CCNA 200-120

By ENG : Mohamed saber

Chapter 1
INTERNETWORKING

CHAPTER 1 : INTERNETWORKING

Network def.

- **Types of Network : (size)**

1. LAN
2. MAN
3. WAN
4. SAN
5. PAN
6. VPN

CH 1

- Network topology :

1. Bus topology
2. Ring topology
3. Star topology
4. Extended star topology

CH 1

- Network transmition media :-

1. Wire :

- ✓ Co-axial cable (10 Base 2,5)
- ✓ TP (UTP – STP) (10,100,1000 base T,Tx)
- ✓ Optical fiber (single mode – multi mode)

2. Wireless

CH1

- Connection types :-

1. Standard (straight-throw)
2. Cross over
3. Rolled over

- Devices types :-
- Midi & midix
- DTE (data terminal equipments)
- & DCE (communication)

CH1

- Network devices :

1. Repeater
2. Hub
3. Bridge
4. Switch
5. NIC

* Collision domain & broadcast domain

CH 1.2 : OSI 7 LAYER

- OSI : open system interconnection

- ISO : international standard organization

OSI 7-LAYER

- Application
- Presentation
- Session

- Transport
- Network
- Data link
- Physical

OSI 7-LAYER

7-Application:- Main user interface

EX : HTTP,SMTP,SNMP,FTP,TFTP,Telnet

6-Presentation:-

- **Format of data,**
- **compression &decompression,**
- **encoding & decoding**
- **EX: ASCII code**

OSI 7-LAYER

5-Session:-

- Set logical connection between different application,
- specify communication mode(simple, half duplex, full duplex),
- authentication & authorization
- EX: SCP (session control protocol)

OSI 7-LAYER

◉4-Transport :-

- ◉ Flow control
- ❑ Buffering
- ❑ Congestion avoidance

(correction) Error recovery ◉

- ◉ Ex: TCP, UDP

OSI 7-LAYER

3-Network :-

- Routing (best path)
- IP addressing
- EX: IP, IPX

IP src	Des. IP	Data

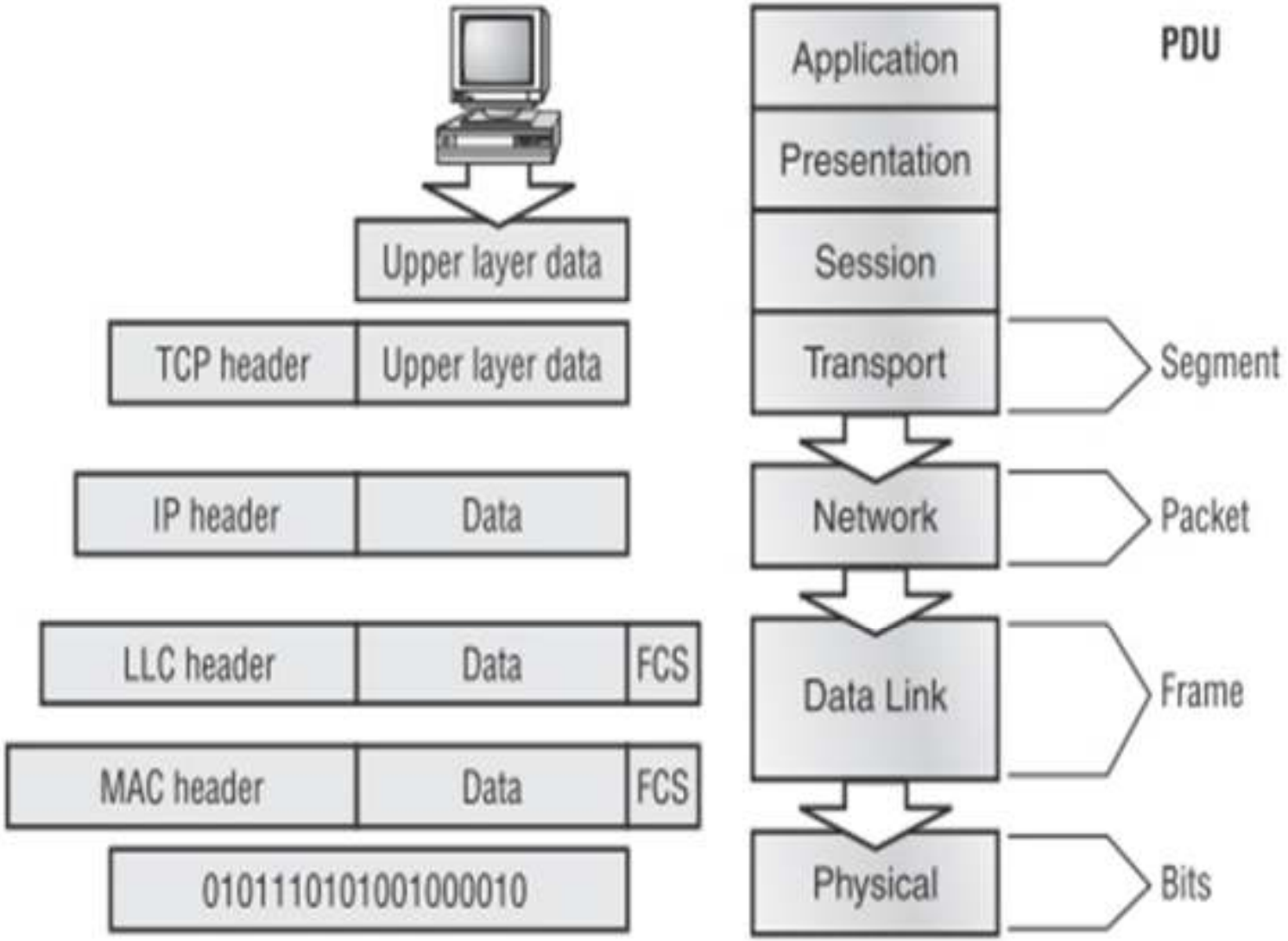
OSI 7-LAYER

2-Data link:-

- Arbitration (best time to send the data) (CSMA/CD – token)
- Error detection(Parity check – CRC cyclic redundancy check)
- Sub layer:
  - LLC(logic link control)
  - MAC (media access control)

