EUROPEAN UNIVERSITY OF LEFKE

FACULTY OF ENGINEERING

COMP 342/EE329
Computer Networks

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NETWORK DESIGN PROJECT

Network engineering and designing are specializing in mid to large-sized corporation design and implementation of LAN and WAN with the goal of providing increased productivity, employee performance and improved workflow.

Students are assigned as the network administrator of the project. Students will be handling the design and implementation phase of the project step by step. The given project will include the design and installation of a given number of hosts. This includes the installation and setup of all the network devices, cabling and interfaces which may include but may not be limited to workstations, multi-function devices, servers, switches, routers etc. by using the CISCO Packet Tracer. The scope of the project is designed to serve the number of the hosts in the university which will consist of different numbers of rooms in a given building. The building currently belongs to the engineering department and will be built out to a specification which at this point is undetermined, allowing for maximum flexibility in the installation of the network being proposed.

Project Marking Scheme

Criteria	Percentage
Project Scope (Knowledge-Based, Conceptual Understanding, Reasoning Based, Skilled based)	(15-25)%
Challenges (Knowledge-Based, Conceptual Understanding, Reasoning Based, Skilled based)	(15-25)%
User-centric design concept (Knowledge-Based, Conceptual Understanding, Reasoning Based, Skilled based)	(15-25)%
Network Design (Knowledge-Based, Conceptual Understanding, Reasoning Based, Skilled based)	(15-25)%

Number	Student ID	Student Name/Surname	Sign	Percentage (%)
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Introduction

Background of the project

In modern world, networking is a critical infrastructure that facilitates communication,resource sharing, and access to learning tools. As institutions scale and diversify, designing networks that are secure,scalable and interactive becomes essential. This project focuses on the simulation of an engineering building's network in a university campus, where by we address the real-world requirements such as interactivity, reliability,adaptability, and security.

Nowadays technology is providing more flexible ways of planing, and visualizing the pre-production items; in that sense instead of setting the network physically in the real-world environment; we use these simulation which are the look-like of a given situation. For ouw case we used Cisco packet tracer.

Why using Cisco packet tracer?

Cisco packet tracer is a powerful tool used to practice and learn networking concepts without needing real devices.It allows you to create virtual networks with routers, switches, PCs servers, etc.It allows users to simulate complex networks using a graphical interface. Even though they are some other alternatives to this tool, it I still among the preferred one in the academic environment.Reason being:

- There is a free version for students: this is the version offered by Cisco's Networking Academy(NetAcad), which is a global educational program launched to teach networking,cybersecurity, and IT skills..

- Because it have an educative version,it mostly has a user friendly Graphical User interface. The easay to use GUI favors the beginner who are learning network oriented contents; and most keep on using it, even for professional work.

- the tool supports CLI commands ,which helps to practice the real Cisco IOS commands; making the learning material offered more accurate to the real world networking scenarios.

- In the tool it self ,we can learn about these scenarios, through even simulation, where we directly see the real world behavior.In these simulation we have the protocols like STP,DHCP and HTP.

- Ideal for CCNA preparation; this is a certification program recognised globally; for any one to work as a Network engineer , needs this certificate. Then the same company, as the creator of Cisco packet tracer; this exam is also given by Sisco Systems,Inc.

- So overall , these testing and learning are done without the real world devices, which are costly, so we like packet tracer, because of this, we can practice without needing physical equipement.

Importance of virtual networking for educational environments.

- It allow institutions to train students on industry-standard technology without high costs.

- Offering safe and controlled environments to leran network configuration and troubleshooting.

- Supporting online and hybrid learning systems, with robust infrastructure.

- Simulating various failure and security scenarios for learning resilience.

<u>Objective of the project</u>

The main objective of this project is to simulate a network for a given depratment buidling within a University campus, Using Cisco Packet tracer.The simulation aims to reflect real-world networking requirements and services typically found in a university setting. The design and implementation are guided by the following goals:

1. Simulation of the department building

    a) To create a realistic and functional network architecture that could be deployed in an engineering department.

    b) Use appropriate,Vlan separation and routing logic to mimic real infrastructure.

2. Ensure key Network Qualities

    Interactivity: Refers to enabled smooth real-time communication between devices, like ping, web browsing.

    Reliability: Refers to implementing redundancy and failure recovery, through STP-enabled redundant links.

    Adaptability: which is allowing the addition of a new devices and systems with minimal reconfiguration, which maybe done through DHCP.

    Security:which is preventing Unauthorized access using techniques like port security and password protection on devices.

3. Support application systems

    We are to implement and simulate a network that can access to essential campus system through logical services.

    a) Student management applications System

        i. Student Registration System

        ii. Examination REsults System

        iii. Library Management System

        iv. Timetable System.

    b) Administration Management Application Systems

        i. Payroll Sytem

        ii. Asset Management System

        iii. Finance System

        iv. HR system

    c) Applications on Student PCs / Labs

        i. Internet Browser

        ii. Simulation tools

iii. Programming IDEs
iv. MS office
v. Email Client
vi. E-learning platform
vii. MatLab

Each application will be hosted on a single server that will be offering multiple services; and given page links; here I mean Student management application systems; Administration management application systems.For the application on student's pc we will use the Cisco provided ones.

<u>Revision of assignment as Understood</u>

This section breaks down the assignment brief to ensure the design and implementation directly address the given user and application requirements.

1. <u>Interpretation of User and application requirements</u>

The project brief requires simulating a university building's internal network using Cisco packet tracer, with a class C network (**204.15.5.0/24)** as the starting point the tasks involve:

NB: This notation of **/24** represent the subnet mask of the class's ip addresses; it is called **CIDR** "*classless Inter-Domain Routing" ;* refers to number of bits used for the network part of an ip address.

