NETWORKS AND SYSTEMS ADMINISTRATION

ENTERPRISE NETWORK IN VIRTUALISED ENVIRONMENT

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1.INTRODUCTION

Networking is without a doubt a critical part of device communication. This communication can be achieved by cables or Wi-Fi. During this communication users are able to:

- share hardware and resources such as printers, GPU, etc
- share data such as text files, images, etc
- access software which allows them to contribute to or control the shared work

This paper presents the design and implementation of an Enterprise Network project in a virtualized environment for a small-scaled digital game development company.

This project includes system administration technologies and networking protocols such as Dynamic Host Configuration Protocol (DHCP), Domain Name System (DNS), Teletype Network (Telnet), File Transfer Protocol (FTP). This project aims to help the aforementioned company with the creation of their internal network which is connected to the internet through a cloud server while all the internal devices' IP addresses are statically assigned or given from the DHCP server.

2. BACKGROUND

The days without hearing reference to the Internet are long gone. The story of the Internet began in 1969 and is continuing to this day. Every computing device in schools, businesses, etc are connected and form a network. This provides a way for users to share information, software and devices. Any device that is being used in a network can be referred to as a node. Nodes can be limited to a room (office) or cover an entire building; this is called Local Area Network (LAN). Another form of sharing can also involve larger projects such as cities, countries, etc; This is named a Wide Area Network (WAN). All the communications between devices need an identifier to find the actual source and receiver. This is called as an Internet Protocol (IP). IP can be also thought as a language between computers.

The Internet is a multitude of networks, which means the message from one device to another may travel through various networks and can encounter many types of hardware and software combinations such as switches, routers, etc.

The following technologies applied in this project:

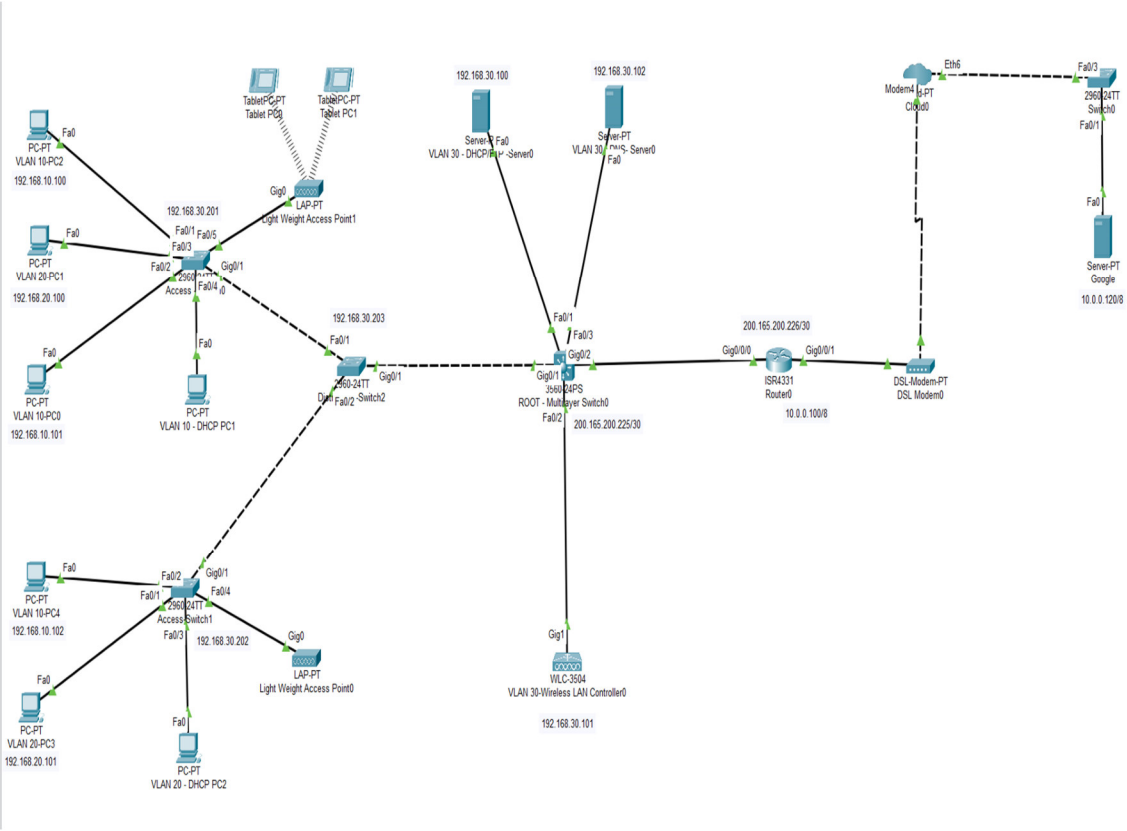
Dynamic Host Configuration Protocol (DHCP): A network management protocol which automates the process of configuring network devices and allowing them to use network services and communication protocols based on UDP or TCP. DHCP server dynamically assigns IP addresses to each individual device on the network to communicate with other IP networks.
Domain Name System (DNS): All devices on the Internet, communicate with one another by using IP addresses. With the help of DNS, users do not have to remember these IP addresses. Instead, users can enter the name of the domain that they would like to visit and be directed to the right place.
Teletype Network (Telnet): Developed in 1969, Telnet is a protocol that provides a command-line interface for communication with another device or server. The most common alternative for this technology is Secure Shell (SSH) Protocol which has higher security considerations.
File Transfer Protocol (FTP): FTP refers to a process that involves the transfer of files over a network. This protocol lets people or applications to share and exchange data from one to another.

3. TECHNICAL DESCRIPTION OF THE PROJECT

The project involves four different VLANs which are named VLAN 10 , VLAN 20, VLAN 30, VLAN 40. These VLANs demonstrate developer, designer, administration, and Wi-Fi networks, respectively. Each device is connected to the network via Access Switches. IP addresses of these networks are configured by the DHCP server or statically. Because all these VLANs have different subnets, a multilayer switch is configured to help these devices to communicate one another (IP Routing).
To ensure there is a wireless connection in the workplace, a Wireless Controller is configured and Light Weight Access Points are connected to the specific switches, a DHCP server is also configured. A router is configured to allow these devices to connect to the internet through a cloud server. The Web server is enabled on the Google Server thorough cloud. The DNS server is configured, and all necessary configurations are set on DHCP server. Finally, Telnet is configured on the Access Switches to give control to the administration of VLANs over switches.
Finally, with FTP enabled, all devices are given the ability to share files over the network.

The following figure is showing the network architecture:

