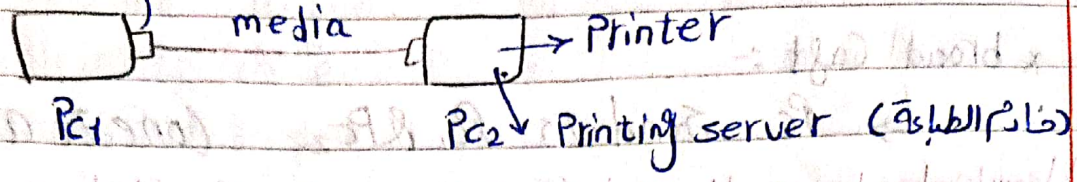
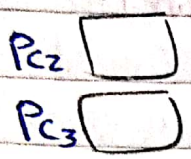
Lec (1)

(Network Interface Card)

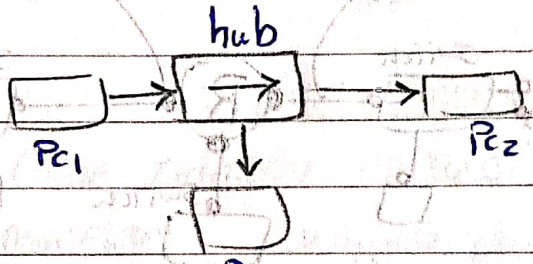
(NIC) كارت الشبكة





* server : جهاز يؤدي وظيفة

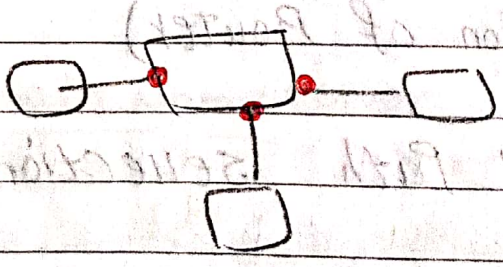
⇒ hub



(one to all)

* disadvantage
  - out put the message from all ports.
  - 1 collesion domain

⇒ switch



(one to one)

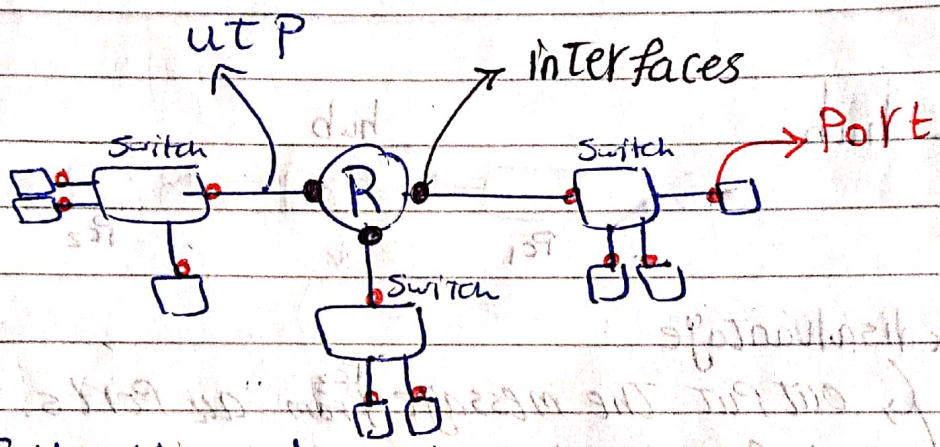
* disadvantage
  - in this ex 3 collesion domain
  - one to one

* unicast :- جهاز بيكلم جهاز
↳ Pc send to another Pc (one to one)

* broad Cast :-
↳ Pc send to Pc_1 & Pc_2 (one to all)
(storm) ولو العدد زاد يحصل حاجه اسمها (مناسب لعدد اجهزة معينة قليلة)

* Multi Cast :-
↳ one to certain group.

(ex)



- 11 Collestion domain
- 3 broad Cast domain
(interface of R makedrol broad Cast)

(function of Router)

1- Path selection

2- Filtring → Denail of Server

3- Break The broad Cast domain.

* (OSI model) → open system interface.

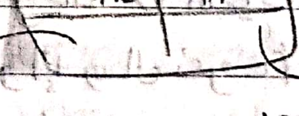
1- Physical layer
2- datalink layer
3- Network layer
4- transport layer
5- session layer
6- Presentetion layer.
7- Application layer. ⟿ (goal from server) ↓ network

* Protocol :-
→ اتفاق بين طرفين على تنفيذ مهمة معينة في وقت محدد

[7] Application layer.

بروتوكولات تحميل الملفات {
→ ftp (file transfer protocol)
(Acknowledge) ← بعد ما يبعتلي بيديني رسالة بيقولي وصل ولا لا *
→ tftp (trevial file transfer protocol)
(unAcknowledge) ← بعد ما يبعتلي مش بيقول حاجة *

بروتوكولات تصفح {
→ http :- Hypertext transfer Protocol.
→ https :- Hyper text transfer Protocol secured.

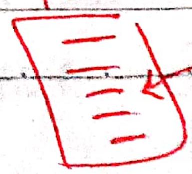
→ DNS :- Domain Name server.
version 4 — 32 bit ⟷ | 192 | 168 | 11 |
(DNS) جوه كل جهاز →  → عنوان الجهاز

uniform secure locator.
* بيدور في IP على عنوان الجهاز لو ملقهوش
بيروح لل DNS عنده ويروح يحطه في IP

→ DHCP :- Domain host Configretion Protocol.

* عملية تخصيص لل IP (dynamic)

IP → static 192 108 110
IP → dynamic

Pool

← IP's

[6] Presentetion layer.

[1] Coding - decoding

ASCII = 8 bit مبقتش ناطقة

unicode = 32 bit

[2] Compression - de Compression

RAR, ZIP

[3] encryption - decryption

---

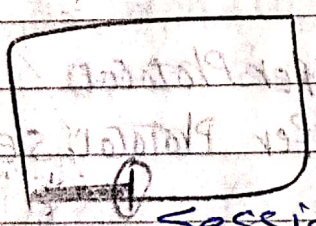
[5] session layer.

[1] half duplex

x ⟷ x

[2] Full duplex

Transmeter ▢ ⟷ ▢ reseiver



session (بيكمل)

* يتم الإحتفاظ بآخر عينة من البيانات تم ارسالها من هنا حدث عطل اثناء الاستقبال والإرسال نعرف آخر ما تم ارساله وعند زوال العطل نبدأ منه حيث انتهينا.

Lec (2)

[7] Application layer
[6] Presentetion layer
[5] Session layer
[4] Transport layer (segment)
[3] Network layer
[2] Datalink layer
[1] Physical layer sending ↓

↑ reciving

④ مسؤل عن (Port) وترتيب (Segment)
لـ بيستخدم
End-To-End-Collection.

[7] Stream ——|——|——|——→
[6] AuI, mP4
[5] half duplex
[4] end-to-end Collection

* layer 4 encapsolation

data ←——→ segment

Pay load

④ →

Port number
- hTTP → 80
- hTTPS → 443
- fTP → 21

blowsing	hTTP → 80 hTTPS → 443
mail	
download	fTP TFTP

④ transport layer :-

→ the actual end-to-end transfer of the data across the network

layer 4 protocol

Transmition Control Plotocol → TCP → (Connection oriented) → need Ack

user Data gram protocol → UDP → (Connection less) → not Ack

بيحتاج سرعة ومش محتاج سرعة

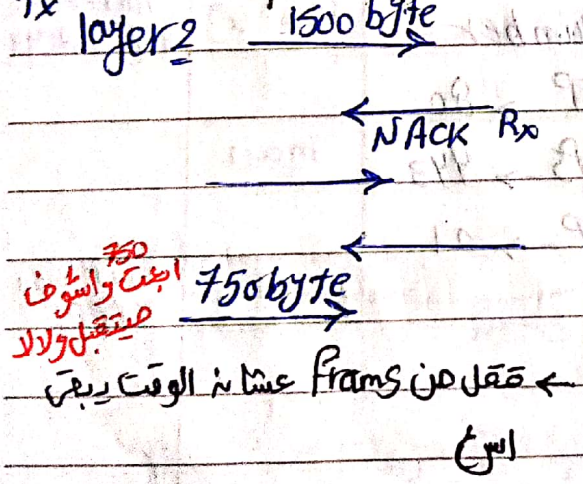
tcp	udp
ftp	tftp
pop	DHCP
http	
https	
Telnet	

