A REPORT

On

Campus Area Network

By

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TABLE OF CONTENTS

1.ABSTRACT

A LAN includes all the user devices, servers, switches, routers, cables, and wireless access points in one location. A LAN includes all devices in the same broadcast domain. A broadcast domain includes the set of all LAN-connected devices so that when any of the devices sends a broadcast frame, all the other devices get a copy of the frame. So, from one perspective, a LAN and a broadcast domain as being basically the same thing. Without VLANs, a switch considers all its interfaces to be in the same broadcast domain. That is, for one switch, when a broadcast frame entered one switch port, the switch forwarded that broadcast frame out all other ports. With that logic, to create two different LAN broadcast domains needs two different Ethernet LAN switches.

With support for VLANs, a single switch can accomplish the same goals of the design to create two broadcast domains—with a single switch. With VLANs, a switch can configure some interfaces into one broadcast domain and some into another, creating multiple broadcast domains. These individual broadcast domains created by the switch are called virtual LANs (VLAN).

Designing campus LANs to use more VLANs, each with a smaller number of devices, often helps improve the LAN in many ways. For example, a broadcast sent by one host in a VLAN will be received and processed by all the other hosts in the VLAN—but not by hosts in a different VLAN. Limiting the number of hosts that receive a single broadcast frame reduces the number of hosts that waste effort processing unneeded broadcasts. It also reduces security risks, because fewer hosts see frames sent by anyone host.

These are just a few reasons for separating hosts into different VLANs.

The following list summarizes the most common reasons for choosing to create smaller broadcast domains (VLANs):

1. To reduce CPU overhead on each device by reducing the number of devices that receive each broadcast frame.
2. To reduce security risks by reducing the number of hosts that receive copies of frames that the switches flood (broadcasts, multicasts, and unknown unicasts)
3. To improve security for hosts that send sensitive data by keeping those hosts on a separate VLAN
4. To create more flexible designs that group users by department, or by groups that work together, instead of by physical location
5. To solve problems more quickly, because the failure domain for many problems is the same set of devices as those in the same broadcast domain.

2.COMPANY PROFILE

Regional Telecom Training Centre has been established in 1973 at Hyderabad by the Department of Telecommunications to impart training to its staff. This training center is situated in 42 acres of land at Gachibowli, I.T hub of Hyderabad City. This comprises Administrative cum academic block, Hostel Block, etc. With the burgeoning growth that is being experienced in the Telecom sector, there is a requirement of manpower to plan, install, operate, and maintain the Telecom networks. The Telecom networks could be fixed access landline voice and broadband, GSM and CDMA wireless, 3G, data networks, optical fiber networks. Specific skills are required for each of these areas and activities.

B. Tech and Diploma in Electronics and Communications engineering education are broad-based and students do not have specific skills required for the different sectors of the industry as they are not exposed to the technologies and equipment in use. Keeping this in mind to provide knowledge and skills for specific activities so that the students possess employable skills from day one, customized training programs have been designed and offered to freshers and persons with some experience.

3.PROJECT DESCRIPTION

In this project, we designed a college campus area Network with VLANs with different Hosts and Departments as per the following requirement.

1. College campus is a (Ground + 4) 5 Floor building.

2. Ground Floor should have 100Mbps connectivity to ISP for the Internet with a CISCO 2811 Router with a single LAN port.

3. First, Second, Third, and Fourth floors have Hosts belongs to CSC/IT//ECE/EEE departments related to I year, II year, III Year, and Final year students classrooms. Each Floor has a switch connecting these hosts.

4. Switch from the top floor is connected directly to its next floor switch and finally, from the First-floor switch, a cable is extended to the ground floor to the LAN port of CISCO Router 2811.

5. I have been asked to configure the departments in different VLAN domains and also instructed that the communication between the departments is also required.

6. I have been asked to place an Access point for wireless connectivity with security password from the Fourth Floor on need basis

7. I have been asked to create security credentials for login to the Router and Switches such that authorized persons only log in.

8. I have been asked to make sure that if anyone connects a host in the vacant ports of the switch on any floor they should not work.

9. I have been asked to allocate 40 Mbps bandwidth to CSC department, 30 Mbps bandwidth to the IT department, 20 Mbps bandwidth for ECE department & 10 Mbps bandwidth to EEE department for Internet access.

10. ISP has given 10.10.10.0/30 subnet to college and asked the administrator to configure the WAN link IP 10.10.10.1 at the College side WAN interface on Router. The Internet IP pool given to college is 117.117.117.0/29.

11. I have been instructed to make sure that all computers available on the campus should be connected with the Internet.

12. I have been asked put college website IP as 117.117.117.3 and this website has to be accessed from the Internet.

4.CISCO PACKET TRACER

In our project I used Cisco Packet Tracer, Packet Tracer is a cross-platform visual simulation tool designed by Cisco Systems that allows users to create network topologies and imitate modern computer networks. The software allows users to simulate the configuration of Cisco routers and switches using a simulated command-line interface. Packet Tracer makes use of a drag and drops user interface, allowing users to add and remove simulated network devices as they see fit. The software is mainly focused on Certified Cisco Network Associate Academy students as an educational tool for helping them learn fundamental CCNA concepts. Previously students enrolled in a CCNA Academy program could freely download and use the tool free of charge for educational use.