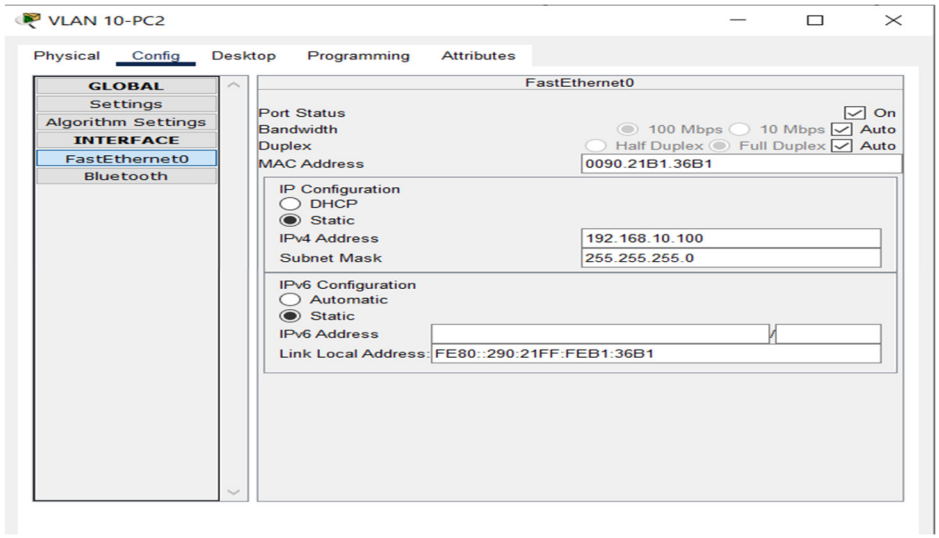
Figure 1. Network Architecture



3.1 Static IP

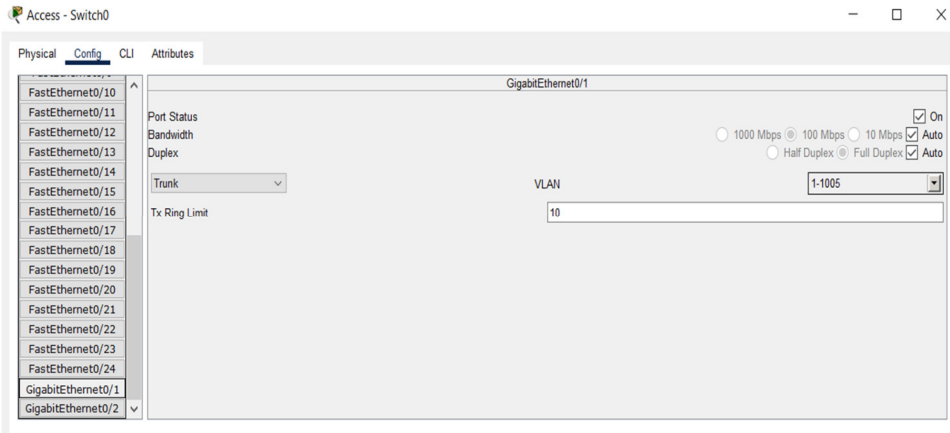
VLANs were created and each computer labeled accordingly to their VLAN. Each computer's IP addresses were assigned statically.

Figure 2. Example of statically assigned IP



Access switches were configured to make sure that each computer can communicate with the other. To make communication possible between different VLANs, trunking were configured on switches.

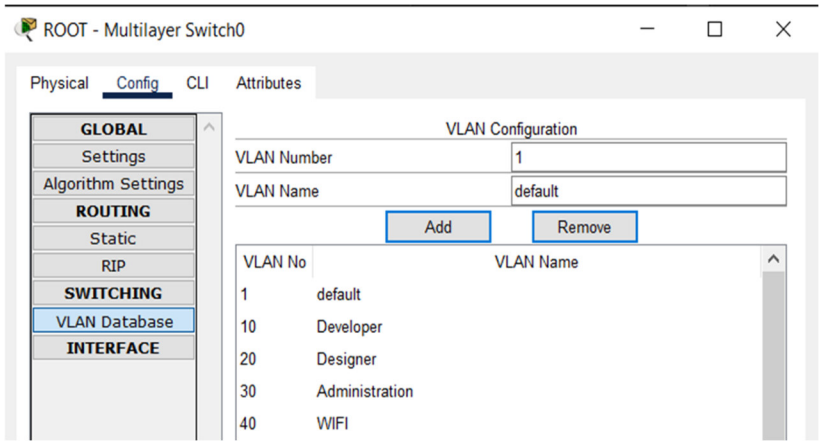
Figure 3. Switchport Trunking



3.2 Multilayer Switch

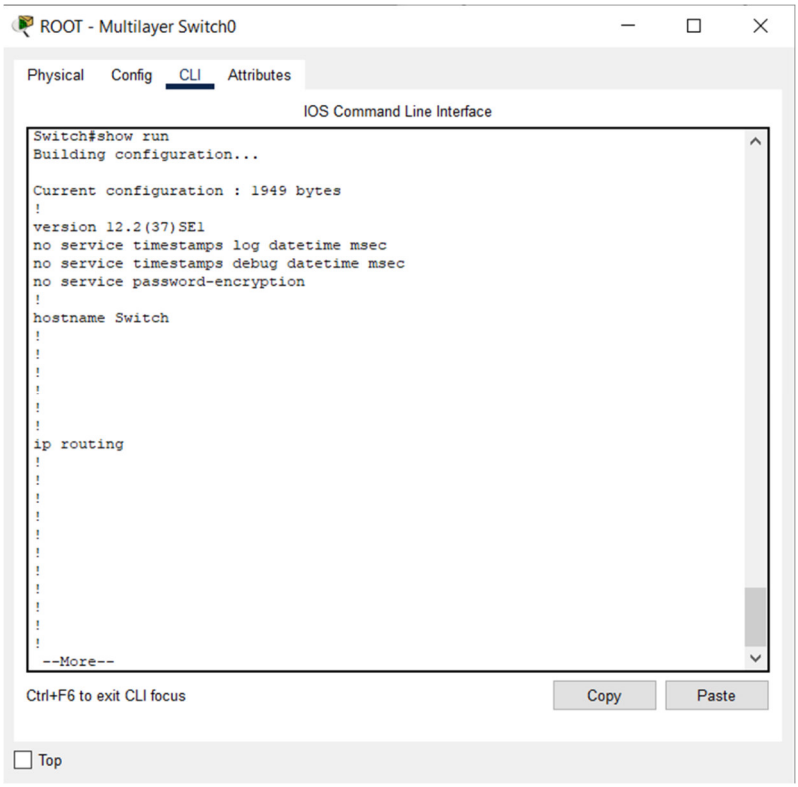
VLANs was identified on Multilayer Switch as shown.

Figure 4. Multilayer Switch VLAN Database



IP Routing enabled on Multilayer Switch

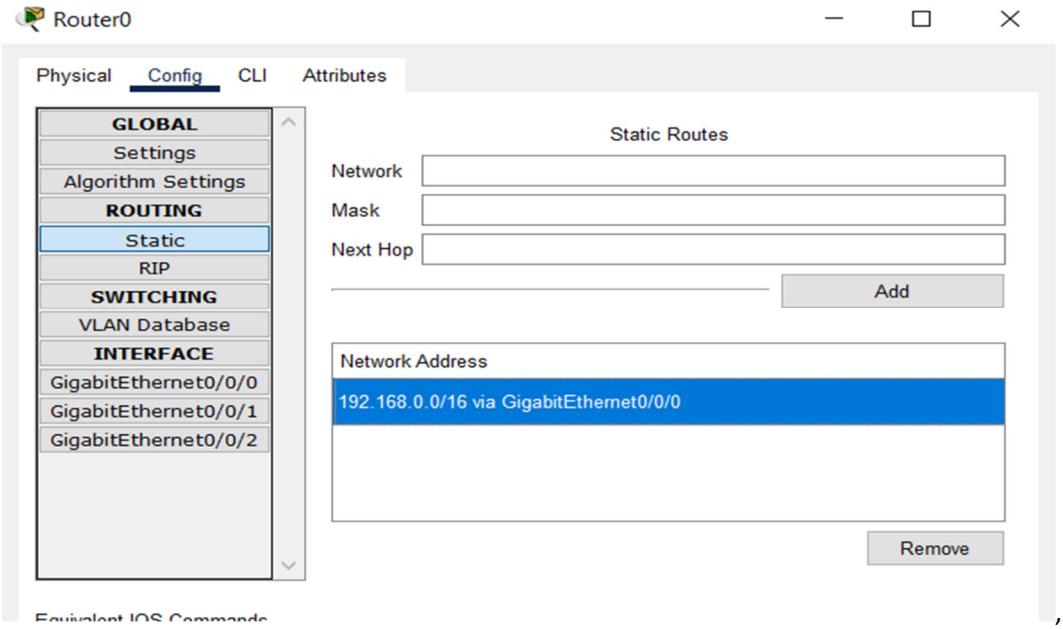
Figure 5. Multilayer Switch IP Routing Enabled



3.3 Router

Necessary configuration made on Router.

