

TSN 2201

COMPUTER NETWORKS

ASSIGNMENT QUESTION 2(MK Malaysia SDN. BHD.)

PREPARED BY

HOSSAIN, MOHAMMAD MUBDIUL (1161303847)

GANI, MOHAMMED OSMAN (1171300039)

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FACULTY OF COMPUTING AND INFORMATICS

MULTIMEDIA UNIVERSITY

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1. Introduction

MK Malaysia SDN. BHD. is a consumer drinking water company at Pasir Gudang. This company is based on three location which are at Pasir Gudang, Shah Alam and Perai. The company has three production plants and admin headquarter on each of the three locations. Shah Alam on the other hand also have seven departments which are Production, Human Resource, Purchasing, Contracts, Planning, IT and Finance & Accounting. The departments have 110, 70, 60, 50, 30, 20, 10 employees respectively. Totalling number of 350 employees. The company was permitted network IP 171.123.0.0/23 or 512 host addresses to design the network infrastructure in Pasir Gudang, Shah Alam and Perai.

171.123.0.0/23 address is divided into 3 section where Shah Alam gets a total number of 480 hosts, Pasir Gudang gets 12 hosts and Perai gets 12 hosts. 8 hosts were used to connect the three cities using RIPv2.

VLSM was done by Inter VLAN on each router of each city. Every VLAN number represents a department. Each department is connected through their respective city's router by their own switches. These switches are connected through bus topology. Every department shares their switch with Admin VLAN and their own department VLAN.

In Shah Alam, The IT department has the servers for various services like DHCP, DNS, EMAIL, FTP, HTTP and HTTPS. Each departments Admin server has their own HTTP and HTTPS server. The employees can connect the device and is automatically assigned by an IP address by DHCP server and the IP assigned will be based on their department.

2. Network Design

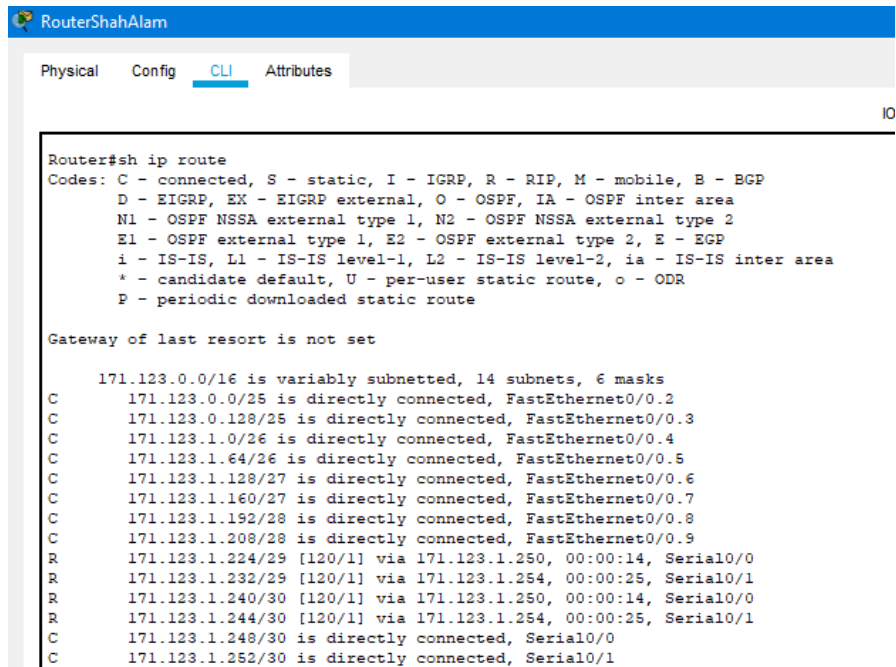
2.1. Logical Design

VLAN

```
Switch>en
Switch#sh vlan
```

VLAN	Name	Status	Ports
1	default	active	
2	Production	active	
3	HR	active	
4	Purchasing	active	
5	Contract	active	Fa0/3, Fa0/4, Fa0/5, Fa0/6 Fa0/7, Fa0/8, Fa0/9, Fa0/10 Fa0/11, Fa0/12, Fa0/13, Fa0/14 Fa0/15, Fa0/16, Fa0/17, Fa0/18 Fa0/19, Fa0/20, Fa0/21, Fa0/22 Fa0/23
6	Planning	active	
7	IT	active	
8	FnA	active	
9	Admin	active	Fa0/1, Fa0/2
1002	fddi-default	active	
1003	token-ring-default	active	
1004	fddinet-default	active	
1005	trnet-default	active	

