Birzeit University
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ENCS413 - Computer Networks Laboratory

Network Review

1. Objectives

- Review network layering (OSI model).
- Introduce you to the network lab devices.
- Review the network subnetting.

2. Introduction

2.1. Open Systems Interconnection (OSI) model

It is a model that characterizes and standardizes the communication functions of telecommunication or computing systems regardless of its underlying internal structure and technology. The model partitions a communication system into abstraction layers. The original version of the model had seven layers (see Table 0-1).

Table 0-1: OSI model by layer

Layer	Examples	Functions	Data to be sent	
Application Layer 7	FTP DNS SMTP HTTP	Services used with end users' applications	Data	**Hosts Layers (between hosts)**
Presentation Layer 6	JPG GIF SSL (HTTPS)	Formats the data to be viewed Encryption/decryption (security)	Data	
Session Layer 5	H322 that is used for VOIP	Manage end-to-end connection between hosts	Data	
Transport Layer 4	TCP UDP	Ensure delivery of entire message	Segments	
Network Layer 3	IP RIP	Routing Path Forwarding Interface	Datagrams	**Media Layers (Over Network)**
Data Link Layer 2	Ethernet MAC ARP	Physical addressing (MAC) Flow control	Frames	
Physical Layer 1	(Transmission media) Ethernet DSL	Signal Transmission	Bits	

2.2. Why layering

- Troubleshooting: easier.
- Change: change in one-layer, other layers are not affected.
- Design: division into layers makes the solution very simple.
- Learning: understanding network communication as layers is easier.

2.3. Network Devices

There are many types of network devices used in building network topology. Some of them are shown in Table 0-2.

Table 0-2: Different Types of Network Devices

Device	Layer	Function	
Hub	Layer 1 (Physical)	Dummy device (receiving information and sending it to all connected devices)	
Repeater	Layer 1 (Physical)	Used to replicate the signal (make the signal stronger)	
DSL splitter	Layer 1 (Physical)	Analog low-pass filter used to split the signals between analog devices (such as analog modems) and a plain old telephone service (POTS) line.	
Switch	Layer 2 (Data link)	Self-learning (Receiving and sending frames to the correct destination)	
Bridge	Layer 2 (Data link)	Divide the LANs into segments to: (i) Reduce the traffic and (ii) Manage each segment separately. It stores the MAC address for all devices in each segment and broadcasts the received packets into the correct segment.	
Router	Layer 3 (Network)	Routing: path from source to destination Forwarding: sending packets to the correct interface within the router.	
Multilayer switch (third layer switch)	Layer 2 + 3 (Data link and Network)	This device works as a switch if the sent data are in the same network and as a router if sent data from different networks.	

2.4. IP subnetting:

Each Network Interface Card (NIC or Network card) present in a PC is assigned one network address called as IP address [or Network address]. This IP address is assigned by the administrator of the network. No two interfaces can have the same IP address on the same network. There is a burned-in address on the NIC called Physical Address [or MAC address or Hardware address]. The MAC address of a network card indicates the vendor of that card and a unique serial number. IP addresses are divided into different classes. These classes determine the maximum number of hosts per network ID. Only three classes are used for network connectivity.

Table 0-3: Classes of Networks

Address Class	IP Range	Bits for Subnet Mask	Subnet Mask
Class A	0.0.0.0 – 127.255.255.255	Left most 8 bits	255.0.0.0
Class B	128.0.0.0 – 191.255.255.255	Left most 16 bits	255.255.0.0
Class C	192.0.0.0 – 223.255.255.255	Left most 24 bits	255.255.255.0
Class D	224.0.0.0 – 239.255.255.255		
Class E	240.0.0.0 – 255.255.255.255		

