TSN2201 Computer Network Assignment

Faculty of Computing and Informatics (FCI)

Question No.7
Group No.6
TBU University Network

Group Members

Mohamed Ahmed Mohamed Elmokhtar Ahmed – 1191102491
Ahmed Hassan Mohammed Salem – 1191102340
Submitted to: Dr. Palanichamy Naveen

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1. IP address design VLSM

Given IP Address Block: **100.20.230.0/23**

1.1 IP address allocation for Puchong (Main Campus)

Table 1.1.0 shows the number of hosts required for Puchong network and the assigned VLAN number for each division

Main Campus (Puchong)		
Division Name	**Number of Employees**	**VLAN No.**
Admin	10	10
Facility Management	20	20
Finance	19	30
Human Resources	15	40
Library	11	50
School of Engineering	23	60
School of Computer Science	31	70
School of Law	20	80
School of Business & Management	21	90
Servers	4	100
Total	174	-

Table 1.1.2 shows the ports allocation for each switch in Puchong

Switch Name	Ports Allocation	Total
Switch_1	Admin(10) + Library(11) + Router(1) + 2(Switch Connection)	24
Switch_2	Engineering(20) + Computer Science(2) + 2(Switch Connection)	24
Switch_3	Facility Management(20) + Computer Science(2) + 2(Switch Connection)	24
Switch_4	Business Management(21) + Engineering(1) + 2(Switch Connection)	24
Switch_5	Computer Science(17) + Servers(4) + 2(Switch Connection)	23
Switch_6	Computer Science(7) + Human Resources(15) + 2(Switch Connection)	24
Switch_7	Finance(19) + Computer Science(3) + 2(Switch Connection)	24
Switch_8	Law(20) + Computer Science(2) + 2(Switch Connection)	24

Table 1.1.3 shows the allocated number of IP addresses for each division

Division Name	VLAN No.	Required	Allocated
Admin	10	13	16
Facility Management	80	23	32
Finance	70	22	32
Human Resources	60	18	32
Library	20	14	16
School of Engineering	30	27	32
School of Computer Science	40	34	64
School of Law	50	23	32
School of Business & Management	90	24	32
Servers	100	7	8
Total	-		**296**

Table 1.1.4 shows the HID, SID and NID for each Subnet

VLAN No.	HID	SID	NID + SID
10	4	5	28
80	5	4	27
70	5	4	27
60	5	4	27
20	4	5	28
30	5	4	27
40	6	3	26
50	5	4	27
90	5	4	27
100	3	6	29
Georgetown	3	6	29
Muar	3	6	29
Kuta Kinabalu	3	6	29
Kuta Bahru	3	6	29
WAN G	2	7	30
WAN M	2	7	30
WAN KK	2	7	30
WAN KB	2	7	30

Table 1.1.5 shows the network address, broadcast address, router interface and usable address range for each subnet in Puchong

VLAN No.	Subnet Mask	Subnet Address	Broadcast Address	Router Interface	Address Range
40	**255.255.255.192**	**100.20.230.0**	**100.20.230.63**	**100.20.230.1**	**100.20.230.2** to **100.20.230.62**
80	**255.255.255.224**	**100.20.230.64**	**100.20.230.95**	**100.20.230.65**	**100.20.230.66** to **100.20.230.94**
70	**255.255.255.224**	**100.20.230.96**	**100.20.230.127**	**100.20.230.97**	**100.20.230.98** to **100.20.230.126**
60	**255.255.255.224**	**100.20.230.128**	**100.20.230.159**	**100.20.230.129**	**100.20.230.130** to **100.20.230.158**
30	**255.255.255.224**	**100.20.230.160**	**100.20.230.191**	**100.20.230.161**	**100.20.230.162** to **100.20.230.190**
50	**255.255.255.224**	**100.20.230.192**	**100.20.230.223**	**100.20.230.193**	**100.20.230.194** to **100.20.230.222**
90	**255.255.255.224**	**100.20.230.224**	**100.20.230.255**	**100.20.230.225**	**100.20.230.226** to **100.20.230.254**
10	**255.255.255.240**	**100.20.231.0**	**100.20.231.15**	**100.20.231.1**	**100.20.231.2** to **100.20.231.14**
20	**255.255.255.240**	**100.20.231.16**	**100.20.231.31**	**100.20.231.17**	**100.20.231.18** to **100.20.231.30**
100	**255.255.255.248**	**100.20.231.32**	**100.20.231.39**	**100.20.231.33**	**100.20.231.34** to **100.20.231.38**

1.2 IP address allocation for each learning centers

Table 1.2.0 shows the network address, broadcast address, router interface and usable address range for each learning center.