IP route (Shah Alam)



```
RouterShahAlam
Physical Config CLI Attributes
IO

Router#sh ip route
Codes: C - connected, S - static, I - IGRP, R - RIP, M - mobile, B - BGP
       D - EIGRP, EX - EIGRP external, O - OSPF, IA - OSPF inter area
       N1 - OSPF NSSA external type 1, N2 - OSPF NSSA external type 2
       E1 - OSPF external type 1, E2 - OSPF external type 2, E - EGP
       i - IS-IS, L1 - IS-IS level-1, L2 - IS-IS level-2, ia - IS-IS inter area
       * - candidate default, U - per-user static route, o - ODR
       P - periodic downloaded static route

Gateway of last resort is not set

171.123.0.0/16 is variably subnetted, 14 subnets, 6 masks
C       171.123.0.0/25 is directly connected, FastEthernet0/0.2
C       171.123.0.128/25 is directly connected, FastEthernet0/0.3
C       171.123.1.0/26 is directly connected, FastEthernet0/0.4
C       171.123.1.64/26 is directly connected, FastEthernet0/0.5
C       171.123.1.128/27 is directly connected, FastEthernet0/0.6
C       171.123.1.160/27 is directly connected, FastEthernet0/0.7
C       171.123.1.192/28 is directly connected, FastEthernet0/0.8
C       171.123.1.208/28 is directly connected, FastEthernet0/0.9
R       171.123.1.224/29 [120/1] via 171.123.1.250, 00:00:14, Serial0/0
R       171.123.1.232/29 [120/1] via 171.123.1.254, 00:00:25, Serial0/1
R       171.123.1.240/30 [120/1] via 171.123.1.250, 00:00:14, Serial0/0
R       171.123.1.244/30 [120/1] via 171.123.1.254, 00:00:25, Serial0/1
C       171.123.1.248/30 is directly connected, Serial0/0
C       171.123.1.252/30 is directly connected, Serial0/1
```

Running configuration (Shah Alam)

```
!  
interface FastEthernet0/0  
  no ip address  
  duplex auto  
  speed auto  
!  
interface FastEthernet0/0.2  
  encapsulation dot1Q 2  
  ip address 171.123.0.1 255.255.255.128  
  ip helper-address 171.123.1.215  
!  
interface FastEthernet0/0.3  
  encapsulation dot1Q 3  
  ip address 171.123.0.129 255.255.255.128  
  ip helper-address 171.123.1.215  
!  
interface FastEthernet0/0.4  
  encapsulation dot1Q 4  
  ip address 171.123.1.1 255.255.255.192  
  ip helper-address 171.123.1.215  
!  
interface FastEthernet0/0.5  
  encapsulation dot1Q 5  
  ip address 171.123.1.65 255.255.255.192  
  ip helper-address 171.123.1.215  
!  
interface FastEthernet0/0.6  
  encapsulation dot1Q 6  
  ip address 171.123.1.129 255.255.255.224  
  ip helper-address 171.123.1.215  
!  
interface FastEthernet0/0.7  
  encapsulation dot1Q 7  
  ip address 171.123.1.161 255.255.255.224  
  ip helper-address 171.123.1.215  
!  
interface FastEthernet0/0.8  
  encapsulation dot1Q 8  
  ip address 171.123.1.193 255.255.255.240  
  ip helper-address 171.123.1.215  
!  
interface FastEthernet0/0.9  
  encapsulation dot1Q 9  
  ip address 171.123.1.209 255.255.255.240  
  ip helper-address 171.123.1.215  
!  
interface FastEthernet0/1  
  no ip address  
  duplex auto  
  speed auto  
  shutdown  
!  
interface Serial0/0  
  ip address 171.123.1.249 255.255.255.252  
  clock rate 2000000  
!  
interface Serial0/1  
  ip address 171.123.1.253 255.255.255.252  
  clock rate 2000000  
!  
router rip  
  version 2  
  network 171.123.0.0  
!  
ip classless  
!
```