2.5. How many networks are there in the figures below

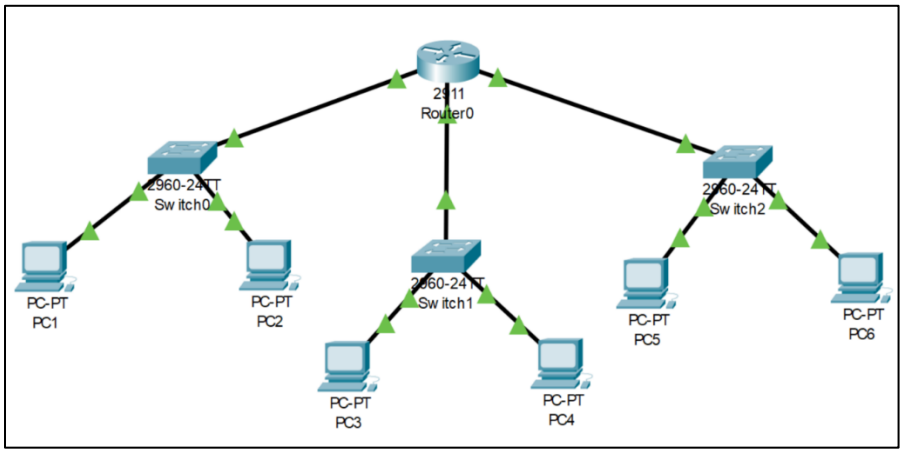

Figure 0-1: Network-1 Topology

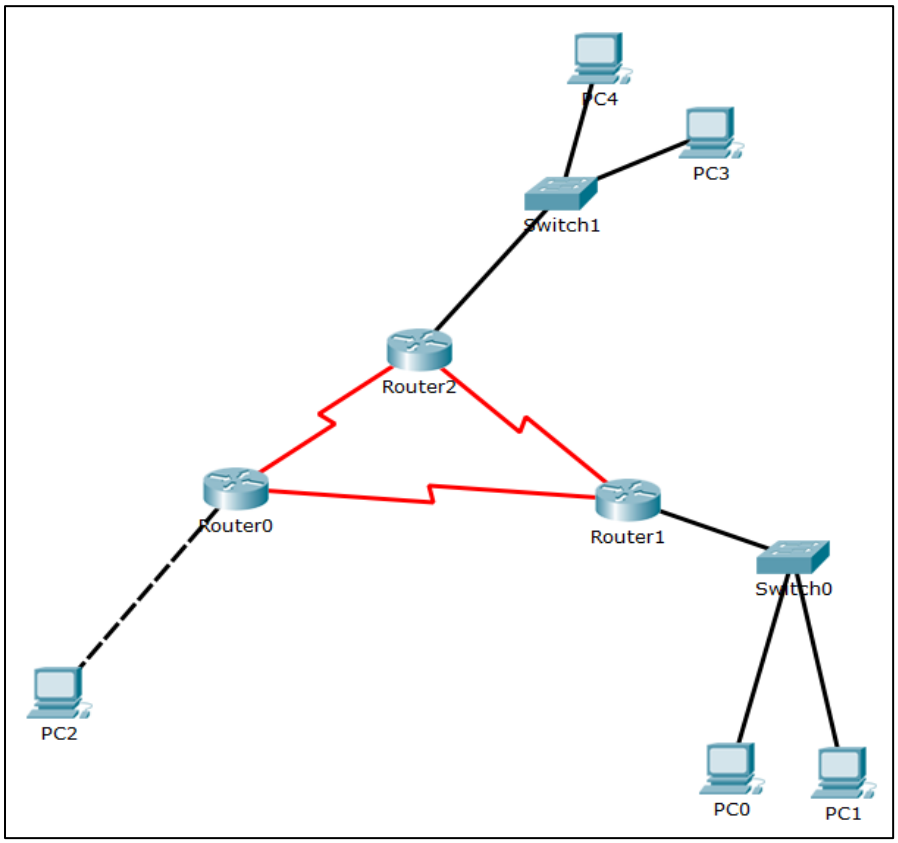

Figure 0-2: Network-2 Topology

6 networks.

2.6. Subnetting example TODO

Given the following, the topology divides the given range 192.168.0.0/24 on Networks A, B, C, D, E using minimum number of IPs.

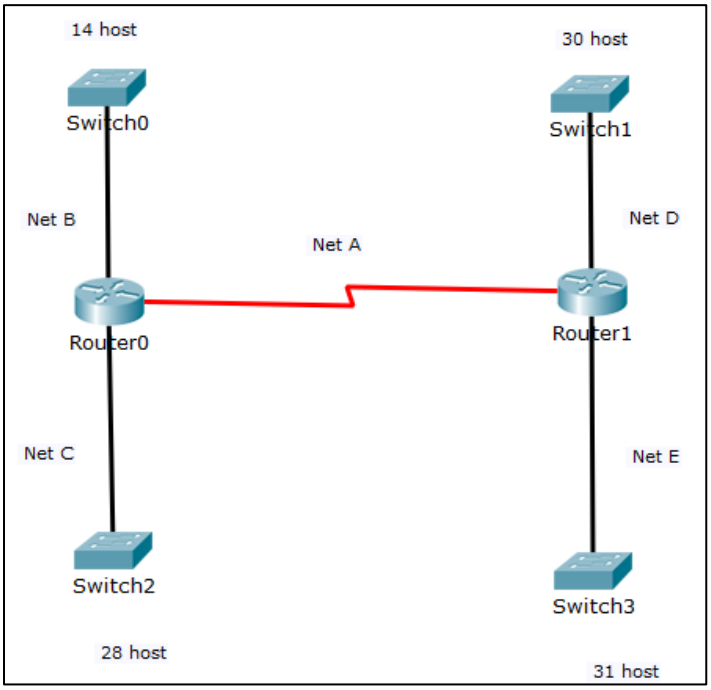

Figure 0-3: TODO Network topology

Table 0-4: TODO Subnets

Network Symbol	Network ID	Subnet Mask	Wildcard Mask	Broadcast IP	First Usable Host IP	Last Usable Host IP
A						
B						
C						
D						
E						