ال IP بالي جاهز بيعطيه على طول

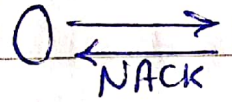
* the function of transport layer
  1. Provides areliable Data delivery
  2. Provides Flow Control
  3. Provides error recovery

layer 4 (segment)
3 (Packet)
2 (frames)

⇒ Flow Control:-
(التحكم في التدفق)

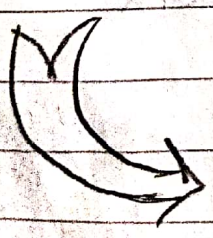


⇒ error recovery



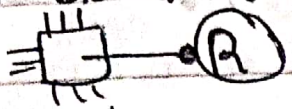
- في الشبكات لو حدث رسالة غلط بدل ما ابعت الرسالة تاني هيدعش بصلحها لوحدها مفيش (auto correct)

ARQ → Automatic Repeat request.



hub	→ layer1
Switch	→ layer2 (lan)
Router	→ layer3

* LAN
→ local Area Network
↳ 1 broadcast domain

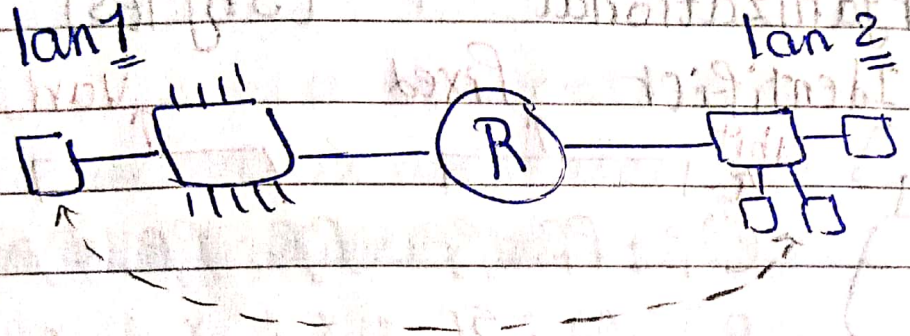


→ IPaddress حسب تعريف

* WAN
→ wide Area Network

---

layer 3 → IP address.
layer 2 → mac address.

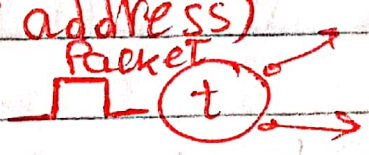


كرت الشبكة الوالدة * mac address

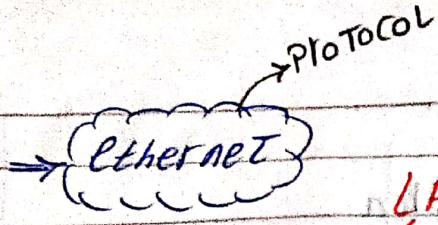
* جهاز من lan بيخاطب جهاز في lan تاني.

---

* Function-
① logical addressing (IP address)
② Path determination
③ Forwarding



* Data link layer
مسؤولة عن تنظيم قواعد الإتصالات بين الأجهزة



LAN Wan

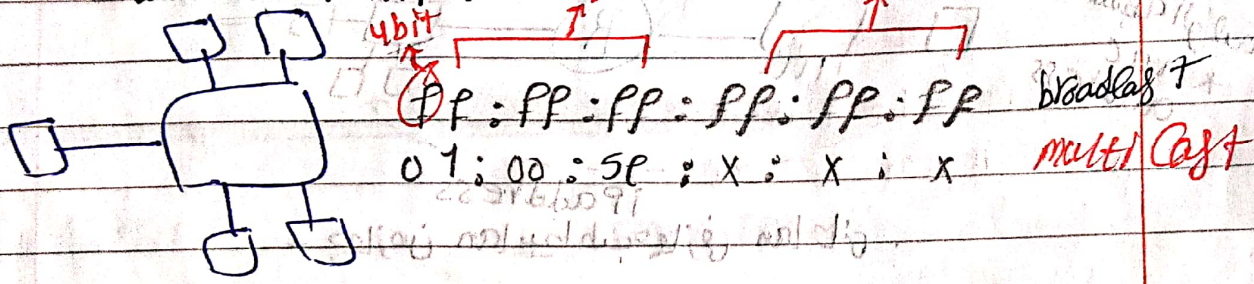
Ethernet Tecnology وال بتستخدم انهارة

(AN) بتشتغل layer1 , layer2

layer 2 → macaddress (48 bit, 6 bytes, hexa)

OUI	manufactring assignment

↳ organizational unique Identifier (3bytes)



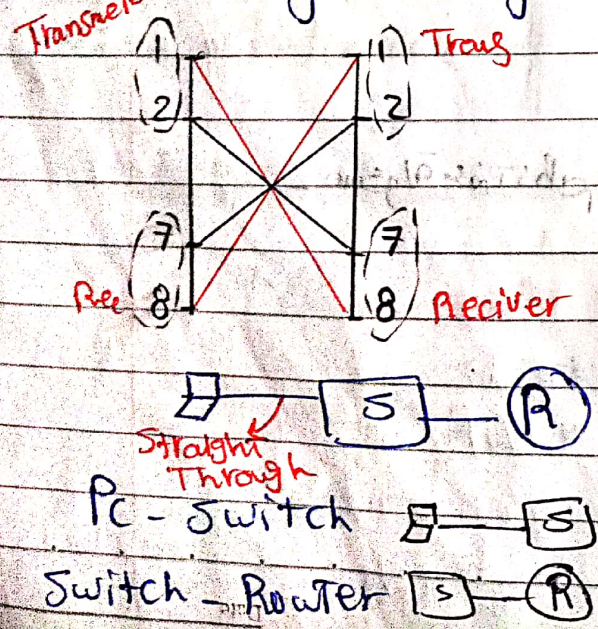
Utp → Unshielded Twisted Pair

Rj45 → Registed Jack

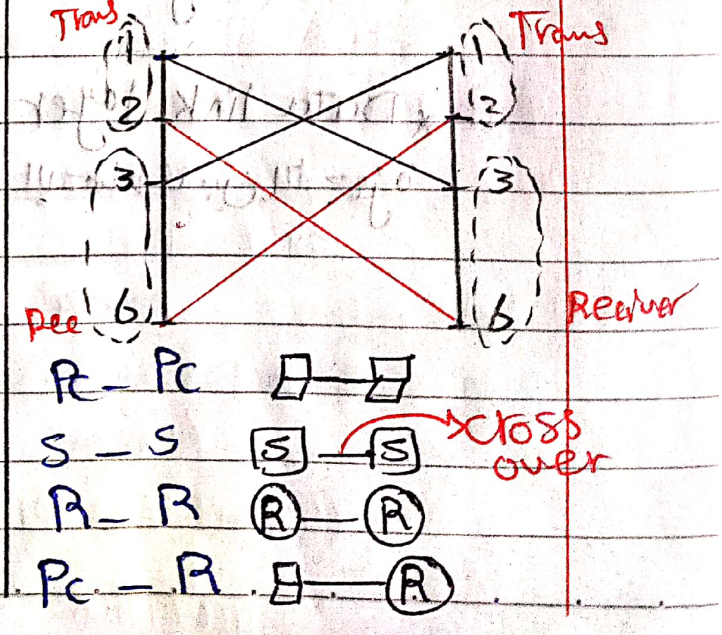
---

* انواع الكيبلات.

straight through



cross over

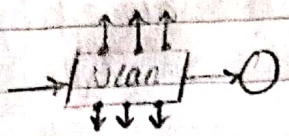


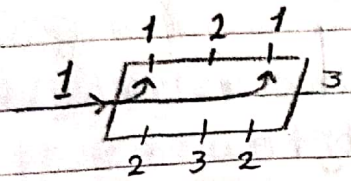
Lec "3"

→ VLAN (virtual LAN)

* LAN — R
Based Cast domain.