Packet Tracer allows students to design complex and large networks, which is often not feasible with physical hardware, due to costs. Packet Tracer is commonly used by CCNA Academy students since it is available to them for free. However, due to functional limitations, it is intended by CISCO to be used only as a learning aid, not a replacement for Cisco routers and switches. The application itself only has a small number of features found within the actual hardware running a current Cisco IOS version. Thus, Packet Tracer is unsuitable for modeling production networks. It has a limited command set, meaning it is not possible to practice all of the IOS commands that might be required. Packet Tracer can be useful for understanding abstract networking concepts, such as the Enhanced Interior Gateway Routing Protocol by animating these elements in a visual form. Packet Tracer is also useful in education by providing additional components, including an authoring system, network protocol simulation and improving knowledge an assessment system

5.PROJECT DESIGN METHODOLOGY

In this Project, the college campus area Network has VLANs with different Hosts and Departments

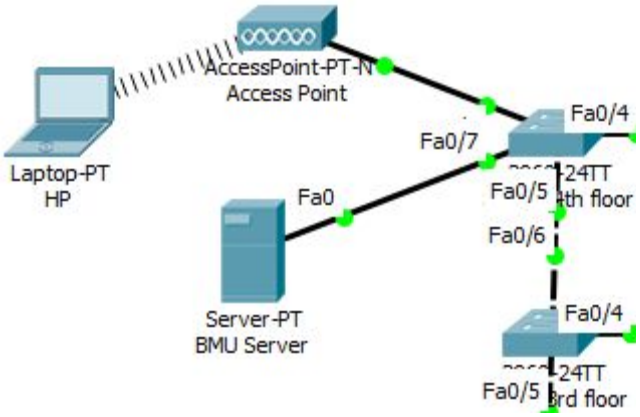
- College campus is a 5 Floor building and I have installed a switch on every floor of the campus building except the ground floor.
- Ground Floor was given 100Mbps connectivity to ISP for the Internet with a CISCO 2811 Router with a single LAN port. The First, second, Third, and Fourth floors have Hosts belongs to CSC/IT//ECE/EEE departments related to I year, II year, III Year, and Final year students classrooms. Each Floor has a switch connecting these hosts.
- Switch from the top floor is connected directly to its next floor switch and finally, from the First-floor switch, a cable is extended to the ground floor to the LAN port of CISCO Router 2811.
- I have been asked to configure the departments in different VLAN domains and also instructed that the communication between the departments is also required so I have created 4 different VLANS named CSE (VLAN -10), IT(VLAN-20), ECE(VLAN-30), EEE(VLAN-40) respectively.

IOS Command Line Interface

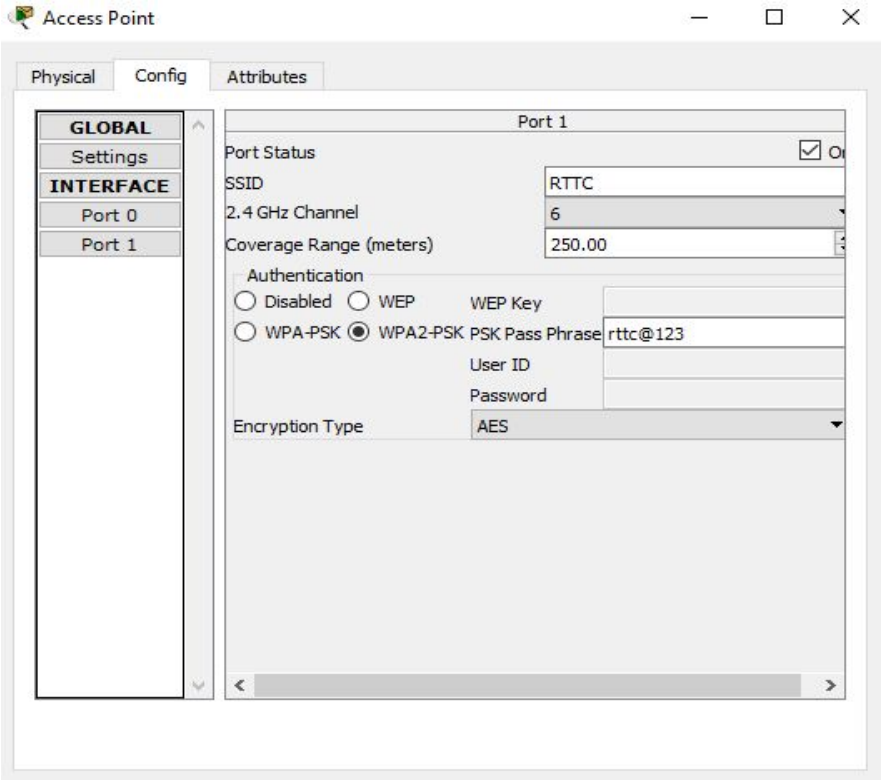
```
VLAN Name                              Status    Ports
---- --------------------------------- ---------
-------------------------------
1    default                           active    Fa0/7, Fa0/8,
Fa0/9, Fa0/10
                                                 Fa0/11, Fa0/12,
Fa0/13, Fa0/14
                                                 Fa0/15, Fa0/16,
Fa0/17, Fa0/18
                                                 Fa0/19, Fa0/20,
Fa0/21, Fa0/22
                                                 Fa0/23, Fa0/24,
Gig0/1, Gig0/2
10   CSE                               active    Fa0/1
20   IT                                active    Fa0/2
30   ECE                               active    Fa0/3
40   EEE                               active    Fa0/4
1002 fddi-default                      active
1003 token-ring-default                active
1004 fddinet-default                   active
1005 trnet-default                     active

VLAN Type  SAID       MTU   Parent RingNo BridgeNo Stp  BrdgMode
Trans1 Trans2
```

The above picture shows the VLANs and the FastEthernet's connected respectively.

