NETWORKERS

CCNA

Lab Guide

CISCO™

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(DoN)

Lab Guide

Lab 1

* Network devices S/W components:

1- IOS : Internetwork Operation System

Stored in flash memory

⇓

Hard disk

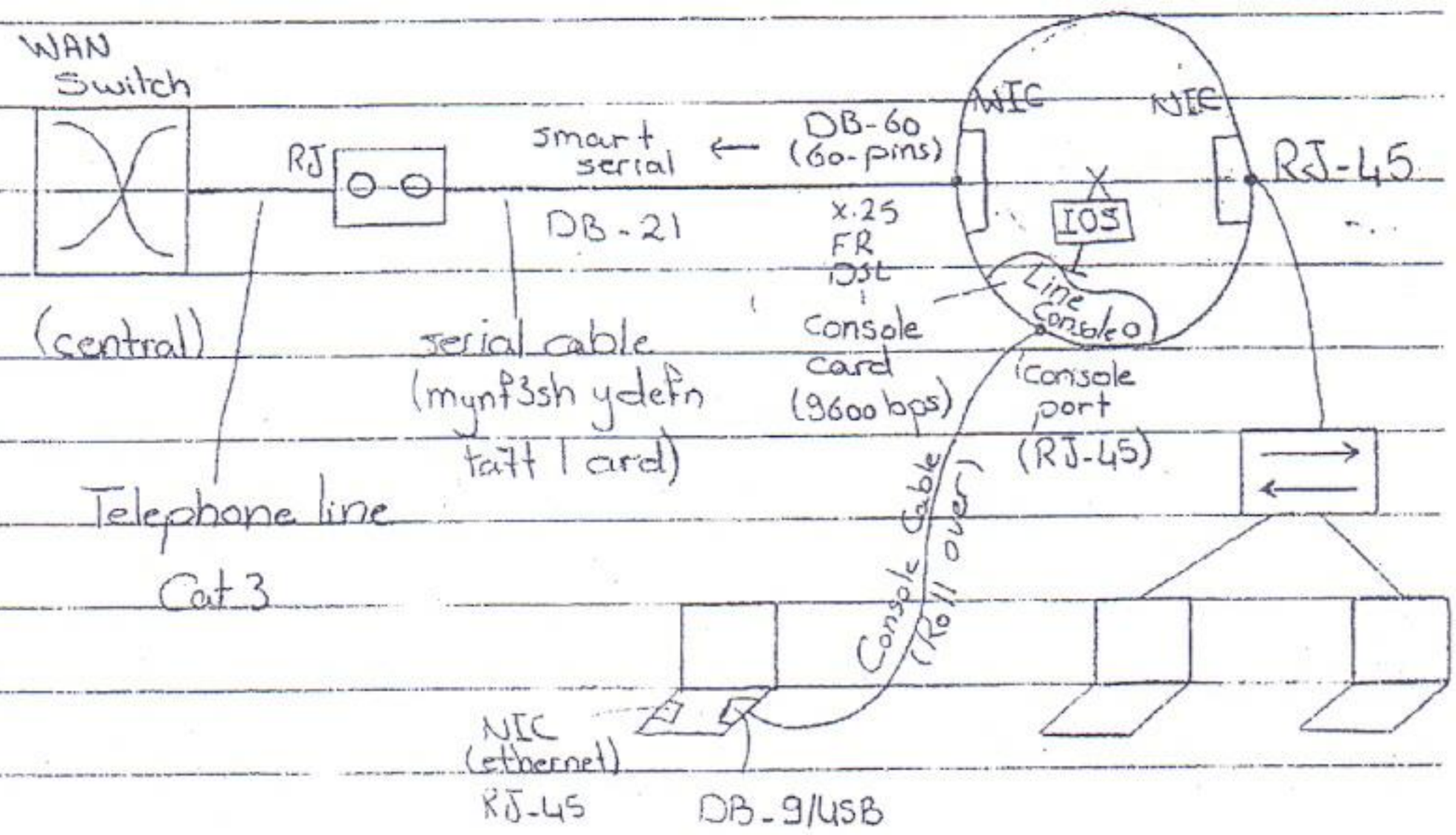
2- Configuration file:

It is a program file that contain commands that tell the device what to do inside network.

Stored in RAM (volatile)

Saved on NVRAM (Non-Volatile RAM).

* How to build a configuration file?



· momayezat 1 DB-21 3n DB-60:

① pins 2a2at

② tawfer 11 caldes

③ 2 ports fe nfs 1 IC

· Hyper Terminal:

Connect using: TCP/IP (Ethernet) x

COM (DB) ✓

Port Settings: Restore Defaults

Would you like to enter the initial configuration dialog? Yes

Would you like to enter basic management setup? Yes

Enter host name [Router]:

Enter enable secret:

· Iaszela dch esma tarza ll mabtadelen

Iroutter howa elly byshalny 3ala mazaga

* Configuration modes:

1- Setup mode:

It is Y/N configuration dialogue.

It is used for basic configuration.

Press Ctrl /C to Abort (to exit without saving).

: w deh esmaha tareka ll mobtadeen aw l fanayen.

2- Exec mode:

: ana 2a2dar aktb commands elly ana 3ayzaha

2.1 User mode : level 1 (500 commands)

Router >

It is used for simple monitoring & troubleshooting

Router > show ip interface brief

BRI: Basic Rate ISDN
Serial 0

· bytala3ly Interface elly 3ala Router

Router > enable

· 3shan 2ar07 3ala level 2 bakteb enable.

مهلا حبايبك

2.2. Admin. mode (Privilege mode) : level 2
(Enable mode) (15,000 commands)

Router #

level 1: Router > enable.
level 2: Router #

disable

It is used for advanced monitoring & troubleshooting.

