

Cisco Network Performance Evaluation Using Packet Tracer

doi: 10.17932/IAU.IJEMME.m.21460604.2015.5/1.905-911

Muhammet Emin KAMILOĞLU¹

Abstract

In this study, a wide area network designed and simulated. These devices are used on the network, cables, provides information about the local area network topology, the application of this information network, Packet Tracer software environment has been subjected in the simulation. Data transmission methods are divided into three groups: single transmission (unicast), multiple transmission (multicast) and broadcast. Single data with a single destination address data transmission, multiple data transmission will also be sent to multiple destination addresses. The broadcast is transmitted to all nodes in the network data. The transmitted data is broadcast to all nodes in the network. This transmission of a single packet sent at all.

Keywords: Router, Switch, Internet Protocol , VLAN , VOIP

1. Introduction

Local Area Networks (LAN), covering large areas that are not usually workstations, personal computers, printers and devices such as servers, data networks are connecting. LAN computer users, shared access to devices and applications, share files between connected users and provide many amenities such as communication between users [1].

Local area networks in a small area of the visual process and the resulting speed advantage with the simplest routing protocols and separated from the wide area network [2].

Multiple computers in a network also cause conflicts to send data to work. Because longer able to transmit data to multiple devices simultaneously [2]. Two methods are used to avoid this situation: CSMA (Carrier Sense

Multiple Access / Collision Detection) and the token passing. CSMA (Carrier Sense Multiple Access / Collision Detection) cables are checked before being sent to the technical package. If there is no other traffic of a communication, to allow communication. Two computers is called the conflict of trying to use more than one cable, and also in such a case two traffic lost [2,3]. The Token Passing this access method uses a framework called the network continuously circulating coins. The Token Passing this access method uses a framework called the network continuously circulating coins. After completing the data transmission computer passes the token frame to the other computers on the network [1,2].

Data transmission methods are divided into three groups: single transmission (unicast), multiple transmission (multicast) and broadcast

¹ İAÜ, Faculty of Engineering and Architecture, Computer Engineering Master, Istanbul , Turkey - m.emin.kamiloglu@hotmail.com

[4]. Single with a single destination address data transmission, multiple data transmission will also be sent to multiple destination addresses. The broadcast is transmitted to all nodes in the network data. All of these transmissions are sent in a single package.

2. Network Structures, Topology and Components

There are four basic LAN topologies. These are: Bus Topology: all computers on the network on a shared bus topology cable (sometimes referred to as the spine) is optional. Ring Topology: Ring topology connects computers to each other in a circular shape. Each computer is connected to other computers that are neighbors and data can move in only one direction around the circle. Star Topology: Star topology all devices in the central device (switch or hub may be) is optional. This device receives signals from a computer on the network, and sends it to the computer should go. Tree topology: Tree topology has branched form of the bus topology. It comprises branched subnet node.

The basic LAN technology and architecture are as follows;

Ethernet: Ethernet and the varieties, Fast Ethernet, Gigabit Ethernet CSMA / CD (Carrier Sense Multiple Access / Collision Detection) access method that is based on the most widely used network architecture. Today, 10Mbps, 100Mbps, 1000Mbps speed in running varieties have been developed. They are classified according to the type of cable products based on Ethernet technology supported [5].

10BASE2: thin coaxial cable
10BASE5: thick coaxial cable

10BASE-T: UTP(Unshielded twisted-pair),
STP(Shielded twisted-pair)
10BASE-F: optical fiber cable

Token Ring Token ring, physically adjacent nodes that each node is connected to two nodes interconnected annular. Token ring network to establish the MAI or the MSAU (Multistation Access Unit) and the so-called devices with multiple Token Ring port for connecting the ends of the system used. MAU device to be connected to a computer must be on 4.16 or 100 Mbps Token Ring NICs. These devices are connected to the adapter cable to MAU [2,5].

Token ring, one data transfer, the coin used for the other two types of frame transmission. Data frame, frame transfer information from one node to another; The coin frame node wanting to give the ring frame is a special frame that allows to grant it short [2,5].

Ring architecture is used in more industrial applications. The most important reason is the absence of conflict and the way a node is to seize the guarantee within a certain time frame [2,3,5].

ATM (Asynchronous Transfer Mode): Asynchronous Transfer Mode (ATM) is a packet switching technology, operating according to the foundation. ATMs provide communication with remote offices, ATMs or used to create a backbone. The most important feature of a few; transfer the cell (cell) called small size and fixed length used data packets, voice, video and supports different types of classes of service needed by applications such as pictures, is again present the quality of service required by these applications [4].

