ElCoM
ELECTRICAL COMPUTER MECHATRONICS

ملخص لمادة شبكات الحاسوب

للطالبة المبدعة
رهف ملحم

إرادة - ثقة - تغيير

ملاحظات :

1- هذا التلخيص يشمل

Ch8 + Ch9 + Ch10 + Ch13 + Ch17 + Ch19 + Ch

2- Ch18 تم تلخيص الـ Concept وتم ارفاقه بعض الاسئلة التي أخذت أثناء المحاضرة ولكن هذا الـ Chapter يفضل دراسته من الكتاب والفيديوهات

(تلخيص شامل لمادة شبكات حاسوب)

دكتور أحمد قطوم

لا تنسونا من صالح دعائكم

Ch 8 : Switching

Switched netowrk : Communicting devices with switch and we have multiple links

Switchig
- ciriaf switching — L1
- Pack switching
  - datagram — L3
  - virical circt — L2
- message Switching

1_ circut Switchig

* by Physical link L1

→ in the circuit, the resource need to be reserved by during Setup phase

Positive:
1_ fast transmetion
2_ in order delvery
3 - minimal delay , Performance , Backe Loses

negative:
1_ Low effeincy
2_ Lack of bandwidth (Bw)

Ex: maybe we have a big wised in circuit Switch in connection with computer

three setup:
1_ setup → connecte
2- data - tranfer
3 - Tear down → cancel or disconnect-

* 2 type of delay here
1 - Transmation delay TD +
2 - Propgation delay PD
→ continous beacuse it's resevd من البداية

Pack switching. there is no resource reservation resource are allocated on demand

2- Data gram switching:

* كل Packet بتعاملها بطريقة أُخرى عن الأخرى

→ in diffrent Path

effecincy: the efficincy is better than circuit-switched

Possitve — negative

1- no waised — 1- lost Packet

2- out of order ← وصلوا ملخبطين كل وحدة اخذت Path

Phase:

no setup and no teardown

one single Phase: data tranfer

a switch in datagram use routing table that based on destention address

→ data transfer Packet tranfer indival Pack no setup (متقطع)

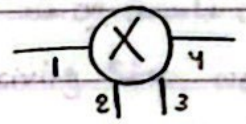
delay:

1- Transmotion delay

2- Processing delay

3- waiting

4- queueing delay.



destenton	Port
1234	1
4150	2

we have 2 option:

1- reserved 2- on demand

datagram: indvsual Packet order

* in the pic in P221:

on demand beacuse transmotion line discrate

* Routing table > VCI

address more complex

3- vertual-circuit network

mix between circuit and data-gram

cricit: setup + data tranfer + tear down

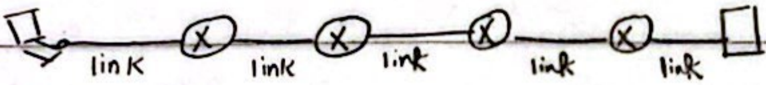
* in the same path (تتبع الصور P219 + 220)

تابع →

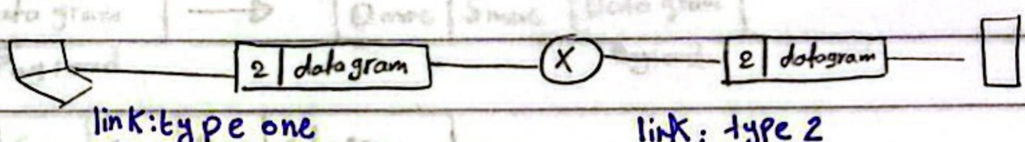
Ch 9 : Data - link - layer.

nodes: end devices + Connectd devices (Sendr + reciver + Routr) → 6 devices

Links: network between Connected devices (Point-to-Point) → 5 links



Server: data Link layer is node-to-node



→ بصير يكون عندي 2type Protocol من بين كل link .

* IP end to end from Source to destntion
* mac Point-to-Point from clinert to router then from router to Serve

servise:

1- Framing : A Packet at the data-link layer is normally called Framig

2- Flow control: يكون عندي تناسق بين عدد bit في sendr + resver

* we cannot have an unlimited buffer-Size at the reciving Size we have 2 choice:
  1- drop the fram if it's buffer full
  2- the receiving data-link a feedback to stop or slow down.

3- Error control: صار لخبطة بين Source addres L destntion (detect + correct)

4- Congestion control: relate in wire Lack of flow control (losess + drop)

data link layer → node-to-node network layer → end to end

Tow categories of linKS:

1- Point to Point (DLC)

2- broad cast (DLC+MAC)

Tow Sublayers:

1- data link control (DLC)

2- meadia accsess control (MAC)

Link layer addressing.

datagram

Source IP	DIP	data gram

Payload

→ Fram

Dmac	Smac	Datagram

Payload

→

Dmac	Smac	SIP	DIP	datagram

* in Page 243 in the book N: IP address L: MAC address

* IP → Logical address + Layer 3 network Layer

* MAC → Physical address + Layer 2 data link layer

ضروري تتبع الورقة 9.5

1- Application →

2- transport → Port number

3- network → Source + IP

4- data link → MAC

5- phiscal →

Dmac | Smac | SIP | DIP

ARB ← Dmac, HW ← Smac, DHCP DNS ← Protocol

ARB ↓ تساعد على بناء Routing table

*علاذا يوجد حالي address router؟ ممكن تشتغل على انه Sendr + reserver

Three type of address:

1- unicast

2- multicast

3- broad cast

كيف اميزهم؟

بتعتمد على أول digit 2

even 0 → unicast

odd 1 → multcast

all ones → BroadCast.

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Address Resoltion Protocol (ARP) : network Layer

← اعطيني IP address برجعلك mac addr

* ICMP: Internet control message Protocol.