23. Global configuration mode:

It is used for configuration commands that affect the entire device

Router (config.) #

level 1: Router > enable

disable

level 2: Router # configure terminal

exit

(Ctrl/Z)

level 3: Router (config.) #

*Basic configuration:

Router (config.) # hostname name

(config) # enable secret password

- enable secret: password for level 2
- password: encryption using MD5 (Message Digest ver.5).

↓

show run

Router (config) # line console 0

(config-line) # password password

- password: password for level 1

(config-line) # login

↓

show run

+ Exam

minus

· Router (config) # service password-encryption

Encrypt all current & future passwords

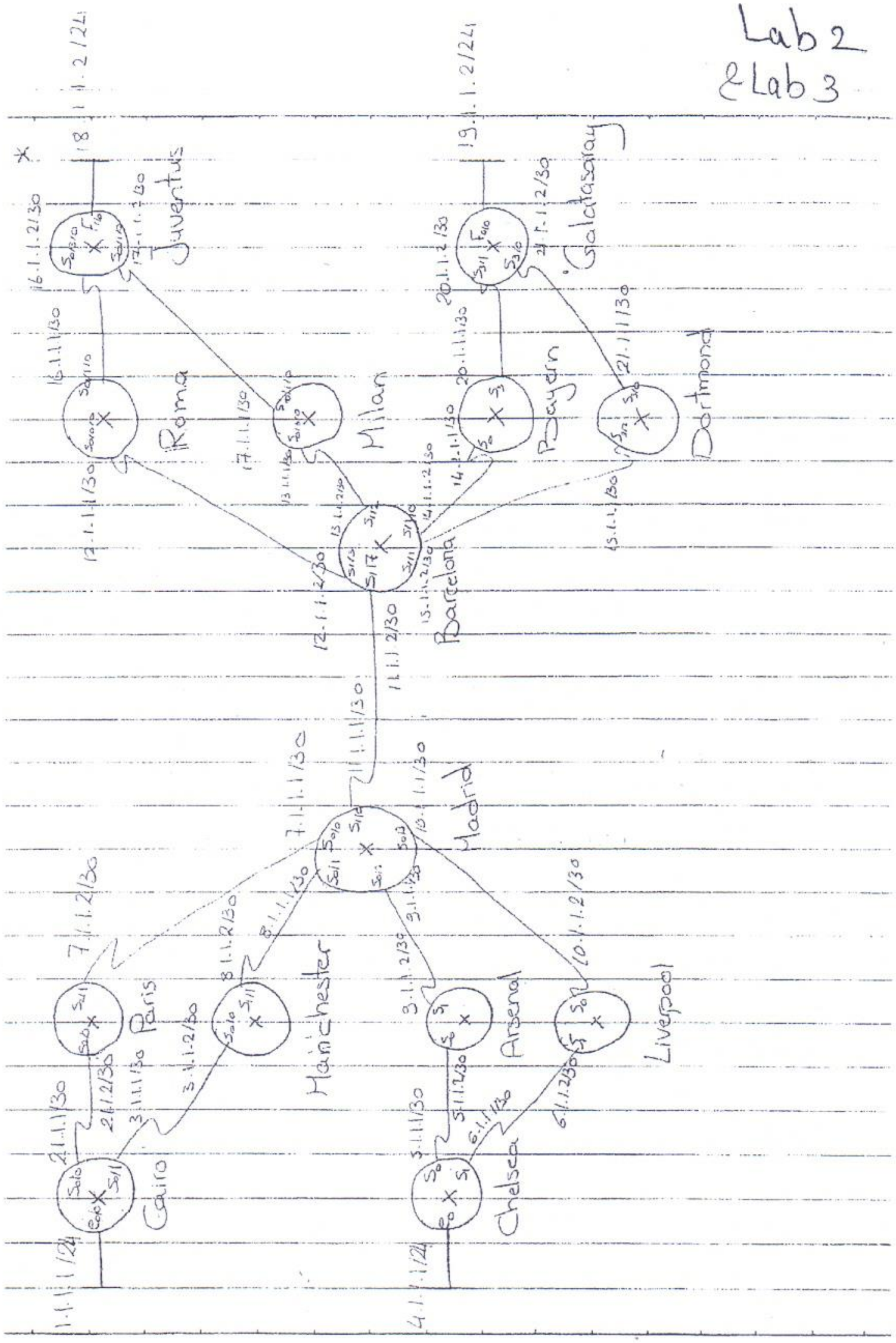
↓

show run

· (config) # no hostname

· 3shan amsat ay taga ana ktbtaha bstaSdm
l amr ~~[illegible]~~ bs 2abto No

Lab 2
& Lab 3


Roma
Milan
Bayern
Dortmond
Barcelona
Juventus
Galatasaray
Madrid
Paris
Manchester
Arsenal
Liverpool
Cairo
Chelsea

Task 1:

> enable

config ter

(config.) # hostname

(config.) # enable secret disco

(config.) # line VTy 0

Virtual Terminal (Virtual Telnet)

: command dah by-activate / telnet s/w

3shan 2a3raf ana 2a2dr 2a5ly kam axted y-telnet
3alaya : (config.) # line VTy ?

: law ana katba fel command : (config.) # line VTy 0 4
yeb2a ana kda 2a2dar 2a5aly 5 ye-telnet 3alaya

(config.-line) # password cisco

(config.line) # login

: Setup mode : Y / N .. Exec mode : > user
privilege
(config) # Global config.

Task 2.