For the ATM networks (User-to-Network Interface) and NNI (network-to -Network Interface) called the two types of connection interfaces are defined. UNI. of the ATM port of the device is used to connect the ATM network, the ATM cloud favors the NNI to be the key device used to connect to each other [5].

ATM cells for transmission network should be established in advance about a virtual circuit between two nodes. The creation of a virtual circuit SVC (Switched Virtual Circuit), other PVC (Permanent Virtual Circuit) There are two different methods called. SVC switched, PVC provides a permanent virtual circuit environment. Dial-up connection as a method reminiscent of the SVC, is reminiscent of PVC leased line applications [5].

FDDI (Fiber Distributed Data Interface) is used in networks that require high speed. At 100 Mbps token -passing have access technical and enables communication over fiber-optic cable.. Token passing technique is used as an access method.

2.1 Network Connections

Cable types used in computer networks; coaxial cable, twisted pair cable, and fiber optic cable.

Coaxial cable: signals at low power is concentrated in environments where electromagnetic pollution is a cable has been developed to transmit. Used in voice and video transmission [5].

Twisted pair cable: The most commonly used type of network cable into each twisted pair are similar in structure to the cable cord. There are two types; coated (Shielded Twisted Pair-STP) wire pairs are wrapped around the cable is coated with metal armor such as in coaxial

cable. Uncoated (Unshielded Twisted-Pair UTP) is in the form of intertwined couples and has a plastic protection on the outside. Wire pairs of intertwined be taken to avoid the signal degradation that may occur from both the external environment and measure themselves [5].

Fiber Optic Cable: According to the fiber and copper cables due to low signal loss over long distances at higher speeds and more data transfer is possible. This distance can be up to 2 kilometers from the use of repeaters. Copper UTP cable is limited by the distance of 100m. Fiber optic cables to pass through which electricity is not affected by electromagnetic fields. Is not conductive, the insulation requirements of places and a small electric current used in the environment may cause an explosion. Fiber optic cable, data loss is minimal and it is much more difficult to play than the other cable data is safe for this reason. LED light to send signals (Lighth Emitting Diode) is called using multi-mode fiber type and is the most common type. Lasers use light, single-mode fiber is not very common because of the high data transfer value Although access to expensive equipment [5].

2.2 Network Components

Basic network components, hubs, repeaters, switches and routers are.

Hub: Hub is a physical layer device. In electrical communication takes place. Self incoming packet, depending on its message to all devices, there is no choice and decision-making [5].

Repeater: Basically it works like a hub, but transmits its signal from strengthening [5].

Switch: The second layer (data link) device. According to the MAC address from the packet transmits the destination address [5].

Router: The third layer of the OSI reference model (network layer) works. Parts of the LAN provides communication with each of the incoming packets based on IP address passes the target address. While transmission also uses a number of routing protocols [5].

3. WAN Realizations

Designed network topology is shown in Figure 1. This topology consists of five main parts. On the map, there are 4 Layer2 switch, 4 layer3 switch, 7 router , 22 pc, 2 HTTP, 2 NTP , 1 TFTP, 1 DNS server and 1 cloud .

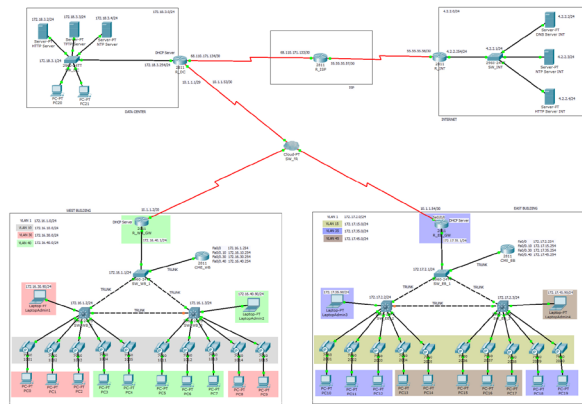


Figure .1 Designed Network Topology

2 pieces are our building. These are the 'left the building' and 'right building' routers (Figure 1 on the left and right sides of the router) connected with a serial cable 'frame relay' cloud and its related 'data center' is located in the router. Accordingly routers subnets are 10.30.0 / 24, 10.1.1.0/30.