How to read it:

As an IPv4 address has 32 bits, ***/x*** *this number (x) represent the first how many bits , are for network part; for our notation* **204.15.5.0/24 ,** it is 24 bits are on network part, nowhost part will be **32-24 = 8** bits. These information are used to know the network ip, ip host range, in which the first on is a gateway Ip" unassigned to the Pc", broadcast.

Number of ip we can generate = $2^{Number\ of\ host\ bits}$ = $2^8 = 256$ IP

The usable IP we remove the Network IP(the very first one) as it represent our class" /24" network. Remaining with **256 - 1= 255** which the highest Octect value.

Another thing is we can not assign the broadcast IP to any PCs, as it is use in broadcastin, means whatever sent on the last IP is echoed all over the nearing IP.

So Host " usable IP" = $2^{Number\ of\ host\ bits} - 2 = 256 - 2 = 254$

Network IP	IP Host range	Broadcast IP	Gateway IP	Host usable IP
204.15.5.0	204.15.5.1 till 204.15.5.255	204.15.5.255	204.15.5.1	204.15.5.2 till 204.15.5.

table 1: example

a) Subnetting the class C network to meet different department workgroup needs based on user counts(number of hosts) per floor.

Floor	Number of hosts	CDIR Subnet mask	Number of Usable IP
G0	30	/27 means 255.255.255.224	30
G1	14	/28 means 255.255.255.240	14
G1	30	/27 means 255.255.255.224	30
G2	25	/27 means 255.255.255.224	30

Table 2: subnet plan

b) Creating a network topology that connects each subnet in a structured and manageable design.

NB:

Why 2 switch per floor?

Here we faced an issue, the switch we were to use had on 24 port, means only 24 hosts can be connect on the network at once , but our requirement on each floor 24 is a very low number; two options we possible, either we use a larger switch or on each floor we use 2 ***24_port switch***

Decision: We chose 2 switches of 24-ports, it was basing on these reasons

- A 24-port switches in particular **Cisco 2960** are widely available and typically cheaper per port than higher-end 48-port models. Instead to over pay for port that might never be used, we think it is not wise for this stage.

- As we are not to even need up to 48 ports, to say that buying a 48 port switch we will be wasting no port; in our case it is not; later if we need more ports we will add another switch on 24 port, is shows that it is scalable horizontally.

- with two switches, one can easily and more naturally segment departments with in **Vlan(Virtual LAN).** It make the combination effect of Vlan and Subnet, be morelogical organized, simplifying management and trouble shooting.

Why 1 router?

- Routers are expensive,especially enterprise-grade, for Inter-Vlan routing and internal traffic, Layer 3 switches are cheaper and faster, so one central router is enough for external(Internet/WAN) communication.

- as we only need routing for Vlan to Vlan communication(which can be done on a layer 3 switch or router-on-a-stick).Add the maximum number of host we are expecting currently is 99 almost 100, so one router can perform these roles efficiently for 100 or fewer hosts.

- switches may be stacked or linked(which we used) without adding complexity, so it is a check on easy management option, where we will be having one routing point, several switching/access layers.

- the fact of having multiple Vlans in our project, one router can manage all of them thanks to Sub-interfaces; where every port on router handle a different set of Vlan, sending and receiving, for Inter-Vlan

- and most ofhost communication are usually internal which is handled by switches, so router is nota bottleneck

What type of topology used?

We used a **Star** topology which is “a hierarchical three-tier” kind, it is broken down as:

- Core Layer: consisting of router connecting all floors for Inter-Vlan routing

- Distribution Layer: Floor-wise switches connected to the core

- Acess Layer: Pcs and devices connected to floor switches.

Which is common in enterprise settings.

<u>Advantages of this topology</u>

- Easy to add more devices or floors without major redesign.

- Vlan reduce broadcast traffic, improving speed.

- Vlan logically separate departments.

- DHCP and FTP servers placed logically for central access

- If one floor/switch fails,other continue working.

Server and Network Room placement, for optimization:

- all these setting should be in one room on each floor with relevant equipment

- better to have that room in the middle of the floor, to reduce the wire lengths,and every room on each floor should be on top of the other, or below. To easily connect them to router.

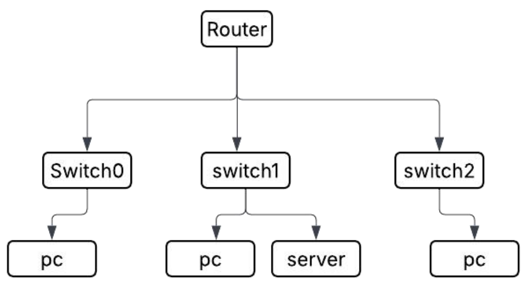


Figure 1: network diagram, in b

c) Configuring network services, like DHCP,DNS and HTTP will demonstrate:

i. Real-time user interaction; as the user can directly browse and ping the IP of another device.Demonstrated by HTTP and DNS.

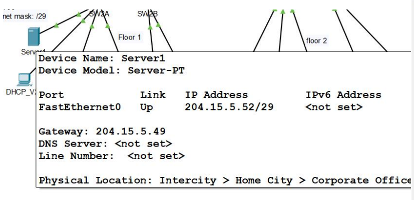
*How it works:**HTTP & DNS***

These are services on a server, http is the one to contain the web pages, and DNS ,in other device we set DNS server as the ip of our server.

Step 1: turning on the HTTP and DNS.