Subnet Name	Subnet Mask	Subnet Address	Broadcast Address	Router Interface	Address Range
Georgetown	**255.255.255.248**	**100.20.231.40**	**100.20.231.47**	**100.20.231.41**	**100.20.231.42** to **100.20.231.46**
Muar	**255.255.255.248**	**100.20.231.48**	**100.20.231.55**	**100.20.231.49**	**100.20.231.50** to **100.20.231.54**
Kota Kinabalu	**255.255.255.248**	**100.20.231.56**	**100.20.231.63**	**100.20.231.57**	**100.20.231.58** to **100.20.231.62**
Kota Bahru	**255.255.255.248**	**100.20.231.64**	**100.20.231.71**	**100.20.231.65**	**100.20.231.66** to **100.20.231.70**
WAN G	**255.255.255.252**	**100.20.231.72**	**100.20.231.75**	**100.20.231.73**	**100.20.231.74**
WAN KK	**255.255.255.252**	**100.20.231.76**	**100.20.231.79**	**100.20.231.77**	**100.20.231.78**
WAN KB	**255.255.255.252**	**100.20.231.80**	**100.20.231.83**	**100.20.231.81**	**100.20.231.82**
WAN M	**255.255.255.252**	**100.20.231.84**	**100.20.231.87**	**100.20.231.85**	**100.20.231.86**

1.3 OSPF Routing Wildcard masks

Table 1.6.0 shows the wildcard masks used in OSPF routing for each network

Wildcard masks			
Subnet Name	**Subnet mask**	**Network Address**	**Wildcard Masks**
VLAN 40	**255.255.255.192**	**100.20.230.0**	**0.0.0.63**
VLAN 80	**255.255.255.224**	**100.20.230.64**	**0.0.0.31**
VLAN 70	**255.255.255.224**	**100.20.230.96**	**0.0.0.31**
VLAN 60	**255.255.255.224**	**100.20.230.128**	**0.0.0.31**
VLAN 30	**255.255.255.224**	**100.20.230.160**	**0.0.0.31**
VLAN 50	**255.255.255.224**	**100.20.230.192**	**0.0.0.31**
VLAN 90	**255.255.255.224**	**100.20.230.224**	**0.0.0.31**
VLAN 10	**255.255.255.240**	**100.20.231.0**	**0.0.0.15**
VLAN 20	**255.255.255.240**	**100.20.231.16**	**0.0.0.15**
VLAN 100	**255.255.255.248**	**100.20.231.32**	**0.0.0.7**
Georgetown	**255.255.255.248**	**100.20.231.40**	**0.0.0.7**
Muar	**255.255.255.248**	**100.20.231.48**	**0.0.0.7**
Kota Kinabalu	**255.255.255.248**	**100.20.231.56**	**0.0.0.7**
Kota Bahru	**255.255.255.248**	**100.20.231.64**	**0.0.0.7**
WAN G	**255.255.255.252**	**100.20.231.72**	**0.0.0.3**
WAN KK	**255.255.255.252**	**100.20.231.76**	**0.0.0.3**
WAN KB	**255.255.255.252**	**100.20.231.80**	**0.0.0.3**
WAN M	**255.255.255.252**	**100.20.231.84**	**0.0.0.3**