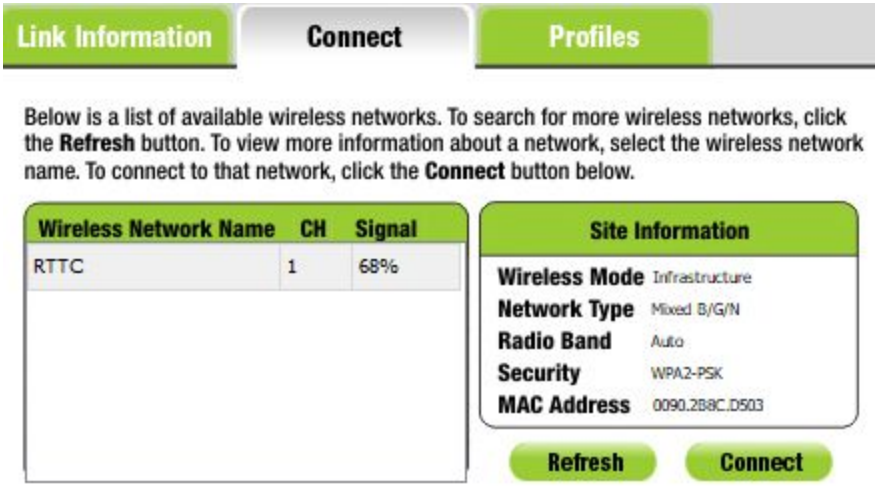
- I have placed an Access point for wireless connectivity with a security password from the Fourth Floor on need basis and also used a laptop to check the connectivity.

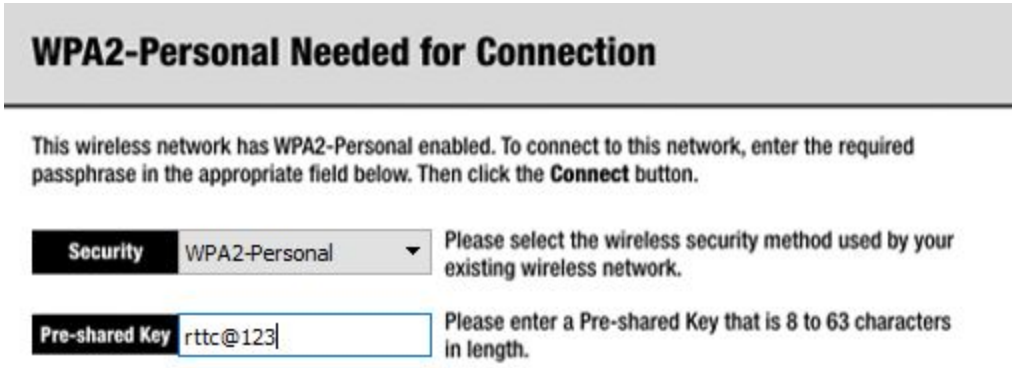


- Then I have created login credentials for the access point on the fourth floor. In the below picture the access point is configured with the WAP2-PSK PSK password.



- And when we try to access the wifi through the access point, it asks for login credentials.



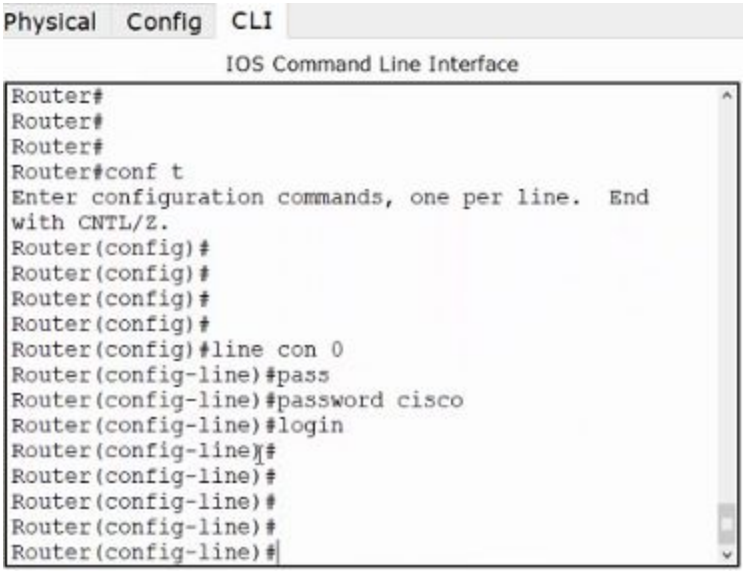


- And also created security credentials for login to the Router and Switches such that authorized persons only log in and made sure that if anyone connects a host in the vacant ports of the switch on any floor they don't work.