(config) # interface _____

(config-if) # ip address IP Mask

(config-if) # no shutdown

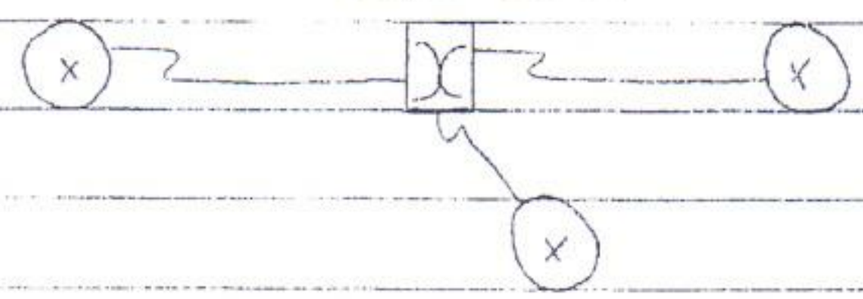
· Speed of serial : 64kbps - 10Gbps
Every 64 kbps, 2x64kbps, 3x64kbps, ...

(config-if) # clock rate 64000 Not for
أقل سرعة ethernet (NIC)

for serial (DCE) In WAN

for DCE only

(SP)
WAN switch



SP mtaadeny by-sa3a mo3ayana fi kol port fel LAN switch Teha sa3a fa switch byzbt kol switch sa3at elh.

· In Lab.: ana bawasal point to-point, w DCE roles yeZom hawa l master fa hayzabt saBet l tany elly hawa l slave w l master fel 7ala deh hayb2a DCE byZom b warefet l switch bshakl efterady

show controller Sx

3shan 2a3raf mn l master w l slave, deh l command elly bay2aly, see info in line 2 or 3

* Task 3:

#show ip interface brief

#show cdp neighbors

#show cdp neighbor detail

show ip protocols

#show ip route

ping IP # Telnet IP

Lab3: Configuring RIP ver 2

(config) # router rip

(config-router) # version 2
(Config-router) # no auto-summary
(config-router) # network IP
→ IP of interface

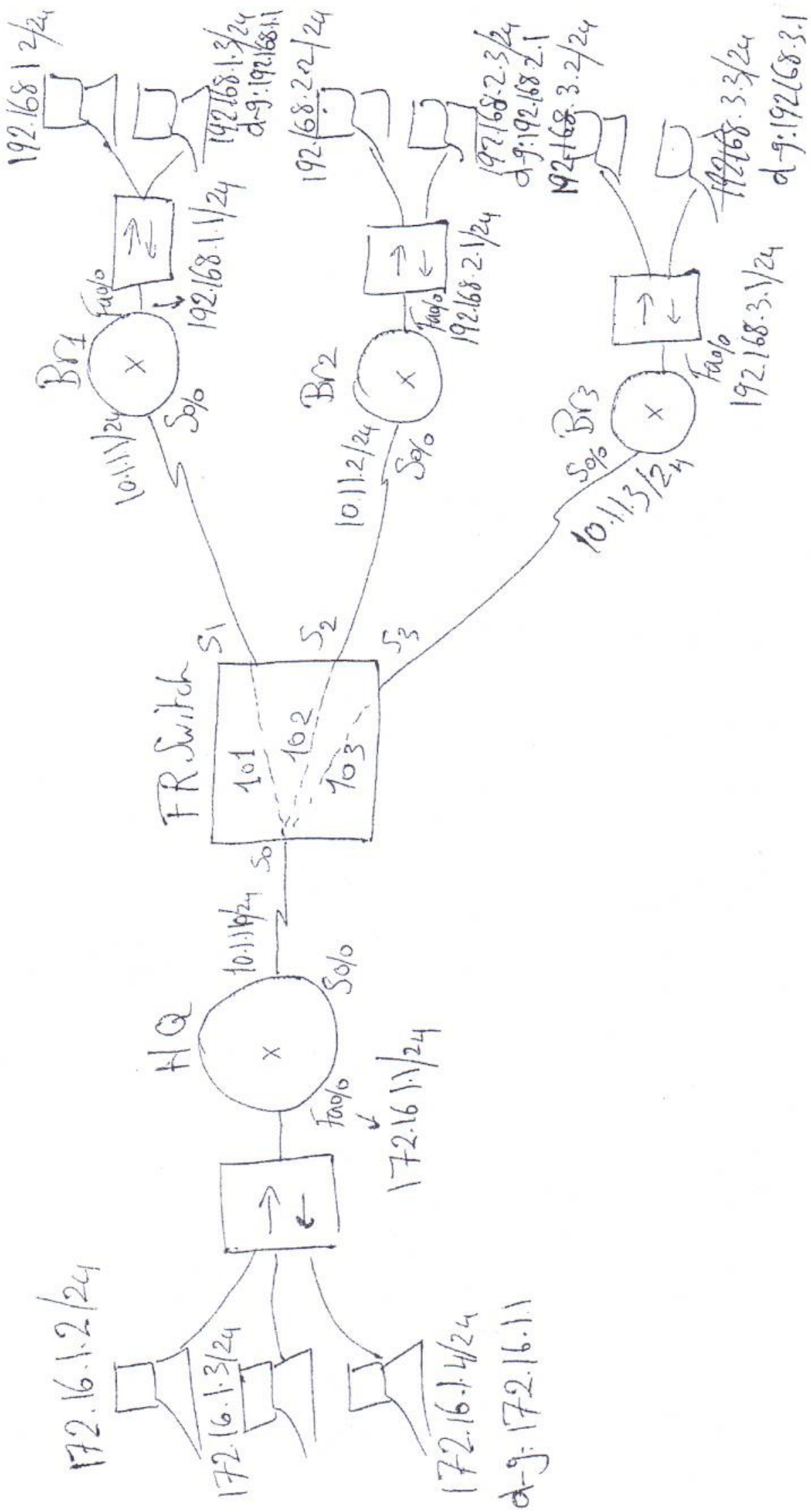
Configuration per interface by writting IP of interface using network Command.
Show ip protocols
Show ip route
debug ip rip
undebug all