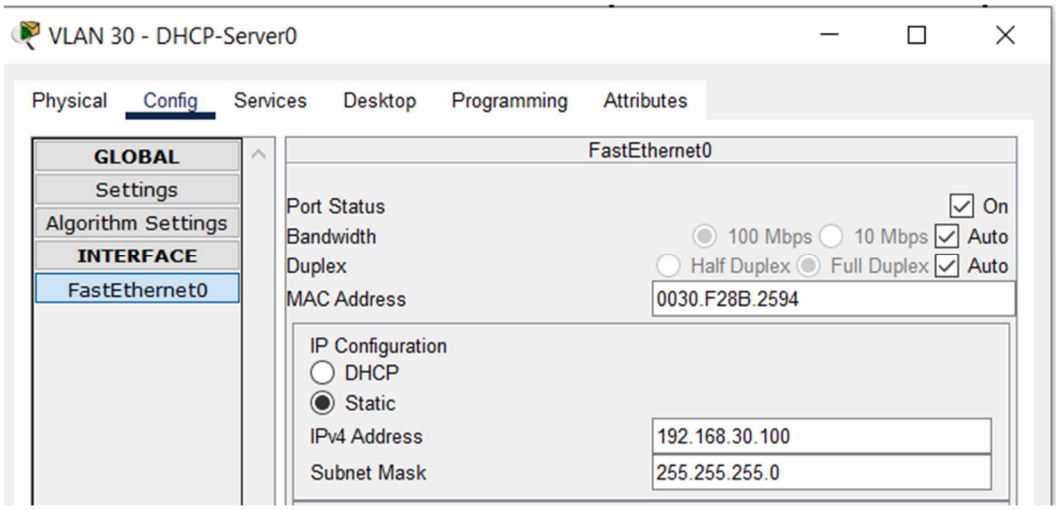
Figure 6. Router Configuration



3.4 DHCP

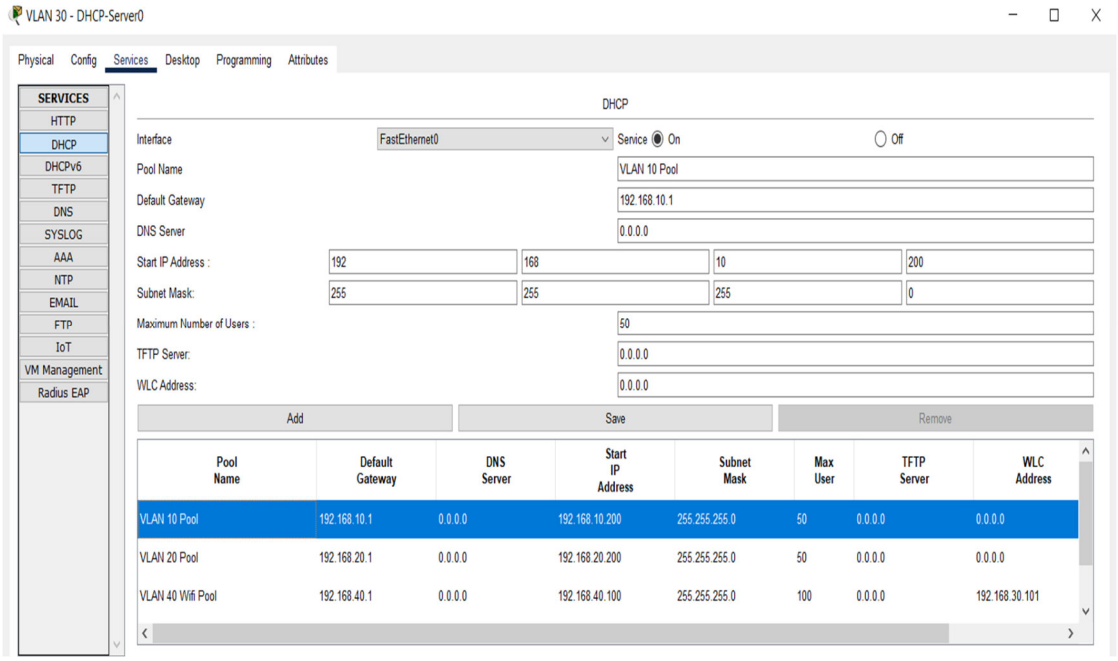
Ip address were statically given to DHCP

Figure 7. DHCP Server statically IP assigned



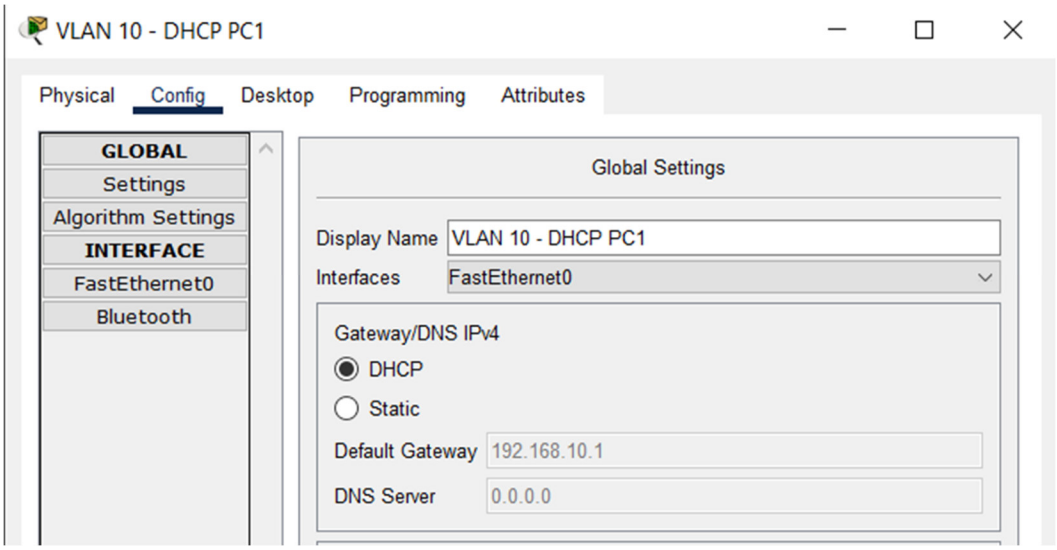
VLAN pools configured on DHCP Server.

Figure 8. DHCP VLAN pool



DHCP server able to give IP adresses to computers.

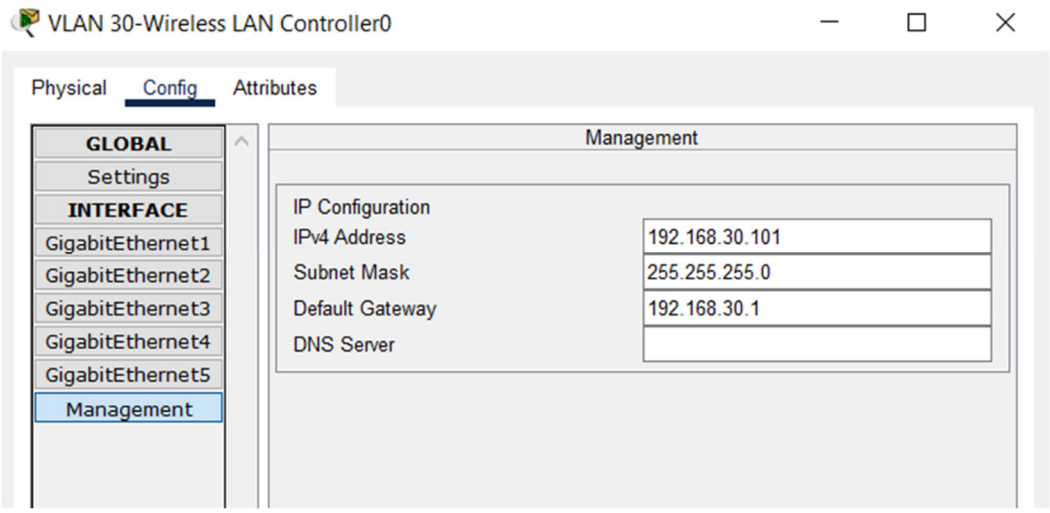
Figure 9. Example of IP assigned by DHCP Server