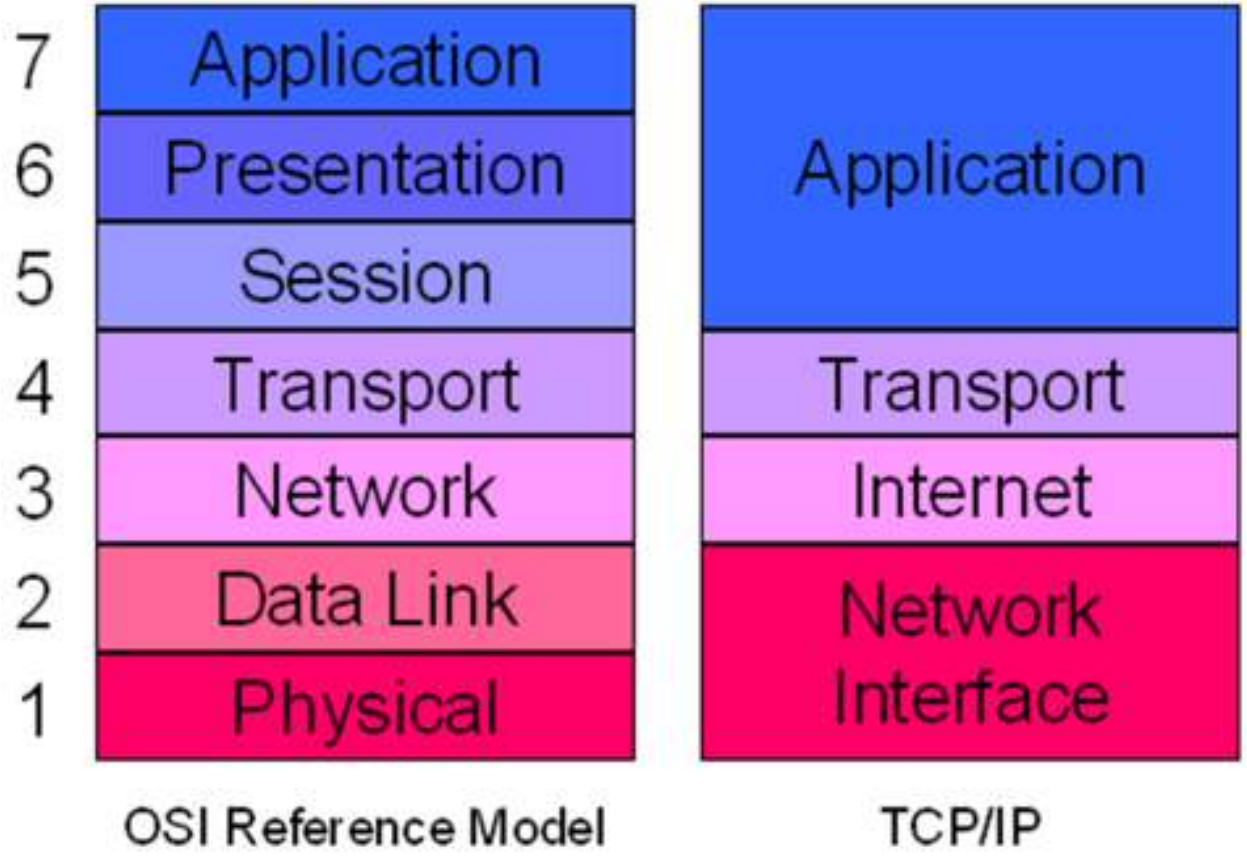
1-Physical layer

OSI 7-LAYER


Application
Presentation
Session
Transport
Network
Data Link
Physical
PDU
Segment
Packet
Frame
Bits
Upper layer data
TCP header
Upper layer data
IP header
Data
LLC header
Data
FCS
MAC header
Data
FCS
0101110101001000010

TCP/IP

- DOD:- department of defense



TCP/IP (INTERNET)

- Contain some protocols

- IP
- ICMP (internet control message protocol)ping
- ARP (address resolution protocol)
- RARP (reverse address resolution protocol)
- IGMP(internet group management protocol)

CHAPTER 1.3 : IP ADDRESSING

Numerical system :-

- Binary number :- (0,1)
- Decimal number :- (0 …… 9)
- Hexadecimal :- (0…. 9 A B C D E F)
- Octal :- (0 …. 7)

Conversion between number system :-

- From binary to decimal & the opposite

IP ADDRESSING

- IP def.

- IP classes :-
  - Class A (1 – 126)
  - Class B (128 - 191)
  - Class C (192- 223)
  - Class D (224 - 239) for multicast
  - Class E (240 – 254) for future use & research

IP ADDRESSING

- Default subnet mask
- Subnet mask with subneting

0000 0000	0
1000 0000	**128**
1100 0000	192
1110 0000	**224**
1111 0000	240
1111 1000	**248**
1111 1100	252
1111 1110	**254**
1111 1111	255

- VLSM

Chapter 2
routing

CH2: ROUTING

Router :-

layer 3 – routing table

Router internal component :-

- CPU(processor)
- Memory (describe in details)
- Interfaces :-

communication ports (connect with switch & pc.s)

EX: F0/1- Serial (S1/1)

configuration ports (to make config. On the router)

EX: console – auxiliary

CH2: ROUTING

Memory :-

- RAM :- like computer (8M, 128M , 256M)

- Flash :-

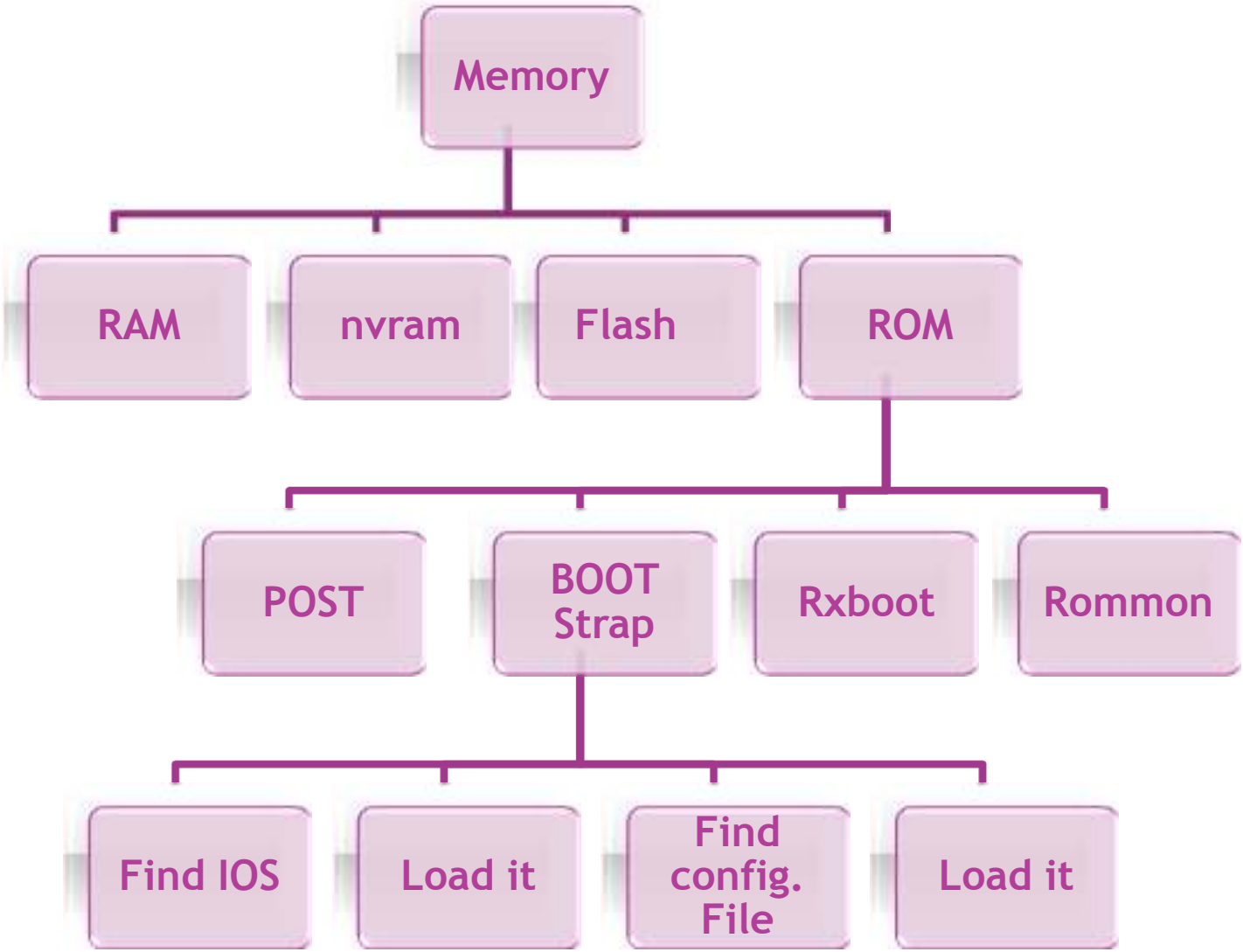
IOS(internet work operating sys.) IOS comprised