Running configuration (Perai)

```
RouterPerai
Physical Config CLI Attributes

!
interface FastEthernet0/0
no ip address
duplex auto
speed auto
!
interface FastEthernet0/0.2
encapsulation dot1Q 2
ip address 171.123.1.233 255.255.255.248
ip helper-address 171.123.1.215
!
interface FastEthernet0/0.9
encapsulation dot1Q 9
ip address 171.123.1.245 255.255.255.252
ip helper-address 171.123.1.215
!
interface FastEthernet0/1
no ip address
duplex auto
speed auto
shutdown
!
interface Serial0/0
ip address 171.123.1.254 255.255.255.252
!
router rip
version 2
network 171.123.0.0
!
ip classless
!
ip flow-export version 9
!
```

IP route (Perai)

```
RouterPerai
Physical Config CLI Attributes

Router#
Router#
Router#
Router#sh ip route
Codes: C - connected, S - static, I - IGRP, R - RIP, M - mobile, B - BGP
D - EIGRP, EX - EIGRP external, O - OSPF, IA - OSPF inter area
N1 - OSPF NSSA external type 1, N2 - OSPF NSSA external type 2
E1 - OSPF external type 1, E2 - OSPF external type 2, E - EGP
i - IS-IS, L1 - IS-IS level-1, L2 - IS-IS level-2, ia - IS-IS inter are
* - candidate default, U - per-user static route, o - ODR
P - periodic downloaded static route

Gateway of last resort is not set

171.123.0.0/16 is variably subnetted, 14 subnets, 6 masks
R 171.123.0.0/25 [120/1] via 171.123.1.253, 00:00:07, Serial0/0
R 171.123.0.128/25 [120/1] via 171.123.1.253, 00:00:07, Serial0/0
R 171.123.1.0/26 [120/1] via 171.123.1.253, 00:00:07, Serial0/0
R 171.123.1.64/26 [120/1] via 171.123.1.253, 00:00:07, Serial0/0
R 171.123.1.128/27 [120/1] via 171.123.1.253, 00:00:07, Serial0/0
R 171.123.1.160/27 [120/1] via 171.123.1.253, 00:00:07, Serial0/0
R 171.123.1.192/28 [120/1] via 171.123.1.253, 00:00:07, Serial0/0
R 171.123.1.208/28 [120/1] via 171.123.1.253, 00:00:07, Serial0/0
R 171.123.1.224/29 [120/2] via 171.123.1.253, 00:00:07, Serial0/0
C 171.123.1.232/29 is directly connected, FastEthernet0/0.2
R 171.123.1.240/30 [120/2] via 171.123.1.253, 00:00:07, Serial0/0
C 171.123.1.244/30 is directly connected, FastEthernet0/0.9
R 171.123.1.248/30 [120/1] via 171.123.1.253, 00:00:07, Serial0/0
C 171.123.1.252/30 is directly connected, Serial0/0
```

Running configuration (Pasir Gudang)

```
RouterPasirGudang
Physical Config CLI Attributes
!
!
!
!
interface FastEthernet0/0
no ip address
duplex auto
speed auto
!
interface FastEthernet0/0.2
encapsulation dot1Q 2
ip address 171.123.1.225 255.255.255.248
ip helper-address 171.123.1.215
!
interface FastEthernet0/0.9
encapsulation dot1Q 9
ip address 171.123.1.241 255.255.255.252
ip helper-address 171.123.1.215
!
interface FastEthernet0/1
no ip address
duplex auto
speed auto
shutdown
!
interface Serial0/0
ip address 171.123.1.250 255.255.255.252
!
interface Serial0/1
no ip address
clock rate 2000000
shutdown
!
router rip
version 2
network 171.123.0.0
!
```