3.5 Wireless Lan Controller

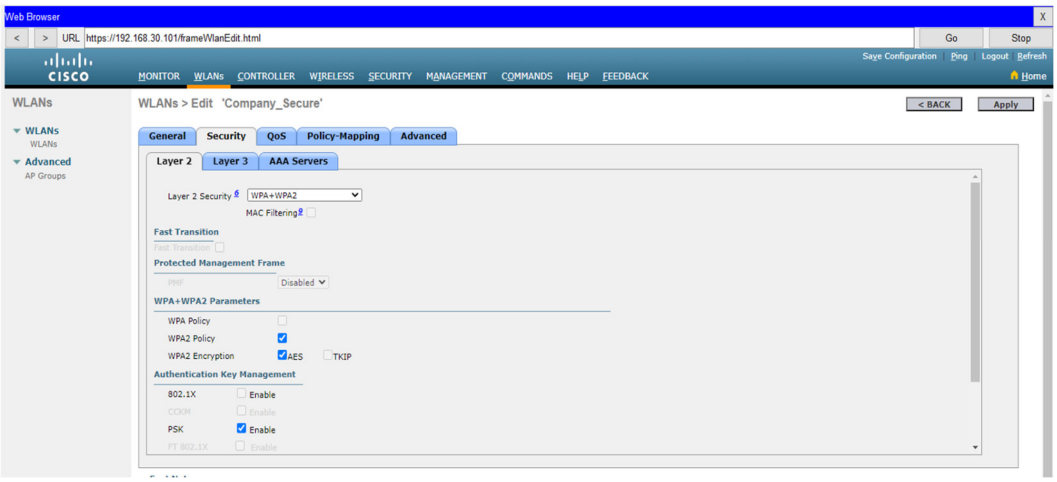
IP address given to WLC

Figure 10. Wireless LAN Controller Configuration



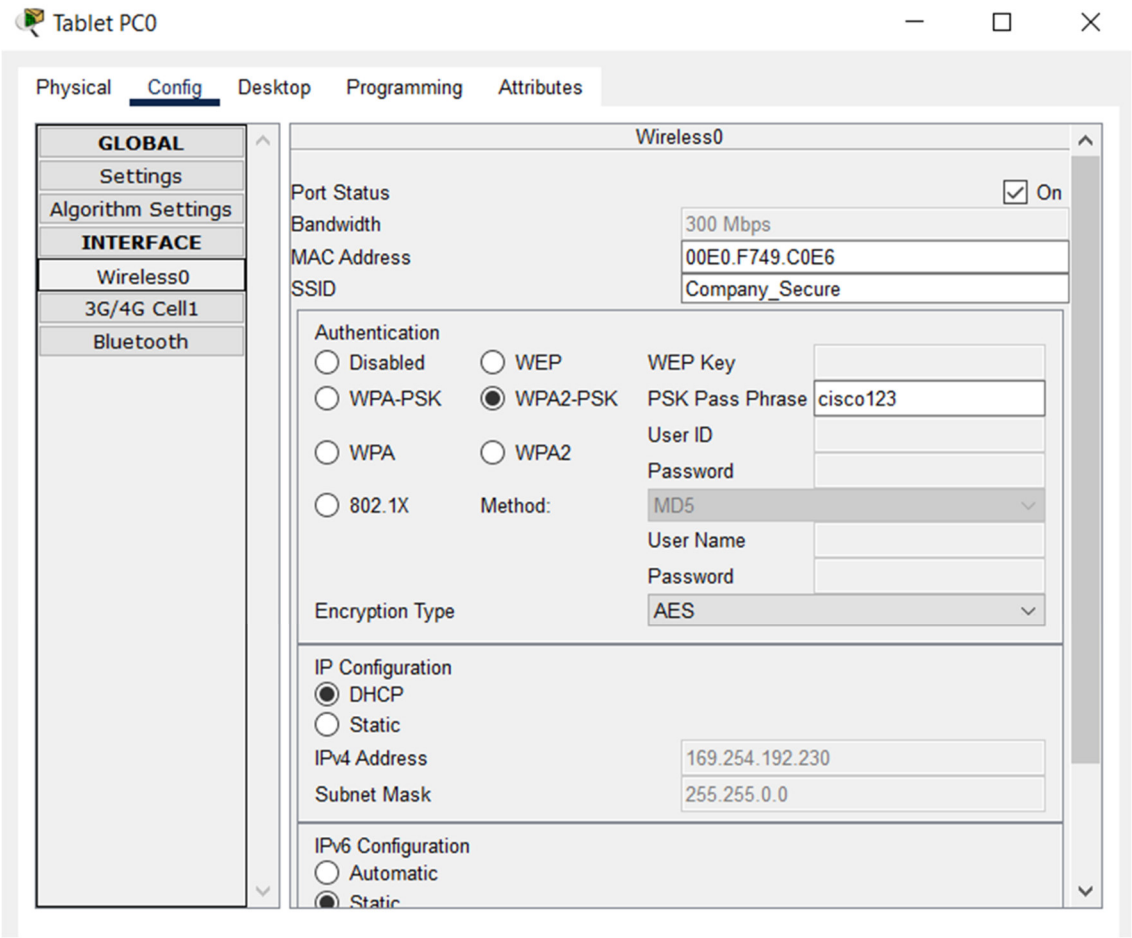
Wireless connection named and settings configured.

Figure 11. Wireless Connection Configuration



Devices can connect to wireless access point with correct password

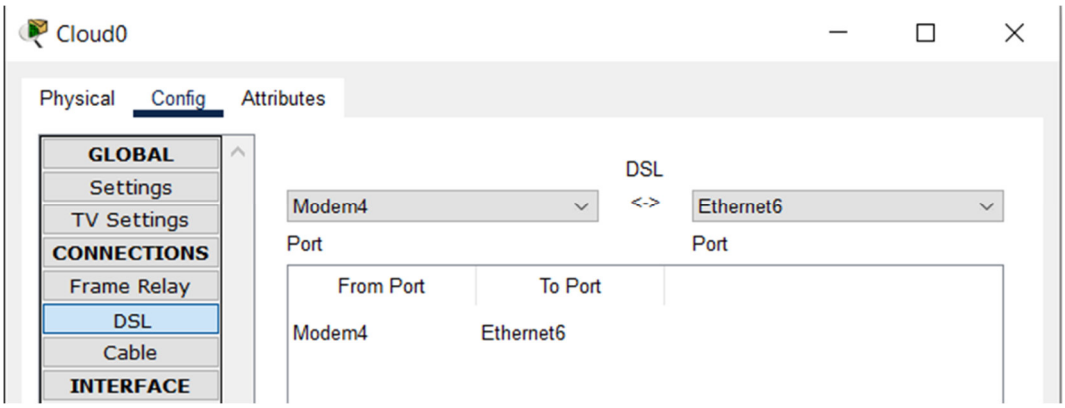
Figure 12. Example of WIFI connection



3.6 NAT

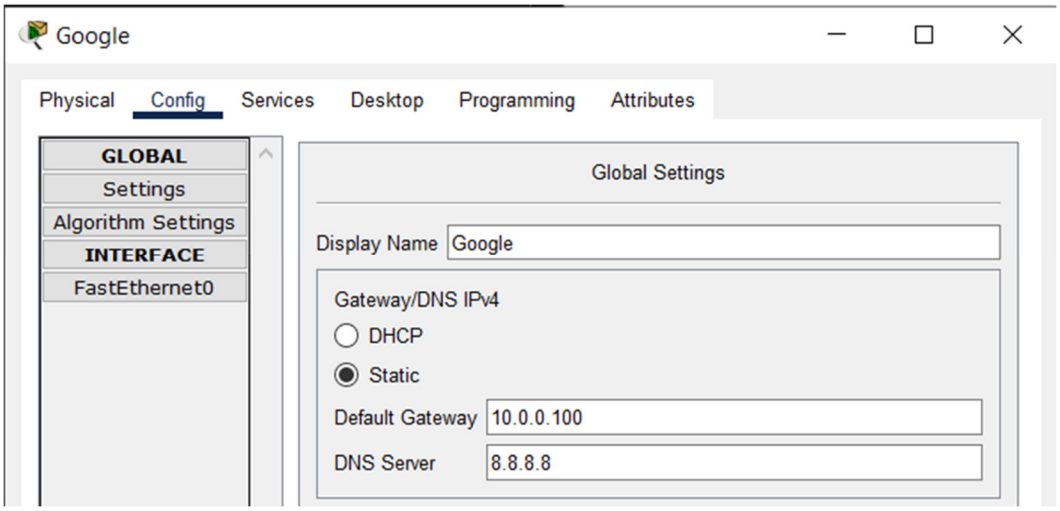
Cloud connected through modem.