- NVRam :- (config. file)
- ROM :-read only memory

(POST – Bootstrap- Rxboot - Rommon (initial ios))

CH2: ROUTING

- Boot strap :-
  - Find ios
  - Load it in RAM
  - Find config. File
  - Load it in RAM
- How router work :-
  - ROM(POST –Boot strap - Rommon)
  - Flash(IOS image)
  - Nvram (config. file)
  - RAM(run ios & config)
  - Config. Register (0x2102 flash- 0x2142 bypass nvram)


Memory
RAM
nvram
Flash
ROM
POST
BOOT Strap
Rxboot
Rommon
Find IOS
Load it
Find config. File
Load it

CH2: ROUTING

- Basic command:-

  - Transfer from mode to other
  - Show command
  - banner message
  - Host name change
  - Passwords for router

- telnet and SSH

CH2: ROUTING

- Basic command:-

  - Password recovery (0x2142)

Rommon1>confreg 0x2142

Rommon2>reset

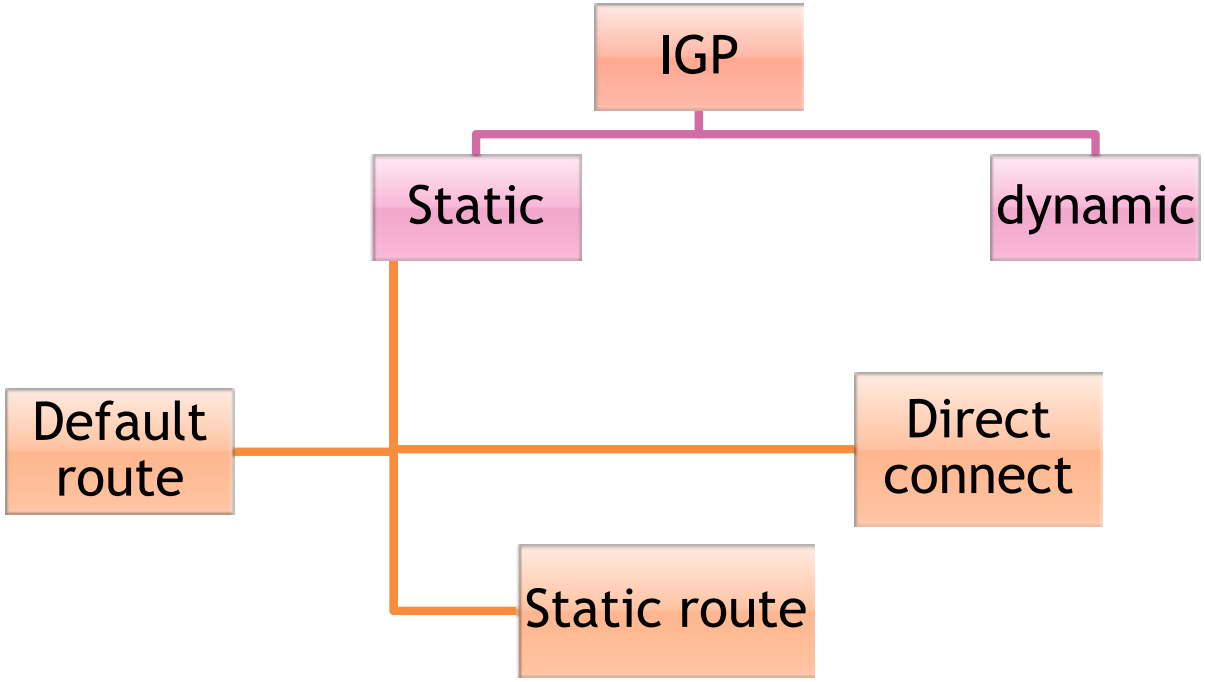
To delete the Conf R1#earse start

To keep the conf R1#copy start run

  - Install IOS to the router (tftp server)

CH2: ROUTING

- IGP(interior gateway protocol)
- EGP (Exterior G P)



CH2: ROUTING

Direct connect :-

When you write the IP on the interfaces
the router recognize it automatic
CDP : Cisco discovery protocol
show CDP neighbor details