Lab 4: DHCP

Lab 5: LAN

Lab 6: WAN - Frame Relay

Lab 7: Routing - EIGRP


192.168.1.2/24
192.168.1.3/24
d-g: 192.168.1.1
192.168.1.1/24
Br1
Fa0/0
10.1.1.1/24
S0/0
192.168.2.2/24
192.168.2.3/24
d-g: 192.168.2.1
192.168.2.1/24
Br2
Fa0/0
10.1.1.2/24
S0/0
192.168.3.2/24
192.168.3.3/24
d-g: 192.168.3.1
192.168.3.1/24
Br3
Fa0/0
10.1.1.3/24
S0/0
FR Switch
S1
S2
S3
S0
101
102
103
10.1.1.0/24
HQ
S0/0
Fa0/0
172.16.1.1/24
172.16.1.2/24
172.16.1.3/24
172.16.1.4/24
d-g: 172.16.1.1

Lab4: DHCP

on HQ & all branches routers.

```
>en
# Conf t
(Config)# interface Fa 0/0
(Config-if)# no Shutdown
(Config-if)# IP address IP mask
```

then use routers as DHCP Servers for its own LAN.

HQ IPs: 172.16.1.x/24 , d-g: 172.16.1.1

Branch IPs: 192.168.br.x/24 , d-g: 192.168.br.1

```
(Config)# ip dhcp pool HQ
                       name
(dhcp-Config)# network 172.16.1.0 255.255.255.0
                       IP of network  mask
(dhcp-Config)# default-router 172.16.1.1
                              IP of d-g
(dhcp-Config)# dns-Server 8.8.8.8
                          dns IP
```

Lab 5: LAN

From PC on HQ use Cmd to Ping on all PCs on Same LAN to check LAN Connectivity.

also from HQ router Ping on PCs on Same LAN

Ping 172.16.1.X

from router Check MACs & IPs of all LAN devices by Checking ARP table

Show arp or # Show ip arp

MAC	IP	Age	Interface

Lab 6: WAN - Frame Relay

On Each Router

(Config)# interface S0/0

(Config-if)# no Shutdown

(Config-if)# IP address 10.1.1.X 255.255.255.0

(Config-if)# encapsulation frame-relay

after Configuring all routers, go to HQ

Show frame-relay map

dLCi 101 , 10.1.1.1 .
dLCi 102 , 10.1.1.2

↓

IARP table

HQ # Ping 10.1.1.br → Success

HQ # Ping 192.168.br.x → fail (no routing yet)

Lab 7: Routing EIGRP

On each router

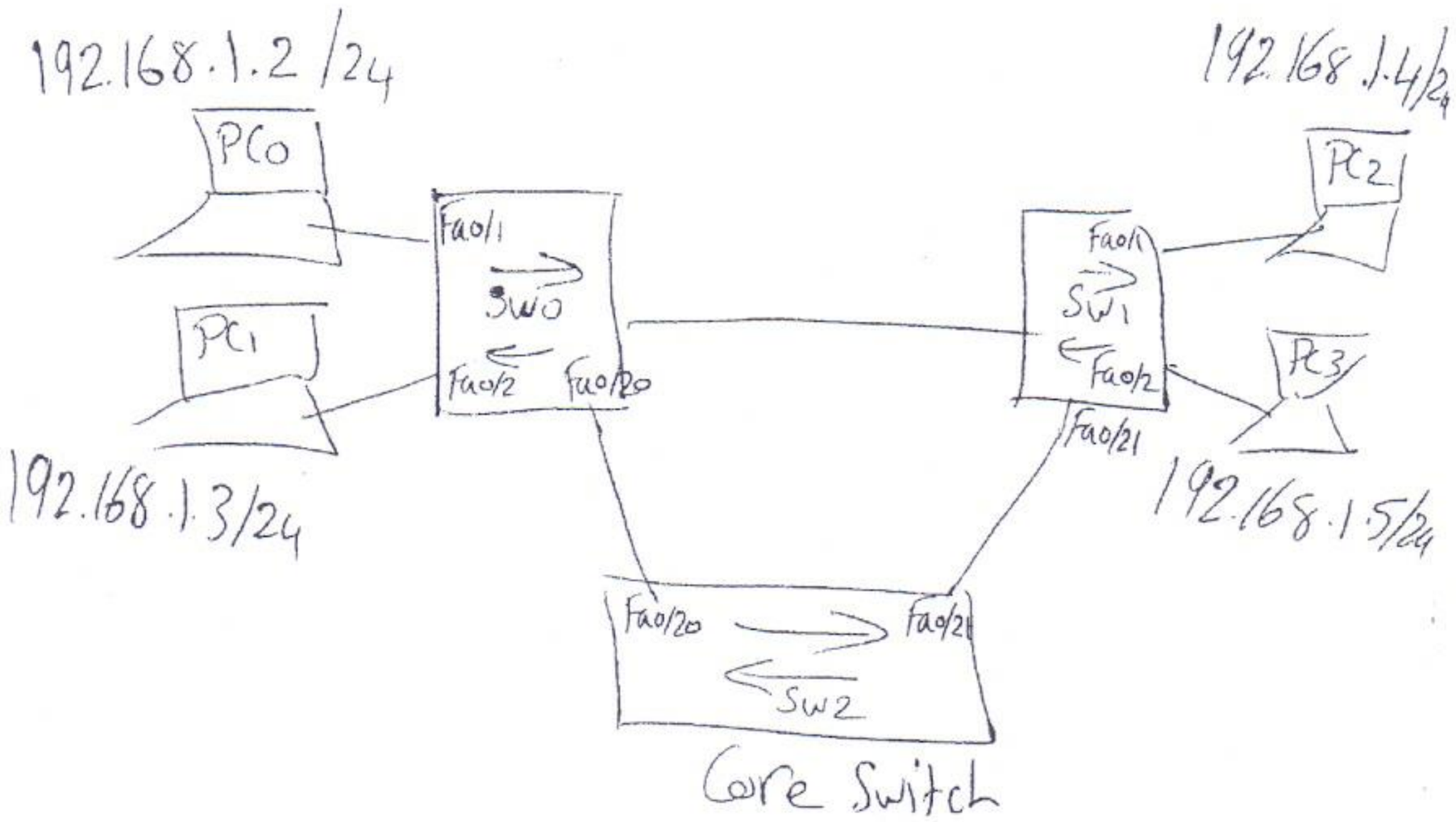
```
# show ip route
(Config)# router eigrp 222
                        AS #
(Config-router)# no auto-summary
(Config-router)# network IP of LAN interface
(Config-router)# network IP of WAN interface

# show ip route
# show ip eigrp neighbor
# show ip eigrp topology
# show ip protocols
```