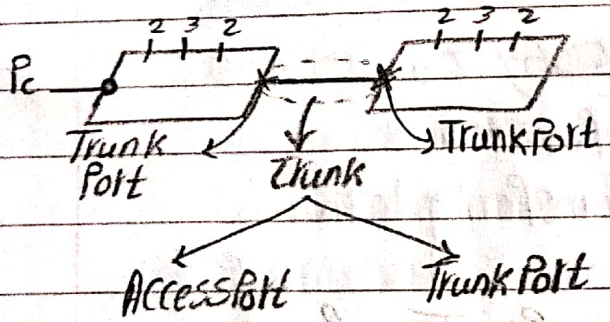
* LAN → VLAN1, VLAN2





→ The virtual LANS is asegmentations for Lan Devices into individual smaller LAN.

② trunking



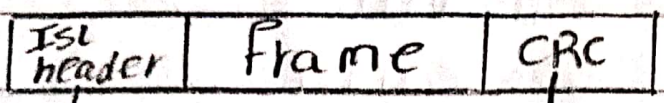
Trunk :- between Two switches
Access :- " switch and Pc (No Trunking)

* The Trunk line asingle Physical Connection between Two switches to Transport (VLAN Information) between This Two switches.

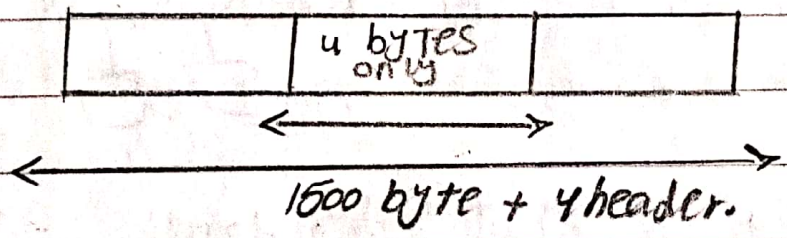
Trunking Protocols

1. ISL Protocol (Inter switch Link) → cisco only
2. IEEE 802.1Q Protocol

* ISL isn't a standard Protocol it's owned by Cisco only
* ISL makes an incabsulation



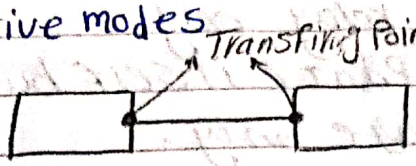
* → CRC → Check Redundency Control
  To Check The Fram.
* IEEE 802.1Q is standard Protocol



Fram 46 byte ~ 1536 by to
- 46 byte → for acknowledge or control of data
- 1536 → for Transfering data

* encapsolation :- adding header for the frame.

→ Administrative modes

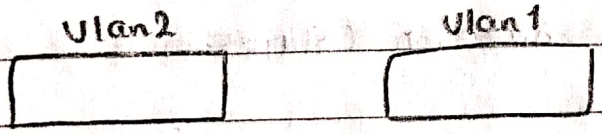


Administrative mode

① desirable → sends messages
② Auto → listening for messages (waiting)
③ off → neither sends nor listening
↳ Access Port

* If both switches are Auto Then There will not be negotiation

* If we have 4 Vlans then we have 4 broadCast

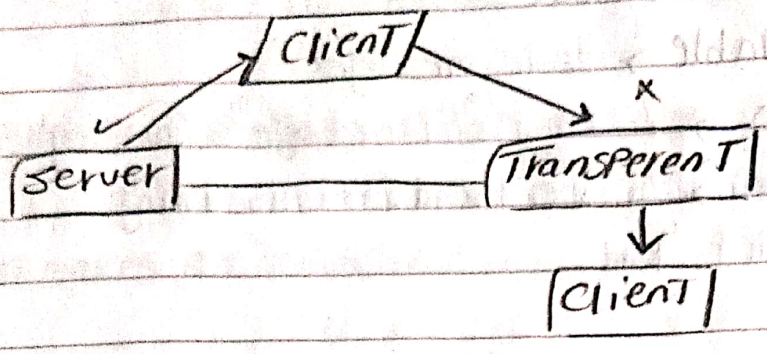


update
create
delete
modify
↳ vtP (virtual Trunking Protocol) → owned by cisco.

* NtP enables Cisco switches to exchange vlan Configuration information.

* ① server mode create, defeat, modify and update
② client mode update relay

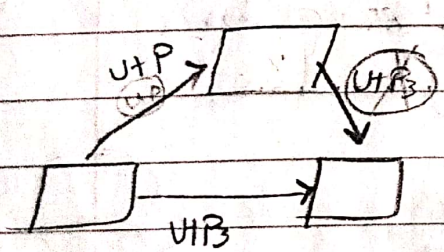
③ Transparent mode relay only
↳ doesn't update itself but sending
the message only



Notes

لابد أن تتبع جميع الـ VTP switches لنفس الـ domain

Configuration Number



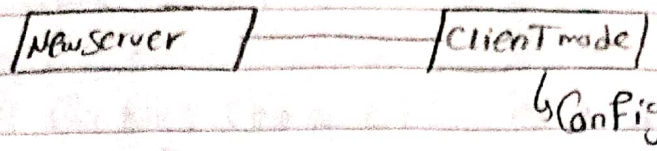
→ Deletes the repeated messages
لو اتكررت (reject يعملها) ←

Notes

Zero = ConfigurationNumber عند إضافة server لابد يكون

* Transparent mode Config No = Zero

* at different domain Configuration Number = Zero.



→ Config Num :- The last sent Number.

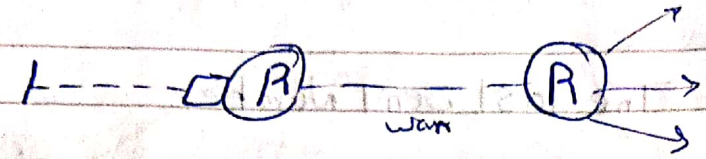
* To add a server we add a transparent with Config Number so Then we Transform it (Change it) To a New Server and it will Take a Config No = 71

* or we Can add a different domain with Client No! = Zero The we Change it To a New Server

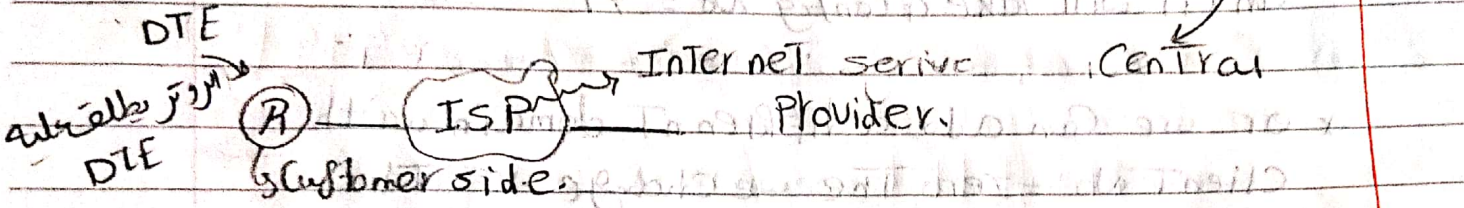
Transparent	different domain

#Lec 4

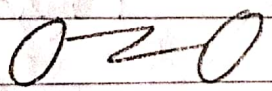
LAN



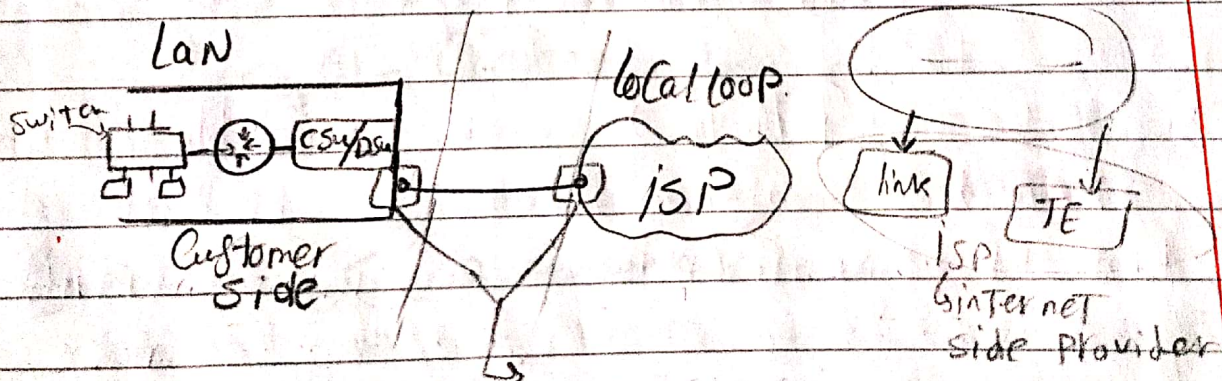
* DTE : (Data Terminal equipment) (typically Customer side)



* DCE : Data Communication equipment
→ Provides clocking signal used To Synchonalize data Transmation between Transmiter and recievер.



frame/sec (لازم يكونوا عارفين التوقيت)



* Demarcation Point.