VLAN Name	Status	Ports
1 default	active	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, Fa0/24
Gig0/2		Gig0/1,
10 VOICE_WB	active	
30 DATA1_WB	active	
40 DATA2_WB	active	Fa0/1
1002 fddi-default	active	
1003 token-ring-default	active	
1004 fddinet-default	active	
1005 trnet-default	active	

Figure .2 VLAN Configuration

Routers on the right and left building is used as the routing protocol EIGRP. DC, static routing between ISP and INT were used. Because the ISP router internal network needs don't know. Routers and switches between flat cables, switches, and layer 3 switches between a crossover cable is used. Computers straight into the layer 3 switch, and the switch is connected to the cable. 'Data Center' network connected to the router are also engaged in the distribution router. It has a switch connected to the router. Left and right building 3 VLAN (Virtual Local Area Network) is formed. This allows computers connected to the same switch are not influenced by each other broadcast traffic.

Thesevlan1 isvlan30andvlan40. WBcomputers 172.17.40.90/24 and 172.17.30.90/24 subnet and vlan30, vlan40 belongs EB computers 172.17.35.90/24 and 172.17.45.90/24 subnet and vlan35, vlan45 belongs, finally IP phones 172.17.10.0 and 172.17.15.0/24, vlab10, vlan15 belongs. It depends on the frame relay cloud to communicate the generated virtual WAN. A subinterface is created for each VLAN and taken to their dot1q encapsulations. Computers connected to the VLAN IPs via DHCP pool gets. Access-list using any device will be unable to WB in VLAN40 subnets,

routers, and of course be able to access the admin PCs. EB VLAN35 subnets will be unable to any device, subject to the router and able to access the admin PCs. It can be accessed on other subnets. I completed the rules. Now, under the rules I set my network can communicate with each other. Figure 3 shows IP phone information.

```

ephone-1 Mac:0030.F20D.EAD6 TCP socket:[1] activeLine:0
REGISTERED in SCCP ver 12 and Server in ver 8
mediaActive:0 offhook:0 ringing:0 reset:0 reset_sent:0
paging 0 debug:0 caps:8
IP:172.16.10.102 1025 7960 keepalive 43 max_line 2
  button 1: dn 1 number 1001 CH1 IDLE

ephone-2 Mac:0030.A37A.3914 TCP socket:[1] activeLine:0
REGISTERED in SCCP ver 12 and Server in ver 8
mediaActive:0 offhook:0 ringing:0 reset:0 reset_sent:0
paging 0 debug:0 caps:8
IP:172.16.10.101 1025 7960 keepalive 43 max_line 2
  button 1: dn 2 number 1002 CH1 IDLE

ephone-3 Mac:0001.6475.B61D TCP socket:[1] activeLine:0
REGISTERED in SCCP ver 12 and Server in ver 8
mediaActive:0 offhook:0 ringing:0 reset:0 reset_sent:0
paging 0 debug:0 caps:8
IP:172.16.10.105 1025 7960 keepalive 43 max_line 2
  button 1: dn 3 number 1003 CH1 IDLE
    
```

Figure .3 IP Phone Information

Figure 4 shows the routing of the router interfaces.

```

Gateway of last resort is 10.1.1.1 to network 0.0.0.0

 10.0.0.0/30 is subnetted, 2 subnets
 C    10.1.1.0 is directly connected, Serial0/0/0
 D    10.1.1.52 [90/2681856] via 10.1.1.1, 03:35:07,
 Serial0/0/0
 172.16.0.0/24 is subnetted, 4 subnets
 D    172.16.1.0 [90/30720] via 172.16.40.254, 03:35:06,
 FastEthernet0/1
 D    172.16.10.0 [90/30720] via 172.16.40.254,
 03:35:06, FastEthernet0/1
 D    172.16.30.0 [90/30720] via 172.16.40.254,
 03:35:06, FastEthernet0/1
 C    172.16.40.0 is directly connected, FastEthernet0/1
 172.17.0.0/24 is subnetted, 4 subnets
 D    172.17.2.0 [90/2686976] via 10.1.1.1, 03:35:07,
 Serial0/0/0
 D    172.17.15.0 [90/2686976] via 10.1.1.1, 03:35:06,
 Serial0/0/0
 D    172.17.35.0 [90/2684416] via 10.1.1.1, 03:35:06,
 Serial0/0/0
    
```

Figure .4 Router Interface Information

4. Simulation

Network simulation, Cisco System Inc. Developed by 'Packet Tracer network simulation 6.1' program was conducted.