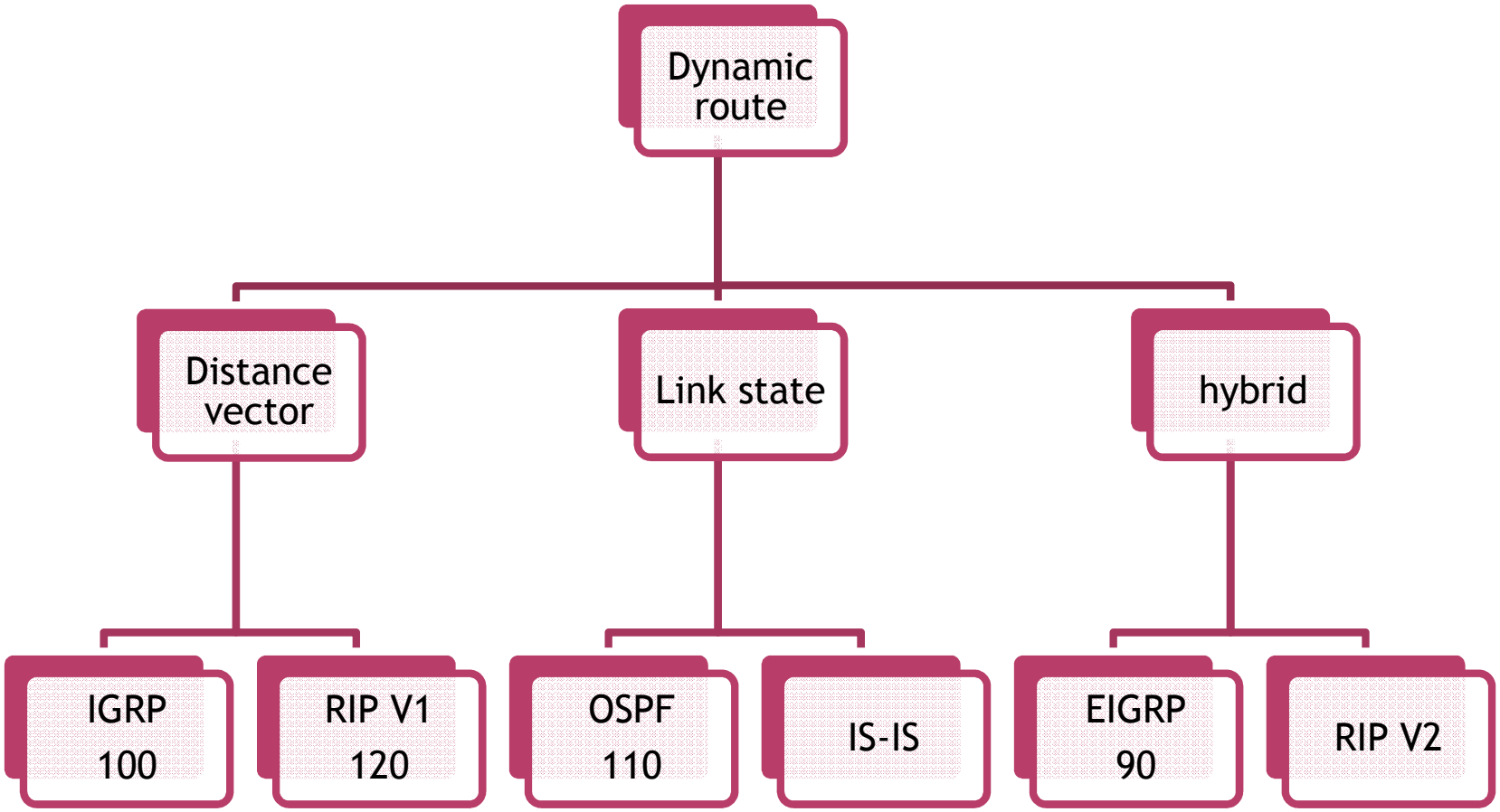
Static route :-

R1(config) # ip route ….. ……. – network you want + submask – ip that you will exit from

Default route :-

R1 (config) # ip route 0.0.0.0 0.0.0.0 - ip that you will exit from -

CH2: ROUTING


Dynamic route
Distance vector
Link state
hybrid
IGRP 100
RIP V1 120
OSPF 110
IS-IS
EIGRP 90
RIP V2

CH2: ROUTING

EIGRP :

Multi cast add = 224.0.0.9
Admin distance = 90

R1 (config)# router EIGRP ……. Ex 1

R1 (config- R1)# network …. We want share + wild mask(optional)

* Wild mask for classless

R1 # no auto-summary (عشان يبعت السابنت ماسك)

EIGRP problems :-

1. route poisoning
2. triggered update
3. Split horizon
4. Hold down timer

CH2: ROUTING

- route poisoning :- sol

R1(config) # key chain ….. (اسم حقيبة كلمات السر و التشفير)

R1 # key 1 (اول كلمة سر)

R1 # key-string …….. 123 (اي كلمة سر)

……

R1#int f0/0

R1# ip authentication mode EIGRP 1 md5

R1# ip authentication key-chain EIGRP 1 (اسم الحقيبة)

CH2: ROUTING

- OSPF : open shortest path first

- Link state protocol
- Classless
- LSA : (link state advertise) contain ip+interface
- Admin distance =110
- Metric = 10^8 / BW
- Multicast address 224.0.0.5
- Time interval = 30 min
- Area = 50 router and should begin
  area 0 (back bone area)

R1,R2 called ABR (area border routers) it linked different area

CH2: ROUTING

- OSPF config :-

R1# router OSPF …. 1 (process id)
R1# network … (network + wildcard) area … 0
R1# network 0.0.0.0 255.255.255.255 area 0
To connect all protocol

sh ip ospf inter f0/0

معلومات ال hello

CH2: ROUTING

ROUTER ID (RID) :-

هو الراوتر الذي يمتلك اعلي IP

لو مفيش loop back interface

R1(config) #interface loop back 0

ip add 1.1.1.1 255.255.255.255

no shut down

& configure ospf in this interface

& reload or # clear ip ospf process

CH2: ROUTING

- Designated Router(DR) :-

priority هو صاحب اعلي

#inter f0/0

#ip ospf priority ……..(0…255)

224.0.0.6 ip that DR cast on it failure network

224.0.0.5 ip that DR cast new ip

- Backup Designated Router(BDR) :-
- Autonyms system boundary Router(ASBR) :-

راوتر عندة معلومات عن شبكة الداخلية لراوتر تاني ويكون الفارق بين منطقتين مختلفتين

R1 (config-router)#area …….. Range …….. الشبكة البعيدة

CH2: ROUTING

- DHCP :
  - Port 67
  - For every network

R1 (config)#ip dhcp pool ……. Mesho

#network …… (N wanted + subnet mask)

For gateway

default-router …….. (gateway ip)

#DNS server …….. DNS IP

For excluded ip

#ip dhcp excluded-address (Range ip)

For showing

R1# sh ip dhcp binding

CH2: ROUTING

- ACL :-

Standard ACL	Extended ACL
• Permit or deny all traffic from a certain src • 1…….. 99 133 …….. 199 Named list **A - R1 (config) #access-list [access no. (1-99)] [deny / permit] [host + ip]**	•Permit or deny a certain type of traffic from src to des. • 100 …….. 199 2000 …….. 2699 **b- R1 (config) #access-list [Access no. (100-199)] [deny/permit] [specific protocol] [host] [wildcard] [dest.] [Wildcard]** لو شبكة حط وايلد لو هوست حط كلمة هوست

CH2: ROUTING

- Inbound & out going :

- Inbound :-

Traffic entire the interface

#IP access-group 1 in

- out going :

traffic leaving the interface

Chapter 3
SWITCHING

CH3 : SWITCHING

- Layer 2 device
- ARP (address resolution protocol): 30 sec
- Access port : connect with pc (Ethernet)
- Trunk port : connect with other SW (Giga Ethernet)
- At work : 15 sec for listening (sending BPDU)+ 15 sec learning (make MAC table) + forward
- Basic command

sh mac- address- table

speed ……. (10-100-auto) in interface

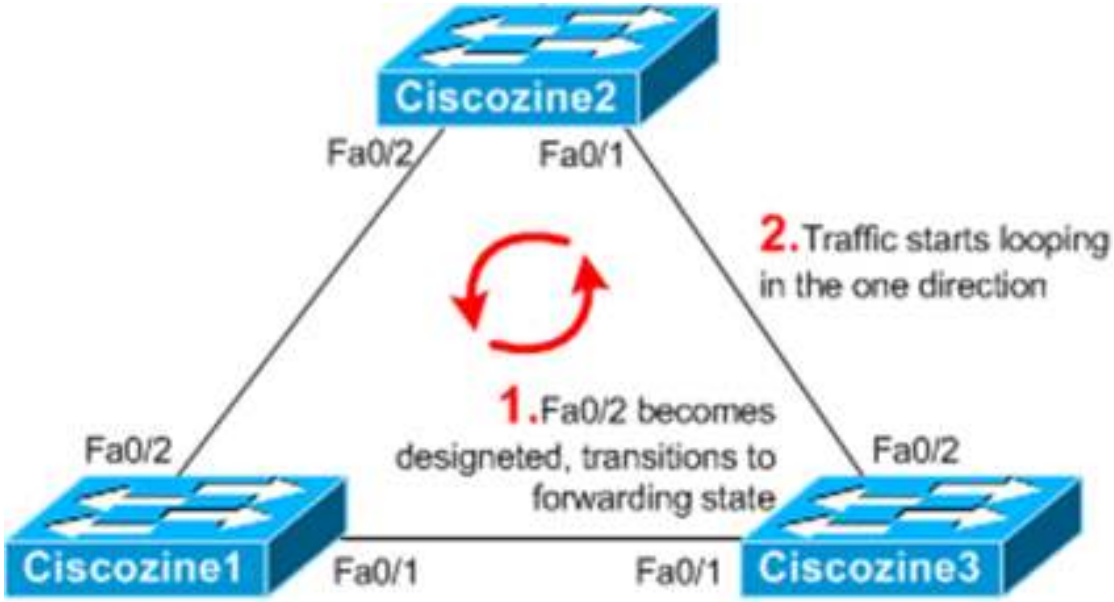
duplex ……. (full-half-auto) in interface

switch port mode ……. (access-trunk-dynamic) in interface

CH3 : SWITCHING

- Layer 2 loop :