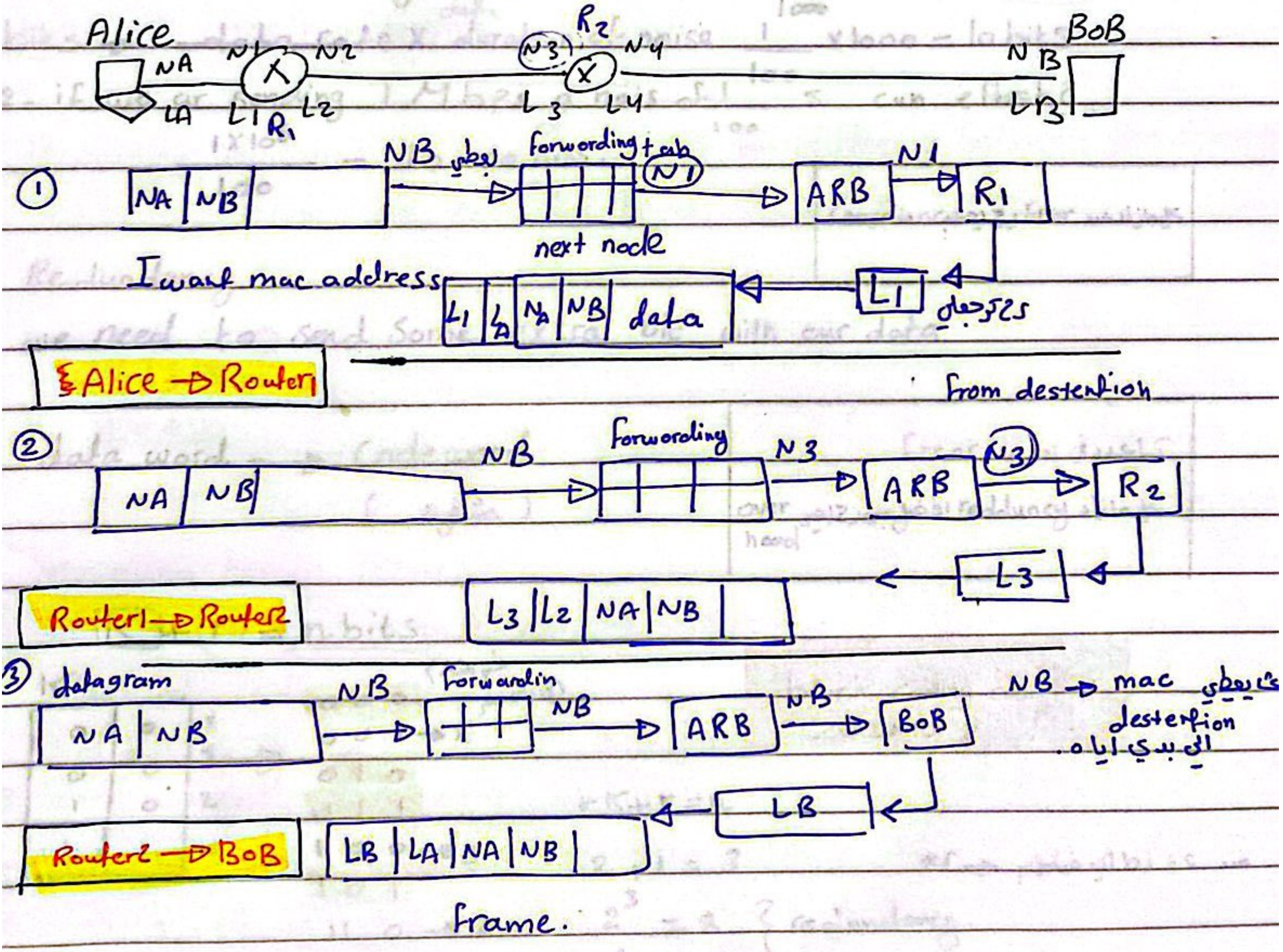
* IGMP: Internet grouping managment Protocol.

1 - ARP → Request is broadcast

2 - ARP → Replay is unicast

P 248   * الاطلاع على Format وتبع ARP

* we use forwording table



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100505 - 001

Ch 10: Error detection and correction.

Type of error
- Single-bit error: means that only 1 bit error
- burest error: means that 2 or more bit error

→ الاشياء الي بتحدد اذا هي Single or Burest.

* the number of bits effected depnds on: (1) data rate and (2) duration of noise

1- ex: if we are sending 1 Kbps (data) a noise of $\frac{1}{1000}$ secon can effect?

bits → ~~data rate~~ x duration of noise $\frac{1}{100} \times 1000 = 10$ bits

2- if we ar sending 1 Mbps a nois of $\frac{1}{100}$ s can effect?

$\frac{1 \times 10^6}{100} = 10\,000$ bits.

كل ما زاد عدد Error رح يصعب Correction

Redundancy:

we need to send some extra bit with our data

data word → Codeword (مشفرة)

تساعدني بتحديد Error
كل ما زاد reddundcy افضل بس رح يصير over head

$K + r = n$ bits

K

0	0	x
0	0	y
1	0	z
1	1.	w

→

000 (غير مستخدم اي بالاصفر)
001 → x
010
011
100 → y
101
110 → z
111 → w

block coding called codeword #

$*K + r = n$

$2 + 1 = 3$

$2^3 = 8$
$2^2 \leq 2^3$
} redundancy.

*r → عدد bits اي ضفتهم

* استخدمت 4 وضل 4

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→ How to find the extra bits? data ward(k) = 8bit, extr(r) = 2

1- 8+2 = 10 → $2^8 = 256$ $2^{10} = 1024$ then

$$\begin{array}{r} 1024 \\ - 256 \\ \hline 768 \end{array}$$

768 ← illeagal extra bit

linear Block Coding: Xoring any codeword with any codeword is a valid Codword #.