IP route (Pasir Gudang)

```
RouterPasirGudang
Physical Config CLI Attributes
Router#sh ip route
Codes: C - connected, S - static, I - IGRP, R - RIP, M - mobile, B - BGP
        D - EIGRP, EX - EIGRP external, O - OSPF, IA - OSPF inter area
        N1 - OSPF NSSA external type 1, N2 - OSPF NSSA external type 2
        E1 - OSPF external type 1, E2 - OSPF external type 2, E - EGP
        i - IS-IS, L1 - IS-IS level-1, L2 - IS-IS level-2, ia - IS-IS inter area
        * - candidate default, U - per-user static route, o - ODR
        P - periodic downloaded static route

Gateway of last resort is not set

171.123.0.0/16 is variably subnetted, 14 subnets, 6 masks
R    171.123.0.0/25 [120/1] via 171.123.1.249, 00:00:07, Serial0/0
R    171.123.0.128/25 [120/1] via 171.123.1.249, 00:00:07, Serial0/0
R    171.123.1.0/26 [120/1] via 171.123.1.249, 00:00:07, Serial0/0
R    171.123.1.64/26 [120/1] via 171.123.1.249, 00:00:07, Serial0/0
R    171.123.1.128/27 [120/1] via 171.123.1.249, 00:00:07, Serial0/0
R    171.123.1.160/27 [120/1] via 171.123.1.249, 00:00:07, Serial0/0
R    171.123.1.192/28 [120/1] via 171.123.1.249, 00:00:07, Serial0/0
R    171.123.1.208/28 [120/1] via 171.123.1.249, 00:00:07, Serial0/0
C    171.123.1.224/29 is directly connected, FastEthernet0/0.2
R    171.123.1.232/29 [120/2] via 171.123.1.249, 00:00:07, Serial0/0
C    171.123.1.240/30 is directly connected, FastEthernet0/0.9
R    171.123.1.244/30 [120/2] via 171.123.1.249, 00:00:07, Serial0/0
C    171.123.1.248/30 is directly connected, Serial0/0
R    171.123.1.252/30 [120/1] via 171.123.1.249, 00:00:07, Serial0/0
-
```

