Link state routing

- flooding → all routers have network graph
- in routers, find shortest path to dest via shortest path graph algo.
  - Djkshtra's algo
  - Create ~~forwarding~~ shortest path tree
  - create forwarding table *

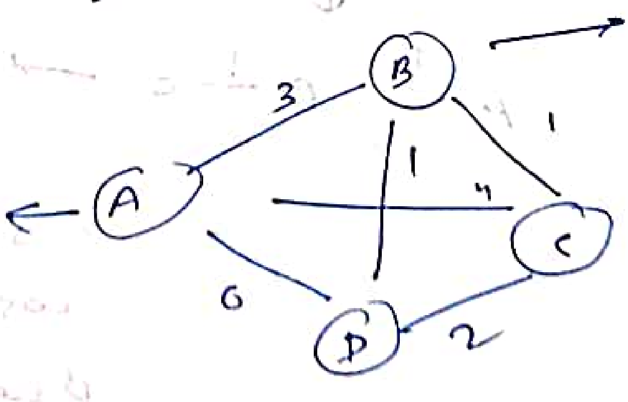
optimal substructure: Path (a, b, c, d) is optimal, then each of P(a, b, c) or P(b, c, d, etc is also optimal.

issues: time complexicity
oscilation

Distance vector routing

- Belman ford
- not flooding, only nodes give ~~graph~~ distance vec. to adj.

$$\begin{array}{c c} A & \\ B & \\ C & \\ D & \end{array}\begin{bmatrix} 0 \\ 3 \\ 4 \\ 0 \end{bmatrix} \leftarrow$$



$$\begin{bmatrix} 3 \\ 0 \\ 1 \\ 1 \end{bmatrix}\begin{array}{c} A \\ B \\ C \\ D \end{array}$$

— share to neighbour → B give to A

A form new ~~m~~ dist vect.

$$
\underbrace{\overset{\text{old}}{\begin{bmatrix} 0 \\ 3 \\ 4 \\ 6 \end{bmatrix}} \longleftrightarrow \begin{bmatrix} 3+3 \\ 0+3 \\ 1+3 \\ 1+3 \end{bmatrix}}
$$

↓ update for min

$$
\begin{array}{c|l} 0 & A \\ 3 & B \\ 4 & C \\ \underline{\underline{4}} & B \text{ (not } D) \end{array}
$$

← updated at A

lly A will update for C as well

this is round 2 of updation. (immediate neighbours)

DV: link cost changes

$A \xrightarrow{\;3\;} B \xrightarrow{\;1\;} C$ → path to A in 4 cost

↓

$A \xrightarrow{\;1\;} B \xrightarrow{\;1\;} C$ → B tells him in cost 2, update

reverse: if C tells cost 4 by B tells, B wont update ~~as~~

$A \xrightarrow{3} B \xrightarrow{1} C$ → way to A in 4

↓ ↓

$A \xrightarrow{\infty} B \xrightarrow{1} C$ → way to A in 4

if now C tells this to B
B update path to A
as B → C — A cost 5

But C's path to A itself
was based on B so,
this path is fake

poisoned back request.

C has path to A via B
so C won't tell B path via A.

DATA LINK LAYER → NIC card & OS kernell

Medium access protocol

↓

Shared media → to coordinate

multiple ppl access

↓

when m need → · Decentralised

· 1 user → use full

· m user → B/m each

· simple

* ALOHA, IBL, wireless

ethernet → CSMA/CD or CSMA/CA

MAC

- channel partitioning (TDMA, FDMA)
- Random access

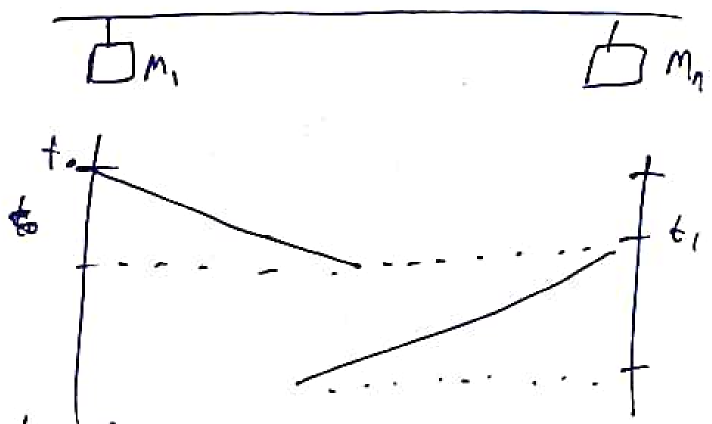
↓

detect collision

recover

CSMA collisions

when distance long, cant detect ideality of chanel cant be determined, transmission time



wifi → no detection possible → CSMA/CA

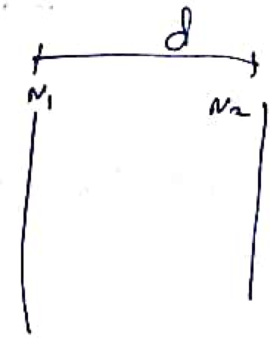
wired → possible → collision → voltage fluctuation (interference) / CSMA CD