* الاطلاع على مثال الكتاب 10.1 P260 #

← ملاحظة مهمة في الفرع الثالث

* an error-detecting code can detect only the types of error for which it is designd; other types of error may remain undetected.

> لما صار عندي Error في أي من Bit لما صار صعب علينا اني احدد Error

Hamming distance: it is the number of diffrence between the crosspenc bits: → can be easy be found if apply Xoring

ex:

```
  0110  ⊕        10101  ⊕
  1111           11110
  ----           -----
  1001           01011
```

hammig distance = 2 → hammigny distace = 3

* اذا كان hammig distance = 0 يعني لا يوجد Error
* اذا كان hammig distance > 0 يعني على وجود Error

minimumm hammig distanc: is the Smalles hamming between all possible Pair of code word.

$d_{min} = S + 1$ S → darntess

S ↓ max # of error

اذا كان معطي 4 valid code بطلع Xoring الهم كلهم وبا خد أقل واحد #.

ex: 011 101 → $d_{min} = 2$

$2 = S + 1$ $\boxed{S = 3}$

Ch 13: Ethernet.

Servies: (format + frame)

1- min Lenthgh   2- feilds   3- Size

IEEE 802: Instute of Electric and Elctronic Engeenir

the relationship of the 802 Standrd TCP/IP and Subdividdle in 2 subplaires: Logical Link Control (LLC) and meadia accsess control (MAC)

data link Layer →

Logicacl وجود MAC جزئها

Logical } flow error, consegtion

LLC (Framing)				datalink
Ethernet	Token Ring	Bus	Framig	
Ethernet	Token Ring	Bus		physical

* باختلاف tecndogy ممكن يختلف Length.

(meadia Accsess control) (MAC).

define CSMA/CD → Carrier sense multiple Accsess/collison detection

Ethernet evolution

- Standrd: 10Mbps
- Fast: 100Mbps
- Giga: 10G.bps
- 10Giga: 10Gbps

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Ethernet frame

min Framelength: 512 bit 64 byte → 14+46+4 = 64 byte
max frame Length: 1518 byte → 14+1500+4 = 1518 byte

Pramble	SFD	des addr	Sadd	Type	data and Padding	CRC
7byte (56 bit)	1byte 8bit)	6byte (48bt)	6byte	2byte		4byte

1- Pramble: 56 bit alternating 0 and 1   Headr
(Phisical layer) Frame مش جزء من

2- SFD: Start frame delimiter (10101011) Frame بس أشوف الواحد مكرر مرتين بلش

3- Type: ARB or IP type of Protocol upper layer.

4- data and padding (Pay Load)

* ليش مهم عندي أحدد ضمن Range معين؟

min pay load lenth: 46 byte

1- كان يكون ضمن حدود معقولة + sensible

max pay load lenth: 1500 byte

2- تبعث ا نوفي Level of signal energy

→ Packet & by CSMA/CD

5- CRC: the last field contains error detection informatino.
→ (4byte)

Format:
1- total lenth
2- fields
3- Lenth each field

Addressing: The Ethernet is 6 byte (48bit)

ex: (47):20:1B:2E:08(:EE) Sent outline

Left to right byte by byte — اذا حكا first bit بنبلش من الشمال

mirror — اذا حكا last bit بنبلش من اليمين

0100 0111 : 0010 0000 : 0001 1011 : 0010 1110 : 0000 1000

11100010 : 00000010 : 11011000 : 01110100 : 00010000.

[1] Strandrd Ethernet: (bus + hup) topolge

* we need to use an access method to control Sharig medim
CSMA/CD

implemtion: UTP or fibe optic

* 10Base 5: we use Trasiver (Kind of cost) (thick coxcial)
Signal attenotion متى اتجنب (reapeter) يعني وضع

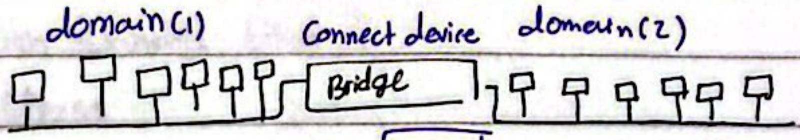
* 10Base 2: Tconnecter (flixeble + Short distance + cost ↓)
long distance more reapetr then I will use 10Base2

* 10Base T: (Star topolgy) Hup → collison
CSMA/CD مش بحاجة Star → no collison

* 10Base F: تجاوزنا collison تماما
Full duplex عشان

Changes in Standrd

① **Bridge Ethernet**



Logical devices = 6+1 = 7   X/10 $\frac{10}{7}$ Mbps   (العشرة من السؤال)*

1 - increas Bw   2 - Speartion domain for collison

② **Switched networ (Ethernet) half-duplex**

Switch = N Port Bridge
# of the node in network

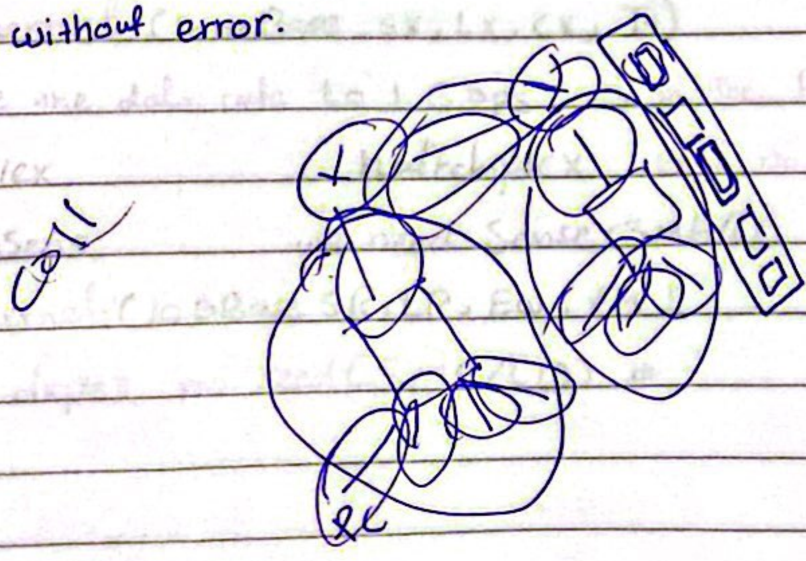
* (more complex   increase Logical Bandwidth   increase the collison domain)

③ **Full-deplex Switched network.**

no need CSMA/CD   we have transmite + Recive

* MAC Sublayer :

designd as a connectionless , There is no explicit flow control or error Control to inform the Sendr that the Frame has not send ~~gsg~~ to destention without error.