Demarcation Point

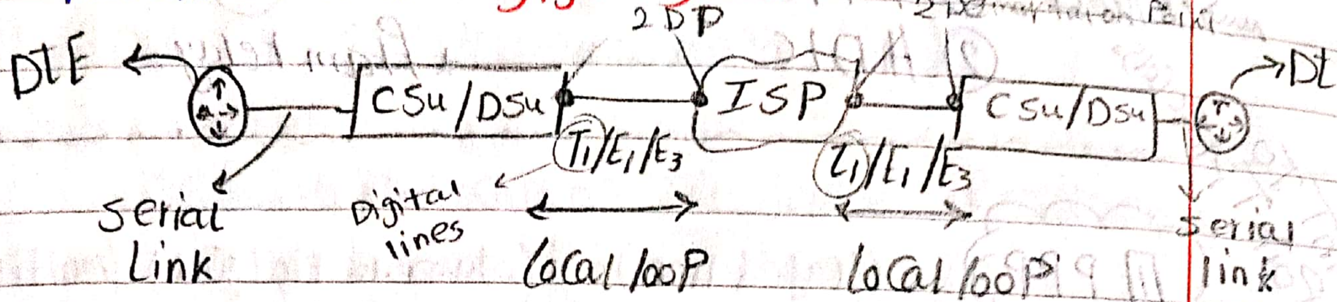
* النقطة يلي بينتهي عندها ISP وبيبدأ عندها Customer side

* The Physical Point where The Public network end and The Private network of The Customer begin.

* local loop :-
↳ a Cable Connects The Customer side To The nearest ISP.

WAN

1- leased line الخطوط المؤجرة

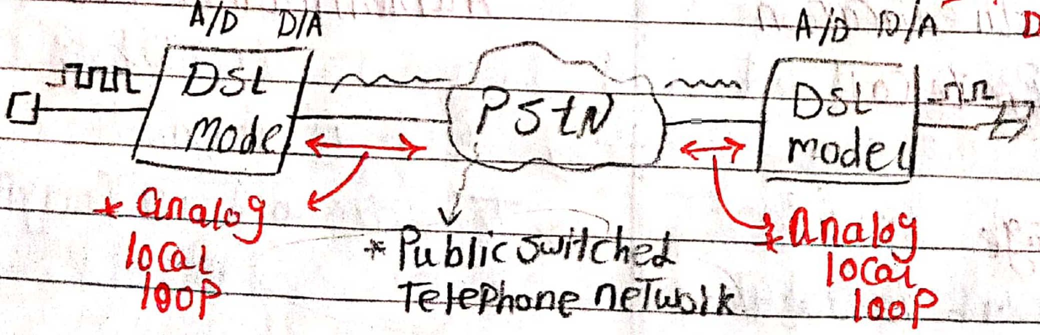


CSu/DSu
↳ channel unit service - Data unit service
used To synchronaliz (يستخدم لأعمال التزامن)
(Digital lines)

* ال Router بالي فالبيت بيحول digital ← analog والعكس ⟸ Note

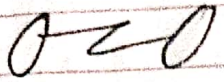
2- DSL
↳ Digital subscriber line

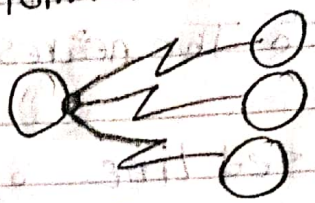
Analog - Digital.
Digital - Analog.



LAN → Ethernet

WAN → Point To Point / Point To multi Point





Protocols
① PPP
② HDLC

* Fram relay *

Point To Point Protocols.

II PPP (leased line) (Standard Protocol) (multiVendor)

→ PPP have a Two Sub Protocols

a) LCP (Link Control Protocol)
* مسؤول عن Auth ومسؤول عن عملية Link setup.

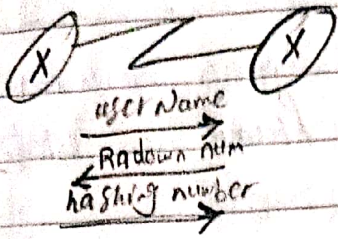
(Auth التحقق من الهوية)

b) NCP (Network Control Protocol)
* مسؤول عن عملية Negotiation (التفاوض)

→ PPP security mechanism.

PAP	CHAP
→ Password Authentication Protocol	→ Challenge handshake Authentication Password
* disadvantage → The Password is Just a text (نص عادي)	→ The Password is Encrypted

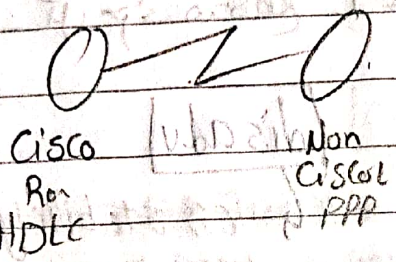
→ hashing function + 3 Handshake



2 HDLC (High level data link)

Default Protocol of The devices of cisco.

(ex)



* مش حيتعاملوا مع بعض بسبب عدم تشابه ال Protocols.

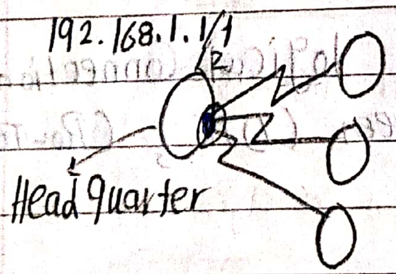
---

fram relay Protocol (اقل تكلفة من ال leased line)

* Point To multi Point.

- need one Physical interface only at The head quarter.

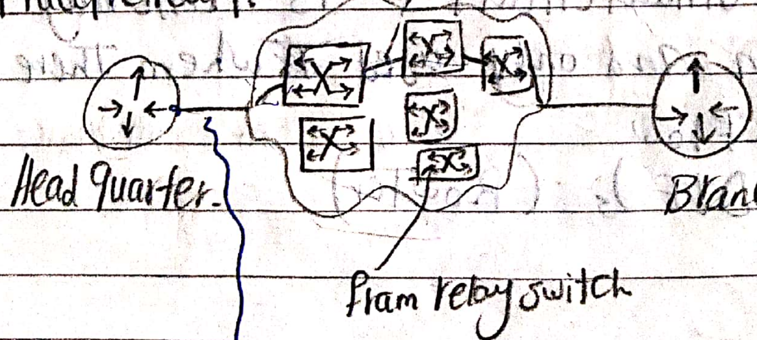
→ one Physical interface but many logically



* (PVC) له
Peremenant دائم

مابتغيرش يتعرف منهم ← محدودين

* (VC) → virtual Circuit.



* (SVC)
switched

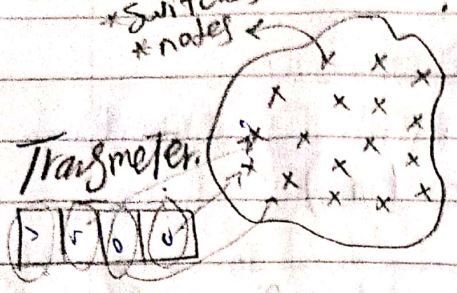
→ one Phsyical interface

* adv
  ↳ stability
    security
* disadv
  ↳ High cost
    Idle time

* Circuit switching (Leased line)

---

* Packet switching
  * switches
  * nodes
  . layer2 frame ← ...