From PC on HQ:

```
> Ping IP of PC on branch
> tracert IP of PC on branch
```

Lab 8: STP & VLANs



Task 1:

Configure each PC with the given IP then from any PC Ping on all other PC to check Connectivity.

that Proves that all devices on Same VLan (Vlan 1)

Task2:

we need PC0 & PC2 on Vlan1
also we need PC1 & PC3 on Vlan2

Show Vlan

- Create Vlan:

on each Switch (Sw0, Sw1 & Sw2)

(Config) # Vlan 2
(Config_Vlan) # name HR

Show Vlan

Vlan 1	default	all Ports
Vlan 2	HR	no Ports

- Activate Vlan:

on Switch (Sw0 & Sw1) only = access Switches

(Config) # interfaceFa 0/2
(Config-if) # Switchport access Vlan 2

Show Vlan

- Trunk Configuration:

on Core or access Switches

```
(Config)# interface fa0/20
(Config-if)# Switchport mode trunk

(Config)# interface fa0/21
(Config-if)# Switchport mode trunk

# Show interface trunk
```

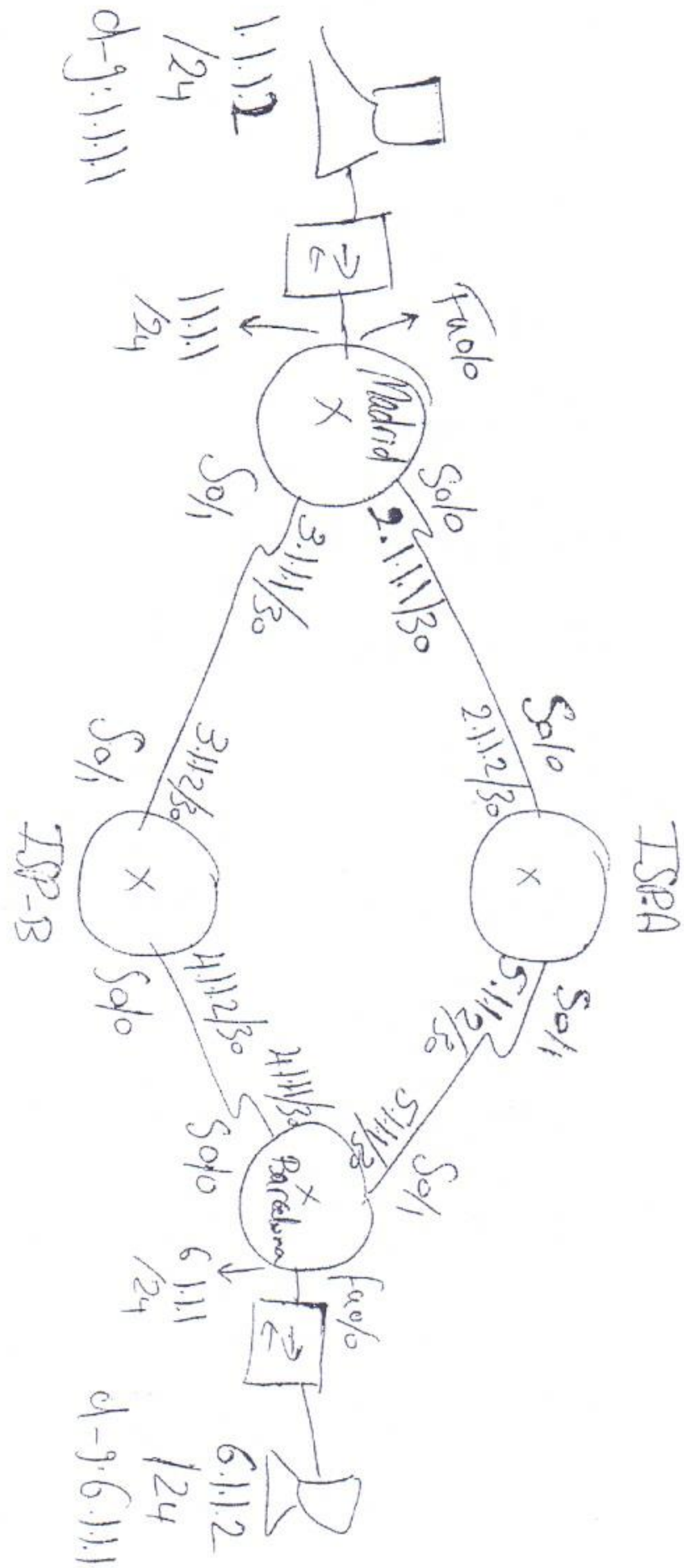
Fa0/20	Trunk	dot1q
Fa0/21	Trunk	dot1q

Success - From PC on Vlan 1 Ping on PC on Vlan 1.