1. Click on your server “ **Server1** “ -> Services -> HTTP -> then turn on HTTP and HTTPS

2. Click on the pc -> config; then if it is configured through DHCP it will bring with the DNS server; if not you go back to the server -> services -> DHCP , then set the DNS server as your server's ip address. Then If it is static ; set the DNS server as the server's ip.



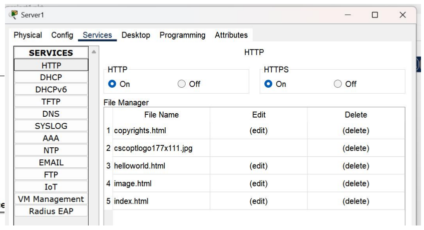
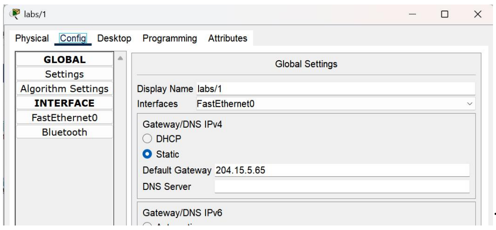


Figure 2: server IP *figure 3: turn on HTTP*



then make DNS SERVER

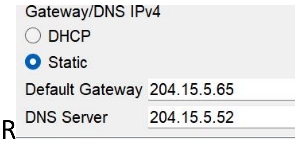
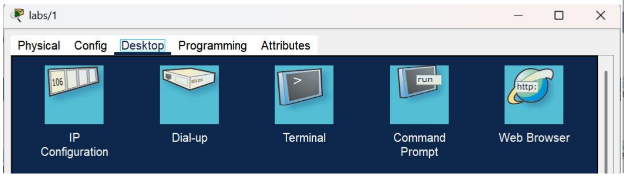


Figure 4: Pc_nothing set *figure 5: now set the server*



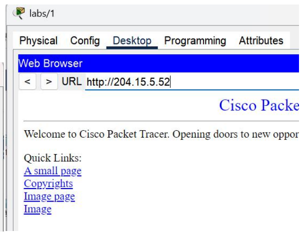
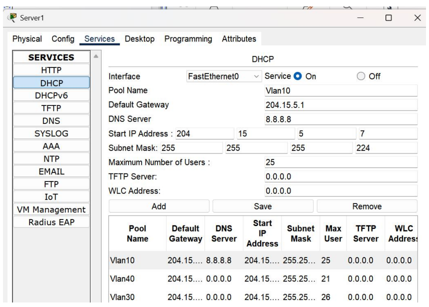


Figure 6:access browser figure7: got the page

ii. Easy device addition; this is in a sense of having an automatic configuration in place whenever you add another pc to you network set-up.Demonstrated by DHCP.

*How it works:**DHCP***

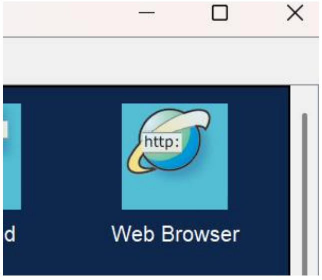
1) Click on server->services->DHCP ; then create the pool(provide pool name, default gateway, DNS server"ip of my server"; strat ip; subnet mask and the maximum number of ip should be generated in that Vlan.Add the pool.



Then do:

Figure 8: setting DHCp

Click on PC -> desktop -> IP config;Use DHCP, and send a request.

Then browse 

browse the server IP.

Figure 9: browser app

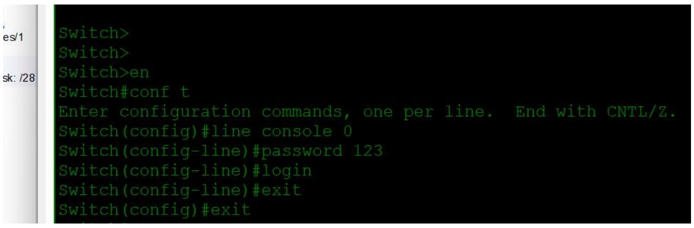
iii. Security enforcement; this is done on the device and restrict the access to the CLI or ftp uses a security enforcement kind of process.

*How it works:**Restrict CLI access***

These are done on switches; reason the main sensitive configuration are done on CLI here.

So lets restrict the switch attached on server.

Switch -> CLI -> press **ENTER ->** enable; configuration terminal; line console 0 ; password *set-Password*; login



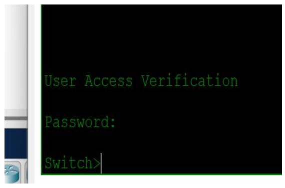


Figure 10: setting CLI password figure 11: required a password

2. <u>Mapping of Real-World Needs into a Simulated Environment</u>

To simulate this network will be done after we properly analyse , and get to know the vlans we are dealing with, which subnet masks to deal with; as we are using one Router how is it going to manage the multiple vlans and Related tasks. To apply this project in oacket tracer the requirements are:

- To determine the Vlans workgroup or per floor, which is segmenting departmental network.

- To make smaller networks from the single class network we had; we were given 204.15.5.0 and we need to sub divide it into smaller networks; this makes a good use of IP addresses we have and increase the network scalability.

- Use of a centralised Server services, this aligns with the Star topology working style.

- Then we should archive Pc-to-server communication via HTTP/FTP this provide an application access per group.

- Then we should be able to monitory the interactivity, by pinging from an address to another, browsing the page provided.

What we did:

Every floor had it own vlan, and on floor 1, the 2 section have there own vlans; and the server has it own vlan. Every vlan goes along with its own subnet; this subnet will make sure not to accommodate more than 30 hosts, and should wast minimum number of IP addresses.*To be clarified in later*

3. Tools Chosen for the Simulation

We used Cisco packet tracer V8.2.2 as it offers several notable features that enhance network simulation and learning.Some of the good features:

- Enhanced Device Support: Wider of Cisco devices and protocols, including new routers, switches and wireless devices.