Because of 2 paths



CH3 : SWITCHING

Spanning tree protocol :

Send bridge protocol data unit (BPDU) (priority &mac)

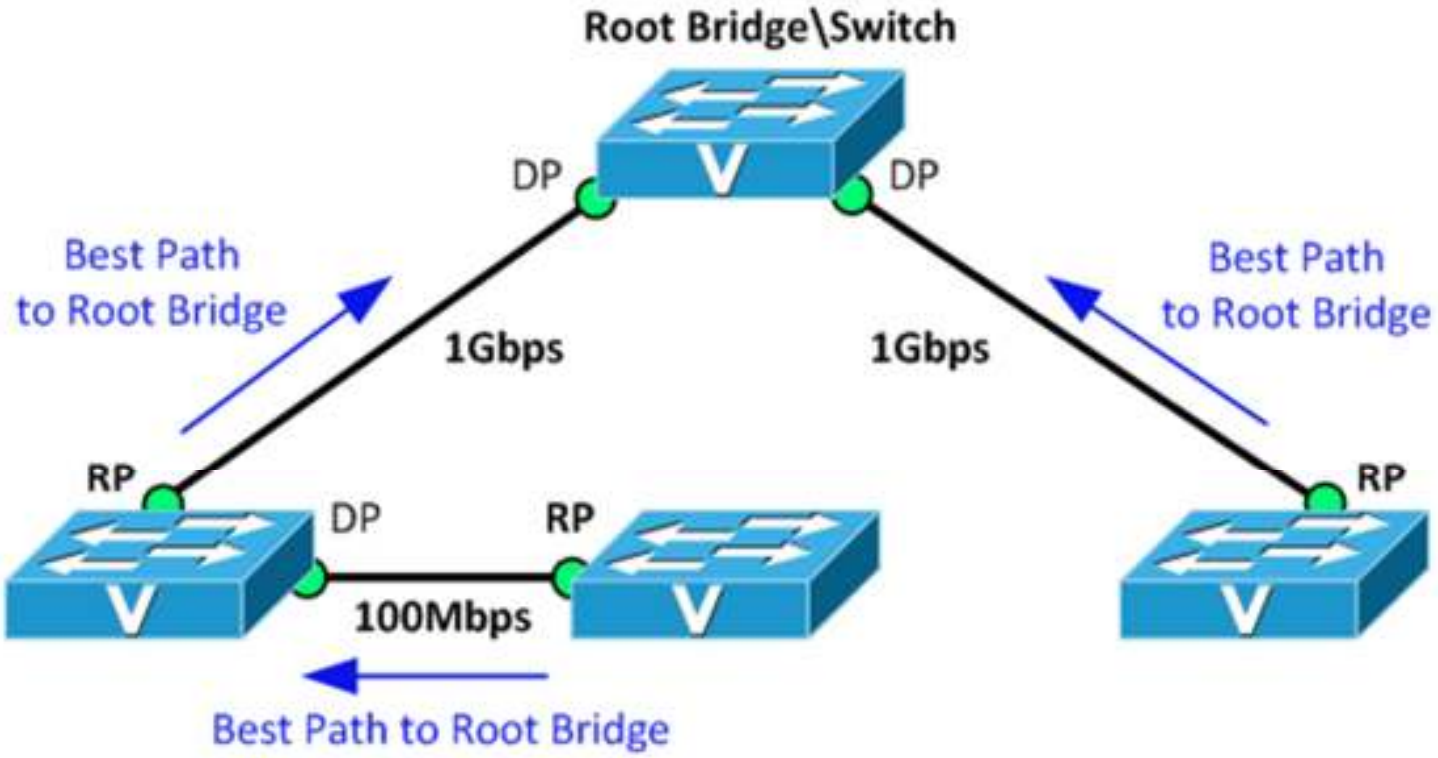
- Root switch : minimum priority & Mac
- Root Port (RP) : for non RS closest port for RS & mini cost
- Designated port (DP): for every cable closest port for RS & mini cost
- Blocked port (BP) : the final port is BP

#sh spanning tree

- Rapid VLAN 802.1w

#spanning-tree mode rapid-pvst

CH3 : SWITCHING



= Port in Forwarding State

= Port in Blocking State

RP = Root Port

DP = Designated Port

FirewallCx

CH3 : SWITCHING

- VLAN :

- VLAN 1 : default VLAN standard in every sw

- Native VLAN : can work with any frame without tag

- Tagging : VLAN ID + Data in Trunk port
  1- IEEE 802.1Q for any sw
  2- ISL (inter switch link) for Cisco only

CH3 : SWITCHING

Configration :

#sh VLAN

(config)# VLAN ……. 10 (2 ….. 1001)

inter rang …….. F0/1-9(wanted interface)

switchport mode access

#switchport access vlan ……. 10

>>

To show trunk link config status

#sh interface trunk

#sh interface switchport

CH3 : SWITCHING

Inter vlan routing :-

to connect different vlan
R1(config) # interfacef0/0
#interface f0/0.10
#encapsulation dot1Q 10
#Ip address ……. Ip address in the same subnet with vlan

Port security :-

R1(config) # interfacef0/0
switchport mode access

switchport port-security mac ….. (the mac address)
Or # switchport port-security mac-address sticky

switchport port-security violation …..(shutdown-protect-restrict)

CH3 : SWITCHING

VTP (VLAN trunking protocol) :

To make server switch
In Domain (server ‘ client ‘ transparent)
Switch # sh vtp status
In server switch
Switch (config)# VTP mode server
Switch (config)# VTP domain …….. Mans
Switch (config)# VTP password …. 123
For client
Switch (config)# VTP mode client
Switch (config)# VTP domain …. Mans
Switch (config)# VTP password ….. 123

CH3 : SWITCHING

- VTP:-

For transparent :

Switch (config)# VTP mode transparent
Switch (config)# VTP domain …. Mans
Switch (config)# VTP password ….. 123

CH3 : SWITCHING

- Switch management :-
  - To connect remotely by telnet

Switch (config)# inter vlan 10

#no shutdown

#ip address …….. 10.0.0.10 255.0.0.0

To write gateway

ip default-gateway ……..

