Data Communication Networks
HW4: Network Layer

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Introduction

In this homework, We are going to simulate different routing protocols youve learned using GNS3. You have gotten familiar with this powerful network simulator in Mini HW. You can find its comprehensive documentation here. Moreover, you can find many online tutorials that cover what you need for this homework. As we are going to work with routers after installing the GNS3, follow these instructions for adding a router to your GNS3. You can use c3725 or any other router you want in this implementation.
You need to assign different non-overlapping IP ranges to each LAN; use 192.168.x.0/24 netmasks. Use pairs of adjacent digits from your student id as x. Follow the instructions in each scenario and build your network to meet goals.

Question 1: L2 Switching

The following topology should be used in this part. Each PC should be able to ping the other one. Provide screenshots of each PC while pinging other PCs.

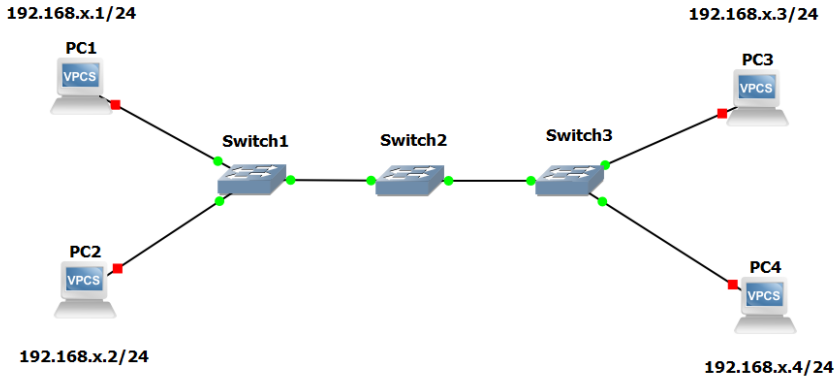

Figure 1: Topology of Question 1

Question 2: Static Routing

Use router instead of the middle switch in the first figure and assign each PC an IP address. As we know, each link connected to a router should connect the router to a unique subnet, and the PCs connected to the

same router should be in the same subnet. Provide screenshots of each PC while pinging another PC and routing table of the routers.

Question 3: Open Shortest Path First (OSPF)

OSPF is a dynamic routing protocol that routes packets within a single Autonomous System (AS). In OSPF, the network is divided into different areas, each maintaining its Link State Database. Read more about OSPF protocol and answer the following questions:
a) Briefly describe how OSPF works and which routing algorithm it uses.
b) What are some advantages and disadvantages of OSPF compared to other routing protocols?
c) Why do we usually divide a network into multiple areas in OSPF? What are the problems of having only one area?
Now that you have become more familiar with OSPF and how it works, consider Figure 2. In this topology, the network is divided into four different areas. Use this topology and configure routers to use OSPF as their routing protocol. Define areas and their boundaries EXACTLY as specified in this figure. All PCs should be able to ping each other. Then:
d) Provide screenshots of the following pings: PC1->PC10, PC8->PC12, and PC6->PC3.
e) Provide screenshots of routing tables of R1, R2, and R3.

