

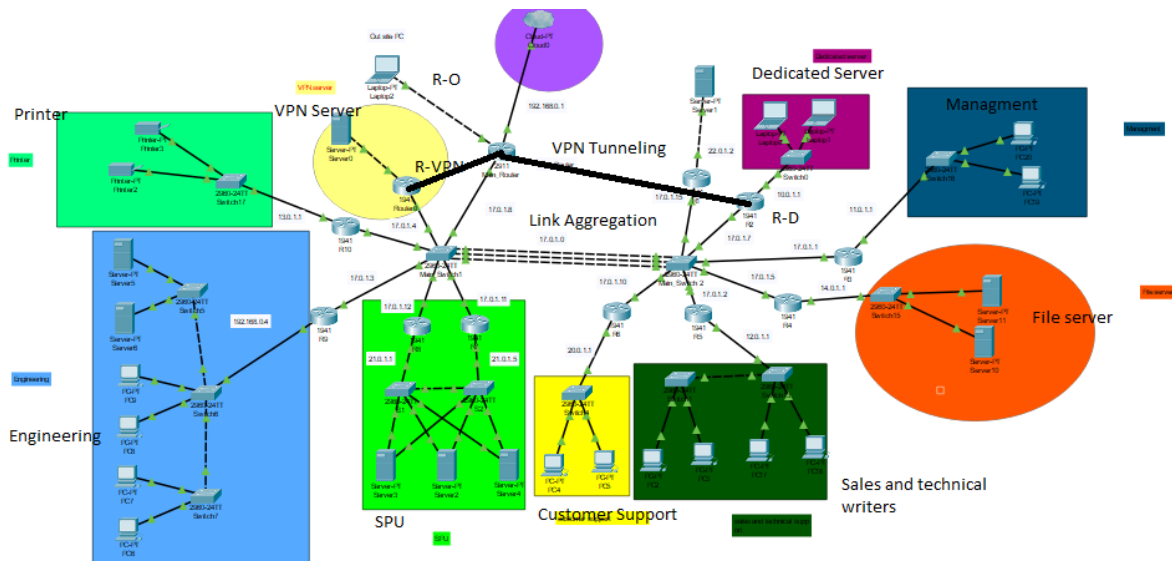
Network and Service Operation (ET2598)

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Workshop-1

Architecture: I have done my architecture with star topology for medium business network it's working every point. I have completed it department by department. I have done my design part by part engineering staff, build box, store server connected them into a router. After that this router connected to main switch. Similarly, sales department I am going to explain the ip address, subnet, bandwidth, growth, routing, VPN and tunneling every part under title of department.



Engineering department:

In this department staff (200), build box people (50) and 10 are in the storage data.

- In this section assigned network 192.168.0.0/23 and netmask are 255.255.254.0.
- For this netmask we can used 510 valid addresses
- Its B class IP address.

- In future we can increase the computer then we can use from 192.168.0.2 to 192.168.0.510 IP addresses.

SPU also in engineering department but we can take it out side with different router.

Sales department:

Two people work in office and 4 people are technical writers working on documentation and adaption of documentation are together in one router total 30 for visiting sales. Sales department some time use SME network from our site in that case we can use a VPN server for sales group.

- For sales people I take IP 12.0.1.0 and netmask 255.255.255.192.
- We can use 62 valid IP address.
- I take customer support team another router with network 20.0.1.0 255.255.255.248 because it's only 4 computers.
- I also take the VPN in different router for remote access.

Management department:

In this section I take one router and network of this section is 11.0.1.0 255.255.255.240 in this IP we can use valid 14 addresses so if in future in management section need increase the number computer, so we can add. They can access all the section in the network connected to the cloud also. They can access dedicated server if they are in out-sourced by VPN.

Bandwidth Calculations: For each group's bandwidth calculation in this table-

For 10000 customers in A	For 10000 customers in B
Here, 10000/h $= 10000/3600$ $= 2.7 \text{ c/s}$ Load in = $0.01 * 1024 * 1024 * 8 * 2.7 / 1000000$ $= 0.25 \text{ Mbps}$ Load out = $1 * 1024 * 1024 * 8 * 2.7 / 1000000$ $= 22.65 \text{ Mbps}$	Here, 10000/h $= 10000/3600$ $= 2.7 \text{ c/s}$ Load in = $0.02 * 1024 * 1024 * 8 * 2.7 / 1000000$ $= 0.45 \text{ Mbps}$ Load out = $2 * 1024 * 1024 * 8 * 2.7 / 1000000$ $= 45.30 \text{ Mbps}$
For 1000 customers in C	For 900 customers in D
Here, 1000/h $= 1000/3600$ $= 0.28 \text{ c/s}$ Load in = $5 * 1024 * 1024 * 8 * 0.28 / 1000000$ $= 11.74 \text{ Mbps}$	Here, 900/h $= 900/3600$ $= 0.25 \text{ c/s}$ Load in = $7 * 1024 * 1024 * 8 * 0.25 / 1000000$ $= 14.68 \text{ Mbps}$