I am sending an ICMP message VLAN30 admin PC to VLAN35 admin PC. So I put a ping. Is NAT works and I'll check on him, is also trying ACL and I'll describe it in check.

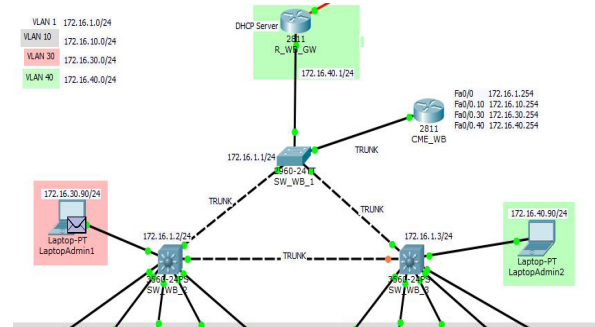


Figure .5 ICMP output from VLAN40 admin PC

For example one can see in Figure 6 IP field computer via DHCP.

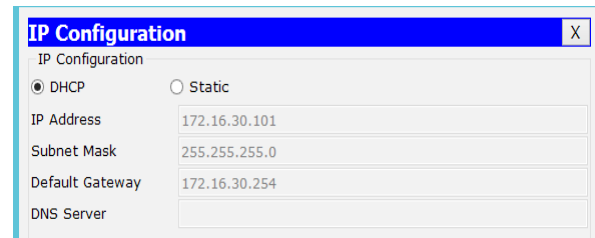


Figure .6 From the DHCP server, dynamic IP obtain on computer

Figure 5 is prepared ICMP packet, SW_WB_2 layer 3 switches can also be seen in Figure 7 delivered.

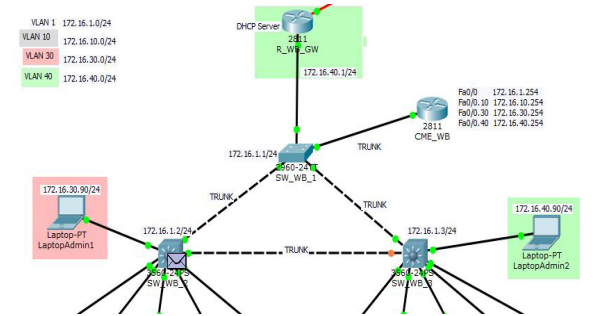


Figure .7 ICMP, clients who reach layer3 SW

Figure 8 due to the spanning tree model, we observed that packet reaches the root switch.

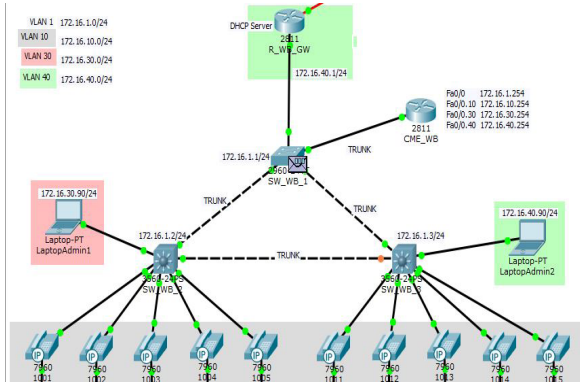


Figure .8 ICMP reach the root switch

IP address of the packet, CME_WB router then checked in, and GW router is routed through the EIGRP routing done on the router's configuration. This figure 9 is also observed.

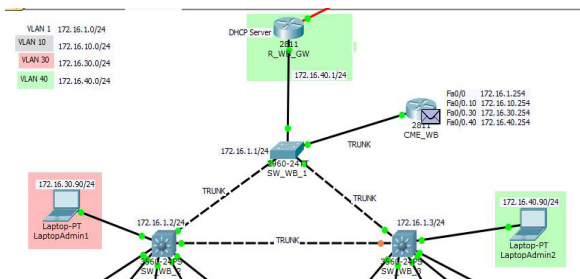


Figure .9 ICMP reach the CME_WB router

Figure 10 shows the packet sent to the GW router.