Success - From PC on Vlan 2 Ping on PC on Vlan 2.

Fail - from PC on Vlan 1 Ping on PC on Vlan 2.

Lab 9: Routing - OSPF



* Configure PCs with Shown IPs, mask & d-g.

Task 1:

>en

Conf t

(Config)# hostname name

(Config)# enable Secret cisco

Task 2:

(Config)# interface ——

(Config-if)# no Shutdown

(Config-if)# IP address IP mask

(Config-if)# Clock rate 64000

اقل سرعة

. for Serial DCE only
. not for Ethernet

Show Controller S x/x

Task 3:

(Config)# router OSPF 1

(Config-router)# network ip of interface 0.0.0.0 area 0

LAN or WAN

wild card mask

repeat for each interface, but note

repeat depending on router interface.

i.e.: Router with two interfaces need only 2 network commands

Show ip route
Show ip OSPF neighbor
Show ip OSPF database

from PC 1.1.1.2:

>Ping 6.1.1.2

> tracert 6.1.1.2

Lab 10: ACL (ACless Control List)

on Madrid, restrict host A only from Ping (ICMP) on 6.1.1.2 only.

Create Acl:

Madrid (Config) # access-list 100 deny icmp host 1.1.1.2 host 6.1.1.2
(src ip, dst ip)

Madrid (Config) # access-list 100 Permit ip any any

Check
Show access-list

Activate Acl:

Madrid (Config) # interface Fa0/0

Madrid (Config-if) # ip access-group 100 in

Check:
Show ip interface

from host A: > Ping 6.1.1.2 (fail) destination Unreachable

From host B: > Ping 6.1.1.2 (Success)

Router Commands

N:	Command	Description
1	Router> Enable	Enable mode for advanced monitoring
2	Router# show run	To show the run configuration on the ram
3	Router# show start	To show the start up configuration that saved on the NvRam (flash)
4	Router# show ip interface brief	To show a brief of all interfaces
5	Router# show ip interface	To show all the details of the interfaces on the router
6		
7	Router# show cdp neighbors	To show the neighbors that directly connected
6	Router# show cdp neighbors details	To show the neighbors details
7	Router# show ip protocols	To show the routing protocol that it's work and give the active protocol , active interface , routing information source , admin distance , routing for network
8	Router# show ip route	To show the route in the routing tables
9	Router# show controllers interface	To check if your WIC connection type (DTE or DCE) in line 2 or 3 to provide clock rate
10	Router# show ip eigrp neighbors	To show neighbors that understand EIGRP
11	Router# show ip eigrp topology	To show the topology table of EIGRP
12	Router# show ip ospf neighbors	To show neighbors that understand OSPF
13	Router# show ip ospf interface	To show the interfaces that run on OSPF
14	Router # show ip ospf database	To show link state database of OSPF
15	Router# ping ip	To check if there is an end to end connectivity
16	Router# Traceroute ip	To track the path hop by hop till reaching an end
17	Router#telnet ip	To login remotely on another device
18	Router# configuration-terminal	Global configuration mode
19	Router (config)# hostname name	To rename the router
20	Router (config)# banner motd $	To make a banner message to be showing in start up the $ you can change it as you want and u must end your message with this signs
21	Router (config)# line console 0 Router (config-line)# password password Router (config-line)# login	To configure login password
22	Router (config)# line vty 0 4 Router (Config-line) # password password Router (config-line) # login	To configure vty used for telnet and ssh from 0 to 15
23	Router (config)# service.password-encryption	To encrypts all current and future unencrypted passwords
24	Router (config)# enable secret password	To configure enable password and encrypt it by MD5
25	Router (config)# interface serial 0	To configure interface serial
26	Router (config)# interface Fast Ethernet 0	To configure fast Ethernet interface
27	Router (config-if)# ip address ip mask	To configure ipv4 address to interface and mask

28	Router (config-if)# no shutdown	To configure interface to turn on (all interface are in shutdown mode by default)
29	Router (config-if)# clock rate 64000	To configure clock rate and synchronization for DCE serial, we use it on null modem configuration (back to back)
30	Router (config)# ip route networkaddress mask vector or ip of next hop	Used to configure static route we use the exit interface or vector if we are direct connected to the other router and we use the ip of next hop if we connected from point to multi point
31	Router (config) # ip route 0.0.0.0 0.0.0.0 s 0/0	This configuration used for summarization of all ipv4 networks
32	Router (config) # ip classless	To activate default route and the classless ip and it's enabled by default
33	Router (config) # Router Rip	To enable rip ver 1 routing protocol
34	Router (config-router)# network direct connected network	To chose the interface that use this network
35	Router (config)# Router Rip Router (config-router)# version 2 Router (config-router)# network direct connected network	To enable rip ver2 routing protocol
36	Router (config-router)#passive-interface interface	To make an interface stop sending updates
37	Router (config)# no anycommand	To cancel any IOS command and return back to default
38	Router (Config)# Router igrp AS#	To enable igrp routing protocol and we have to chose the autonomous system number
39	Router (config)# Router eigrp AS#	To enable eigrp routing protocol and we have to write the as number
40	Router (config-router)# no auto-summary	To stop automatic summarization and advertise subnets details to other routers
41	Router (config) # Router ospf processid Router (config-router)# network network w.c.m area id	To run ospf routing protocol with process id to separate the database and area id to aid summarization
42	Router # debug ip rip	To monitoring the processing of rip in the background
43	Router # debug ip eigrp packets	To show the processing of eigrp packets
44	Router # debug ip ospf adj	to show processing of ospf operation
45	Router # undebug all	To terminate all opened debugs
46	Router (config)# ip Nat inside source static private ip public ip	Enable static NAT
47	Router (config)# ip Nat pool poolname startip endip {netmask|prefix-length} subnetmask Router (config)# ip Nat inside source list acl# pool poolname Router (config)# interface e0 Router (config)# ip nat inside Router (config)# ip nat outside	Enable dynamic NAT And enable it on interface inside and outside
48	Router (config)# ip nat pool poolname startip endip {netmask|prefix-length} subnet mask Router (config)# ip nat inside source list acl# pool poolname overload	To enable PAT (dynamic NAT with overload)