Figure 13. Cloud Configuration



IP address configured for Google Web Server

Figure 14. Web Server Configuration



IP Routing configured on Multilayer Switch and Router

Figure 15. IP Routing on Multilayer Switch

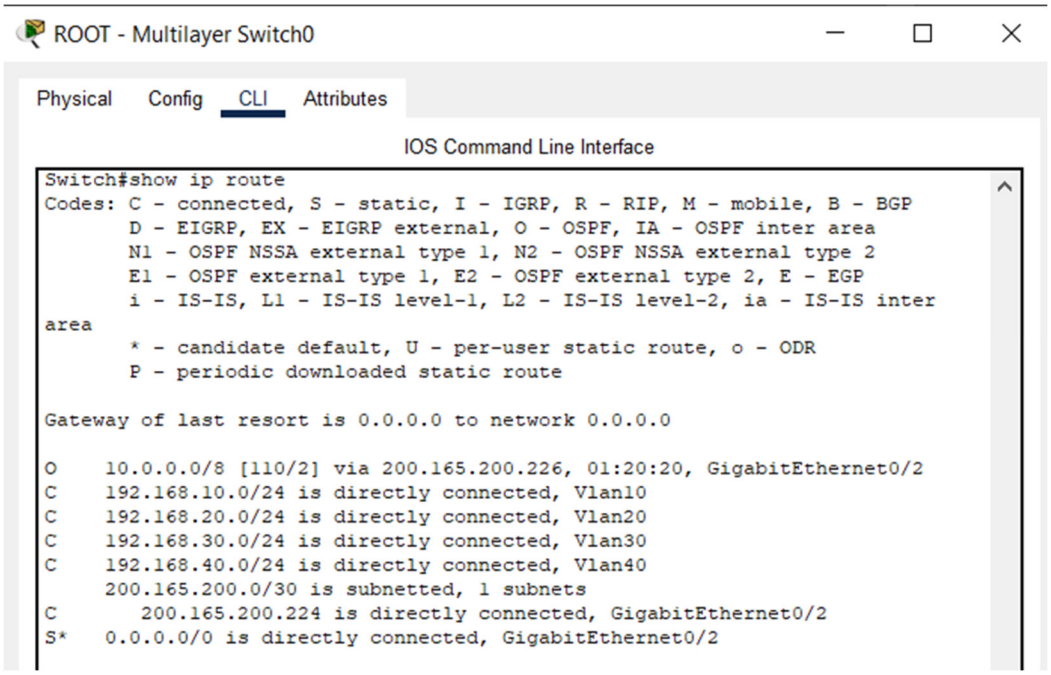
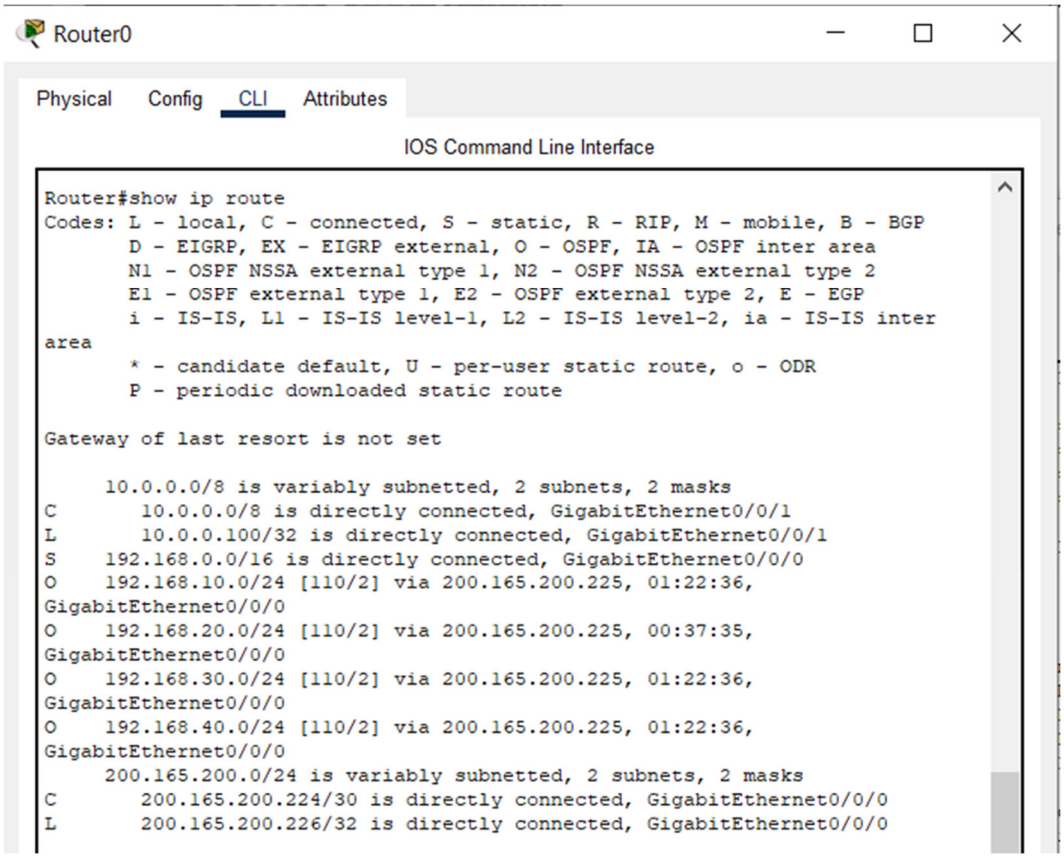


Figure 16. IP Route on Router




```
Router#show ip route
Codes: L - local, C - connected, S - static, 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

     10.0.0.0/8 is variably subnetted, 2 subnets, 2 masks
C       10.0.0.0/8 is directly connected, GigabitEthernet0/0/1
L       10.0.0.100/32 is directly connected, GigabitEthernet0/0/1
S    192.168.0.0/16 is directly connected, GigabitEthernet0/0/0
O    192.168.10.0/24 [110/2] via 200.165.200.225, 01:22:36,
GigabitEthernet0/0/0
O    192.168.20.0/24 [110/2] via 200.165.200.225, 00:37:35,
GigabitEthernet0/0/0
O    192.168.30.0/24 [110/2] via 200.165.200.225, 01:22:36,
GigabitEthernet0/0/0
O    192.168.40.0/24 [110/2] via 200.165.200.225, 01:22:36,
GigabitEthernet0/0/0
     200.165.200.0/24 is variably subnetted, 2 subnets, 2 masks
C       200.165.200.224/30 is directly connected, GigabitEthernet0/0/0
L       200.165.200.226/32 is directly connected, GigabitEthernet0/0/0
```

3.7 DNS & Web server

IP given to DNS server and web server's IP assigned to 2 different name as shown.