- Improved User Interface: more intuitive and user-friendly interface for easier navigation and configuration.

- Advanced Network Simulation: Support for more complex network topologies and detailed simulation of network behaviors.

- Updated IoT support:Better simulation of internet of things devices and scenarios.

- Real-time simulation and Simulation Modes:Flexible modes for testing network behavior in real-time or step-by-tester.

- Enhanced packet Analysis: more detailed packet capture ad analysis tools.

- Bug fixes and stability: Improved performance reduced bugs, and greater stability.

We used this software for network design , configuration, simulation and testing.

Ip addressing Scheme

We based on 204.15.5.0 class C or in CIDR notation /24 means octet 1 til 3 for network and last octet for host.

Main tasks:

- create subnets, at every selected group, ensuring that the maximum host we can accommodate is 30 hosts.

This will be achieved by reducing the numbers of bits in the host part, where we will keep of borrowing and increasing our 24 of CDIR, means increasing the number of bits in the network part.

Up to the point $2^{Number\ of\ host\ bits} - 2$ is equal to the number of hosts we are to have, or slighly higher to it.To do not wast the IP addresses.

- At each subnet we should assign a specific unique Vlan

Core Device Configuration

- we configured the router for Inter-Vlan routing, and gateway roles; which we followed a Router - on -a-stick technique

- On switches we configured the Vlans,and Subneted the offered network on every port to be used.

- On the servers: we configured Hosting DNS and DHCP

- PCs: Representing first few pcs per every department as given in the project description; then cofuger the rest via DHCP.

<u>**Networking Design**</u>

Block diagram of network

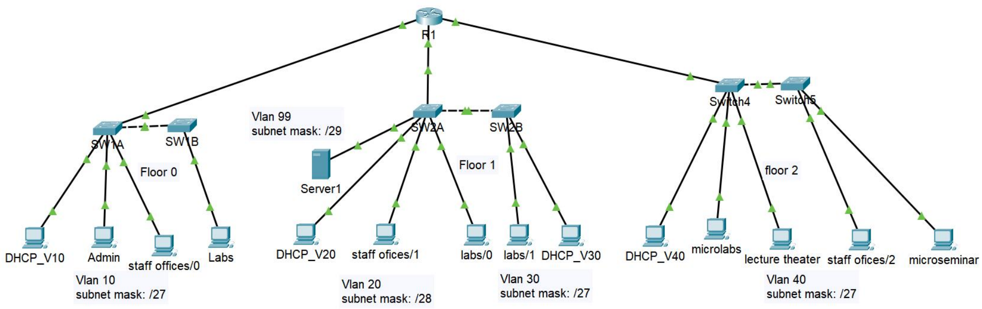


Figure 12: Block diagram

The network is structure to represent the engineering department forexample. Each floor contains specific departments and labs, connected through switches to a central router, which interfaces with servers providing essential services.

Footnote:

- IP addressing: this is very important as we use it to know the exact range of IP addresses we will be using and for which Vlan and Subnet that we will have created.As we saw earlier we will base on 204.15.5.0/24

- **Vlan logic:** Each department or lab is assigned a unique Vlan to Segment network traffic and enhance security.

NB: There things we must well be aware of; is what kind of CDIR we are using.as we saw in **table 1** we will use /27 and /28 ; reason being that those are the on to match the number of hosts we are expecting at every vlan.

The Note is; A subnet always starts at a base IP that is a multiple of the **block Size;**

Block size = $2^{\text{host bits}}$

What it mean:

For /27 ; we have number of host= $32 - 27 = 5$

For /28 ; we have number of host= $32 - 28 = 4$

The block sizes are:

For /27 ; 2^5 = 32

For /27 ; 2^4 = 16

So we if we are using /27 we may use: **0-31** or **32-63** or **64-95** etc

So we if we are using /28 we may use: **0-15** or **16-31** or **32-47** etc

<u>**VLAN and IP addressing plan**</u>

We will identify at every floor, the vlan , the subnetmask, range of ip chosen , network ip, the boardcast ip; gateway ip , and the usable ip addresses.

Footnote:

Subnetmask: we present the CDIR in decimal notation in 4 Octets , separated by a period(a point);

Range: after examining the possible starting ip address we chose one which is feasible.

Network IP: it is the first ip in the range of P addresses, that one is not assignable to any PC, it represent our Subnet; in our whole setup.

Broadcast address: is the last IP address; this one also is not assignable to any device in particular; it is used when we want to communicate with whoever that might hear us; simply send message to any one we may reach to.

Now the device we are using(Switch) will be given an IP address to which is the **gateway** the first IP address in the so called usable IP address; this is not a must though but it is a good practice to asign this to the switch as gateway.

Floor	Vlan	Subnetmask **CDIR**	IP range	Network address	Broadcast address	Gateway address	Host usable IPs
G0	10	255.255.255.224 **/27**	204.15.5.0 till 204.15.5.31	204.15.5.0	204.15.5.31	204.15.5.1	204.15.5.2 till 204.15.5.30
G1	20	255.255.255.240 **/28**	204.15.5.32 till 204.15.5.47	204.15.5.32	204.15.5.47	204.15.5.33	204.15.5.34 till 204.15.5.46
G1	30	255.255.255.224 /27	204.15.5.64 till 204.15.5.95	204.15.5.64	204.15.5.95	204.15.5.65	204.15.5.66 till 204.15.5.94
G1	99	255.255.255.248 **/29**	204.15.5.48 till 204.15.5.55	204.15.5.48	204.15.5.55	204.15.5.49	204.15.5.50 till 204.15.5.54
G2	40	255.255.255.224 **/27**	204.15.5.96 till 204.15.5.127	204.15.5.96	204.15.5.127	204.15.5.97	204.15.5.98 till 204.15.5.126

Table 2: IP addressing and Subnetting

So we get to a conclusion that the IP that we can give to the hosts start form the third IP from the initial IP of the range, and ends at one IP to the last IP of our range.