* Serial number

. كل جزء مقطع بياخد سيريال نمبر عشان اعرف اجمعهم بترتيبهم

adv
↳ Low cost
  idel Time

disadv
↳ less stability
  less security

→ PVC ex for Circuit switching

VC
↳ The Virtual Circuit = is The logical Connection Through The fram relay between (DTE)s (Rowter)

SVC
↳ Switched virtual circuit = is Temporary Connection and only used when There is data flow between (DTE)s (Rowter)

PVC
↳ Permenant virtual circuit - Predefined virtual Circuit (leased line)

lec(5)

* WAN
  1. Leased line (digital)
  2. ADSL
  3. DSL → (عمل يشرح دا ناقش فالامتحان وهو مكمل)
  ASL

* main Tecnology

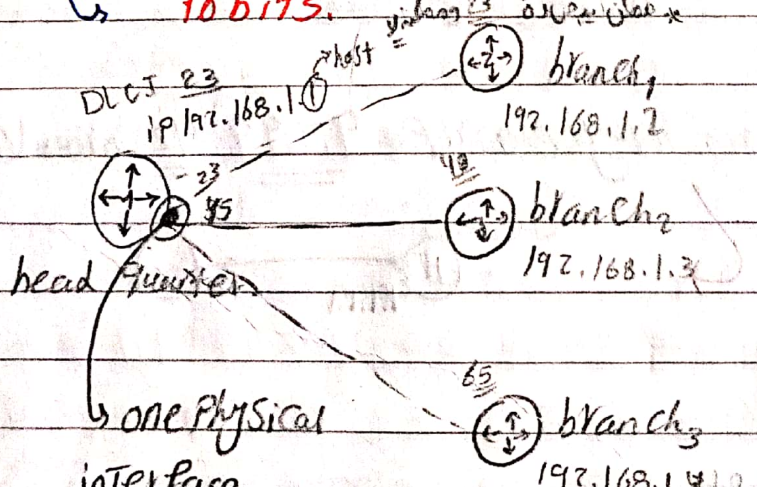
→ layer 2. ethernet Fram.

mac	IP	(Lan)
↔	← layer 3 →	

DLCI	IP	(wan)
2	3	

* DLCI → Data link Connection identefir.
  → used To build up logical circute
  → DLCI is uniq Per Router But may be The same Number Can be on The other Router.
  → 10 bits.

* ممكن يبقى زي 23 وهكذا



→ one Physical interface.

LAN

Sorce mac	destenction mac	Sorce IP	Desti IP

* local DLCI. remote IP.

local	remoT
23	192.168.1.2

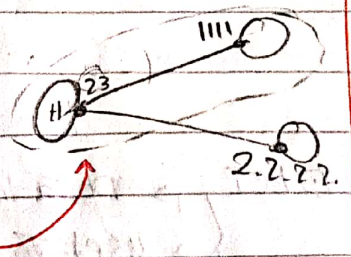
لو عايز ابعت Fram من 1 لـ branch 2 تاني لازم استخدم الـ local والـ remote

* Mapping :-
↳ local DLCI between Remote and IP
AND Done by Two methods
1. Manually
2. Dynamically

1) manuaLy (STaTiC).

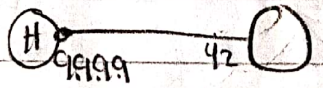
* R# global
R(Config)# Config model
R(Config-if)# Interface model

→ HeadQuarter (Config-if)# Fram relay map iP 1.1.1.1 23 broad Cast
remoteIP local DLCI



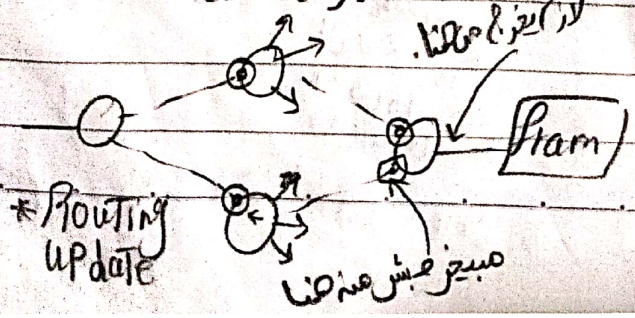
→ Head quarter (Config-if)# Fram relay map iP 2.2.2.2 45 broadCast

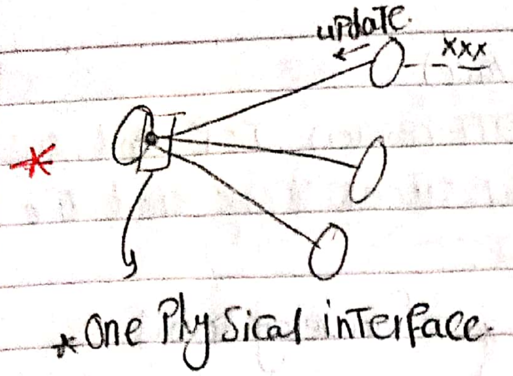
→ R(Config-if)# fram relay mapIP 9.9.9.9 42 broadCast



* The keyword broad Cast.
↳ To Prevent split horizon → (which Prevent updates from Routing segments from send back on The same interface it received).

Ex:-





Note → * في حالة Frame relay
بيعط broadcast علشان يشغل
(Split_horizon).

[2] Dynamically

* using Inverse ARP To learn IP Address on The Neighbouring Router.

→ By default Physical Interfaces have Inverse ARP Enabled

ARP

↳ Address resolution Protocol

Layer 3 ⇄ Layer 2 (Neighbour)

* يدّي الـ IP بياخد ___ ال mac.

ARP →

192.168.1.1 mac — 192.168.1.2 getway mac

Inverse ARP

↳ عكس الـ ARP

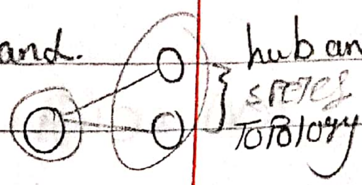
layer 2 ⇄ layer 3

* يدّي الـ DLCI بياخد ___
الـ IP.

Notes

↳ if static mapping is Performed Inverse ArP is Auto disable.

↳ To verify The Type of mapping we write Command.

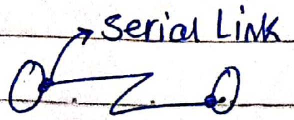


↳ HeadQuarter # show fram-relay map

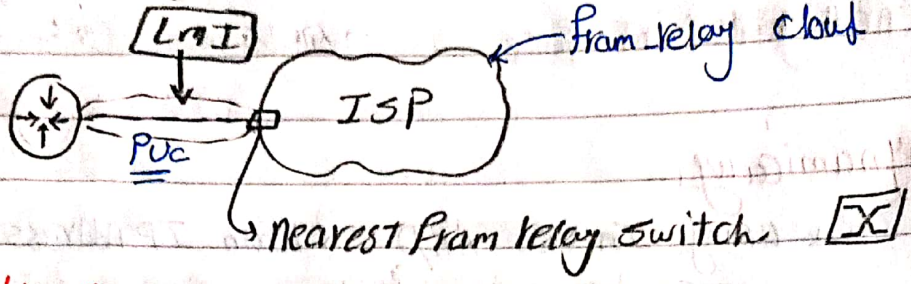
serial 0/0 <ip> ip 1.1.1.1 dlci 23 dynamically

ip 2.2.2.2 dlci 23 dynamically

* e
* f
* G — LAN
* S — WAN

* WAN 

* LMI :- (Link manjment Interface)
↳ is a message between DTE (Router), ISP and used To manage each Physical access link and The PVC. That used on That link.



* function :-
⊛ keepalive between ISP and Router ISP (The Nearest switch on The cloud).