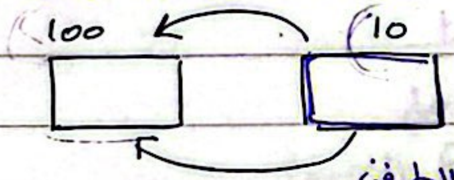
[2] Fast Ethernet

1- upgrage the data rate 100 Mbp
2- make it compatible with standrd Ethernet
3- Keep same 48bit address
4- Keep the Same Fram format.

* CSMA/CD depends on the transmation rate, the minumm size of the frame and maximum network length.

* A new feature added to Fast Ethernet is called Autonegotion. it allowes a Station or hap Range of capabilites it Allow tow device to negotite the mode or data rate of operation.

* دايما اذا كان عندي half-duplex
لازم استعمل CSMA/CD



no data → rata وهو ما بجيب 10 أوتومتي

يعني بالمختصر بتفاوضوا على Rate معين يناسب الطرفين
في حال بقنا 100M وكان Reaiver شغال على 10M

* Point-to-Point → Star topolog. (hub or Switch) #

[3] Giga Ethernet (1000Base_SX, LX, CX, T4)

[1] upgrade the data rate to 1 Gbps

Full duplex — no need Sens

halfduplex — we need Sense CSMA/CD

* in the full deplex mode of Giga no collison, the maximum length of the cable deter by the singal attennution.

[4] 10 Giga Ethernet (10GBase SR, LR, EW, X4)

Just full duplex no need (CSMA/CD) #

Ch17 : connecting devices and virtual LANS.

hubs (Layer 1 Physical Layer)
1- Connection.
2- Amplifire this Signal.
3- Look if it has attenuation.

Switch (L1 + L2 data Link layer)
1- has table used in filtring (Learning table)
2- we can put the information in this table (manual or Automotic)
3- does not change the link layer (mac) address in a frame

* الجهاز ليبعث مابكون عل table
* الجدول بتعبى من كل Source mac بوصل

address	Port
71:2B:-	1

*Laarning Switch P 497 Fig (17.4)

في Examble بحكي عن Loop proplem in بسبب وجود 2 switch
a Learnig Switch

← بحل المشكلة هاي عن طريق حذف أحد ال Swich

* P 498 fig 17.5.
System of connected LANS and it's graph represntion

→ in Fig 17.6 P 499 we have 5 Switches and we have ruddndnt Path

← بحل المشكلة عن طريق: 1- Spannig tree one single Path
2- collection of Path.

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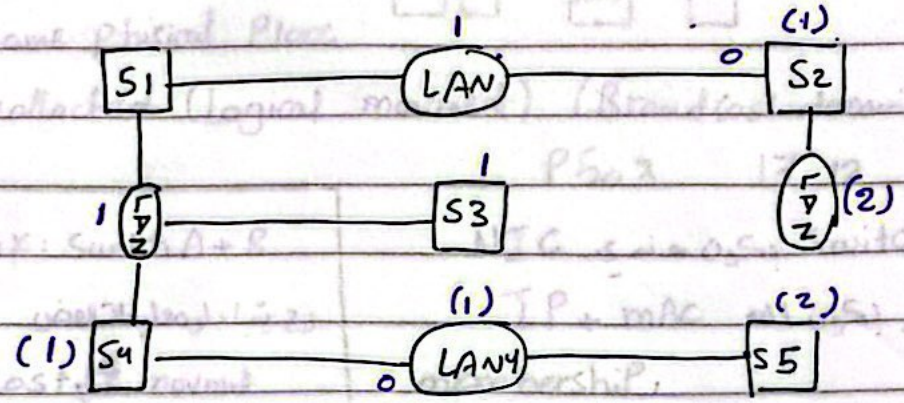
Spannig tree: only one single Path from the same root to all Possible destention

* least Cost tree : Path بحدد افضل

\# of node + destention + trafic

* Switch → LAN → (1)

* LAN → Switch → (0)



* أنا ما بشيل ال Path ع بعمل
Blocking لل Path والي بيبي
Forwording اياه بعملو

3 - Router (L1, L2, L3 network Layer)

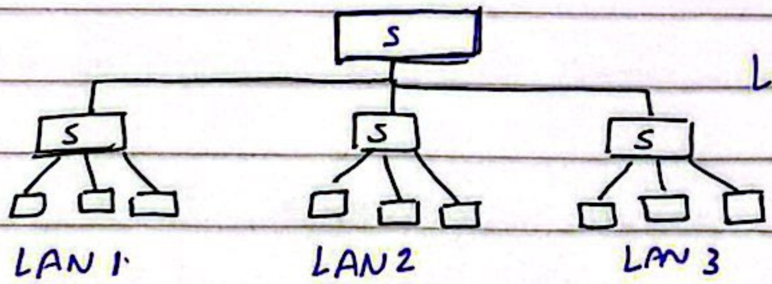
1 - Amp + mac + IP address

we used routing table

router chang the Link Layer address

connected over the internet

a Switch connecting three LANs



مثلا اذا احتجنا جهاز مثلا على LAN2
رح يصير عندي Physical movment
وهاد الشي مش عملي ممكن
يصير عندي Failer .