  After assigning the password for the router, when we open the CLI mode, this verification pops up.

```
User Access Verification

Password:

Router>enable
Password:
Router#
```

This is the backend code given in the CLI,



The unused ports are shut-down for the 1st-floor switch in the below picture,

Port	Link	VLAN	IP Address	MAC Address
FastEthernet0/1	Up	10	--	000A.F300.D201
FastEthernet0/2	Up	20	--	000A.F300.D202
FastEthernet0/3	Up	30	--	000A.F300.D203
FastEthernet0/4	Up	40	--	000A.F300.D204
FastEthernet0/5	Up	--	--	000A.F300.D205
FastEthernet0/6	Up	--	--	000A.F300.D206
FastEthernet0/7	Down	1	--	000A.F300.D207
FastEthernet0/8	Down	1	--	000A.F300.D208
FastEthernet0/9	Down	1	--	000A.F300.D209
FastEthernet0/10	Down	1	--	000A.F300.D20A
FastEthernet0/11	Down	1	--	000A.F300.D20B
FastEthernet0/12	Down	1	--	000A.F300.D20C
FastEthernet0/13	Down	1	--	000A.F300.D20D
FastEthernet0/14	Down	1	--	000A.F300.D20E
FastEthernet0/15	Down	1	--	000A.F300.D20F
FastEthernet0/16	Down	1	--	000A.F300.D210
FastEthernet0/17	Down	1	--	000A.F300.D211
FastEthernet0/18	Down	1	--	000A.F300.D212
FastEthernet0/19	Down	1	--	000A.F300.D213
FastEthernet0/20	Down	1	--	000A.F300.D214
FastEthernet0/21	Down	1	--	000A.F300.D215
FastEthernet0/22	Down	1	--	000A.F300.D216
FastEthernet0/23	Down	1	--	000A.F300.D217
FastEthernet0/24	Down	1	--	000A.F300.D218
GigabitEthernet0/1	Down	1	--	000A.F300.D219
GigabitEthernet0/2	Down	1	--	000A.F300.D21A
Vlan1	Down	1	<not set>	00D0.FF4E.3EDB

Hostname: Switch

- I have allocated 40 Mbps bandwidth to CSC department, 30 Mbps bandwidth to the IT department, 20 Mbps bandwidth for ECE department & 10 Mbps bandwidth to EEE department for Internet access.

```
Router(config-subif)#ip add 192.168.2.1 255.255.255.0
Router(config-subif)#badn
Router(config-subif)#band
Router(config-subif)#bandwidth 30000
Router(config-subif)#end
```

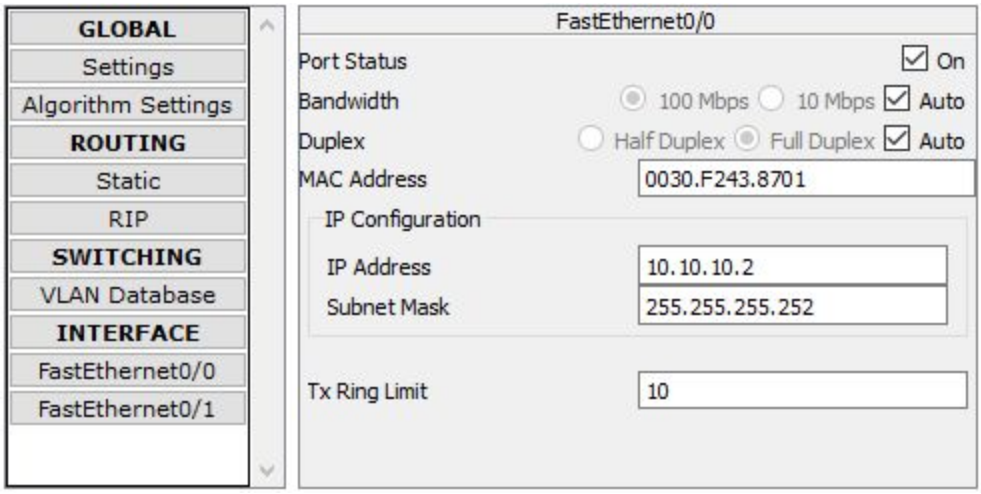
Likewise, I configured VLAN10, VLAN30, VLAN40 respectively.

- ISP has given 10.10.10.0/30 subnet to college and asked the administrator to configure the WAN link IP 10.10.10.1 at the College side WAN interface on Router. The Internet IP pool given to college is 117.117.117.0/29.