<u>**flow chart**</u>

Flow of user interaction.

About: user set DNS and HTTP

User to set these services on, one access the server, and in services tab;

Decide on doing either http or dns first;

Let say , we are doing http first; we only turn it on; we may create our own web page, but I we do not know how to do so, very well in the packet tracer; that is why it is not among the options in our flow chart.

Then turn on the service; in the top of the tab.

As we have not done the DNS yet, means they are not all of them turned on.

We go for DNS ; we click on the DNS service configuration

In there we may chose to add a new web domain resolution, or edit one, we can also delete but as we are setting things up, let just focus on building not destroying;

If we are editing we click on the pool to edit, and edit the save content; if it is adding; we fill in new data combination. And say add; while on editing we said save.

We are saying a different data combination as you can not add the same information multiple times, no redundancy allowed.

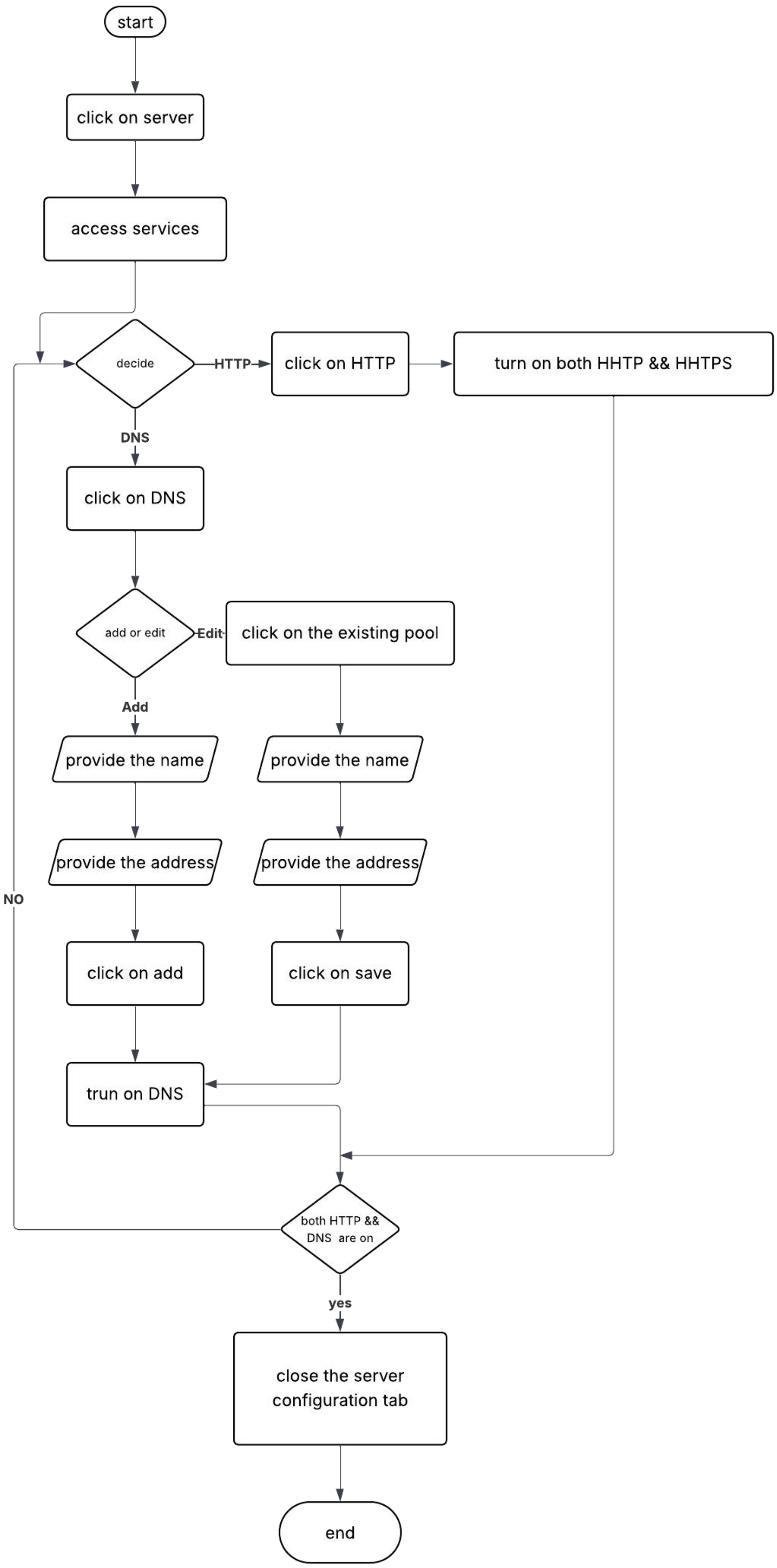


Diagram 1: flow chart, setting HTTP&DNS

Description of my network

1. Router Configuration

We used **Router 2911** mode , as it has 3 ports of gigabitethernet and we are using the gigabit ort on switches to connect to router too.

Why gigabitEthernet?