← في عندي حل

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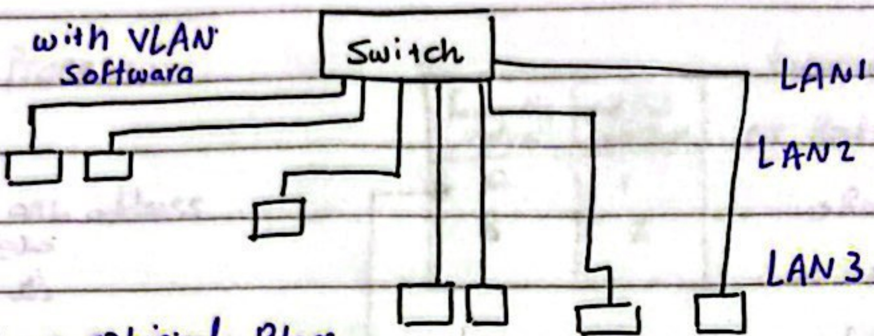
Switch using VLAN : vertual local Area network



not in the same phisical place

I can do reallocted (logical movment) (Broadcast domain)

P503 17.12 في قاعة اضا *

Tax: Switch A+B
رح يتبادلو معلومات لبعض
cost ↓ movment
time ↓
more Privacy

← كل Switch بكون عندي NIC

← كل جهاز بكون اله IP + MAC

membership,

interface, Port number, MAC, IP, IP multicast

*configration:

1- mannual: the admministrator uses VLAN

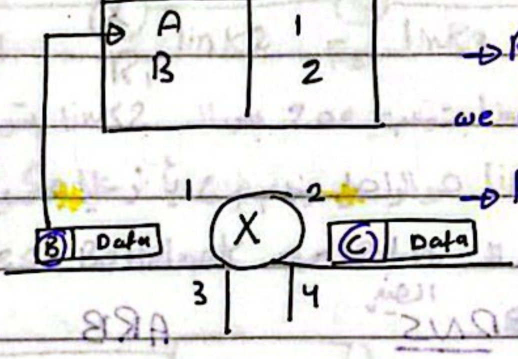
2- Automatic: Connected or disconnect VLAN using crieteria defind by admminstrat

3- semiautomatic: intilze manual. migrations automaticlly.

Ch18: Network layer

Forwording Process:

Forwordig value	out-Put interface
A	1
B	2



forwording table or Routing table
→ Routing Protocol we can build table.
→ forwording التخدم المعلومات

* Routing ماله address صلاحية (VCS) ينير

* VCI اذا كان اي متخدم B and C ممكن يكون

* IP اذا كان متخدم Just B لازم يكون

other services:

*Lack of flow control → Error control + consetgion control.

1- Flow Control: regulates the amount of data a source can send without overhelming (ينظم عملية التدفق دون إرهاق المرسل)

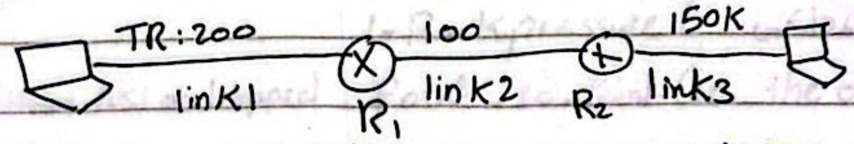
2- Congestion: too many datagram are present in an area of the internet - maybe send duplicates of the lost Packet

3- Quality of Service: real time communication

4- Security: To Provide security for connection less we need to have another vertual level to meket connection orianted this vertual layer call IPsec network layer Perormance

1- Throughput: the number of bits passing through the point in a seond

~~2- delay~~



عندي هون الـ link1 بتوعب 200 بس الـ link2 بتوعب 100 والثالث 150

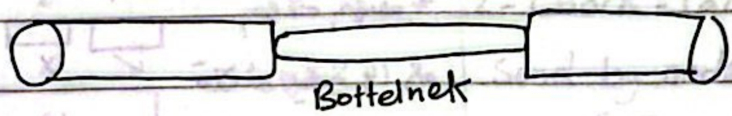
بس عا انو link 2 هو الواصل بينهم فرح يأثر علينا بكمية الـ Bit المبعوثة

→ simulation using pipes: Bottelnek ael Path هاد الـ (negative)

الصغير

- Packt loss

- more retransmotion



*Consetion control: improve Performance

2- delay

- Transmation delay: $Tr = \frac{\text{message size or Paket Length}}{\text{transmation rate}}$ (Sender → router)

- Propagtion delay: $Pr = \frac{\text{distance}}{\text{Prop Speed}}$ (on Link) Prop Link on

- Processing delay = Pr = Time required to process Packet in Route or destenton h

⊗ or destion

- Queueing delay = The time a packet waits in input and output queue in Route

Total delay = (n+1)(Tr + Prop + Proc) + (n)(Queu)

ma (n+1)

S.

Congestion Control (throupt)

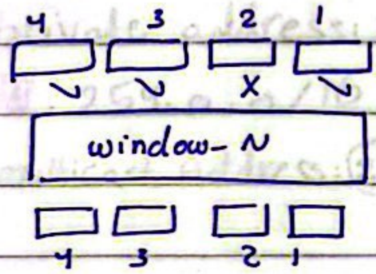
Open loop (Prevent ← تجنب)

1- retransmation:

if the packet feel there lost or dropped

2- window Policy:

*go-Bak-N



*ببعتهم كلهم مع انو 2 فيها مشكلة بالتالي الحل رح تتفاقم المشكلة

*Selective-repet: أخي انتقائية بكون محدد مكان فيه مشكلة

3- Acnolgment: اذا ما وصل (Pos Acnol) بسبب

ex sendr → reciver (20 s) Timer out لو صار عند ي

ACN اذا وصلت خلال (5s) لازم ارجع بالوقت المتبقي

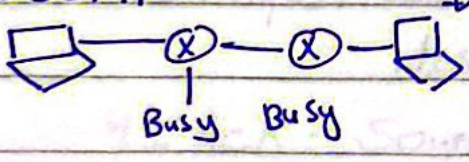
Packt field

4- discarding: بميز diffrent Levl of server → بطالع Paket الي اولويتها اقل وبعمل discarding

5- admission:

* V.C.S ← من البداية ما عندي قدرة

- setup



→ deny Beacuse I don't have any Space.