W

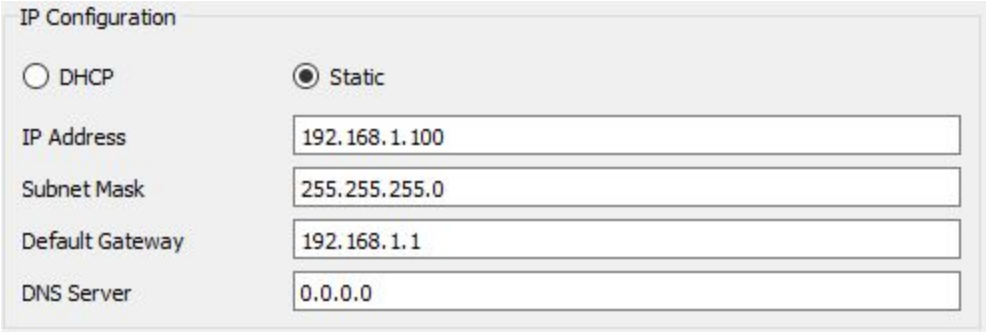
```
Port              Link   VLAN   IP Address       IPv6 Address                              MAC Address
FastEthernet0/0   Up     --     10.10.10.2/30    <not set>                                 0030.F243.8701
FastEthernet0/1   Up     --     2.2.2.1/30       <not set>                                 0030.F243.8702
Vlan1             Down   1      <not set>        <not set>                                 000C.CFCA.14E2
Hostname: ISP
```

We used dot1Q IEEE standards encapsulation for assigning the bandwidth.



The FastEthernet 0/0 configuration is shown in the above picture.

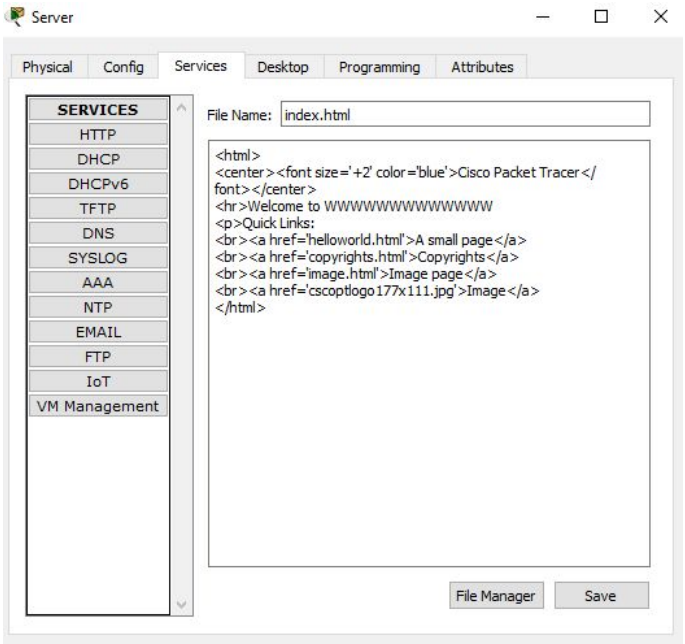
- And made sure that all computers available on the campus are connected with the Internet and kept the college website IP as 117.117.117.3 and this website has to be accessed from the Internet.



The website is in the BMU server, the above picture shows the IP configuration of the server. And then I did natting,

```
Router(config)#ip nat pool RTTC 117.117.117.1 117.117.117.1 netmask 255.255.255.248

Router(config)#ip nat inside source static 192.168.1.100 117.117.117.3

Router(config)#ip nat inside source list 1 pool RTTC overload
```

Created a server to check internet access with IP address 2.2.2.2,



6.PROJECT IMPLEMENTATION OF COMPUTER NETWORK DESIGN

This project was implemented using WAN and LANs,

A wide area network is a telecommunications network that extends over a large geographical area for the primary purpose of computer networking. Wide area networks are often established with leased telecommunication circuits.

Here in this project, I used WAN at the ISP side, gave 100MBPs connection to the router using FastEthernet cable.

A local area network (LAN) is a collection of devices connected together in one physical location, such as a building, office, or home. A LAN can be small or large, ranging from a home network with one user to an enterprise network with thousands of users and devices in an office or college.

A virtual LAN (VLAN) is any broadcast domain that is partitioned and isolated in a computer network at the data link layer. LAN is the abbreviation for local area network and in this context, virtual refers to a physical object recreated and altered by additional logic. VLANs allow network administrators to group hosts together even if the hosts are not directly connected to the same network switch. Because VLAN membership can be configured through software, this can greatly simplify network design and deployment. Without VLANs, grouping hosts according to their resource needs the labor of relocating nodes or rewiring data links. VLANs allow networks and devices that must be kept separate to share the same physical cabling without interacting, improving simplicity, security, traffic management, or economy.

Here in this project, I used four different VLANs for each branch of CSE, IT, ECE, and EEE. I have provided a bandwidth of 40MBPs to CSE (VLAN-10), 30MBPs to IT (VLAN-20), 20MBPs to ECE (VLAN-30), and 10MBPs to EEE (VLAN-40) respectively for internet access. And also gave ACL(permit any) and did Natting with a public IP Pool.

```
Router>
Router>enable
Router#conf t
Enter configuration commands, one per line.  End with
CNTL/Z.
Router(config)#ip nat pool BMU 117.117.117.1
117.117.117.1 netmask 255.255.255.248
Router(config)#ip nat inside source static 192.168.1.100
117.117.117.3
Router(config)#ip nat inside source list 1 pool BMU
overload
Router(config)#exit
Router#
%SYS-5-CONFIG_I: Configured from console by console
exit
```