Figure 17. DNS Server configuration

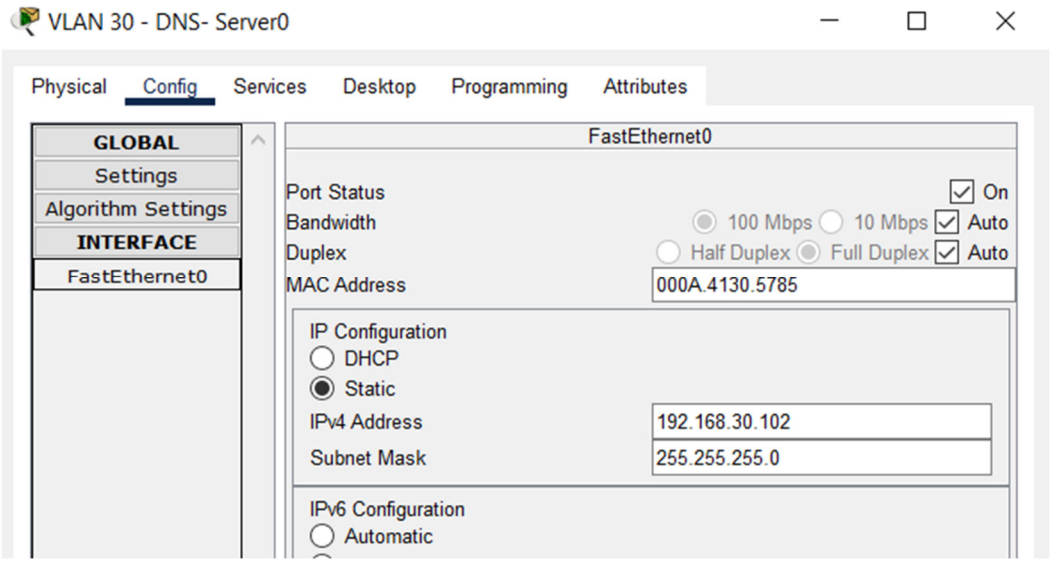


Figure 18. DNS Server configuration 2

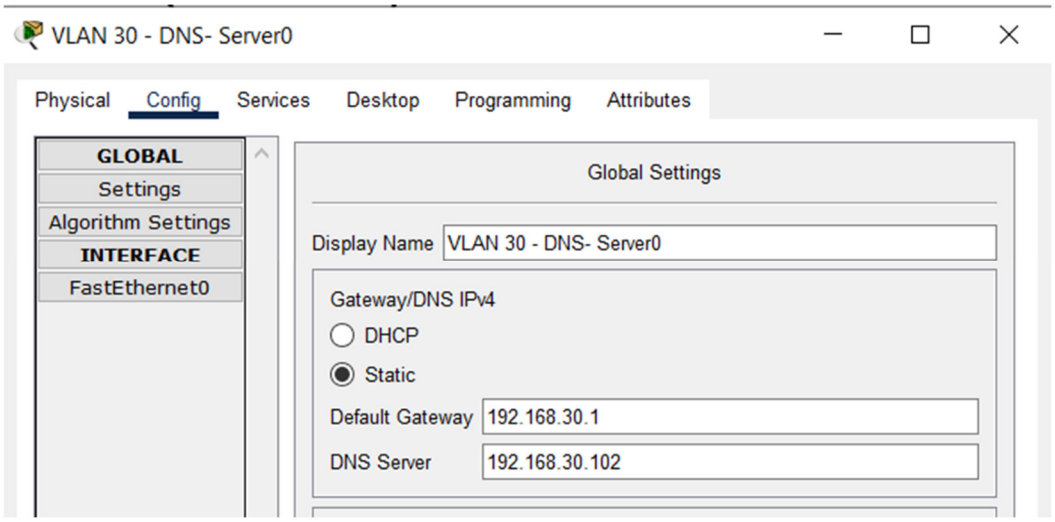
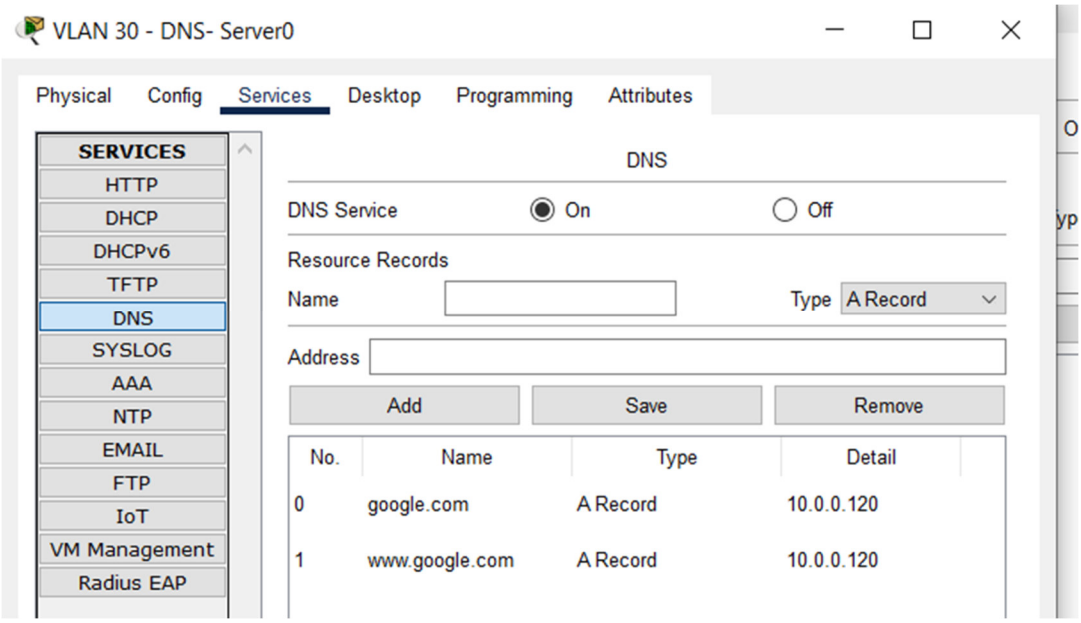


Figure 19. DNS names for Web Server



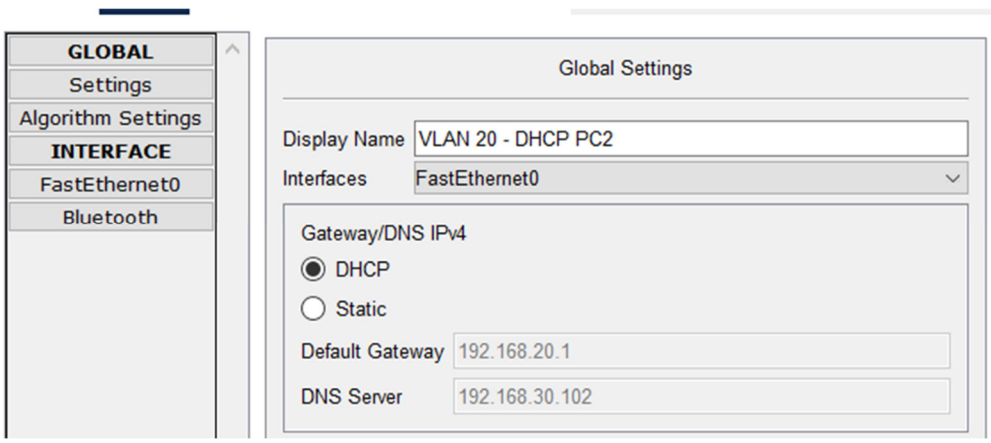
DNS Server assigned to VLAN on DHCP Pool

Figure 20. DHCP Server Pool after DNS

Pool Name	Default Gateway	DNS Server	Start IP Address	Subnet Mask	Max User	TFTP Server	WLC Address
VLAN 10 Pool	192.168.10.1	192.168.30.102	192.168.10.200	255.255.255.0	50	0.0.0.0	0.0.0.0
VLAN 20 Pool	192.168.20.1	192.168.30.102	192.168.20.200	255.255.255.0	50	0.0.0.0	0.0.0.0
VLAN 40 Wifi Pool	192.168.40.1	192.168.30.102	192.168.40.100	255.255.255.0	100	0.0.0.0	192.168.30.101
serverPool	0.0.0.0	0.0.0.0	192.168.30.0	255.255.255.0	255	0.0.0.0	0.0.0.0