Close loop (to remove)

1- Backpressure (توصيل في الاتجاه المعاكس)

Point-to-Point (in the oppiste direction)

بعمل Block على Path معين

بس لما يكون Path معروف (vertual-circut)

2- Chock-Packet:

Send by node to source directly

ex (ICMP)

3- Implict Signaling: ضمني

The delay in reciving an Acnolgment the source to slow down

4- Explict Signal:

the Packet that carry Signal

Signaling can occure in eaither Forword or Backword direction

ex: ATM.

Private:
- 10.0.0.0/8
- 172.16.0.0/12
- 192.168.0.0/16
- 169.254.0.0/16

Special address:

1- This host address: 0.0.0.0/32
2- limited broadcast: 255.255.255.255/32
3- loopback Address: 127.0.0.0/8
4- brivate address: 10.0.0.0/8, 172.16.0.0/12, 192.168.0.0/16, 169.254.0.0/16
5- multicast Address: 224.0.0.0/4

* 10.0.0.0/8
* 172.16.0.0/12
* 192.168.0.0/16
169.254.0.0/16

DHCP: Dynamic Host configration Protocol (الأفضل شوف فيديو الدكتور)

* Application layer Solve the proplem IP from static to dynamic

→ broadcast Limit connection Less

~~(0.0.0.0/32)~~ 1- subnetmast, IP, gateway, DNS,

Clinet IP:? → Server IP: 181.14.16.170

this host

1- DCHCP discover → Source address ~~broadcast limit~~ (0.0.0.0/32)
destention adress → Broadcast (255.255.255.255/32)

2- DcP offer: Source address (تبع server) → 181.14.16.177/32
destenton addres → 255.255.255.255/32

3- Requst: Source address → 181.14.16.182 (تبع Clinet)
desterton → 255.255.255.255

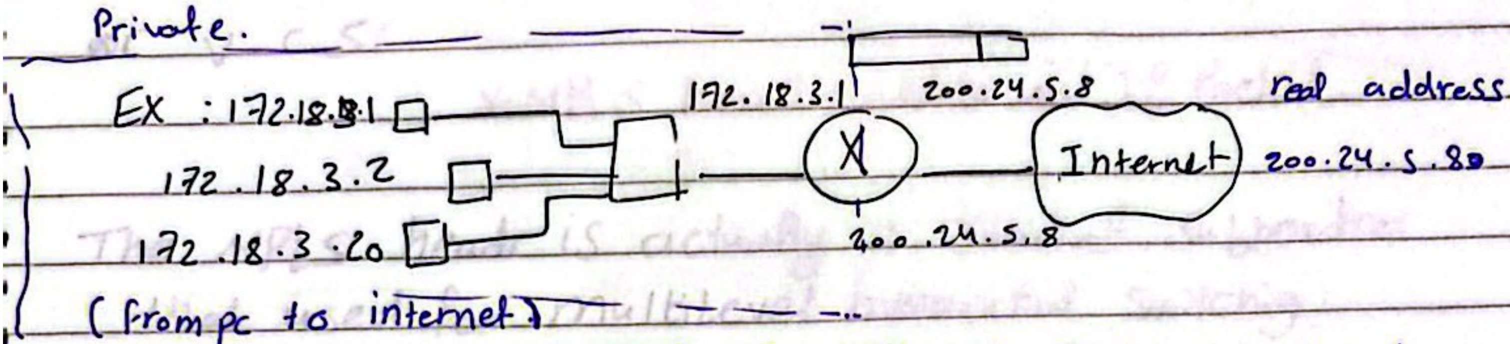
4- Ack: Source addres → serve. 181.14.16.170
destention → 255.255.255.255

Scanned with CamScanner

NAT: Private address (IP depition (التقليل من الحاجة)

2 IP (real) مثل الجامعة الهاشمية يكون الها

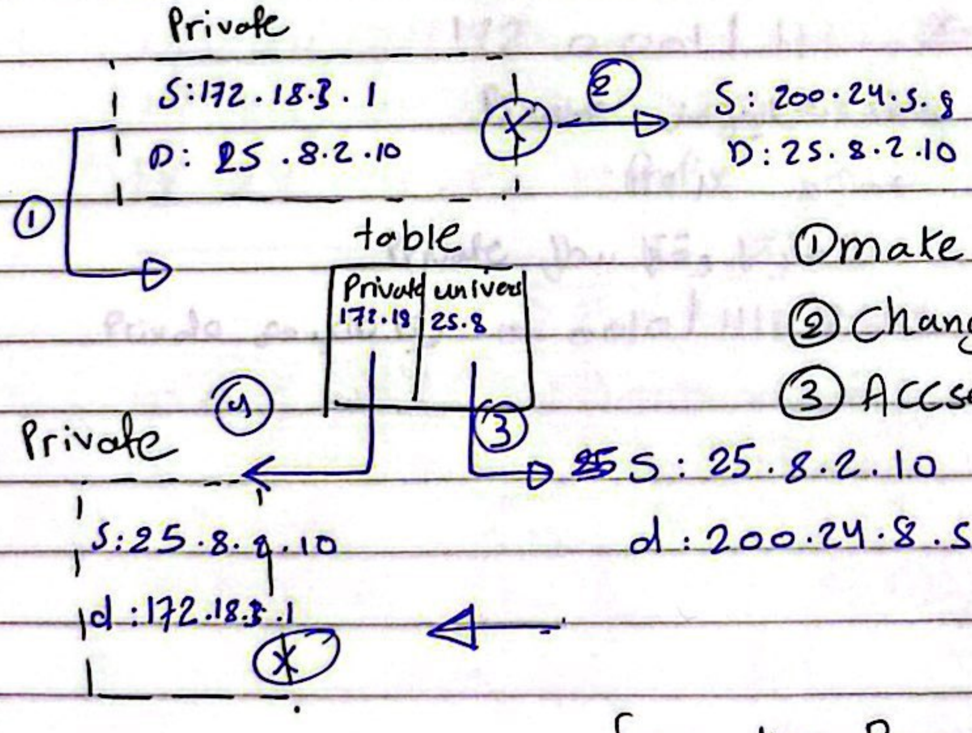
Private.