It is 10x faster, compaire to FastEthernet, for the communication switch and router we want enough speed, better performance and reasonable scalability.as there will a lot of traffic going on.

So here we have to make sure each Vlan has its own interface but again **the issue** is we have 5 Vlans , subnetworks but we have only 3 port. Approach to this problem we use sub-interfaces; So as we are dealing with 3 floor , then every port receive whatever coming from it respective floor; then we sub divide the interface into min-interfaces much the number of Vlan we are dealing with.

Most importantly we enable routing to allow communication between different Vlans.

And make sure at each port connected to a switch is of mode trunk.

To be well shown in implementation part….

2. Switch Configuration

We used **Switch 2960** mode , as it has 24 ports of fastEthernet and 2 gigabitEthernet ports and we are using the gigabit port to connect to the router; why used fastEthernet to connect to PCs

Why fastethernet?

Yes they are slow, but cheap, and we would highly favor the speed if there was a long distance we are covering; this works as , if the distance is long there will be distortion, which reduces the speed, but if it is large enough the information will reach where it is going; so now we are not worried of attenuations, so a moderate speed can serve us.

So here we must assign every usable port to a given Vlan; we make the mode to these port connected to the PCs as access not as trunk, and make sure these port are allowing the relevant Vlan it is assigned to, and any other Vlan that might need to communicate with it, like server's Vlan

To be well shown in implementation part….

3. Pc Configuration

Here we are very limited on option, we used the PC provide by the Packet tracer; it is a command based one, not an Operating System dependent

What facilitating tools on the device?

It is provide command prompt used to ping, to send files using FTP.

There is a browser to access the IP address of the server and check on the save webpages

There I an email used to text and visual communicate between pcs

What to be careful, we must configure the Pc either with DHCP, or manual known as statically assigning, to give it an IP address; and Label the Pc basing on its use" it is not a must , but you mut be confused on which Pc was which.

To be well shown in implementation part….

4. Implementation

This network simulate models an engineering department building Using Cisco packet Tracer. It support:

- Multiple Vlans mapped to departments and labs.

- Dynamic IP configuration Via a central DHCP server

- Internal access to HTTP,DNS,FTP.

Tools used:

multiple Pcs in different Vlans

6 2960-switch; 2 per floor

1 2911-router

1 server, in Vlan 99 with static Ips

Why server has /29 subnet ?

For a school institution option of 8 servers is extremely large enough, so that Vlan will be there, and accommodate how ever much of courses they might plan to use.

Now we do the **IP plan** which is done in **table 2;** but what to recall is that we first calculat the subnet CDIR and know how much to accommodate in one Vlan; and always the range of IPs we get we remove IPs as they are not assignable to an end device; and the 2^{nd} first IP in the range is taken by the switch , for better organisation of you work.

Devices and their roles

- Router: It handles the Inter-Vlan routing (Router - on - a-stick)

-switch: connect thr trunk pcs to the trunked router ports

- Pcs: they are end devices

- Server : they deliver services: HTTP and DHCP.

Building the set-up in packet tracer:

NB: most of the configuration , are done in CLI; we do

- enable **or** en

- configuration terminal **or** conf t

To reach privileged use to change things around.

1. Put the router in the working place;

   a) Setting the sub interfaces(router-on-a-stick):

      i. Router -> CLI -> press ENTER [-> no] optionally.

ii.

```
Router>en
Router#conf t
Enter configuration commands, one per line.  End with CNTL/Z.
Router(config)#int gig0/0.20
Router(config-subif)#
%LINK-5-CHANGED: Interface GigabitEthernet0/0.20, changed state to up

%LINEPROTO-5-UPDOWN: Line protocol on Interface
GigabitEthernet0/0.20, changed state to up
enca
Router(config-subif)#encapsulation dot1Q 20
Router(config-subif)#ip address 204.15.5.128 255.255.255.224
```

Figure13: route-on -a-stick

iii. Exit

iv.

```
Router(config)#int gig0/0.10
Router(config-subif)#no shutdown
Router(config-subif)#exit
Router(config)#ip routing
Router(config)#exit
Router#
%SYS-5-CONFIG_I: Configured from console by console

Router#
```

Figure14: make it route

This will allow the router to work with Vlan 20

2. Put the switch in work place , and connect to the router using straight through cable

a) Switch Vlan and Trunk setup

i. Vlan creation:

1. Click of switch -> configure ->Vlan database // then add a vlan

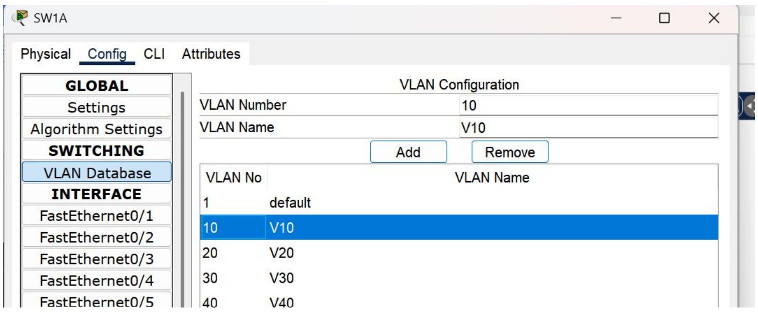
2. 