2. Network Design

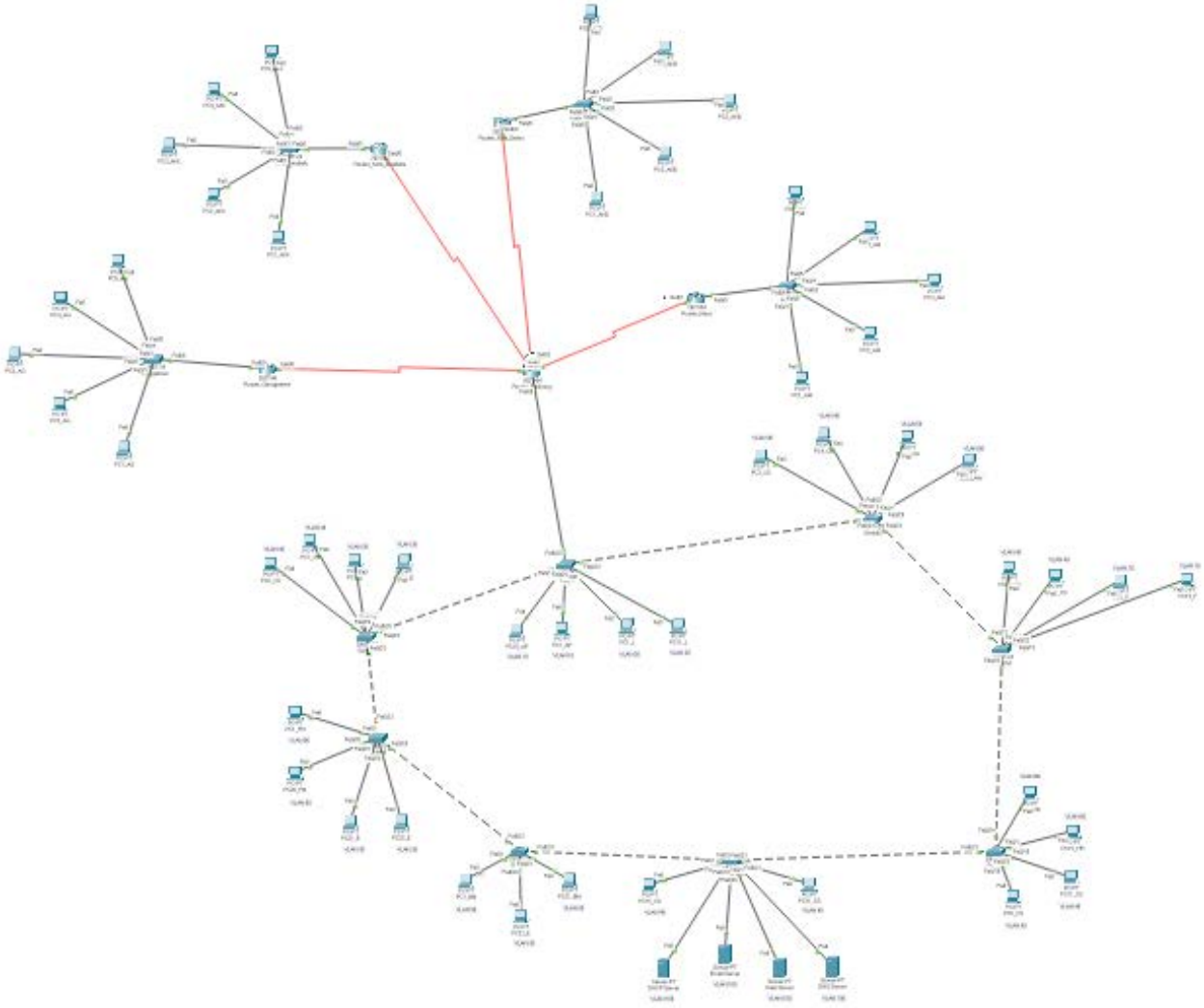

Figure 2.0 Shows the overall design of the entire organization

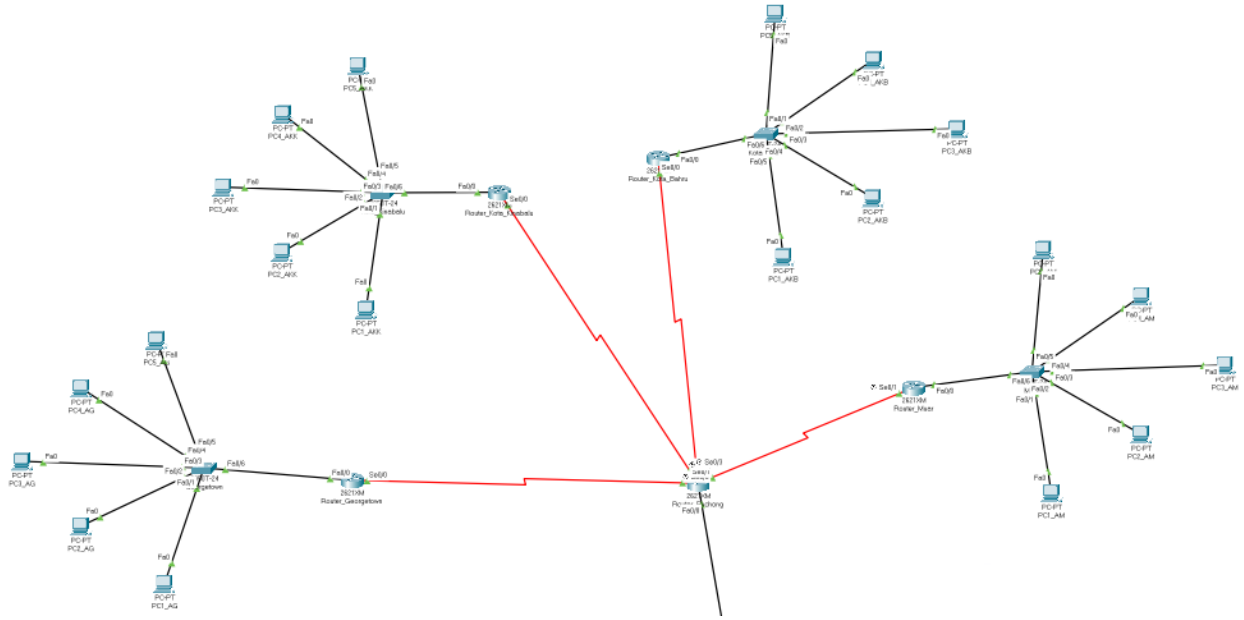

Figure 2.1 Shows the network design of learning centers connected to main campus via Router_Puchong