١- لما توصل لل Router رح يبدل ال PrivateIP لل realIP

٢- لما يصير Replay بعرف real IP ويشيل لل Router PrivateIP

٣- لازم يكون عندي NAT table



① make table entry

② change source address

③ Accses table

④ change destation address

Forwording Based

Lable (VCI)	destention
direct Access	v.c. s
sequntal بدون	orinted in delivery

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Router as Packet Switches

* Router can be configured to acts as either datagram or V.C.S

*MPLS headr add to an IP Packet.

The MPLS headr is actually a stack of Subheadres that used for multilevel hierarichal switchig.

Private

172.17   172..0001 | 0000.0.0

172.0001 | 1111.85.255

ضلت لانه التغير صار Private

عندي بعد Prefix

انا صار قل وحقا بيطل Private   16 → 31

Private زي هاي مش ← 0010 | 1111.255S

Class Less

Class A 0 [000 0000 – 111 1111] – n=8bits (0→127)

Class D →1110
Class E →1111

Class B 10 [00 0000 – 11 1111] n = 16 (128→191)

Class C 110 [0 0000 – 1 1111] n=24 (192→223)

→ Subneting (Prefix ل Sufix باخذ جزء من)

suberneting (Suffeix ل Prefix باخذ جزء من)

* we will learn:
① Total number of address in the network [network space]
② The first address in the network (network Id)
③ Last address

230 . 8 . 16 . 132 /16 ← Prefix Length # of network

① networspace → $2^{32-16} = 2^{16}$ address (#of address)

② First address → 230 . 8 . 0 . 0 /16
③ Last address → 230 . 8 . 255 . 255 /16

230 . 8 . 16 . 132 /26

① network space = 2^{32-26} = 64 address (#of address)
② First address = 230 . 8 . 16 . 1 0|00 0100 (network Id)
230 . 8 . 16 . 128 /26

③ Last address = 230 . 8 . 16 . 191 /26

23 . 30 . 67 . 92 /12 → 23 . [000] 1110 .
① network Space : $2^{32-12} = 2^{20}$
② First addres : 23 . 0001 0000 . 0 . 0 /12 → 23 . 16 . 0 . 0 /12
Last address : 23 . 0001 1111 . 255 . 255 /12 → 23 . 31 . 255 . 255 /12

Ex 18.1: 167 . 199 . 170 . 82 /27   82 = 010|1 0010

#of address → 2^{32-27}
= 32 address

first address network Id = 167 . 199 . 170 . 0100 0000 → 167 . 190 . 170 . 64 /27

Last address = 167 . 199 . 170 . 0101 1111 → 167 . 190 . 170 . 95 /27

mask address

Prefix bits — all ones — net

Sufix — all zero — Host

169 . 199 . 170 . 82 /27

255 . 255 . 255 . 1111 0000   mask
0101 0010

255 . 255 . 255 . 224

(not mask)
→ 255 . 255 . 255 . 0001 1111
0101 0010
0101 1111

→ First address [network Id] Anding → 169 . 199 . 170 . 0100 0000
169 . 199 . 170 . 64

→ Last address [host] → 169 . 199 . 170 . ~~1111 0010~~
169 . 199 . 170 . 95

Address space → NOT(mask) + 1 = 32 address

Example: 230 . 8 . 24 . 56 /16   0001|1000

(16) 230 . 8 . 0 . 0 → 230 . 8 . 255 . 255   * اذا كان suffix في 1 بكون host Lastaddress

(20) 230 . 8 . 16 . 0 → 230 . 8 . 31 . 255   * اذا كان zero فبكون network Id.

(26) 230 . 8 . 24 . 0 → 230 . 8 . 24 . 63

1000 address → $\log_2 1000$ ≈ 10   1024 address

Prefix Length → 32 − 10 = 22

18 . 14 . 12 . 0 /22 ← big #

Ex:18.5

14.24.74.0/24

Space address $= 2^{32-24} = 2^8 = 256$

Block
- 10 → 16
- 60 → 64 * we want start with biggest on
- 120 → 128 ① Find the new prefix length (Prefix the sub-block)

1 - Subnet 120 → 128

$32 - \log_2 128 = 25$

First: 14.24.74.0/25

Last: 14.24.74.127/25

2 - Subne 60 → 64

new Prefix $= 32 - \log_2 64 = \boxed{26}$

14.24.74.128/26 ← بلش من محل ما وقفت

First: 14.24.74.128/26 (Last وبجل عليه)

Last: 14 24.74.141/26

3 - Subnet 10 → 16

new prefix: $32 - \log_2 16 = 28$

first 14.24.74.192/28

Last 14.24.74.207/28

Examble of address aggregtion

160.70.14.255/24 requed SubBlock

Block1

$\log_2 4 = \boxed{2}$

Prefix بضيفهم ع الـ Prefix القديم

$24 + 2 = 26$ ← new Prefix

⓪ 160.70.14.0/26

First: 160.70.14.0/26

Last: 160.70.14.63/26 ← (زدنا 64)