NAT: 192.168.1.100 → 117.117.117.3

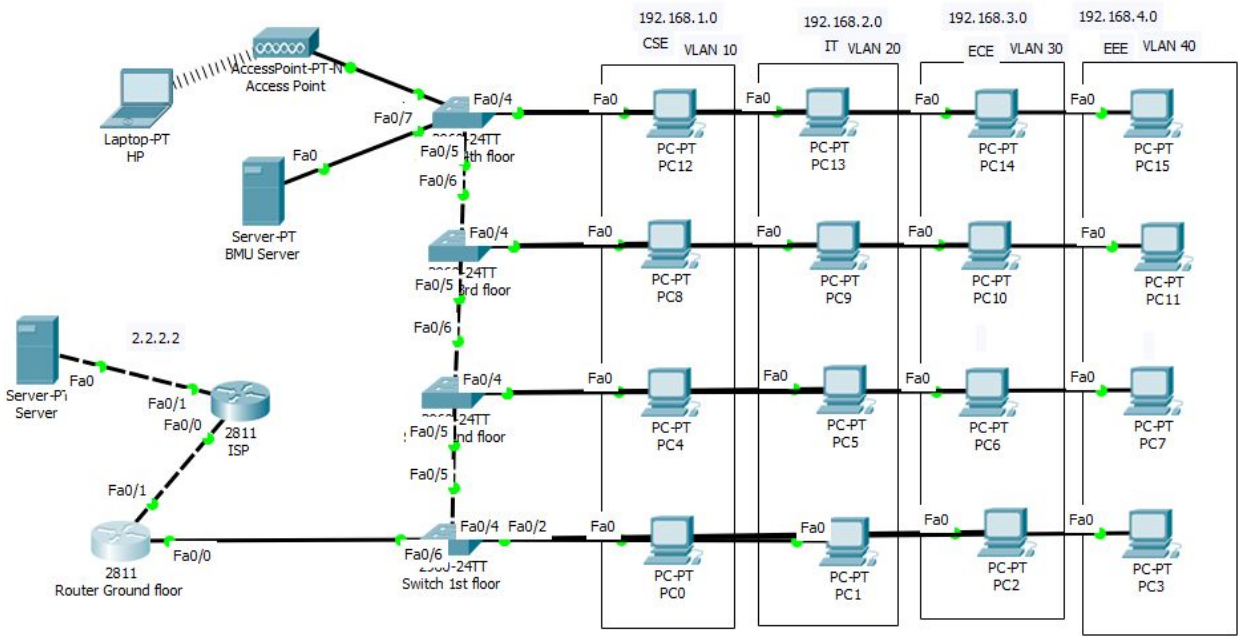
7.PROJECT THESIS

A College campus building has 5 Floors. The Ground Floor router was given 100Mbps connectivity to ISP for the Internet. The First, Second, Third, and Fourth floors have Hosts belongs to CSC/IT//ECE/EEE departments related to I year, II year, III Year, and Final year students classrooms. Each Floor has a switch connecting these hosts. Switch from the top floor is connected directly to its next floor switch and finally, from the First-floor switch, a cable is extended to the ground floor to the LAN port of CISCO Router 2811. I have configured the departments in different VLAN domains and also provided the communication between the departments is also required. And placed an Access point for wireless connectivity with security password from the Fourth Floor on need basis and create security credentials for login to the Router and Switches such that authorized persons only log in. And made sure that if anyone connects a host in the vacant ports of the switch on any floor they should not work.

I have allocated 40 Mbps bandwidth to CSC department, 30 Mbps bandwidth to the IT department, 20 Mbps bandwidth for ECE department & 10 Mbps bandwidth to EEE department for Internet access.