- Ethernet channel:-

inter range f0/1-3

#channel-group 1 mode on

All ports work as one port , 2-8 ports

CH3 : SWITCHING

- Port fast :-

When the DHCP active in network it occurs a low speed obtaining Ip

inter range f0/4-24

#spanning-tree port fast …….. (disable – trunk)

Ch4 : different subject

Ch4 : different subject

IP V6 :

- It consist of 8 colon (:) every colon have 4 character in hexadecimal every char consist of 4 bits

8 * 4 * 4 = 128 number of bits

- Ex :- 2001 : 0000 : abcd : 1111 : 0000 : 0000 : 2222 : 1111

Ch4 : different subject

- How to write IP V6 :-

Ex:- 1fe2 :0000 : 0000 : ABCD : 0000 : 0000 :
0000 : 0058

1- Any zeros convert to one zero

1fe2 :0:0:ABCD:0:0:0:58

2- Any group of zeros 2 or 3 convert to (::) but not more one

1fe2 :: ABCD :0:0:0:58 or

1fe2:0:0:ABCD::58

Ch4 : different subject

- Loop back test in IP V6 (::1)

- Prefix determine the host and network part

1fe0 ::ABCD:1111:58 \ 64

64/4 = 16 …. 16/4= 4 ….. 4 colon for network

|| 1fe0 : 0 : 0 : 0 || 0 :ABCD:1111:58 || \64

N.W Part for LAN host Part

Ch4 : different subject

- Types of communication in IP V 6 :

- Unicast
- Multi cast:

Periodic update for EIGRP ff02::A

For OSPF ff02::5

- Any cast : for the closest server and next , in IP V6 only

Ch4 : different subject

- Types of IP V6 :-

1- Link local :

In IP v4

if no IP it use APIPA (automatic private IP addressing) it class B 169.254. any . Any

In IP v 6

If no IP it put Ip start with fe80

ex: in router

#inter f0/0

#no shutdown

IP V6 enable

Ch4 : different subject

#sh ipv6 interface brief

How it consist :

1 – at first fe80

2- divide the mac add 6-6 and in center FFFE and start from right

3- put zeros to the rest

Ch4 : different subject

2- site local :

It mean I write it ‘‘fEC0

3- global :

Like public Ip , I buy it and start with 2000,2001

4- multicast :

Start with ff

Ff02::1 for all notes

FF02::2 for all routers

Ch4 : different subject

- IP v6 configration :

- Put in interface

inter f0/0

#ip v6 add 1feo:1111::1\32

- Ip route

#sh ipv6 route

Ch4 : different subject

- Static route :-

#ip V6 unicast-routing
#ipv6 route …….. The far network

- Default route :-

#ipv6 route ::\0 ….. ip port will exit

Ch4 : different subject

- EIGRP

#ip V6 unicast-routing

#ip V6 router EIGRP 1

#no shutdown

#router id 1.1.1.1

Put in all interfaces

#inter f0/0

#ipv6 eigrp 1

Ch4 : different subject

- OSPF

#ip V6 unicast-routing

#ip V6 router OSPF 1

#no shutdown

#router id 1.1.1.1

Put in all interfaces

#inter f0/0

#ipv6 OSPF 1

Ch4 : different subject

- NAT (Network Address translation):
- Inside local ip ex: 192.168.1.10
- Inside global ip ex : 65.41.25.52
- Outside global ip ex : 88.63.52.100
- Outside local ip ex: 10.0.0.3

- Private ip recommended :
- 192.168.1.0
- 172.16.0.0
- 10.0.0.0

Ch4 : different subject

- Types of NAT :-

1- static NAT

It one ip public and work with it in internet

(one to one translation)

2- Dynamic NAT

It take a pool of ip and work with it in the internet (one to one translation)

3- PAT (port address translation)

It depend on port number & it called overload

Ch4 : different subject

- Configration :-
  - Static :

ip NAT inside source static …. Private ip (10.0.0.2) public ip (65.1.1.1)

#inter f0/0

#ip nat inside

#inter s0/0

#lp nat outside

Ch4 : different subject

- Dynamic :-

#access-list 1 permit ….network (10.0.0.0 0.255.255.255)

#ip nat pool (name) … first ip .. End ip …. net mask (255.0.0.0)

#ip nat inside source list 1 pool (name)

#inter f0/0

#ip nat inside

#inter s0/0

#lp nat outside

Ch4 : different subject

- PAT :-

#access-list 1 permit ….network (10.0.0.0 0.255.255.255)

#ip nat pool (name) … first ip .. same ip …. net mask (255.0.0.0)