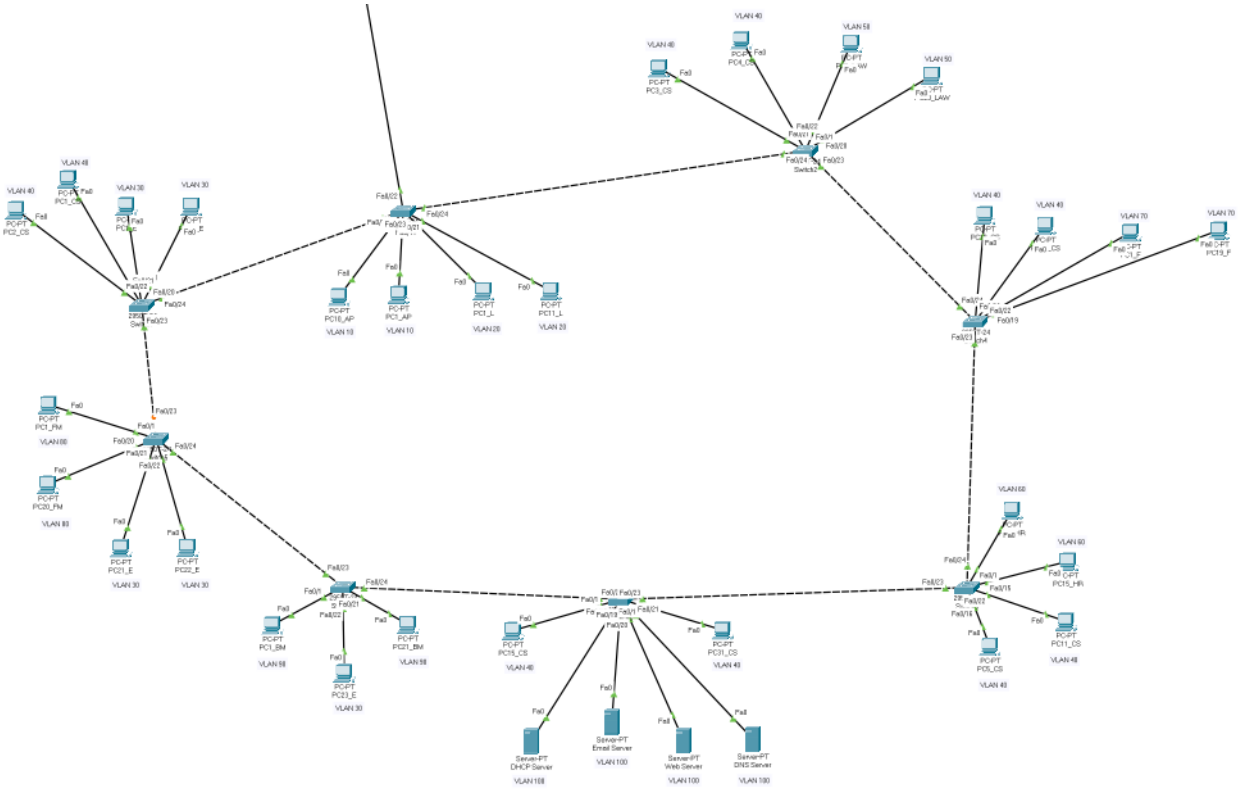

Figure 2.2 Shows the network design of main campus (Puchong)

As shown in Figure 2.0, all the learning centers are connected to the main campus using routers and all the learning centers' admins are connected to a switch that connects the admins to network router to connect to the main campus network. Figure 2.1 shows a clearer image of how learning centers' admins are connected to the switches and then to the router. Figure 2.2 shows how the devices in the main campus were divided among the switches and shows the how the divisions were divided over 10 vlans to decrease the number of switches requires for more efficiency in terms of cost and performance and for more security. Each vlan represents a division and each vlan has its own network address and broadcast address.