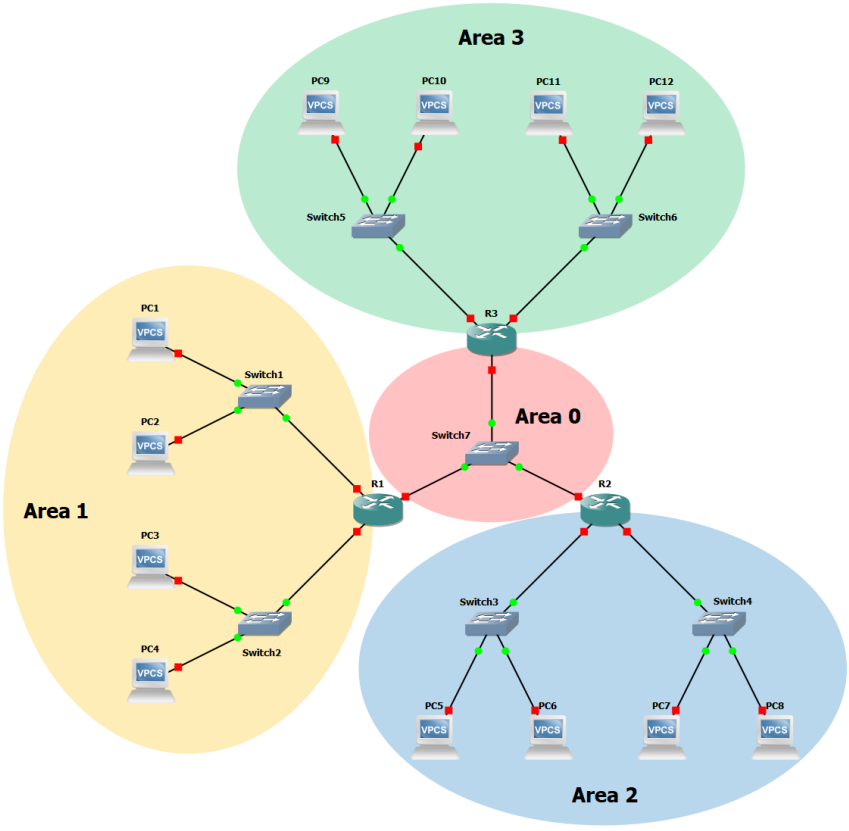

Figure 2: Topology of Question 3

Question 4: Dynamic Host Configuration Protocol (DHCP)

DHCP is a network management protocol used to automate configuring devices on IP networks. Use the topology in Figure 3 and configure routers as DHCP servers. Please DO NOT set the IP address of any PC manually; you should configure them to obtain their IP addresses from the DHCP server. All PCs should be able to ping each other. In this question, you are allowed to use any routing protocol you want. Then:
a) Provide screenshots of the following pings: PC1->PC6, PC3->PC4, and PC5->PC2.
b) Provide screenshots of DHCP binding table, DHCP pool table, and DHCP server statistics of R1.

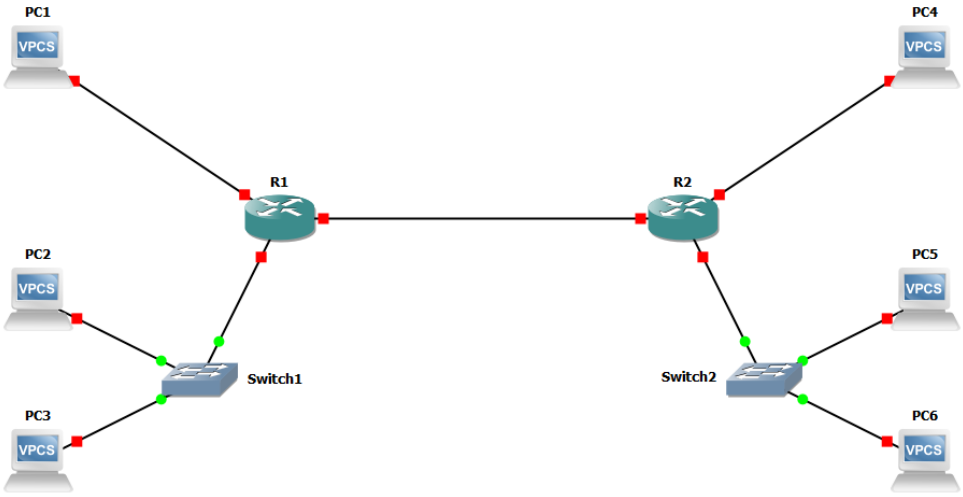

Figure 3: Topology of Question 4

What Should I Do?

You must upload your GNS3 files alongside your report. Your report should contain the configuration and final routing table of routers and explain what happened in routing for each scenario. Compress all files and rename the compressed file to STUDENT-ID-HW4.zip. If you have any questions regarding the problem statement or understanding the concept, ask your questions in the Quera forum.