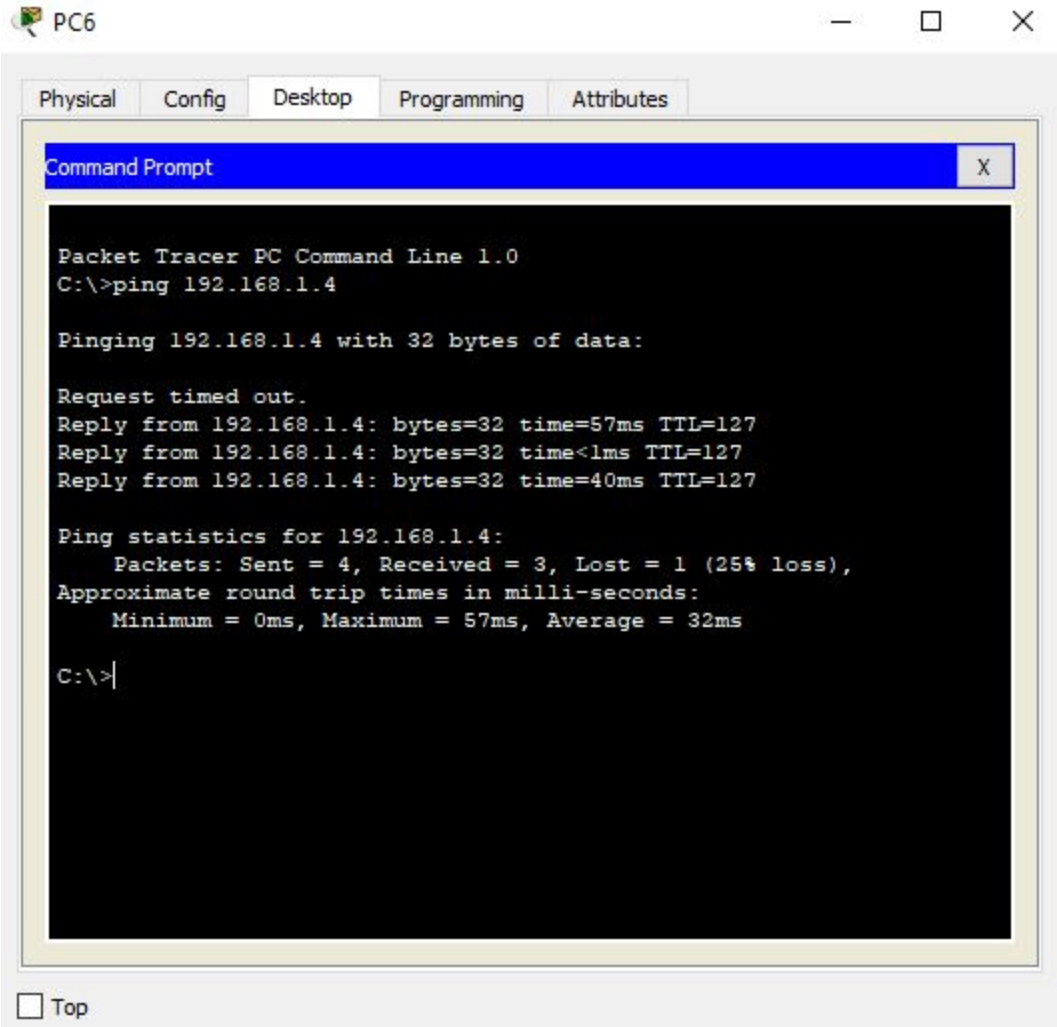
ISP has given 10.10.10.0/30 subnet to college and asked to configure the WAN link IP 10.10.10.1 at the College side WAN interface on Router. The Internet IP pool given to college is 117.117.117.0/29. And made sure that all computers available on the campus are connected with the Internet. And kept the college website IP as 117.117.117.3 and this website has to be accessed from the Internet.

Final Campus Area Network,



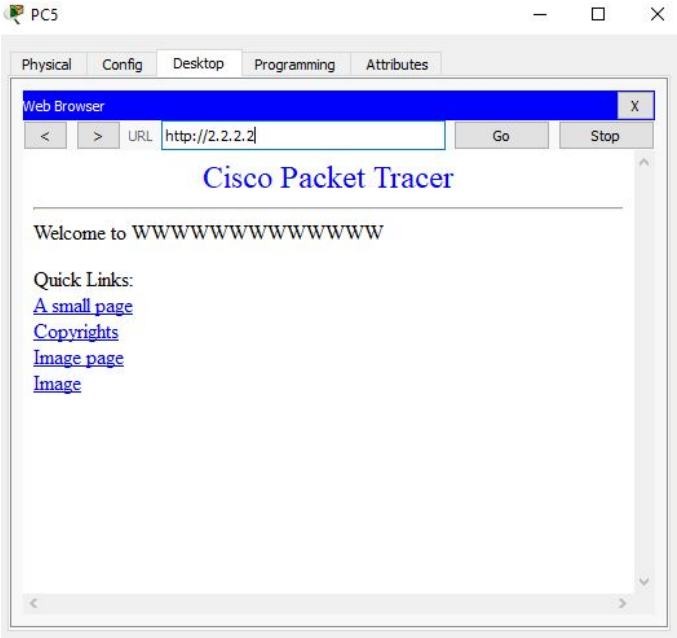
Results:

(i) After creating the VLANS, the intercommunication of batches made possible.

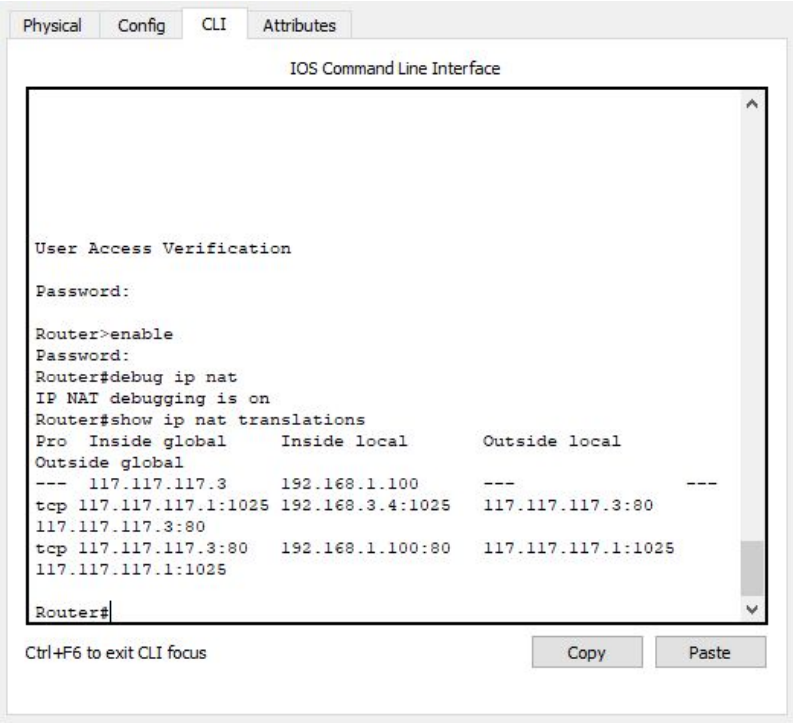


Pinging is done to check the connectivity/ communication between all the PCs available in the Local Area Network. We made sure that the communication is also done between the different VLANs.We can send receive packets/data from one PC to another.