#ip nat inside source list 1 pool (name) overload

#inter f0/0

#ip nat inside

#inter s0/0

#Ip nat outside

Ch4 : different subject

Serial ports :-

- Two types

Wic called T1 its speed 1.5 M

Wic called T3 its speed 45 M

Config :-

#Show controllers

To show if the serial DCE or DTE to put the clock rate

#clock rate 4 000 000

Ch4 : different subject

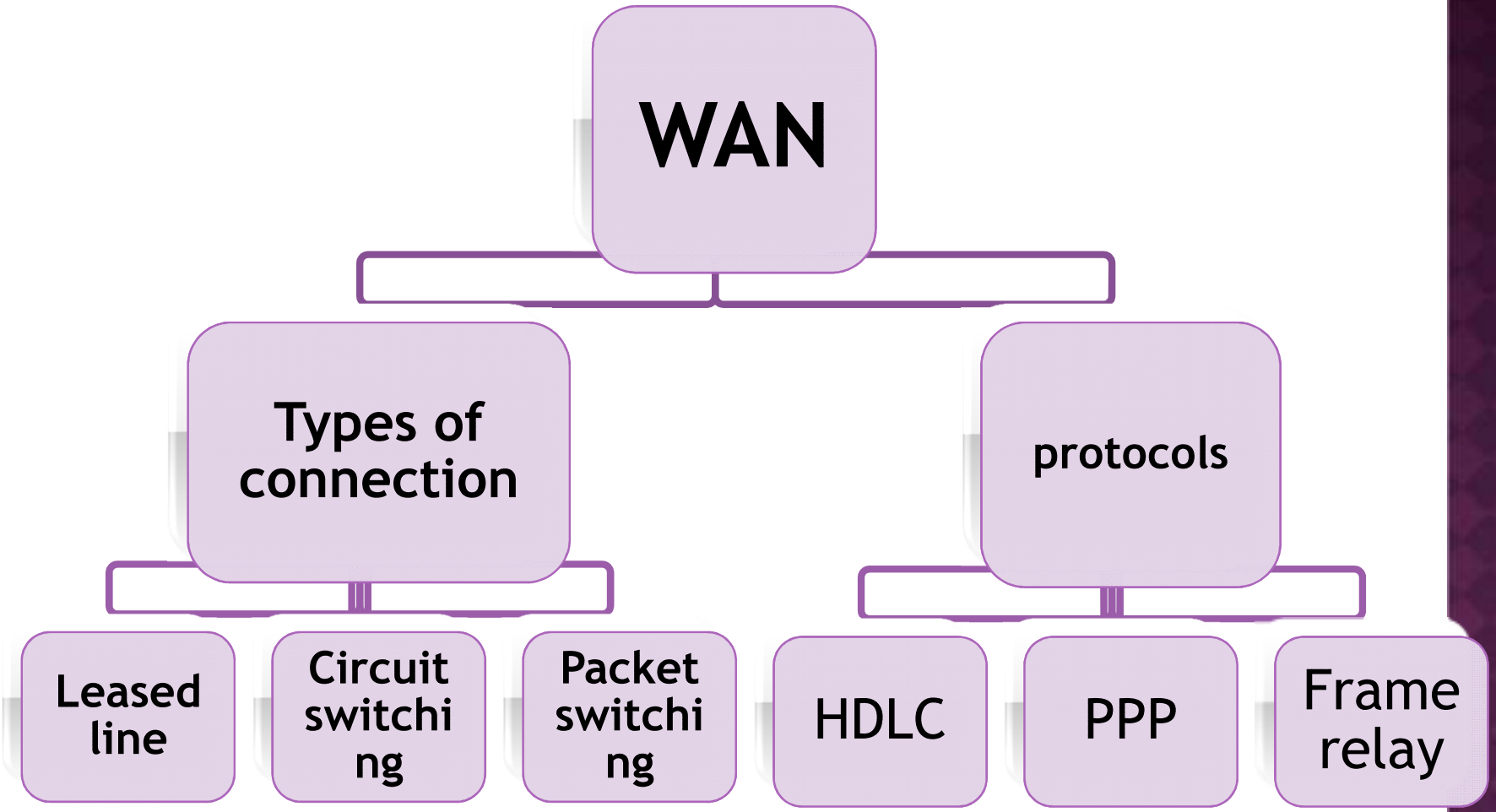
- WAN Technology :-

Notice :-

- Wan protocols work on serial ports only

- Wan protocols called Bandwidth protocol

Ch4 : different subject



Ch4 : different subject

1- leased line :- (dedicated)

- It's (1:1) speed (DW L , up L)

- CSU-DSU (channel service unit – digital service unit) converter

Convert from serial port to leased line & opp.

- must be (Public ip & same WAN protocol)

Ch4 : different subject

2-circuit switching :-

It’s dial up connection

Advantage :-

Cheapest than leased line

It’s config is easy

Disadvantage :-

Very slow speed

Ch4 : different subject

3- Packet switching :-

Mix between leased line & circuit switching

It share leased line at DSLAM (digital subscriber line access multiplexer) it convert from Ethernet to tel.

Ch4 : different subject

- ADSL (asymmetric digital subscriber line)

The speed not constant

- SDSL (symmetric digital subscriber line)

1:1 1:4 1:8

- VHDSL,GHDSL:

It make a test before use on the line

It must work on VHDSL , GHDSL router

Ch4 : different subject

- WAN protocols :-

In Ethernet the data transfer from R1 to R2 by src mac & des mac but in serial cables it use (L2 address) make from wan protocols encapsulation

Ch4 : different subject

- HDLC(high level data link control):-

Cisco – HDLC for Cisco only

IOS – HDLC for any router

- PPP (point –to – point protocol) :
- Sub layers (LCP (link control protocol) L2 – NCP (network control) L3)

#sh interface s0/0

To convert encapsulation

#inter s0/0

#encapsulation ppp

Ch4 : different subject

PPP has two kind (PAP (PPP authentication protocol) no encrypt

- Chap (change authentication protocol) encrypt)

#username ….. - (Tanta) Router name- password ……. 123

#inter s0/0

#encapsulation PPP

#PPP authentication ….. CHAP

To see the negotiation process

#debug PPP negotiation

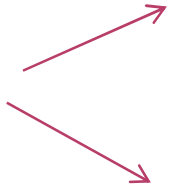
To stop

#un debug all

Ch4 : different subject

- Frame Relay :- to apply F R

A- Encapsulation : frame relay



CISCO

IETF (internet engineering task force)

B- LMI (local management interface) : type

Cisco – ANSI – Q933a

C- DLCI (data link connection identifier) :

ISP convert it's router to FR switch with no ip

Ch4 : different subject

- PVC (permanent virtual circuit) : it's routers for ISP

- It has start no. & end no. From ISP company
- The main router can't take the same DLCI
- The serial port can take many deferent DLCI
- DLCI can fixed from start to end PVC

Ch4 : different subject

⊙Design F R :-

1- mesh design :

All routers connect together , but it high cost

2- partial mesh :

some routers connect together

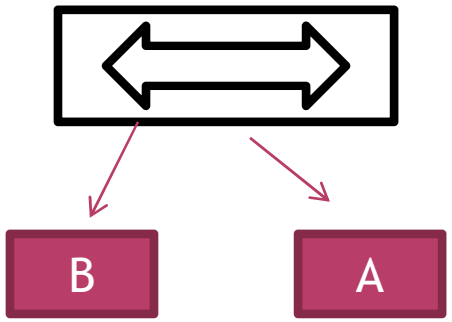
3- Hub & spoke :

The low cost

like hub & spokes

But it slow & if the heart

Down the network down



Ch4 : different subject

- Hubs & spokes types:

1 –point to multi point :

Because of split horizon the branch routers can't deal with themselves

But by FR map can solve the problem

2- point to point :

to make sub interfaces with two IP s

Ch4 : different subject

- F R configration :-

Point to multi

For every router

inter s0/0

encapsulation frame-relay IETF

frame-relay LMI-type ANSI

To make the branches routers ping together

#Frame-relay map ip …… (wanted ip to ping)
……. 100 (DLCI for it's router)

Ch4 : different subject

- F R configration :-

sh frame-relay PVC
#sh frame-relay map
To make frame relay switching in ISP
#conf t
#frame-relay switching
#Inter s0/0
#encapsulation frame-relay
#frame-relay route .. 100 .. inter s0/1 ..100
#frame-relay-inter-type DCE