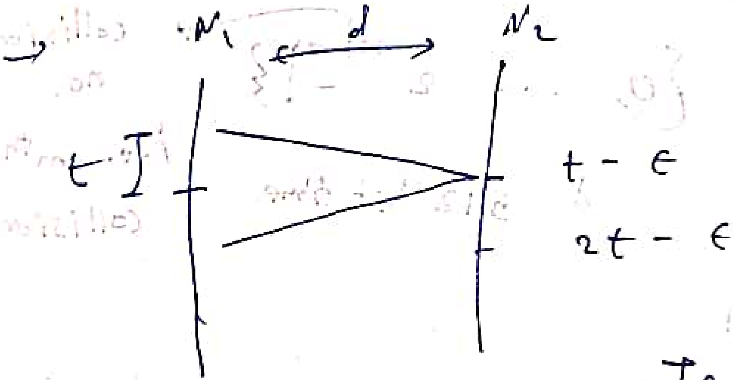
CSMA/CA * imp

- send

CSMA/CD

Q. find min. frame length to detect collision





$T_{fram} \geq 2 T_{prop}$

* why ethernet has no length field

probablistic → choose one of {0, 1} if 0 → stop
1 → send

Stop for 512 sec → bit time → for 10 bit ethernet
(* imp why?)

*

probablity of clash 1st time → $\frac{1}{2}$, n^{th} time → $\left(\frac{1}{2}\right)^n$

- each NIC card / adapter has MAC or LAN adress
- 48 bit

$2T_{prop}$ or RTT $\leq$ T_{frame} → clash detection

time wait : $\{0, \ldots 2^{m}-1\}$ → collision no. i.e. m^{th} collision it is

$\times$ 512 bit time

1	0, 1
2	0, 1, 2, 3
3	0, ... 7
4	0, ... $2^4 - 1$
⋮	⋮
10	0, ... $2^{10} - 1$
11	0, ... $2^{11} - 1$ → max is 10, fix after it

* ~~Sloted~~ ~~pure~~ pure ALOHA → whenever have paket → send

system transmitting → prob. p

* sloted ALOHA :

prob. $P($ i succed without clash $) = p(1-p)^{N-1}$

↓

$U =$ Prob (all succeed) $= N \times p(1-p)^{N-1}$

$$\frac{dU}{dp} = N\left(\left(1-p\right)^{N-1} - p(N-1)(1-p)^{N-1}\right\} = 0$$

$$\Rightarrow (1-p)^{N-1} = p(N-1)(1-p)^{N-2}$$

$$\Rightarrow \quad p = \frac{1}{N}$$

for N users, U is max for each system transmit with $1/N$ prob.

U is prob. of all succeed or utilisation or efficiency

for Large value of N, $U = Np(1-p)^{N-1}$

$p = 1/n$

$= \left(1 - \frac{1}{N}\right)^{N-1}$

↓ $N \to \infty$

$U = \frac{1}{e}$ at best

so 0.37 or 37% ← $U = \frac{1}{e}$ (Taylor series) gateway ?!

ARP

MAC of same LAN known, direct send

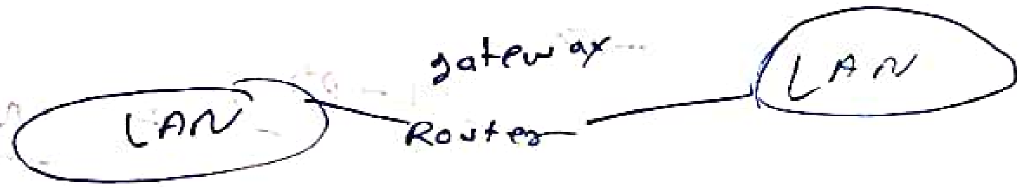
IP_A + mask = net ID_A

IP_B + mask = net ID_B } → if same, flood in LAN network

↓ not

give to gateway router

to get mac : ARP protocol

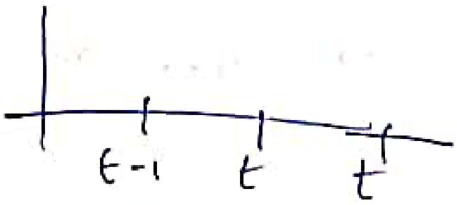


ARP :

my IP	dest IP
my MAC	fff...

← ethernet frame

Q 20 machin, 8 port, 3 switch, draw network digram pure (unsloted) aloha



P(success by given node = $p(1-p)^{2(N-1)}$

* paket length fix for ~~ALOHA~~

$$U = Np(1-p)^{2(N-1)}$$

$$du/dp = N(1-p)^{2(N-1)} - p \cdot \frac{N(p-1)^{2N-3} \cdot N}{N-1} = 0$$

$$\rightarrow \cancel{(1-p)} - 1 + \frac{N(p-1)^{-1}}{N-1} = 0$$

$$\frac{1}{p-1} = \frac{1-N}{-N}$$

$$p = \frac{-N}{1-N} + 1$$

$$= \frac{1-2N}{1-N}$$