2.2. Physical Design

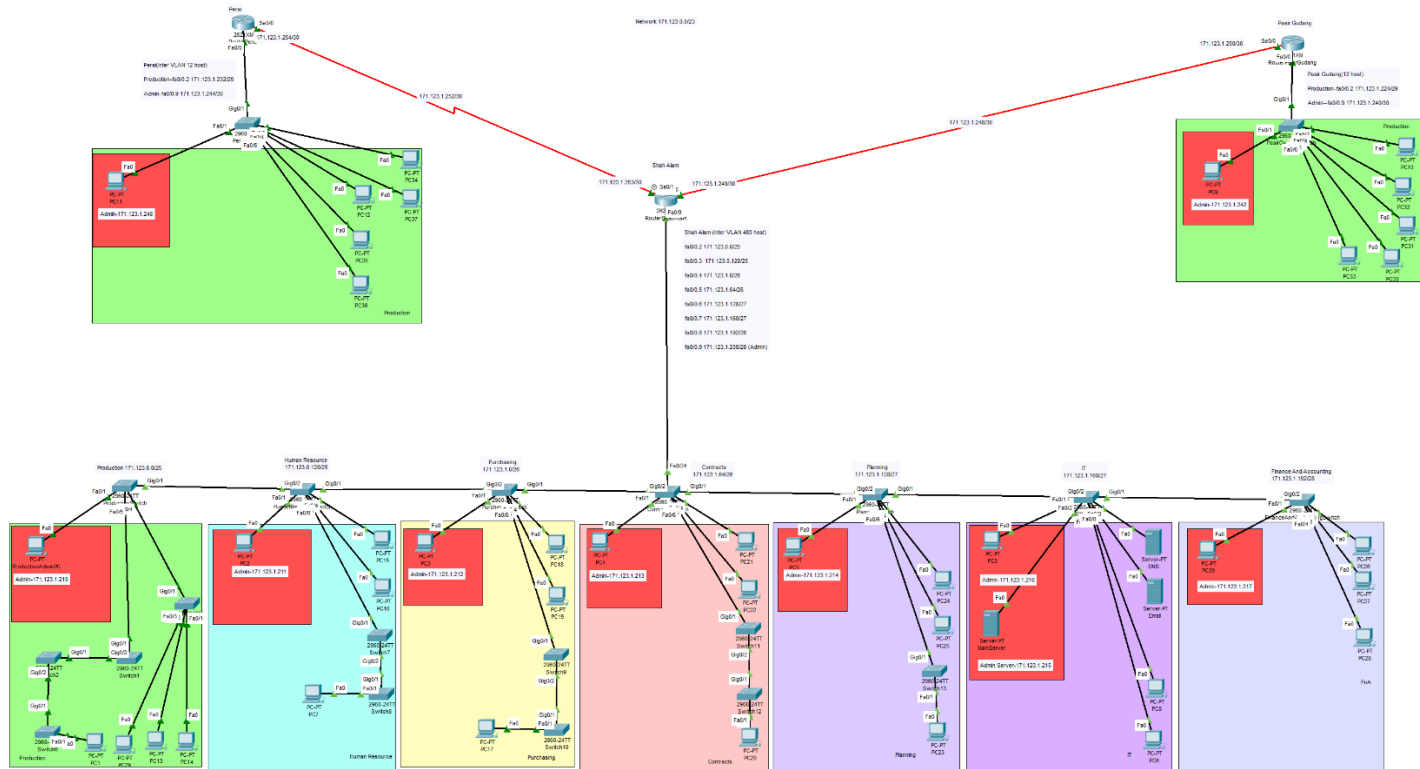


Figure 2.2.1: Physical Topology

3. Network Performance

3.1. Cost

Total Router used 3. Per router cost 170.

Total Router cost= $3 \times 170 = 510$

Total Switches used 19. Per Switch costs 250

Total Switch cost= $19 \times 250 = 4750$

Total Servers used 3. Per Server costs 2000

Total Server cost = $3 \times 2000 = 6000$

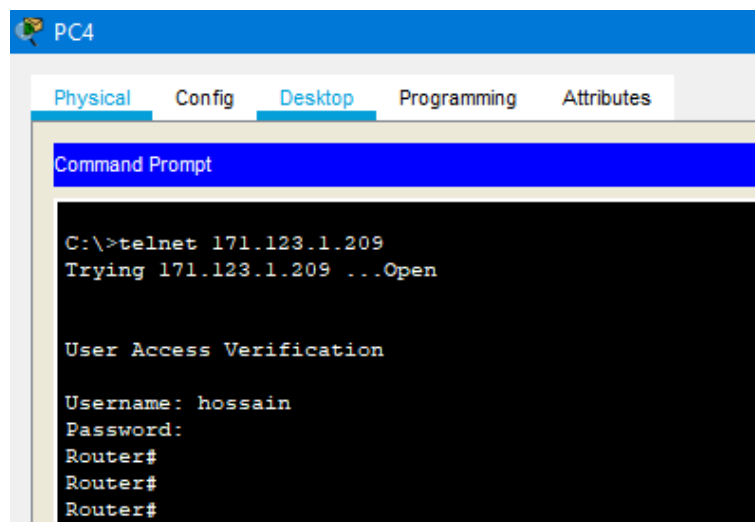
Total approximate cost ~11260

Considering the huge infrastructure cost is relatively low. Because this system uses minimal routers and switches to established connection depending on the company's need.

3.2. Security

Each department have their own VLAN. So, they cannot communicate directly through LAN although they are connected by switches. Communications have to be established by the router must. Even in Admin is separated from the rest of the employees which further increases security. The servers, especially EMAIL server uses client user name and password. Which means email service is secured. Main Server uses SSL for HTTP service.

To access the routers, username and password is required. That's why every router was set to access by the admins only. Shah Alam router can be access by production and IT admin only. The rest two routers can be accessed by their production admin. Example is shown below.