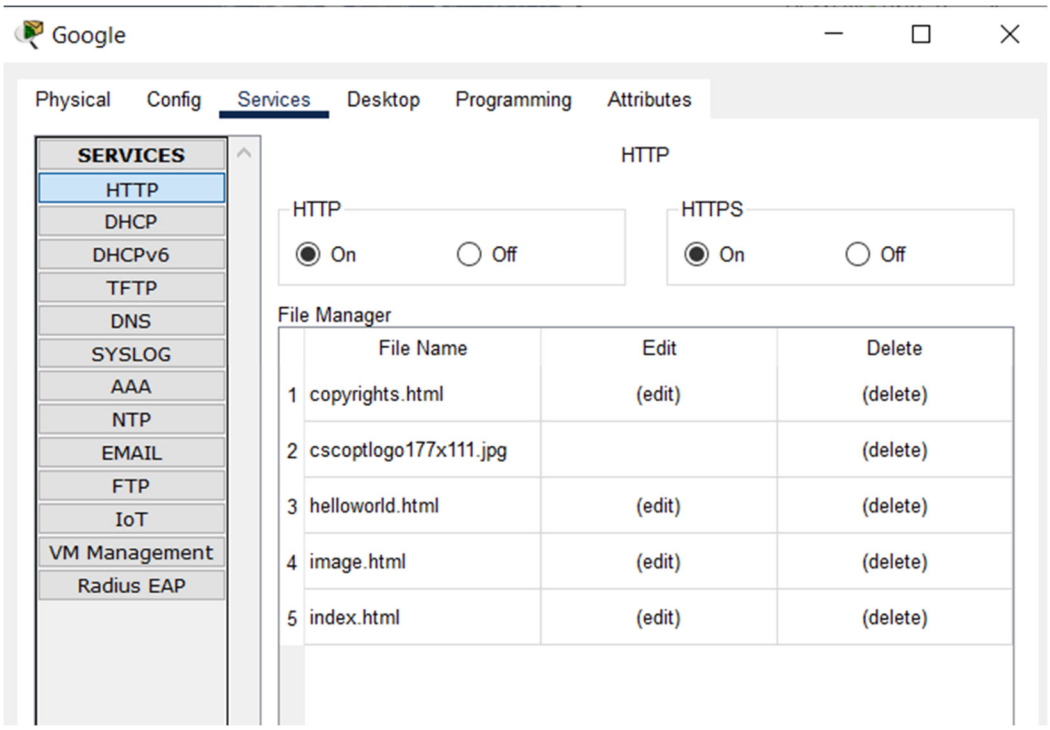
Devices could get a DNS server automatically.

Figure 21. Example of automated DNS assignment



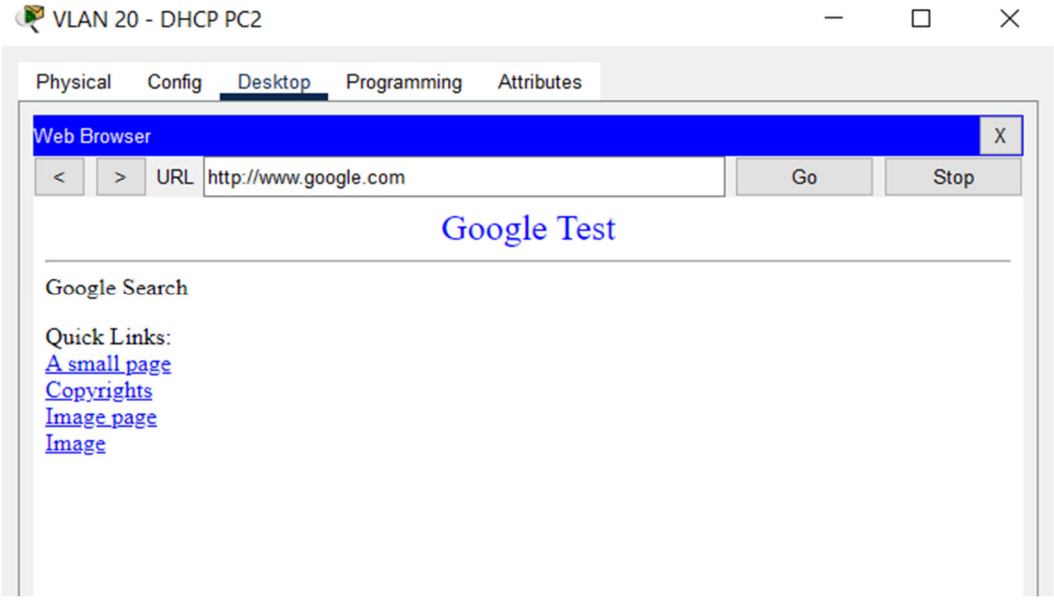
HTTP and HTTPS protocols were activated on web server, and for the test purposes ''index.html'' edited.

Figure 22. Web Server Configuration



Devices could connect to the web server via given DNS without a need to know IP adress.

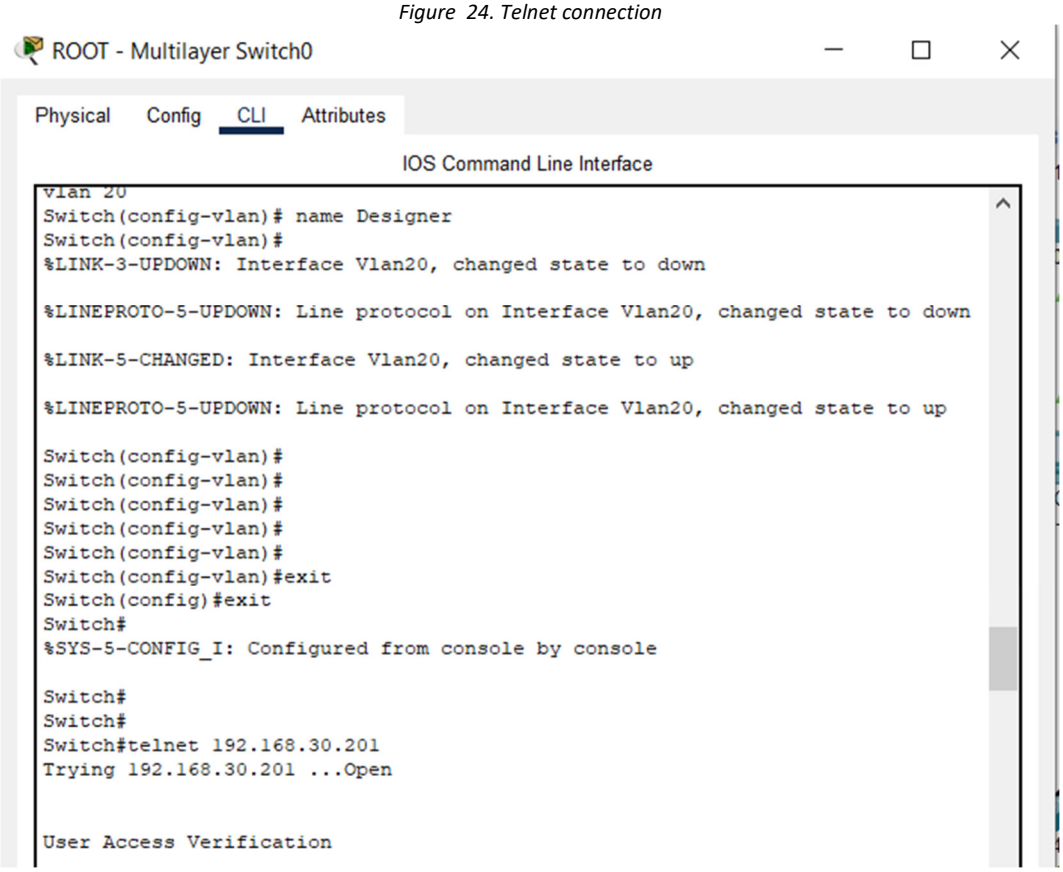
Figure 23. Example of Web Server Connection



3.8 Telnet

Telnet configuration made on every switch as shown below.