Load out = $10 \times 1024 \times 1024 \times 8 \times 0.28 / 1000000$ = 23.49Mbps	Load out = $2 \times 1024 \times 1024 \times 8 \times 0.25 / 1000000$ = 4.19Mbps
For 730 customers in E	For 100 customers in F
Here, 730/h = $730 / 3600$ = 0.203 c/s Load in = $0.001 \times 1024 \times 1024 \times 8 \times 0.203 / 1000000$ = 0.0017Mbps Load out = $1 \times 1024 \times 1024 \times 8 \times 0.203 / 1000000$ = 1.70Mbps	Here, 100/h = $100 / 3600$ = 0.028 c/s Load in = $5 \times 1024 \times 1024 \times 8 \times 0.028 / 1000000$ = 1.17Mbps Load out = $10 \times 1024 \times 1024 \times 8 \times 0.028 / 1000000$ = 2.39Mbps
For 1000 customers in G	For 1200 customers in H
Here, 1000/h = $1000 / 3600$ = 0.28 c/s Load in = $10 \times 1024 \times 1024 \times 8 \times 0.28 / 1000000$ = 23.49Mbps Load out = $0.001 \times 1024 \times 1024 \times 8 \times 0.28 / 1000000$ = 0.0023Mbps	Here, 1200/h = $1200 / 3600$ = 0.33 c/s Load in = $0.02 \times 1024 \times 1024 \times 8 \times 0.33 / 1000000$ = 0.055Mbps Load out = $4 \times 1024 \times 1024 \times 8 \times 0.33 / 1000000$ = 11.07Mbps

Here total bandwidth **Load In** and **Load Out**

Groups	Load In	Load Out
A	0.25Mbps	22.65Mbps
B	0.45Mbps	45.30Mbps
C	11.74Mbps	23.49Mbps
D	14.68Mbps	4.19Mbps
E	0.0017Mbps	1.70Mbps
F	1.17Mbps	2.39Mbps
G	23.49Mbps	0.0023Mbps
H	0.055Mbps	11.07Mbps
Total	51.84Mbps	110.80Mbps

- For all service group required bandwidth under 100Mbps load in and load out bandwidth total is 51.84Mbps and 110.80Mbps. So, we can connect them by CAT5 Copper Straight-Through cable because this can transfer data per second 100Mbps.

Growth:

For 20000 customers in A	For 15000 customers in B
Here, 20000/h = $20000 / 3600$	Here, 15000/h = $15000 / 3600$

$=5.55 \text{ c/s}$ Load in = $0.01*1024*1024*8*5.55/1000000$ $= 0.47\text{Mbps}$ Load out = $1*1024*1024*8*5.55/1000000$ $= 46.55\text{Mbps}$	$=4.17 \text{ c/s}$ Load in = $0.02*1024*1024*8*4.17/1000000$ $= 0.70\text{Mbps}$ Load out = $2*1024*1024*8*4.17/1000000$ $= 69.96\text{Mbps}$
For I, 1000 customers	For J, 7000 customers
Here, 1000/h $=1000/3600$ $=0.28 \text{ c/s}$ Load in = $10*1024*1024*8*0.28/1000000$ $= 23.49\text{Mbps}$ Load out = $0.001*1024*1024*8*0.28/1000000$ $= 0.0023\text{Mbps}$	Here, 7000/h $=7000/3600$ $=1.94 \text{ c/s}$ Load in = $5*1024*1024*8*1.94/1000000$ $= 81.37\text{Mbps}$ Load out = $10*1024*1024*8*1.94/1000000$ $= 162.74\text{Mbps}$

- After 6 months A and B service group updated, it will be 20000 customer/h and 15000 customer/h. In that case,
- **Load In** increase= $[51.84\text{Mbps}+(A_{\text{new load in}}+ B_{\text{new load in}})-(A_{\text{old load in}} + B_{\text{old load in}})]$
 $=51.84\text{Mbps}+0.47\text{Mbps}+0.70\text{Mbps}-0.25\text{Mbps}-0.45\text{Mbps}$
 $=52.31\text{Mbps}$
 - **Load Out** increase= $[110.80\text{Mbps}+(A_{\text{new load out}}+ B_{\text{new load out}})-(A_{\text{old load out}} + B_{\text{old load out}})]$
 $=110.80\text{Mbps}+46.55\text{Mbps}+69.96\text{Mbps}-22.65\text{Mbps}-45.30\text{Mbps}$
 $= 159.36\text{Mbps}.$