Block2

① 160.70.14.64/26

160.70.14.64/26 (first)

160.70.14.127/26 (last)

Block3

② 160.70.14.128/26

160.70.14.128/26 (first)

160.70.14.191/26 (last)

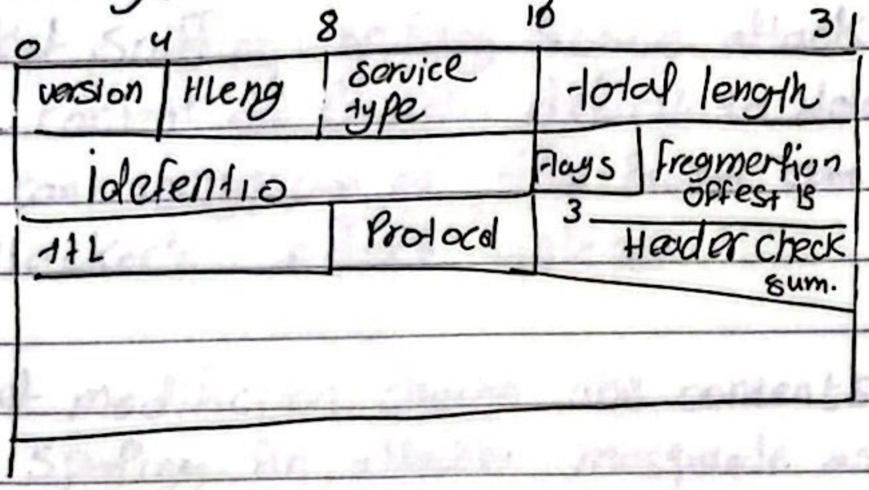
Block4

③ 160.70.14.192/26 (first)

160.70.14.255/26 (Last)

Ch19: network Layer Protocol.

IP datagram



→ ICMP 01
IGMP 02
TCP 06
UDP 17
OSPF 89

Ex:

1 → 4 3 → 12
2 → 8 4 → 16
5 → 20 6 → 24 7 → 28 8 → 32

Version He total

4|5|00|00 28|0001 0000|01|02

TTL Protocol.

version = 4

Headr length = 5×4 = 20

How many hops can can this Packet travel before → being dropped?

*

D → 1 not allowed 0 → fragment allowed
M → 1 not Last Packt 0 → last Packet

Security Sniffing

① Packet Sniffing: sniffing Passive attack doen't change the content of Packet. defuclt to detect
we can encryptoion of the Packet can make the attacker's effort unless

② Packet modifiction: change the contents. attac can detected.
③ IP spofing: An attacker masqurade as Someboady bank

ICMP v4:

Ch 20

Unicast Routing

Routing Algorthim →

1 – distance Vector: is the rationale for the name distance vector routing. A least cost tree is a combination of least-cost Path.
each node send what it Know about the whole internet to it's neighbour.
we use Bellman-Ford equation: to find shortest distance between source

$$D_{xy} = \min\{d_{xy}, C_{xz} + D_{zy}\}$$

But we have a proplem: count to infity → Tow node instability

* we have tow Soltution:

① Split Horizon: بخلي Entry فاضية بس فيها مشكلة اذا تجاوزنا Timmer بصير ∞ unreachable

② Poison Reverse: بخلي Entry الـ A بعدل vector محطوط فيها ∞

2- link State Routing: it is send as A information to all whole internet (floading) → Link State Data Base (LSDB)
we use Dijkstra Algorthim → Shortest Path

3- Path Vector Routing: Best Path with Policy.
Each node send what it Know about the whole internet to it's neighbour. X[ ] = Best [X( ), X + y[ ]] ✓

unicast Routing Protocols:

Protocol ISP
- → Intersion, intradomain, intra A.S (RIP, OSPs) within.
- → Extersion, interdomain, inter A.S (BGP) between

Autonomous System: ISP → A.S → self managment
we cannot use sigle Protocol: adminstritve, Scalabity.
1- Stub A.S: has only one connection to another As (Coustemr network)
2- multihomed A.S: can have more than one connection to athoer As. but doesn't allow data to traffic to throug it (Provider network)
3- Transient As: connect to more than one other As also allows the traffic to Pass through it (Backbone).

[I] RIP Protocol: Routing information Protocol
hop cout = # of Router from Source Router to host destention. depend forwording table.
implemmentd: use UDP L4 demon Process (Running in background). (abbreviation for route demon and Prononced Route dee)

Timer in RIP:
1- Periodic timer: 25 → 35 S — * منع يبعتو مع بعض
2- expiration time: 180 S بكون في مشكلة — اذا ما وصل اشي لبعد 180
3- garbage collison timer: 120 S

Performance:
update message: Local Simple
convergance: RIP used distance vector (16 considerd infinty)
Roubustness: if there is a failure or Corruption in one router then it will be affected for all router.

(Dijkstra Algo).

[2] metric in OSPF: layer 3 we caluclate from source Router to host destention OSPF that diffrent (tos)

* the same A.S with RIP

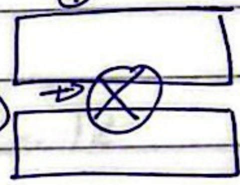
1- N1 = 5 + 3 + 4 = 12

2- N2 = 3+4 = 7

3- N3 = 4 cost

RIP and OSPF the reason for this consistency is that both Protocol use shortest Path tress to define best Route from Source to destion

Areas: we need to divided into Small Area to prevent the volume of traffin in a huge Large A.S. and we need Areao Backbone for gluing area togther ① and we have Area Border Router → ②



Performance:

① update: complex format

② Convergance of forwording taple: quicly

③ Robustness: better than RIP.

③ BGP: Border Gateway Protocol only interconnection using in internet today — BGP

BGP peers or BGP Speekrs

- eBGP — external
- iBGP — internal — $\frac{n(n-1)}{2}$