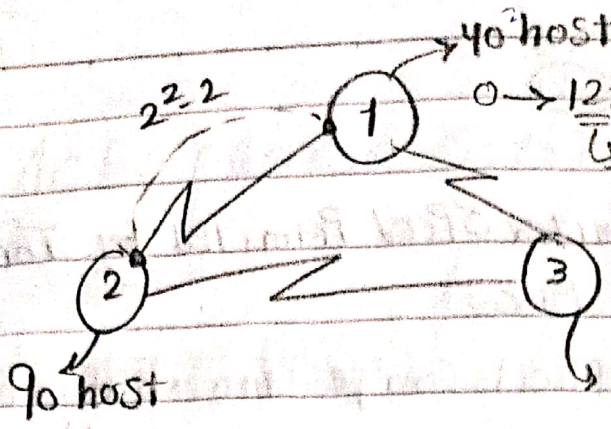
⊛ Determine if The Pvc is active or not

* Types of LMI :-
[redacted]
1. Cisco DLCI = 1023 ;
2. ANSI DLCI = Zero.
3. Itu Q933A DLCI = Zero. (Standard)

* Auto Sence O ↔ O (Cisco)
↳ The router Can adjust The Type of LMI Automatically To match The same Type By The Property LMI Auto Sence (default)

(Ex) * Class C Take 100.
$2^8 - 2 = 254 - 100 = 154$ #

(ex) HW



IP 0 → 255

$2^2 - 2$

$2^5 = 32$

* 90 host

2^1
2^2
2^3
2^7
2^8

90 host → $128 = 2^7$

∴ 128

* Network layer Concurences Framelayer Protocols-

[1] one subnet Contain All Fram relay DTE (Router)

(Tepically mesh) → one Physical.

* (mesh) = $\frac{n(n-1)}{2}$

[2] one subnet /PVc

العيوب ← استهلاك عدد كبير من IP نظراً لوجود عدد كبير من subnet.

* hybrid approach

* 4 subnet

* Congestion.

U.I.P * CIR ____ max limited Speed Permited by The ISP on The PVC

* flags { * FECN : forward explicit Congestion Notification,
* BECN : Backward " " "
* DE : discard eligibility.

*3 bits

→ if No Congestion FECN = 0

ISP ← FECN=1

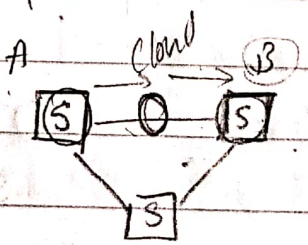
FECN=1 →

BECN=1 ← BECN=1

* (QofS)

(QofS) 3 bits.

FECN = 1

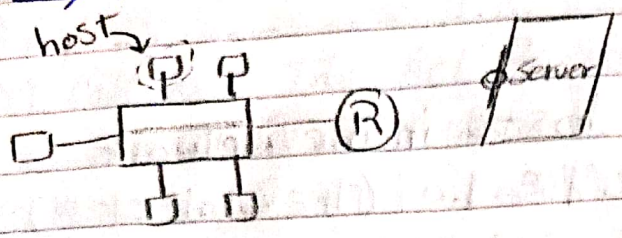


→ FECN = 1
→ B.ECN = 1

DE = 1

M → Lec(6)

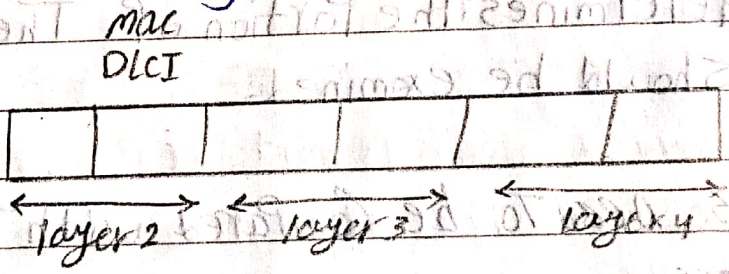
→ ACLs (Access lists)



* Daniel of service

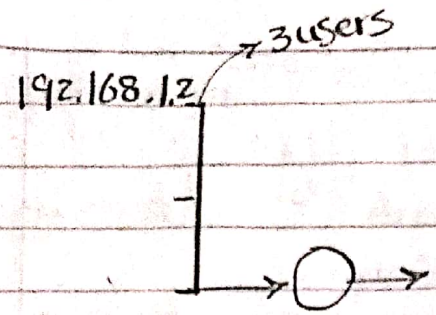
* Acl is a filteration to Prevent Some Application By closing it's Port

(ex) Port of Browsing (hTTP = 80)
" " downloading Port → (21)



Acl
- Standard ⇝ search in service ip (layer 3)
- extended ⇝ source ip
  ⇝ destination ip } (layer 3)
  ⇝ source port
  ⇝ destination port } (layer 4)
  ip, TCP, UDP

* layer 4 means That we already In. The device.



* To prevent all the hosts in the network we prevent 192.168.1.0 (the whole class).
or using Subnetting

wildmask

11111 000

Network bits	host bits

192.168.1.0 255.255.255.0

* wildmask:-
↳ determines the portion of the IP address should be examined.

→ 0 bit's need to be compared with the IP address

→ 1 bit's No need to be compared (don't care bits)

(ex) if we have 0.0.0.0 we need compare the 32 bits the 0.0.0.0 with IP for(ex) 192.168.1.0

(ex) 192.168.1.0
↳ wild mask of this IP 0.0.0.255 /24
↳ 2^{24} matching

* لو بنقل اختبار على 0.0.0.0 على (32 bit) يعني بقارنه او بتكلم عنه جهاز واحد بس.

(ex) 0.0.15.255

255, 255 255.255.248.0

0.0. wildmask

(ex) Calculate The Acl Range IP

access List 1 Permit 172.16.200.0 0.0.7.255

↳ check for 21bits

* mask → 255.255.248.0

16

11111/000, 00000000 200

11001/000, 00000000 201

11001 111

206

192.168.1.0 255.255.255.0

192.168.1.0 /23 255.255.254.0

I) Standard ACL :-

* Standard IP Lists

1 → 99 & 1300 → 1999

→ ACL 301 is an Extended Acl

172.16.3.10 — S0/0 R1 S0/0 — 172.16.1.100

172.16.1.1

Configration

interface S0/0

IP address 172.16.1.1 255.255.0.0

IP access group 1

access list, deny 172.16.3.10 mask (0.0.0.0)

access list, Permit 0.0.0.0 255.255.255.255

access-list 1 deny host 172.16.3.10
access-list 1 permit any

---

[2] extended:-

100 → 199 (2000 → 2699

(ex)
#Access list 101 deny IP any host 10.1.1.1
source destination

(ex)#Access list 101 deny TCP any gt 1023
source

host 10.1.1.1 eq 23 Telnet
destination. greater than

(ex)#Access List 101 Permit TCP 172.16.1.0
source
0.0.0.255 172.16.3.0 0.0.0.255
eq source 21 destination.
↳ FTP

---

* Port 21 _ ftp _ use Protocol TCP
* Port 23 _ Telnet _ " " TCP
* Port 53 _ DNS _ " " TCP/UDP
* Port 67 _ DHCP _ " " UDP
* Port 69 _ TFTP _ " " UDP
* Port 80 _ hTTP _ " " TCP

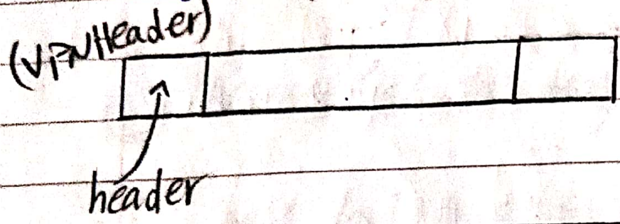
* Port 110 POPS use TCP

* Port 443 HTTPS // // TCP

Lec 7

* VPN: Virtual Private Network.

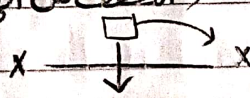
* defin:
  - ↳ solve security problem when using The internet as wan.
  - ↳ an encrypted Connection between private NeTwork over a Public Network.



---

* Basic 4 requirments of security:-

1. Privacy (confidenTially)
   → By encryption.
2. inTegrity (ضمان سلامة وصول الرسالة)
   - Algorith used in This State ##
3. Auth (التحقق من الهوية)
4. Anti replay

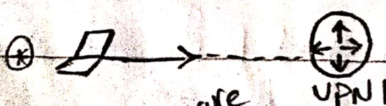


* بياخد الرسالة ويعدل فيها ويبعتها تاني أسماك.

→ To Prevent Some Person on The internet from Copy The Packet To send it later as legal sender.

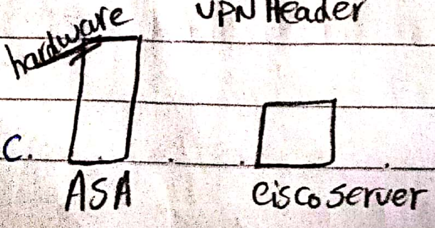
---

* who add VPN header?