49	Router#show ip nat translation	To display NAT/PAT table
50	Router (config)# int Gi 0/0 Router (config-if)# no ip address Router (config-if)# no shutdown Router (config)# int Gi 0/0.1 Router (config-subif)# encapsulation dot1Q vlan# Router (config-subif) # ip address ip mask	To divide the physical interface to sub interfaces you can divide them to 4 billion sub interface we use it for enable routing between vlans We have to chose the encapsulation type and tagging , we have to assign the encapsulation type for each sub interface
51	Router# copy running-configuration start-configuration Famously : Router#copy run start More famously: Router#WR	To save the configuration from the RAM to the flash memory (NVram)
52	Router # erase start-configuration	To erase saved configuration from the flash memory (NVRAM)
53	Router # show version	To show software and hardware features Displays RAM, NVRAM, Flash sizes and configuration-register value
54	Password recovery on router: Router power on/off CTRL + BREAK (while router restarting) Rommon > confreg 0x2142 Rommon > reset Router # copy start run After changing password you must save your work Router # copy run start Do not forget to change the value of 2142 to the default value to run in normal sequencing Router (config)# configure-register 0x2102	To reset enable password This steps must be done with console cable only Router will restart and open the dialog configuration also we will say no and then go on into enable mode After last step you can change the password to make sure that all the configuration is still alive
55	Router (Config) # ip dhcp pool name Router (config-dhcp)# network network mask Router (config-dhcp) # default-router ip of router Router (config-dhcp) # dns server ip of dns1 ip of dns2 Router (config) # ip dhcp excluded-address startip endip	To configure DHCP service on a router and assign a pool
56	Router # show ip dhcp binding	To show assigned ip address to witch host
57	Router (config) # access-list no 1->99 permit/deny src ip w.c.m	To create standard access list it's used to filter traffic
58	Router (config) # access-list {standard/extended} aclname Router (Config-std-nacl)# {permit/deny} srcip w.c.m	To create standard named access list
59	Router (config) # interface serial 0 Router (config-if) # ip access-group no#/name {in/out}	To activate access list on a interface
60	Router (config) access-list 100->199 {permit/deny} protocol srcip src w.c.m operator src port protocol dst ip dst w.c.m operator dst port protocol	To create numbered extended access list that we can deny a certain pc to a certain protocol such as http or ftp or https or certain dst ip

61	Router (config) # ip access-list standard/extended name Router (config-ext-nacl) # permit/deny protocol srcip srcw.c.m operator src port protocol dstip dst w.c.m operator dst port protocol	To create extended named access list
62	Router (config-if)# ip access-group no#/name {in/out}	To activate extended named access list on certain interface
63	Router (config) # line vty 0 4 Router (Config-line) # access-class aclno#/name in	To activate acl on line vty for telnet uses it's increase security for the telnet
64	Router # show access-list Router # show ip access-list Router#show ip interface	To display ACL creation To display which interfaces have active ACLs

Switch Commands

1	Switch > enable	To open enable mode Privilege mode for advanced monitoring
2	Switch # show running-configuration	To show the running configuration on the RAM
3	Switch # show startup configuration	To show start up configuration file that saved on the flash
4	Switch # show spanning-tree	To show spanning tree information
5	Switch # show vlan	To show vlan.dat file (vlan database and what is stored on it)
6	Switch # show vtp status	To show the status of the vtp domain and the revision number
7	Switch # show interface trunk	To show details of all trunk interfaces
8	Switch # show dtp interface	To show dynamic trunk protocol information
9	Switch # show arp	To show arp table
10	Switch # show cdp neighbors	To show details of neighbors Cisco only
11	Switch #show Mac-address-table	To show Mac address table
12	Switch # show port-security	To show witch port are secured
13	Switch#show flash	Display Flash memory files (IOS.bin, VLAN.dat ,Config.text)
14	Switch # show version	To show version of IOS , software and hardware
15	Switch # configure terminal	To enter the global configuration mode
15	Switch (config) # hostname name	To change the display name for the device
16	Switch (config) # vlan #	To create a new vlan
17	Switch (config-vlan)# name name	To create a name for the vlan
18	Switch (config-if)# switchport mode access	To change port mode from dynamic to access we use port access for end devices only
19	Switch (config-if)# switchport mode trunk	To change port mode from dynamic to trunk mode In Cisco switch it's done automatically
20	Switch (config-if) # switchport access vlan #	To assign vlan in certain port on the switch
21	Switch (config) # vtp domain name	To configure vlan trunking protocol VTP DOMAIN (CISCO PROPERIATERY)
22	Switch (config) # vtp password password	To assign a password for the vtp domain
23	Switch (config) # vtp mode {server|client|transparent}	To choose switch VTP mode
24	Switch (config) # line vty 0 15	To mange switches remotely
25	Switch (config-line)# password password	To assign a password for the vty
26	Switch (config-line)# login	To assign this password while logging to switch remotely
27	Switch (config)# interface vlan 1 Switch (config-if) # ip address ip mask Switch (config-if) # no shutdown	To assign ip address for switch processor to use it in telnet connection Assign ip address and mask