Figure 15: make a vlan

3. Click add// keep adding as you will be needing

4. To assign vlan manual on by one it is time consuming :

a) Click like on fastethernet0/1

b) Make the mode **access**

c) Allow a Vlan one of those you created if you want to allow multiple Vlan it can only be done using CLI

5. Using CLI

a) From fastEthernet 0/1 til 0/7 I made them access mode and they are accessing Vlan 10

b)

```
Switch>enable
Switch#
Switch#configure terminal
Enter configuration commands, one per line.  End with CNTL/Z.
Switch(config)#
Switch(config)#int range fa0/1 - 7
Switch(config-if-range)#switchport mode access
Switch(config-if-range)#switchport access vlan 10
Switch(config-if-range)#exit
Switch(config)#
```

Figure 16: configure multiple port at once

6. Make the port connecting to the router to trunk mode, and access all the vlan that are on you switch

a) I made it to mode trunk and my trunk port is allowed to acces vlan 10 and 10; because my switch is only dealing with vlan 10 , if it had another vlan like 30 it could be **allowed vlan 10,30**

b)

```
Switch(config)#int gig0/2
Switch(config-if)#switch
Switch(config-if)#switchport mode trunk
Switch(config-if)#switchport trunk allowed vlan 10,10
Switch(config-if)#exit
Switch(config)#
```

Figure 17: trunk and allow multiple vlan

3. Pc configuration

a) DHCP auto IP

i. Click on pc -> Ip config -> DHCP

ii.

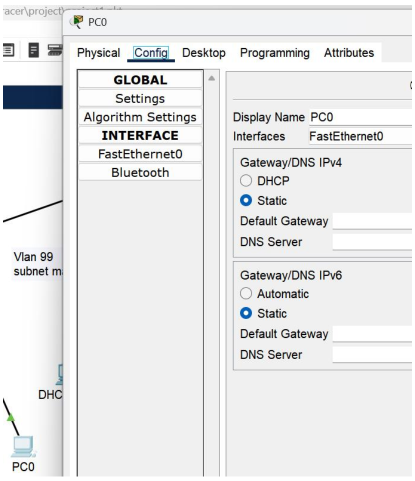


Figure18: no configuration yet

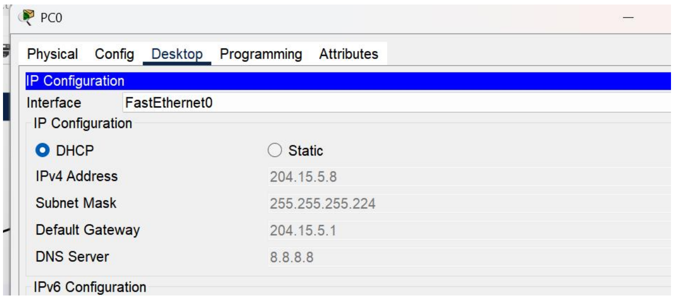
iii. 

Figure 19:DHCP provided.

b) Manually

i. Click on pc -> Ip config -> DHCP

ii. Fill yourself

1. Ip address that is the host usable ip of tha vlan, and not taken by another device yet.

2. The subnetmask, for that vlan, check **Table 2**

3. **Default gateway** is the fisrt usable ip from the range, the one following the network address

4. Server configuration

a) This one is in Vlan 99 , you chose any IP from the usable ips, not the very first one though

i. For it is configure statically on other option

1. Server -> conf -> desktop -> Ip configure

2. Clarify:

a) IPV4 address; the IP to give the server

b) The subnet mask

c) Its default gateway

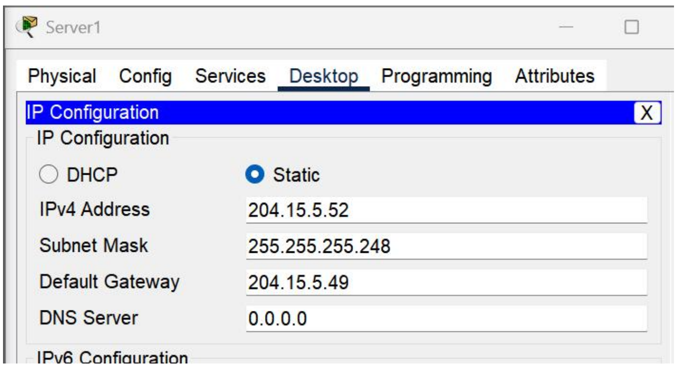
3. 

Figure20: server configuration

ii. One can set the DHCP as we guided above, by creating a pool , and state which starting ip and ending ip

iii. After doing DHCP on server you need to make the router Vlan port to ask suport from the server to generate the ip for it. We say it is an ip helper

```
Router>en
Router#conf t
Enter configuration commands, one per line.  End with CNTL/Z.
Router(config)#int gig0/0.10
Router(config-subif)#ip help
Router(config-subif)#ip helper-address 204.15.5.52
Router(config-subif)#exit
Router(config)#
```

iv.

Figure 21:on route insure the server is helping

<u>Results and Discusion</u>

Ping the gateway

DHCP_V20

Physical Config Desktop Programming Attributes

Command Prompt

```
Cisco Packet Tracer PC Command Line 1.0
C:\>ping 204.15.5.33

Pinging 204.15.5.33 with 32 bytes of data:

Reply from 204.15.5.33: bytes=32 time<1ms TTL=255
Reply from 204.15.5.33: bytes=32 time<1ms TTL=255
Reply from 204.15.5.33: bytes=32 time=1ms TTL=255
Reply from 204.15.5.33: bytes=32 time<1ms TTL=255

Ping statistics for 204.15.5.33:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
    Minimum = 0ms, Maximum = 1ms, Average = 0ms

C:\>
```

Figure 22: ping gaway

Ping the server

```
Device Name: Server1
Device Model: Server-PT

Port             Link   IP Address        IPv6 Address
FastEthernet0    Up     204.15.5.52/29    <not set>

Gateway: 204.15.5.49
DNS Server: <not set>
Line Number:  <not set>
```