3. IP addresses for PC's and Servers

The protocol used to set PC's IP address is **DHCP** (**D**ynamic **C**onfiguration **H**ost **P**rotocol)

Table 3.0 shows the email associated with each PC in the network

Device name	Email Address
PC1_AP	pc1_ap@tbu.edu.my
PC10_AP	pc10_ap@tbu.edu.my
PC1_L	pc1_L@tbu.edu.my
PC11_L	pc11_L@tbu.edu.my
PC2_CS	pc2_cs@tbu.edu.my
PC1_CS	pc1_cs@tbu.edu.my
PC1_E	pc1_e@tbu.edu.my
PC20_E	pc20_e@tbu.edu.my
PC1_FM	pc1_fm@tbu.edu.my
PC20_FM	pc20_fm@tbu.edu.my
PC1_BM	pc1_bm@tbu.edu.my
PC21_BM	pc21_bm@tbu.edu.my
PC23_E	pc23_e@tbu.edu.my
PC15_CS	pc15_cs@tbu.edu.my
PC31_CS	pc21_cs@tbu.edu.my
PC5_CS	Pc5_cs@tbu.edu.my
PC11_CS	pc11_cs@tbu.edu.my
PC15_HR	pc15_hr@tbu.edu.my
PC1_HR	pc1_hr@tbu.edu.my
PC12_CS	pc12_cs@tbu.edu.my
PC14_CS	pc14_cs@tbu.edu.my
PC1_F	pc1_f@tbu.edu.my
PC19_F	pc19_f@tbu.edu.my
Pc3_cs	pc3_cs@tbu.edu.my
Pc4_cs	pc4_cs@tbu.edu.my

PC1_LAW	pc1_law@tbu.edu.my
PC20_LAW	pc20_law@tbu.edu.my
PC1_AG	pc1_ag@tbu.edu.my
PC2_AG	pc2_ag@tbu.edu.my
PC3_AG	pc3_ag@tbu.edu.my
PC4_AG	pc4_ag@tbu.edu.my
pC5_AG	pc5_ag@tbu.edu.my
Pc1_AKK	pc1_akk@tbu.edu.my
Pc2_AKK	pc2_akk@tbu.edu.my
Pc3_AKK	pc3_akk@tbu.edu.my
PC4_AKK	pc4_akk@tbu.edu.my
PC5_AKK	pc5_akk@tbu.edu.my
PC1_AKB	pc1_akb@tbu.edu.my
PC2_AKB	pc2_akb@tbu.edu.my
PC3_AKB	pc3_akb@tbu.edu.my
PC4_AKB	pc4_akb@tbu.edu.my
PC5_AKB	pc5_akb@tbu.edu.my
PC1_AM	pc1_m@tbu.edu.my
PC2_AM	pc2_m@tbu.edu.my
PC3_AM	pc3_m@tbu.edu.my
PC4_AM	pc4_m@tbu.edu.my
PC5_AM	pc5_m@tbu.edu.my

4. Network Security

Table 4.0 shows the network settings

Setting	Configuration	Effect
Routers secret password	tbu_access0	Restrict access with password only
telnet password	tbu_admin0	Restrict telnet access with password only
Session limit for learning centres	5	Restrict maximum active sessions to 5 only
Session limit for Puchong	10	Restrict maximum active sessions to 10 only
Session Timeout	5 minutes	Set session to timeout after 5 minutes of inactivity

Telnet access is only done by admin to remotely configure the routers within their network; therefore, the telnet settings were set for 5 vty lines in learning centers routers and 10 vty lines in main (Puchong) campus

5. Routing Protocol justification

For the routing protocol, our group decided to go for Open Shortest Path First (OSPF) routing protocol. This is due to several advantages offered by OSPF over other protocols. Firstly OSPF routing protocol provides a complete knowledge of the network topology. Due to this, it is able calculate the best routes based on the incoming requests. Additionally, OSPF protocol has no restrictions on the hop counts, unlike RIP protocol that has only 15 hops as the maximum hop counts. Therefore OSPF converges faster than RIP.

6. Devices used

Devices	Price	Used for
Router 2621XM	180	Connecting different learning centres to Puchong
Switch	550	Connecting different division in Puchong and the learning centres
PC-PT	1000	End device for staff in each division
Server	2000	Allocating IP addresses to networks automatically, allow emails in different networks to send/receive messages and allow end devices in different networks to access web browser
Copper Cross-Over	-	Connecting switches of different divisions to each other in Puchong
Copper straight-through	-	Connecting end devices to the switches in different divisions
Serial-DCF	-	Connecting routers from different learning centres to the router in Puchong

7. Assumptions

The following assumptions have been made in the network design:

1. The first usable address for each network is considered as the Router Interface