So, after 6 months total bandwidth required = Load In + Load Out

$$=52.31\text{Mbps} + 159.36\text{Mbps}$$

$$=211.67\text{Mbps}$$

- After 12 months new two service group add I and J than total load in and load out is
- **Total Load In** = $52.31\text{Mbps}+23.49\text{Mbps(I)}+81.37\text{Mbps(J)}$
 $= 157.17\text{Mbps}$
 - **Total Load Out** = $159.36\text{Mbps}+0.0023\text{Mbps(I)}+162.74\text{Mbps(J)}$
 $= 322.1023\text{Mbps}$
 - **Over all Bandwidth required after increase the service group**
 $= \text{Total Load In} + \text{Total Load Out}$
 $= 157.17\text{Mbps} + 322.1023\text{Mbps}$
 $= 479.27\text{Mbps}$
 $=480\text{Mbps(round)}$

- **So over all we can take 500Mbps net connection. This bandwidth covers every service group but in J group need link aggregation because in this group load out and load in together 244.11Mbps. Normal CAT5 Copper Straight-Through cable can able transfer only 100Mbps.**
- **After 24 months** we need to change subnet of engineering section because we need merge into the existing group we need required more usable IP address. In that case we can replace /23 by /22 so we get 1022 usable IP address.

DHCP:

Dynamic Host Configuration Protocol is a client server protocol. In this network every router is in DHCP mode. It will helpful to add new computer in this network no need to configure by static. In big network if we configure by manually it will be difficult to remember other IP address. In DHCP mode we get host IP by request of DHCP and host get Ip address automatically.

SPU:

In this architecture I have used two routers to actively work the load balancer for both routers. In these two routers configured a virtual gateway which is helping to send data if one of them not working or shut down. Configuration of those router-

R1: G0/0 21.0.1.1/28, G0/1 17.0.1.12/26

R2: G0/0 21.0.1.5/28, G0/1 17.0.1.11/26

For both router default-router is 21.0.1.10

In those routers apply HSRP (Hot standby routing protocol) protocol system to create the virtual default-router and it's work perfectly. When active router works another router, state is inactive or standby. If active router gets any problem, then standby router works automatically no need any notification.

Link Aggregation: Link aggregation establish between the main switch 1 and main switch 2 and I also apply the channel port 1 for those links. In those center switches of the network faced more traffic if we use single link between them it will be risky. In disturbance of the link 1 then other link can be active. So very important to active the network any odds condition between these switches.

Cross connection:

Management department connected to all department (Engineering, sales, SPU and printer also). Engineering section also connected with SPU file server printer and customer support section. SPU, Management, engineering, sales peoples connected with the internet. All section can access to printer.

Monitoring:

For monitoring I have used another server with a different router and turned on SYSLOG mode for monitoring notification for any router and switches. I installed the code “logging (IP address of SYSLOG server)” in every server and switch and saved them. My code is “logging 22.0.1.1”. If I disconnect any router or switch or shut down any port, then text will go to SYSLOG server.

- ❖ **My session for monitoring for the SME PRTG monitoring tools it will cover the filters IP address, protocols, total traffic, port sniffer, file transfer traffic and remote control etc.**
- ❖ **After 24 months if in engineering section grown 25-50 people and in 5-6 sales staff there are no issues to connection because capacity of the network is two time capable.**

VPN and tunneling:

I have done the tunneling for remote cell with the main route which is connected to the internet I have used the virtual IP address is 100.0.0.1 for main router and IP address 100.0.0.2 for remote cell section. For VPN tunneling there are no effect on the other routers and switch. If we configure the routers going to be faster. VPN tunneling between the VPN server and for dedicated server are done.

In this network two VPN tunneling are done

- One Out site router link to dedicated server.
- Second VPN server to Out site router link

Printer:

Management, engineering, sale group are connected with the printer router.

References:

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- [3] https://www.youtube.com/watch?v=iLEcE_8BOd8&fbclid=IwAR2seX7l8nYjWZYeN4AmicAj2IkGr3d9PcG2fbBTv_c-aBJDBip5hcUophU
- [4] <http://www.firewall.cx/networking-topics/cabling-utp-fibre/112-network-cabling-utp.html>