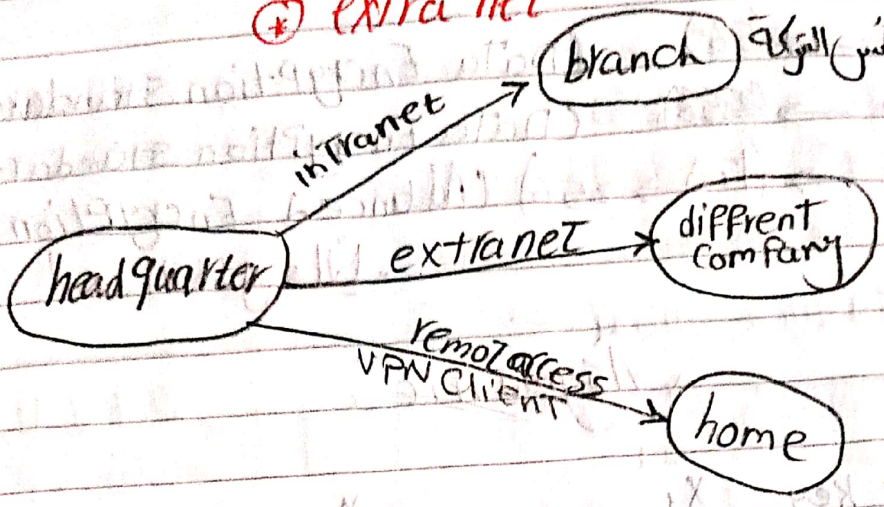


* Router added VPN Header.

→ ASA:
↳ Adaptive security ~~applicance~~ apliance.
(يستخدم في المواقع الرئيسية)



* intra net
* extra net



→ in remot access VPN (VPN client) The laptop must b provided with additional software called (VPN client)

---

* IPsec → (suit) ـــــــ (مجموعة من البروتوكولات)

* IPsec (يعني) → (encryption / key exchange / integrity / Auth.)

→ encryption ≥ protocols (DES - 3DES - AES)

Symattric

→ key exchange. DH

(انا الاثنين عندنا نفس المفتاح) Symatric Asymatric (كل واحد بيكون مختلف)

→ integrity : (MD5 - SHA)

→ Auth : → Pre-shared key → Digital signature

encryption + hash

(البصمة الرقمية)

Encryption

Symatric
- DES → (56) (Data Encryption Standard)
- 3DES → (~~112~~) 168 (Data Encryption Standard)
- AES → (128 → 256) (Advanced Encryption Standard) ← الأفضل حالياً

---

* Asymatric *

Public key X_1 (24) → X_2

Private key

1 * 24
2 * 12
3 * 8
4 * 6

Public key X_1

* Solve by private key

DH, RSA } Asymatric

* يستخدم الـ Symtric في تبادل الـ Data
ويستخدم Asymtric في تبادل الـ Key

* Key exchange
  - DH1 → 768
  - DH2 → 1024
  - DH5 → 1536

* ويشمل النوعين Asymatric & Symtric

- Symatric → fast but less secure.
- Asymatric → slow but more secure.

IPsec Integrity

allows to reciever to Confirm That The messages are not changed while Transmition. (hashing function). (MD5, SHA)

عامل زي الطلاء ولايمكن استرجاع الـ data منه.

(one way Function)

IPsec Auth

(1) Preshared key:- Two devices are PreConfigured for VPN By The same secret key

(2) digital signature:- encryption + hash

⊛ Negotiation VPN Protocol:-

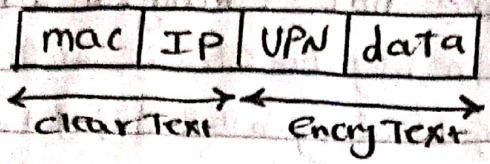
ESP:- Encapsulated Security Payload

AH :- Authentication header.

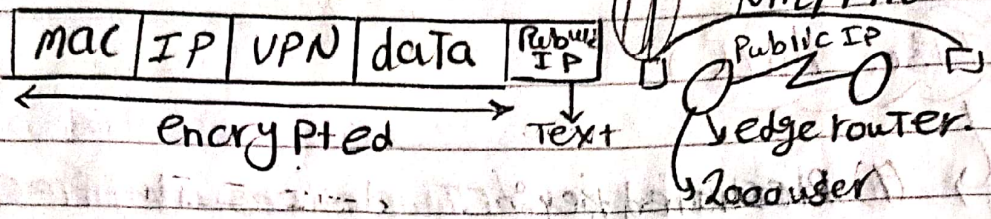
Feature	ESP	AH
Auth	✓	✓
Integrity	✓	✓
encryption	✓	✗
Antireplay	✓	✗

IPsec Models

→ (1) transport mode.



→ (2) Tunnel mode.



---

* (cryp to VPN map)

[1] Phase 1 :- for key exchange and has a life time. To change the key automatically after predetermined time.

[2] Phase 2 :- for data exchange ESP is used via Internet
AH via interval Network

[3] Phase 3 :- ACL in.

SSL VPN [Secure Socket layer]

→ SSL support an famous web browser

* if is locked :- SSL is used.
* if opened :- SSL is not used.

→ SSL uses :-

(1) well known Port 443.

(2) Encrypted data between browser & source.

(3) authenticating the user.

⊛ SSL Advantage :

→ No additional software.

⊛ SSL disAdvantage :-

→ The Permission of use The web browsers only

- في حاله اذا ما أردت تأمين APP أخرى غير web browser

⊛ ويوجد أحد حلين لهذه المشكلة.

١- باستخدام IPsec

٢- باستخدام (additional software) يسمى (based Thin Client)

(T.L.S) → Transport layer security.

. Not standard. الأحدث ولكنه

Lec 8

- ACL
  - Standard
  - extended

- Advanced ACL
  - Named ACL
    - Standard
    - extended
  - Numberd ACL
    - (standard extended)

→ Advanced ACL (Advantage)

* يمكن اضافة او اضافة من غير حذف الملفات Destroy

Named ex ACL (extended)

ip access_list extended [science] ← الاسم الذي اريد

Permit TCP host 10.1.1.2 eq www any.

لحذف Remove → # Deny UDP 10.1.1.1 (source) 10.1.2.0 0.0.0.255 (destenition.)

Deny IP 10.1.3.0 0.0.0.255 10.1.2.0 0.0.0.255

Permit any any

interface fa 0/1
ip access-group [Science] out
ip access-list extended [Science]
No ip access-list extended [science]

verification

show run-config
show access-list

* يظهر كل ما هو موجود في الRouter

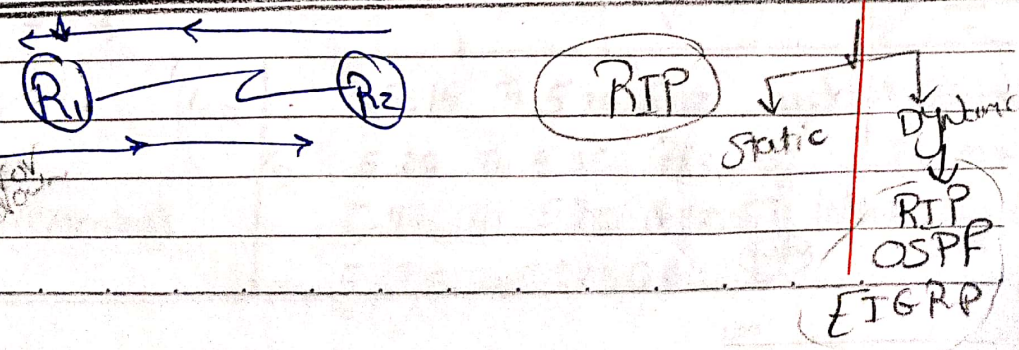
→ Advanced Number ACL:

Standard

ip access-list standard [24]
Permit 10.1.1.0 0.0.0.255
.2.0
.30
ip access-group [24] out
show ip access-list [24]
10 Permit 10.1.1.0 0.0.0.255
20 2
30 3

verification

No 20 (Remove)
5 deny 10.1.4.0 (add)

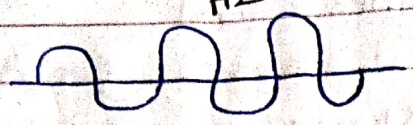


Router-11 ← Config ← software

K (10^3)
M (10^6)
G (10^9)

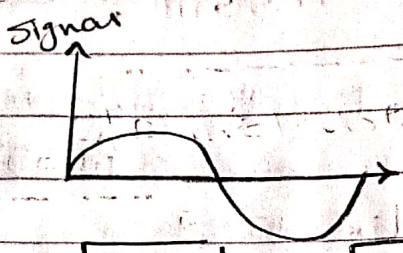
* WiReless

* Freq: Hz



* wavelength: sec → distance.

