | 192.168.38.96  | /27              | 192.168.38.97        | 192.168.38.126      | 192.168.38.127    |
|    | A&E Department     | 6              | 192.168.38.128 | /29              | 192.168.38.129       | 192.168.38.134      | 192.168.38.135    |
|    | Link #1            | 2              | 192.168.38.136 | /30              | 192.168.38.137       | 192.168.38.138      | 192.168.38.139    |
|    | Link #2            | 2              | 192.168.38.140 | /30              | 192.168.38.141       | 192.168.38.142      | 192.168.38.143    |
|    |                    |                | 192.168.38.144 |                  |                      |                     |                   |

### 3. Question 3

(a) Internet Protocol version 4 (IPv4) consists of three types of addresses within an address range: network address, broadcast address and host address. Differentiate these THREE (3) types of addresses. (6 marks)

|    | Differences      | Network Address                       | Broadcast Address                               | Host address  |
|----|------------------|---------------------------------------|---|---|
|    | Address location | The first address in a network subnet | The last address in a network subnet            | The addresses between network & broadcast address     |
| i. | Purpose          | Indicate subnetwork                   | To flood packets to all devices in a subnetwork | To send packet to a specific device                   |
|    | Assignability    | Cannot be assigned to any devices     | Cannot be assigned to any devices               | Can be assigned to one device at one time in a subnet |

(b) Examine the THREE (3) migration techniques that play crucial roles in solving the coexistence issue of Internet Protocol version 4 (IPv4) and Internet Protocol version 6 (IPv6) in a network. (9 marks)

- i. Translation: In a translation migration technique, packets from devices with IPv4 address have to pass through a translation unit, and have their address be converted to IPv6 addresses before being attached to IPv6 packets. The vice versa must also happen. When IPv4 address is translated to IPv6, it utilizes a process called NAT46 (Network Address Translation, IPv4 to IPv6), the opposite is called NAT64.
  - ii. Tunneling: In a tunneling technique, packets from an IPv4 host are encapsulated into IPv6 packets before being sent to IPv6 hosts, the vice versa happens with IPv6 hosts.
  - iii. Dual-stack: All intermediary devices on a network run both IPv4 and IPv6 at the same time. End devices which runs only on IPv4 will be communicated via IPv4, while end devices which runs only IPv6 will be communicated via IPv6. If the device is dual-stack too, then the device can pick either one.
- (c) Describe the processes of how a router uses the addressing field in an IP header to determine where to forward a packet. (6 marks)
- i. First, the router checks the network prefix of the addressing field in an IP header. If it matches a directly connected network address, then the datagram is delivered directly to the destination IP address over the network link.
  - ii. However, if the network prefix is not found, but the routing table contains a route for the network prefix, then the datagram is sent to the next hop address listed in the routing table.
  - iii. Otherwise, the datagram is sent to the default route, if an default route exist.
  - iv. If all the above fails, a forwarding error message is sent to the originator.
- (d) Compare between global unicast address and link-local address. (4 marks)

#### 4. Question 4

- (a) TCP/IP uses two common protocols: Transmission Control Protocol (TCP) and User Datagram Protocol (UDP) in transport layer to establish a temporary communication session between two applications and deliver data between them.
- i. Discuss THREE (3) main roles of TCP. (9 marks)
    - A. **Track individual conversation:** TCP is responsible for tracking each individual conversation flowing between a source and a destination application separately.
    - B. **Segment & reassemble data segments:** TCP is responsible for dividing data into segments that are easier to manage and transport.
    - C. **Identify applications:** TCP is required to ensure all applications on a device receive the correct data even if multiple applications are running.
  - ii. Describe THREE (3) characteristics of UDP. (6 marks)
    - A. **Connectionless:** No connection is established before data transfer begins.
    - B. **No ordered data reconstruction:** Data is reassembled the way they are received, no extra overhead to number individual packets.
    - C. **No flow control:** Data is sent on a 'fire-and-forget' basis without taking in account of the maximum data rate receivable by the end device. Unhandled packets are simply dropped instead of retransmitted.
- (b) Explain how Domain Name System (DNS) works by using a domain name: www.netacad.com as an example. (8 marks)
- i. First, the domain name is entered into the address field of the browser. The browser then passes the name, 'www.netacad.com' to a DNS resolver.
  - ii. The DNS resolver sends a DNS request containing the address of www.netacad.com to a DNS server.
  - iii. The server then searches its record for matching www.netacad.com entries, and resolves the name with a corresponding IP address if found.
  - iv. If the name is not found, the server passes the request to another server to handle the request, this is repeated either until the maximum hops is exceeded, or a valid entry is found.
  - v. Once a valid entry is found, the DNS server sends the IP address back to the resolver, which passes the IP address back to the client that made the request.
  - vi. The IP address is then used by the client in the encapsulation process as the destination address for packets going to www.netacad.com.
- (c) Provide any TWO (2) examples of top level domains. (2 marks)
- i. .org
  - ii. .com