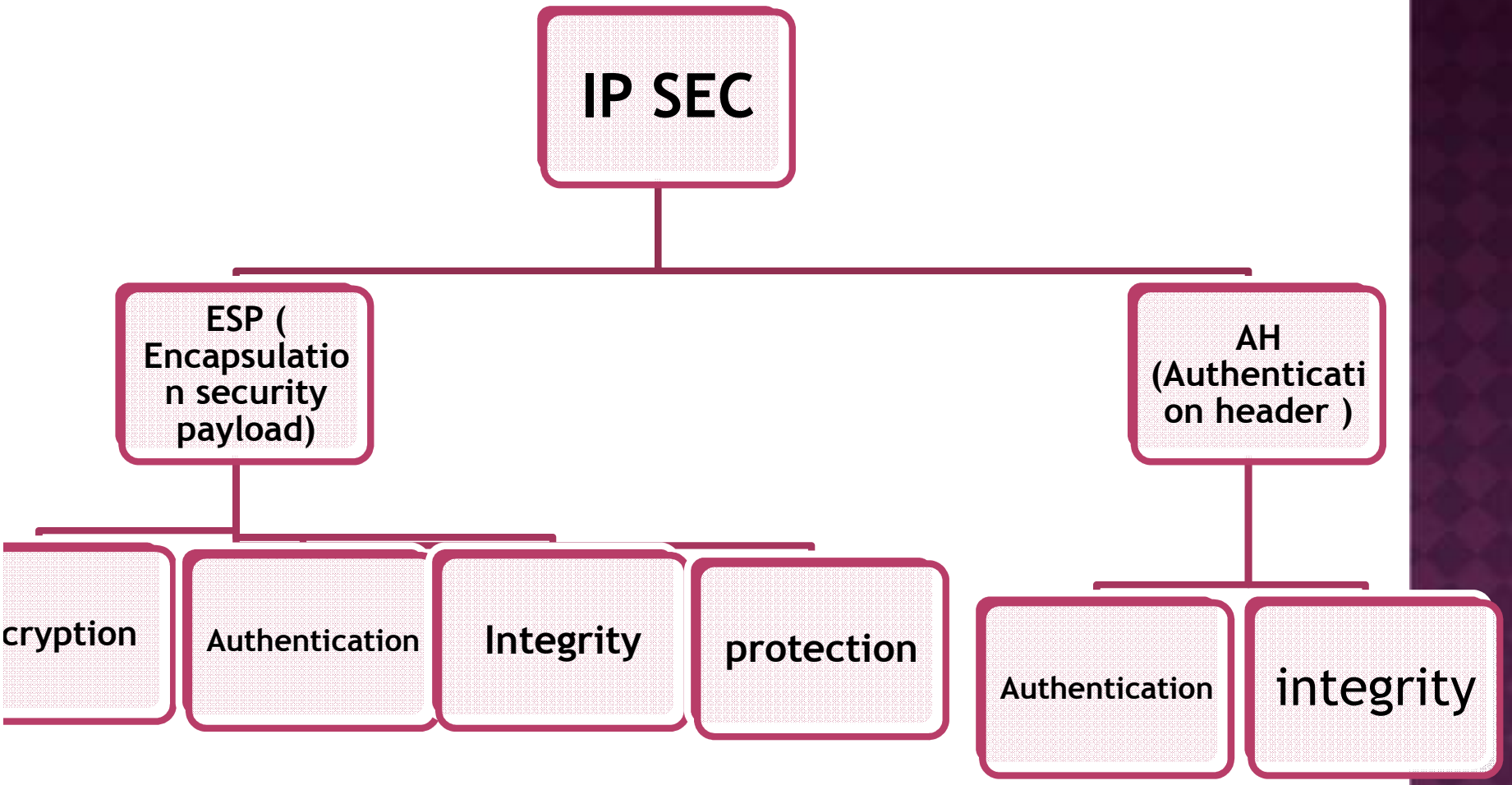
Ch4 : different subject

- VPN (virtual private network) :

To make control in R remotely

VPN security : (depend on IP sec)

Ch4 : different subject



Ch4 : different subject

- Authentication : to enter the system should be user name & pass
- integrity : it make hashing to the data (one way equation)
- Confidentiality : it make encryption to the data
- Anti replay : it close the session when it find a strange segment

Ch4 : different subject

- Redundancy protocol backup gateway :

To make deferent gateways in one network with virtual IP & MAC

By 3 protocols :

1- HSRP (hot standby router protocol)

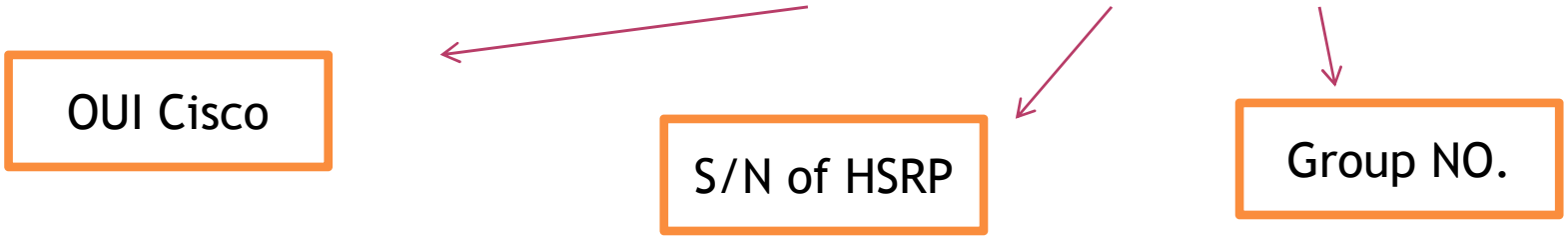
2- VRRP (virtual router redundancy protocol)

3-GLBP (Gateway load balance protocol)

Ch4 : different subject

1- HSRP (hot standby router protocol)

- It make R1 active and R2 standby
- Work on routers & switches
- Can use multi routers standby
- Cisco property
- Hello time = 3 sec HOLD time = 10 sec
- Has Virtual mac private 0000.0c 07.AC 05



Ch4 : different subject

2- VRRP (virtual router redundancy protocol)

- IEEE property Multi vendor
- It make R1 master and R2 backup
- Has Virtual mac private 0000.5e 00.01 XX
- Hello time = 1 sec hold = 3 sec

3- GLBP (Gateway load balance protocol)

- Cisco property
- Two R work together as active with load balance
- Has Virtual mac private 0007.b4 XX.XXXX
- 1024 AVF (active virtual forwarders) max R
- 4 AVG (active virtual gateways) max gateways

Ch4 : different subject

- Config HSRP :-

For R1 active

#inter f0/0

#standby …. 5(Group no.) ip …. 10.0.0.1 (V IP)

#sh standby

To make priority

#standby .. 5 priority 150

#standby …. 5 preempt

R2

standby …. 5 preempt

Deferent between config standby to VRRP,GLBP

Ch4 : different subject

- SYS LOG :-
  - To save logging in the router (internal buffer or logging buffer) but the space is very low so we make SYS LOG server
  - APP kiwi SYSLOG
  - To make user & pass

#enable password 123

#username ..... (any) privilege secret ….. (any)

#line VTY 0 4

#login local

To enable SYS log server

#logging …….. (server IP)

#logging trap (0 : 7) 7 debug

Ch4 : different subject

- Logging trap :-

0 emergencies
1 Alerts
2 Critical
3 Errors
4 Warning
5 Notifications
6 informational
7 Debugging

Ch4 : different subject

- SNMP :

To show the router details

SNMP component :-

1- SNMP manager :

the server has APP free MRTG or money PRTG

2- SNMP Agent :

The client router or switch

3- MIB (management information base)

The information sent

Ch4 : different subject

- SNMP message :

1-get :-

Take the data from R1

2- set :-

Give message or order to R1

3-trap:-

If something happened , do something

Ch4 : different subject

- SNMP types :-

1- V1 : can transfer to speed 100 Mbps
2- V2 : can transfer to speed 10 Gbps
Make a clear pass
3- V3 : more security hashing & encryption

#SNMP-server community …… (any pass) ?

Get	R O	read only
Get+ set	RW	read write

Work on port 161

Ch4 : different subject

- NET flow :

Analyze network traffic by

IP – used protocol – ports

- Types :

Flow cashing (on R)

Flow collector (on PC)

Data analyzer (on PC)

Ch4 : different subject

- Net flow config :

#ip flow-export destination …….. (IP) ……. 2000 (port No.)

#ip flow-export V ….9(version no.)

#inter s0/0

#ip flow ….(egress/ingress)

Ch4 : different subject

- NTP (network time protocol) :

To set the routers clock

#show clock

#clock set manually

#NTP server …… (sever ip)

تمت بحمد الله

With my best wishes
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