Figure 23: server ip

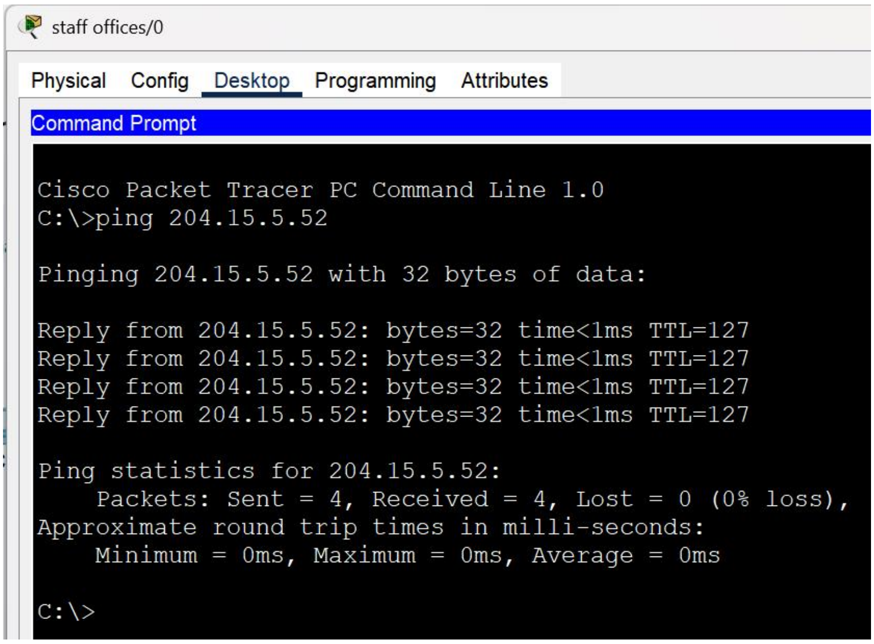


Figure 24: ping server

Web access

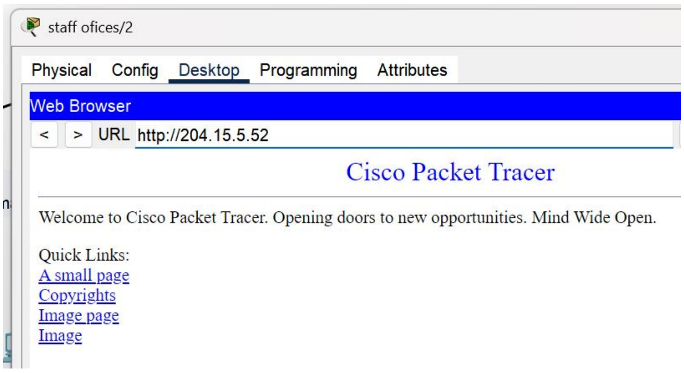


Figure 25: access webpage,

Bar chart:

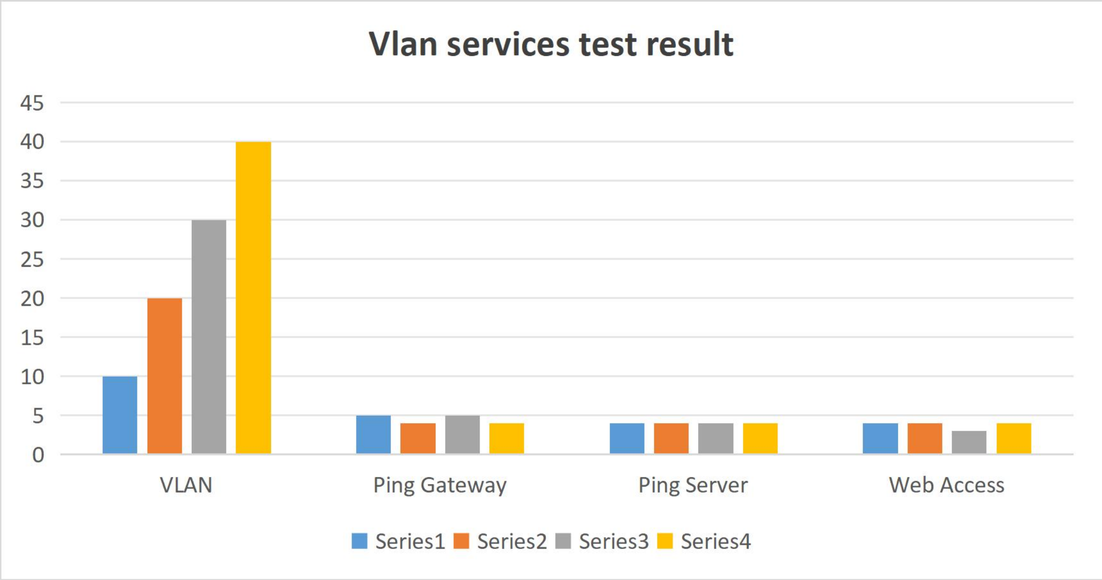


Figure 26:sumary chart of othermany tests.

Conclusion

This project provided a comprehensive and practical understanding of buidlinglevel network design using cisco packet tracer. By simulating and this building with vlans,dynamic IP allocation, inter-Vlan routing and core services like DHCP,Dns and Http, we were to replicate a realistic educational network environment.Through configuration routers, switches,Pcs and servers, we reinforeced key networking concepts such as segmentation,service centralization, trunking ans security policies.The success of the simulation validates our understanding of Layer2 and layer 3 networking.Moving forward,we are well-positioned to explore more advanced topics like Wan configuration, in wide practice and real-world hardware implementation.

Reference

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