* Power:



Adv	disadv
higher bit rate	Less Coverage area

* $f \uparrow \rightarrow$ Coverage area ↓

* $\lambda \uparrow \rightarrow$ Coverage area ↑

* $P \uparrow \rightarrow$ higher Coverage area.

AP → Access Point

watt

اللجنة الاستشارية للاتصالات

⊛ Regulating bodies

→ itu _ R (الأمم المتحدة)	→ Fcc (us)	→ Esti (أوروبا)
→ international Telecommenecation Unio_RadioCommon	→ Fedral Communication Commetion	→ European Telecomminication Standard Industrial
* يتم التقسيم الى ٣ مناطق - اوروبا _ افريقيا - الأمريكيتين - استراليا وجنوب اسيا	داخل الولايات المتحدة وتوجد بعض الدول تستخدم هذه القوانين	① 2.4 To 2.5 GHz ② UNII bands GHz ولكن في بعض الاختلافات
⊛ unlicensed . الترددات * ISM → 2.4 To 2.5 GHz → 5.725 To 5.825 GHz	① 2.4 To 2.5 GHz ② UNII band 5GHz (unlicensed National information infrastructure)	

→ يوجد ترددات → licensed / → unlicensed

→ interference (تشويش)	* يحدث عندما تستخدم جهتين نفس التردد.

⊛ Fcc → باقي الترددات

UNII 1	5.15 To 5.25 GHz	indoor (50 mW)	milliwatt
2	5.25 To 5.35 GHz	250 mW	
2 (extended)	5.47 To 5.725 GHz	(1mW) indoor - out door	
3	5.725 To 5.825 GHz	(1mW)	

⊛ IEEE Standard Body

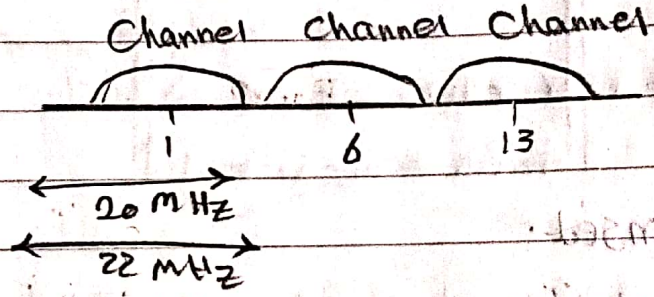
هاي بتوليد المعايير التقنية.

تقسم لـ Data link layer _ Physical layer

IEE 802.2 ⟶ Data link layer. (بتحدد شكل الـ Fram)
IEE 802.3 ⟶ ethernet
IEE 802.11 ⟶ wireless

⊛ 802.11 Channel use

⊛ ISM ⟶ 2.4 ⟶ 2.5 GHz



- 22 MHz
  - DSSS
- 20 MHz
  - OFDM

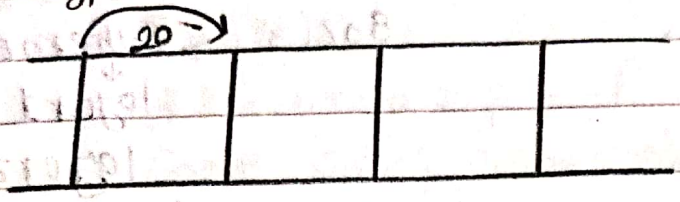
(الفرق مابين كل قناتين متتاليتين 5MHz)

(14 Channel عندي)

* يكفين استخدام 3 قنوات
وميكنش مابينهم تداخلات (overlap)
وهما 1-6-13
وهيه مابينهم * Save gap

channel IN U.NII band

* تبعد كل قناة عن الاخرى (20 mHz) بينما في Ism (بعد 5) وعرض القناة باستخدام ofdm (20 mHz) ofdm



* يمكنه استعمال قناتين متجاورتين (من قبل جميع الشركات AP)

IEEE 802.11 Standards

1) 802.11 b (1997) 1, 2, 5.5, 11 mbps
band 2.4
* Transformation Type DSSS
* Modulation : DQPSK

	Coding	modulation
1 mbps	(Barker	+ DBPSK) → binary
2 mbps	(//	+ //)
5.5 mbps	(CCK-16	+ DQPSK) → quadrature
11 mbps	(CCK-128	+ DQPSK)

Lec 9

itu / fcc / Esti

ISM
2.4 GHz

IEEE ← توحيد المعايير العالمية

802.3 → Ethernet
↓
layer 1
layer 2

802.11 → b

*(MCS)
↳ modulation Coding Scheme.
(speed) ← (modulation + Coding) كل نوع يعطينا

		MCS
MW	70	0
	50	1
		2
		3 ⇒ الأصل

* Kind of modulation → DBPSK , DQ PSK.

2 IEEE 802.11g. (2003) 1, 2, up To 54 mb
band 2.4 GH

* Transimation Type → oFDM 20 MHz
→ DSSS 22 MHz

* modulation :- DBPSK
DQPSK
16 QAm
64 QAm
128 QAm

(11 mcs)

* Coding :- Barker
cck16
cck128

[3] 802.11a band 5 GH

* Total 28 Channel

US → 23 European → 19

Speeds (8) :

* Transmission : OFDM

→ use Same coding and modulation of (802.11g)

→ Channel 54 mbps

→ subchannel 1.125 MHz

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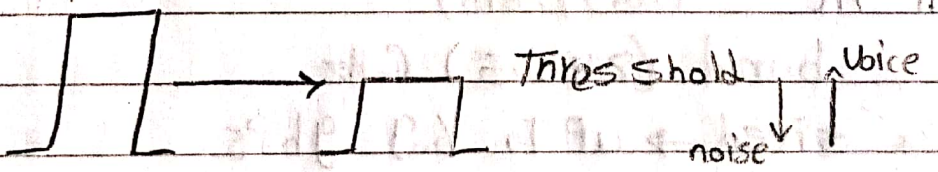
[4] 802.11 n

→ The first standard use 2 band (2.4 , 5)

→ Speed → up to 600 mbps

→ use Tecnology → MIMO (Multiple Input multiple

* (ThroughPut) → outPut/inPut



* ThroughPut → (Bitrate معدل البت)

→ 802.11 n uses 3 Technologies To increase ThroughPut (Bitrate).

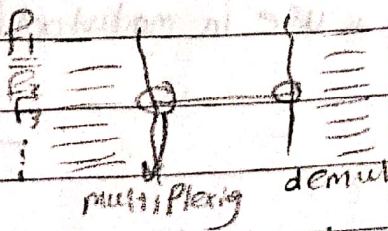
→ relipility & toget more Coverage area.

[1] Channel aggregation.

[2] Spatial Multi Plexing.

[3] Mac layer

Multiplexing



* Mac layer
  - Reliability → To get Coverage area
  - Transmit → Format
  - MRC (Maximum Ratio Combine)

5 GHz ←— 20 MHz —→ ←— 20 MHz —→

OFDM ←———— 40 MHz ————→

- (Access Point Types) AP types :
  1- Dual radio AP
  → has 4 الهوائيات
  Two of them (2.4) - Two of them (5)

  2- Dual band AP
  → has 4 الهوائيات
  (2.4) (5) اي واحد طبعي بقدر يشغل

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5) 802.11 Ac (2013/2016)
* band (2.4 - 5) GHz
* speed → up to 6.9 gbps.

* Technology → Robust channel aggregation
* Can aggregat 4 channels, each 40 mHz
To get one channel with band 160 MHz
* use in modulation
256 - QAM 3/6