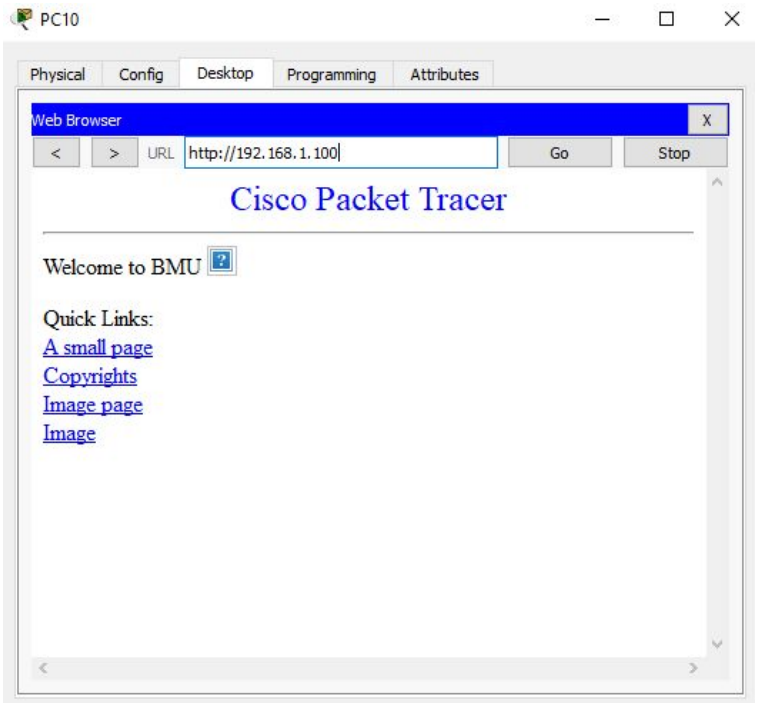
(ii) All PCs are allowed to access the internet as per ACL

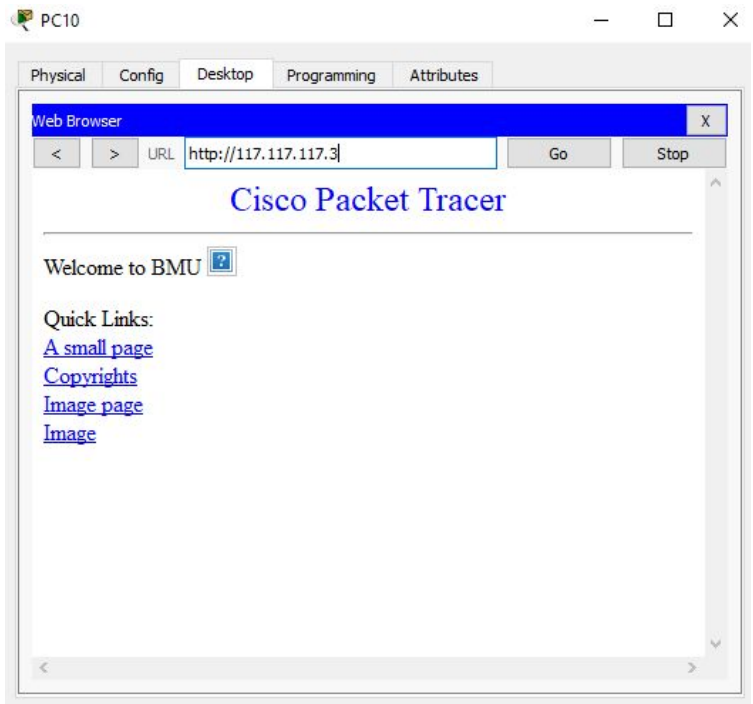


(iii) Natting is done, the picture below displays the IP NAT Debug.



(iv) Display of College Website on 192.168.1.100 and public IP 117.117.117.3.





8.FUTURE SCOPE OF THE PROJECT

Future work can be continued with refinement in the framework with inclusion on upcoming technologies like 802.11ac (IEEE 802.11ac is a wireless networking standard in the 802.11 sets of protocols (which is part of the Wi-Fi networking family), providing high-throughput wireless local area networks (WLANs) on the 5 GHz band.). More improved estimations for coverage area and placement of access points are possible with algorithms and simulation tools that can work for both indoor and outdoor simultaneously. Single integrated tools for performance measurement will definitely help network administrators to keep an eye on WLAN and delivery of content can be monitored.

9.CONCLUSION

This report is a brief account of network design techniques and the reasons for the widespread use of WAN and LANs. The Campus Area Network project simulations are done in CiscoPacket Tracer. The simulations give the behavior of the physical components and hence we could build a campus area network using components like PCs, Switches, Routers, and Servers. And created security credentials for login to the Router and Switches. And made sure that all computers available on the campus are connected with the Internet.