	Switch (config) # ip default gateway ip of router	Add default gateway (router ip)
28	Switch (config) # copy running-configuration start configuration	To save configuration from RAM to flash memory (NVRAM)
29	Switch (config-if)# switchport port-security Switch (config-if)# switchport port-security maximum number of users	To activate port security Chose number of allowed Mac address that can run on this port
30	Switch (config-if) # switchport port-security Mac-address Mac address	To assign Mac address statically
31	Switch (config-if) # switchport port-security mac-address sticky	To make the first Mac saved is the only Mac that can use this port and drop other data from any other Mac
32	Switch (config-if) # switch port port-security violation {shutdown/restrict/protect}	To change the action from shutdown to restrict or protect if other Mac address not assign in security
33	Switch(config)#interface range Fa0/2-4, Fa0/7-9 Switch(config-if-range)#	Command to select range of interfaces at same time - Used to select continuous range of ports , used to select discontinuous range of ports
34	Switch(config-if-range)#channel-protocol pagp Switch(config-if-range)#channel-group # mode {desirable|auto}	Enable Ether Channel using Cisco PAGP on ports, Choose new name for the group of ports and choose a mode: desirable (actively try to negotiate EC), auto (passively wait negotiation then respond with negotiation back)
35	Switch(config-if-range)#channel-protocol lacp Switch(config-if-range)#channel-group # mode {active|passive}	Enable Ether Channel using standard LACP on ports, Choose new name for the group of ports and choose a mode: active (actively try to negotiate EC), pasive (passively wait negotiation then respond with negotiation back)
36	Router(config-if)#standby # ip virtual ip Router(config-if)#standby # priority priority Router(config-if)#standby # track serial0	Enable HSRP to merge many physical routers to appear as one virtual router
37	Router(config-if)#vrrp # ip virtual ip Router(config-if)#vrrp # priority priority	Enable VRRP to merge many physical routers to appear as one virtual router
38	Router(config-if)#glbp # ip virtual ip Router(config-if)#glbp # priority priority Router(config-if)#glbp # track #	Enable GLBP to merge many physical routers to appear as one virtual router

Network Devices

1- Repeater :

It's regenerates the signals it's layer 1 device there is a rule to use the repeater maximum 4 repeaters to avoid large delay and collision it's run by hardware

2- Hub:

It's a multiport repeater it's layer 1 device forward data by flooding bits, send bits out of all ports except the receiving port all connected pcs are member in single broadcast domain single collision domain , they operate in half duplex it's run by hardware

3- NIC : (Network Interface Card)

Its devices understand Mac its layer 2 devices has Mac address, Mac method, Mac frame and Mac flow control in the new devices of NIC support MDI/MDIX and its run by hardware

4- Bridge:

It's act as layer 2 repeater , understand Mac address , forming Mac table , max ports can support 16 it's run by software (Slow switching)

5- Switch:

It's multiport bridge, its layer 2 devices, it's support only one technology by hardware. Forming Mac table, its run by hardware (Asics) (FAST) and also use micro segmentation.

It learns from Source MAC in incoming frames and forward by comparing destination MAC to MAC table, if Destination is known so it will forward correctly, if destination is unknown it will flood, if destination is broadcast or multicast it will also flood.

Switch port can learn the existence of more then one device on the same port but it will never learn the existence of same device on different ports , all devices connected to switch are members of a single broadcast domain , each port are a single collision domain , all devices connected to a switch can operate in full duplex switches support VLAN , STP , RSTP , by default all switch port are in VLAN 1 , all switch port by default : no shutdown , no security

Switch Port Types:

a- Access port : port that connected to an end device it's member on only 1 vlan
b- Trunk port : port that connected to intermediate network devices and it's by default member in all vlans

Switctch STP Port States:

A-listen state: (led amber) :Port is sending & receiving BPDUS , port is performing election (root switch , BPDU , DP , RP, BP) (15 second)

B-Learn state : (Amber led) Complete election if required , port start forming Mac table and drop data (15 sec)

C-Forward state : (green led) start sending data and continue learning

D-- Blocked state: (green led) port only can receive BPDUs only

E-Discard state: (Led is off) no cable connected to port or port is shutdown

Switch Port States: (RSTP):

a- Discard State: same as blocked state
b- Learn State : (Amber led) Complete election if required , port start forming Mac table and drop data (Max 15 Sec)
c- Forward state : (green led) start sending data and continue learning

Port fast (RSTP) : port that goes to Fwd state immediately , it's must be connected to pc or router

Switch modes:

a- Adaptive cut through :

It's start as cut through till errors frame reaches a big percentage then it's automatically change it's operate to store & forward till errors frames reach a small number then it's return back to cut through , we can use this kind of switches as core switching . (1- Cut through 2- store & forward 3-cut through)

b- Store and forward :

Switch store full frame and check if there are any errors then forward
[Error types]: 1- CRC error 2- Runt frame < 64 byte 3- Giant frame >1518

c- Fragment Free:

Its wait tells the minimum frame size 64 byte then forward.

d- Cut through :

Wait after 14 byte then forwarding (waiting for preamble and DST Mac).

6-Wireless access point :

Its wireless switch (Air switch) , WiFi , there is 3 types of antenna in wireless switch 1- omni directional (2dbi from 100 meters to 300 meters) 2- semi directional (14dbi 12 km) 3 highly directional (dish antenna 50 km)

7-Router :

It's a device that supports multiple technologies , it's deliver data from end to end it's layer 3 device , interface of router called serial interface or WIC (WAN Interface Card) and also have NIC (Ethernet Interfaces), Router never floods either route (if destination known) or drop (if destination is unknow) , broadcast is processed.

8-Modem (Modulator-DeModulator)

9-Digital modem (CSU/DSU=Channelised Service Unit / Data Service Unit)

10-Firewall (ASA=Adaptive Security Appliance)

11-VPN concentrator (Virtual Private Network)

12-IDS/IPS (Intrusion Detection System / Intrusion Prevention System)