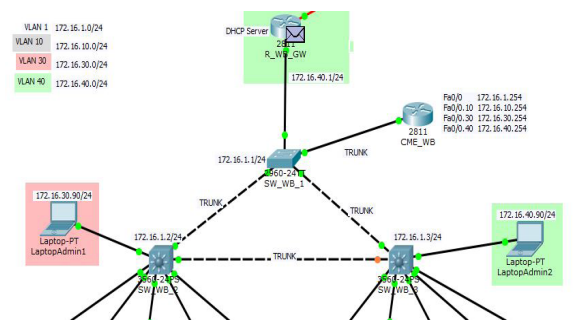


Figure .10 ICMP reach the gateway router

We can see in figure 10 packets reaching the frame relay configuration works.

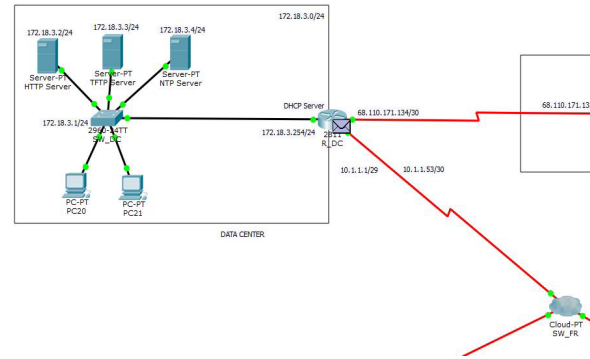


Figure .11 ICMP reach the data center router

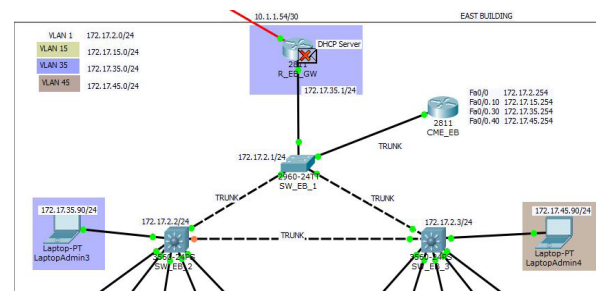


Figure .12 ICMP, don't pass through on VLAN35 router

As seen in the pictures, pack before going VLAN gateway that is defined, there is going to come out of the network gateway. Then the frame-relay switch goes, there goes the data center router. In this way we can see that the NAT structure works. Inbound or outbound doing the checks. Then, turning back frame-relay switches, there goes the other network gateway router, and can not go from here. In this way, we can see that the ACL works. Because Admins could only access their network. And finally, frame-relay structure, we can see that the routers forwarding the package communicates works.

5. Conclusion

In this study, Routers, switches, hubs, IP telephony, frame-relay and the necessary servers, including a wide area network was carried out and local area networks. During the realization of this network topology Packet

Tracer software were used, and the actual router, switch programming, and programming is made of identical devices. VLANs are defined, these VLANs are configured with the necessary equipment. Defined DHCP pool for PCs, and it was observed that receive IPs to PCs. Defined VoIP IP phones, routers DHCP pool has been created through CEM, and TFTP server have been identified. IP phone was observed to obtain an IP, and they can call each other was seen. EIGRP static and rip routing protocols on routers have been identified. On frame-relay swim, and on routers, the required network configuration made has been observed that communicate with each other. NTP server, master and client data center and is defined in the Internet network. DNS servers are defined and distributed to PCs via DHCP pools. Defined HTTP server, and access was observed. Network Local Area and Wide Area Network has been working literally. NAT is defined. Internal network and external network control is provided. In other words, the task is to make a simple firewall. Access lists are defined. Which will be accessible to the network access to which is determined. And which devices will have access to which devices have been identified. Trunk structure and spanning tree structure has been defined and observed that work. Finally, CCNA and CCNP level has been reached in this study. Everything that can be done in Cisco's education, has been applied to this system. Imaginary an extensive network is designed. ISPs have been identified. In a large network and must be on a local network basis apparatus and protocols are used.

Both static and dynamic IP configurations were simulated simultaneously. Simulation results show that the network can reach the target with the source of trouble in any package.

References

- [1] T. Lammle, "CCNA: Cisco certified network associate study guide", 5th Edition, SYBEX Press, 2003.
- [2] N. Baykal, "Bilgisayar Aglari", Seckin Yayinlari, 2005.
- [3] D. Barnes, B. Sakandar, "Cisco LAN Switching Fundamentals", CISCO Press.
- [4] www.cisco.com/univercd/cc/td/doc/cisintwk/ito_doc/introlan.htm
- [5] J. Trulove, "LAN Wiring", McGraw Hill Press,