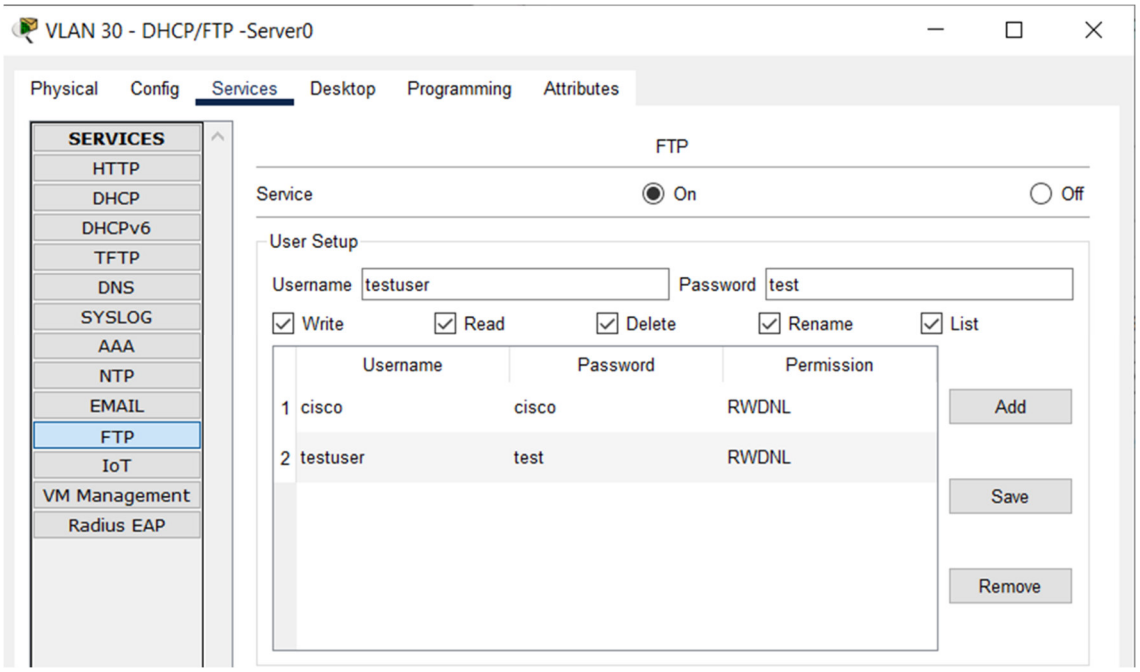
Figure 24. Telnet connection



3.9 FTP

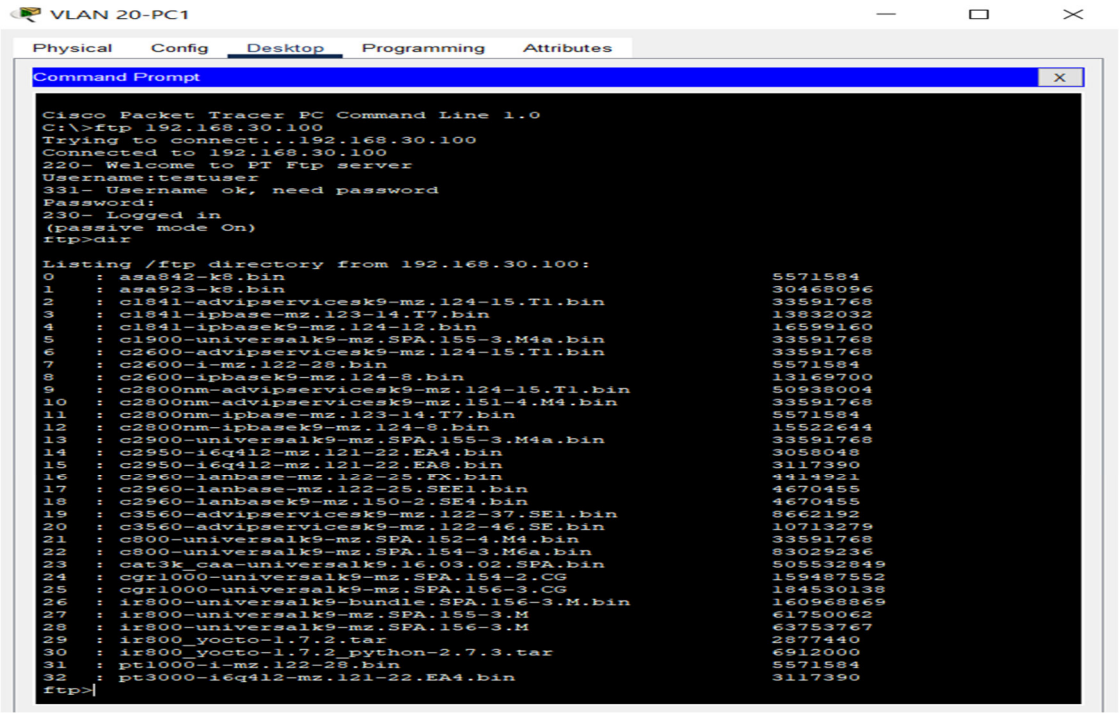
FTP server configured and user setup and all permissions given for testing purposes.

Figure 25. FTP Server Configuration



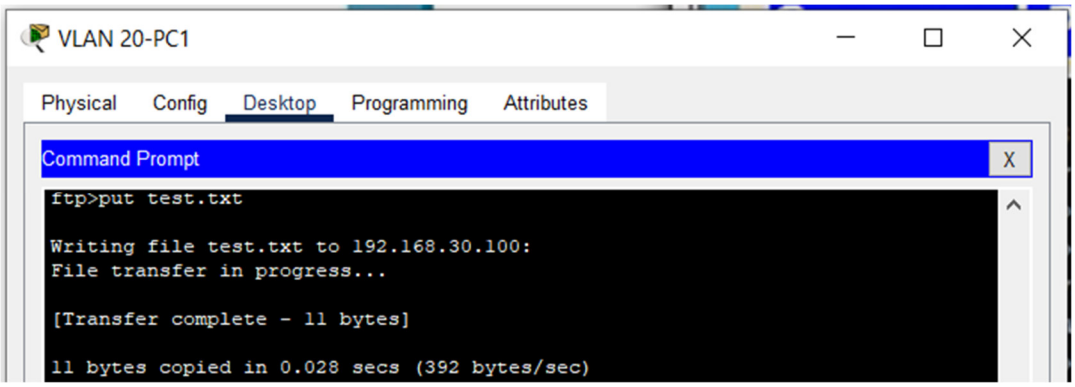
Devices can connect to FTP Server with given username and password.

Figure 26. Example of FTP connection



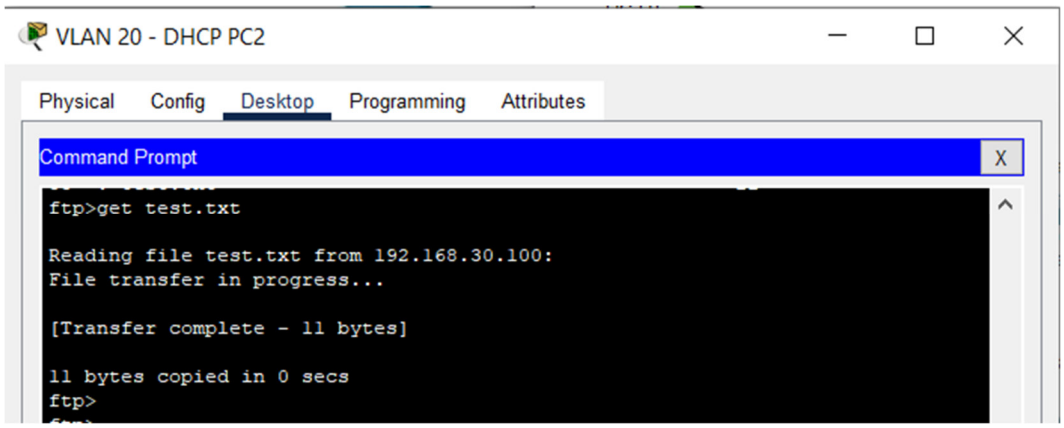
Test file succesfully transfered to FTP Server

Figure 27. Example of file transfer



Same file copied to another devices succesfully.

Figure 28. Example of file transfer 2



4. Conclusion

In this project multiple networking technologies are demonstrated. This technologies would make any kind of network implementation much easier. Using SSH instead of Telnet would make this network much secure then it is now. DHCP and DNS solutions makes users life much easier when they are trying to visit various websites.

5. Bibliography

DNS,HTTP,FTP,DHCP. 6th of November 2021. Available at: https://www.youtube.com/watch?v=3TPXviZNTHE&t=150s

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Exploring Networking with Cisco Packet Tracer https://skillsforall.com/course/exploring-networking-cisco-packet-tracer