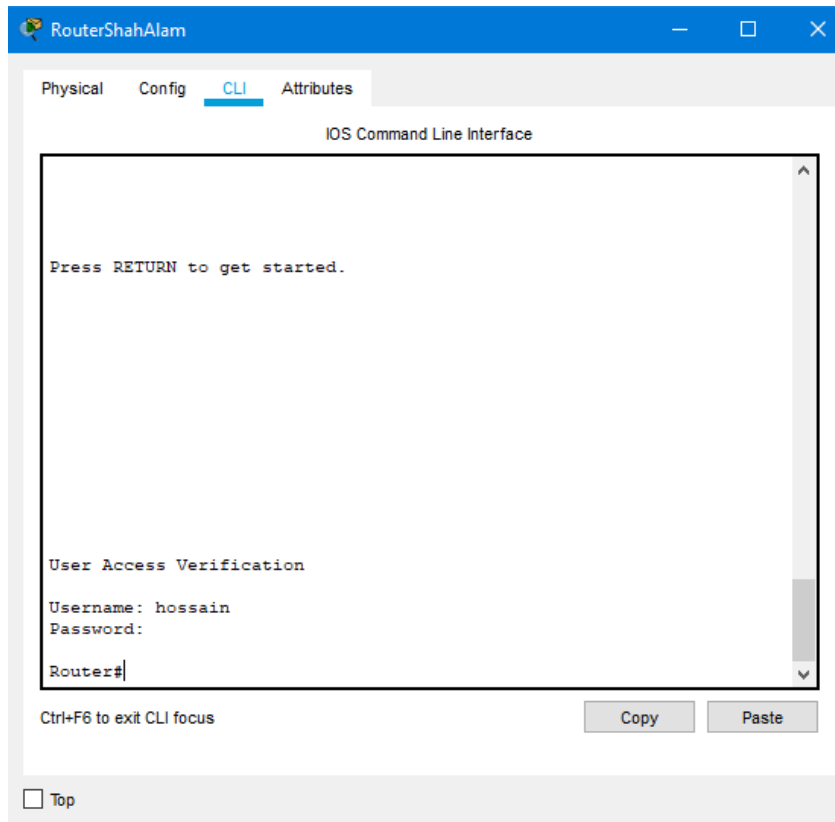


The screenshot shows a PC4 desktop environment with a taskbar at the top. The 'Desktop' tab is selected in the top navigation bar. A 'Command Prompt' window is open, displaying the following text:

```
C:\>telnet 171.123.1.209
Trying 171.123.1.209 ...Open

User Access Verification

Username: hossain
Password:
Router#
Router#
Router#
```

4. IP Address Design (VLSM)

City	Department	VLAN Number	Network ID	Range	Broadcast Address	Subnet Mask	CIDR
Shah Alam	Production	2	171.123.0.0	171.123.0.1 - 171.123.0.126	171.123.0.127	255.255.255.128	25
	Human Resource	3	171.123.0.128	171.123.0.129 - 171.123.0.254	171.123.0.255	255.255.255.128	25
	Purchasing	4	171.123.1.0	171.123.1.1 - 171.123.1.62	171.123.1.63	255.255.255.192	26
	Contracts	5	171.123.1.64	171.123.1.65 - 171.123.1.126	171.123.1.127	255.255.255.192	26
	Planning	6	171.123.1.128	171.123.1.129 - 171.123.1.158	171.123.1.159	255.255.255.224	27
	IT	7	171.123.1.160	171.123.1.161 - 171.123.1.190	171.123.1.191	255.255.255.224	27
	Finance & Accounting	8	171.123.1.192	171.123.1.193 - 171.123.1.206	171.123.1.207	255.255.255.240	28
	Admin	9	171.123.1.208	171.123.1.209 - 171.123.1.222	171.123.1.223	255.255.255.240	28
Pasir Gudang	Production	2	171.123.1.224	171.123.1.225 - 171.123.1.230	171.123.1.231	255.255.255.248	29
	Admin	9	171.123.1.240	171.123.1.241 - 171.123.1.242	171.123.1.243	255.255.255.252	30
Perai	Production	2	171.123.1.232	171.123.1.233 - 171.123.1.238	171.123.1.239	255.255.255.248	29
	Admin	9	171.123.1.244	171.123.1.245 - 171.123.1.246	171.123.1.247	255.255.255.252	30
Connection	Shah Alam to Pasir Gudang		171.123.1.248	171.123.1.249 - 171.123.1.250	171.123.1.251	255.255.255.252	30
	Shah Alam to Perai		171.123.1.252	171.123.1.253 - 171.123.1.254	171.123.1.255	255.255.255.252	30