Acce

$\boxed{2 \text{ min}}$

Access control methods

$\boxed{2 \text{ min}}$

$\boxed{\text{No Study}}$

classes will

cover everythi

doubts → will start

Today or tomorrow

Yaswanth Kanethkar ???

"let us C" → most popular book for 'c' in the world

'C' → $\boxed{\text{God of C}}$

$\boxed{\text{C programming}}$

Do you want to meet him?

Do you want him to teach 'C pro' in gate live

Gate DA

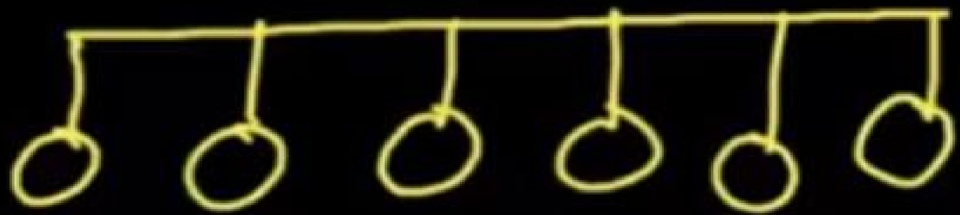
$\boxed{\text{Python.}}$

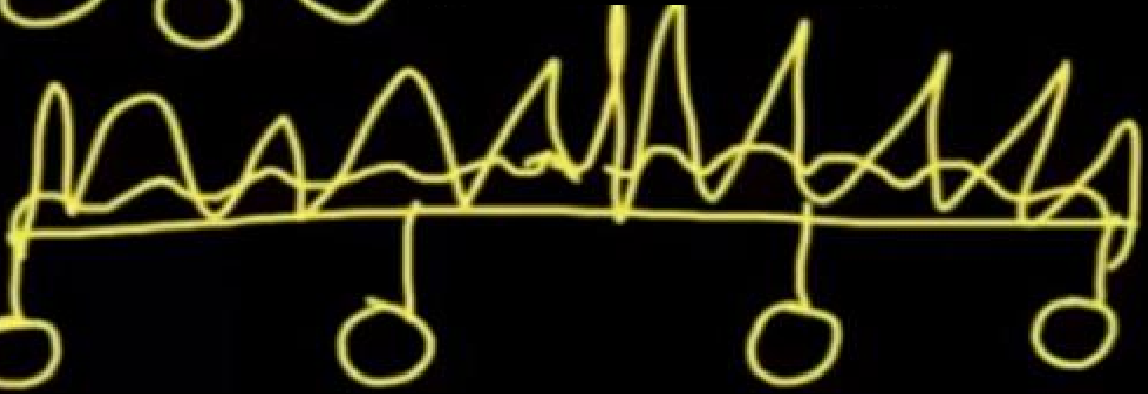
$\boxed{\text{Friend}}$ → $\boxed{\text{close friend}}$ → $\boxed{\text{60's}}$

Access Control methods (1-2) marks

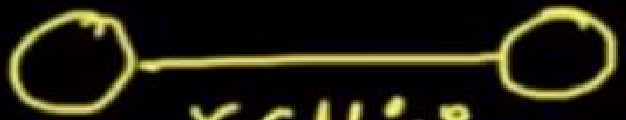
links

Broadcast links.





Point to point

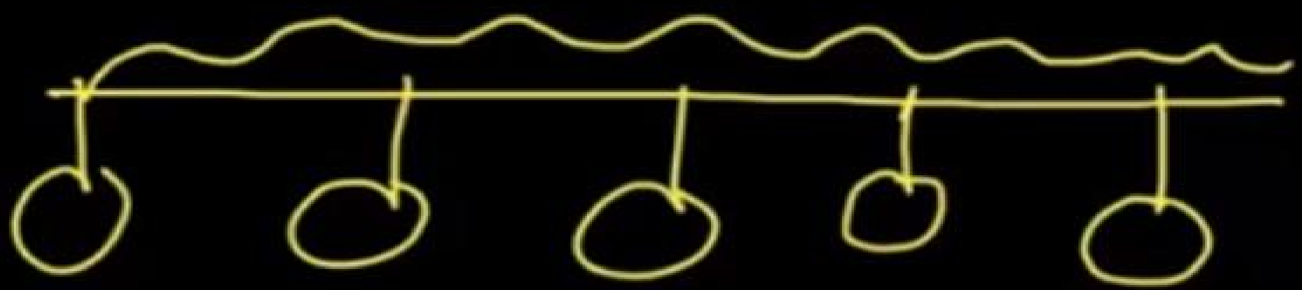


× collisions

? full duplex link

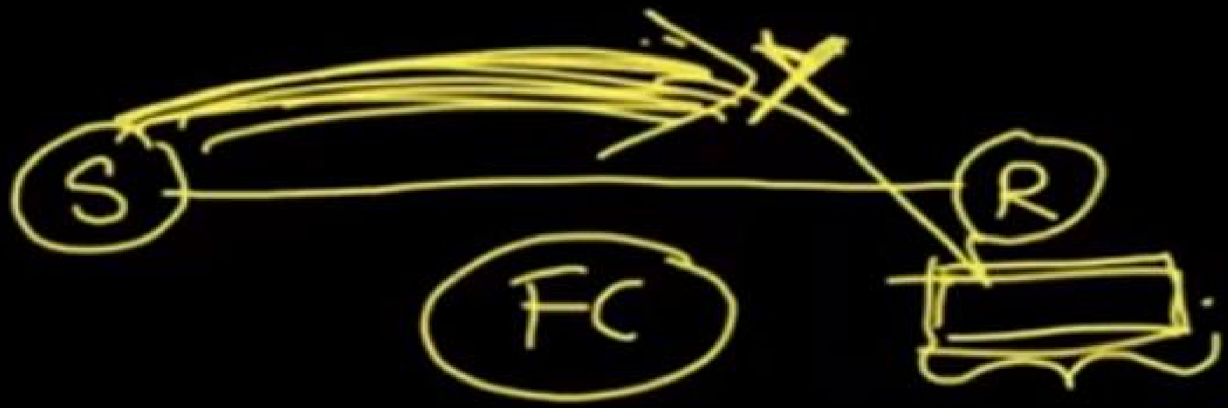
- 2 stations can transm

AC:



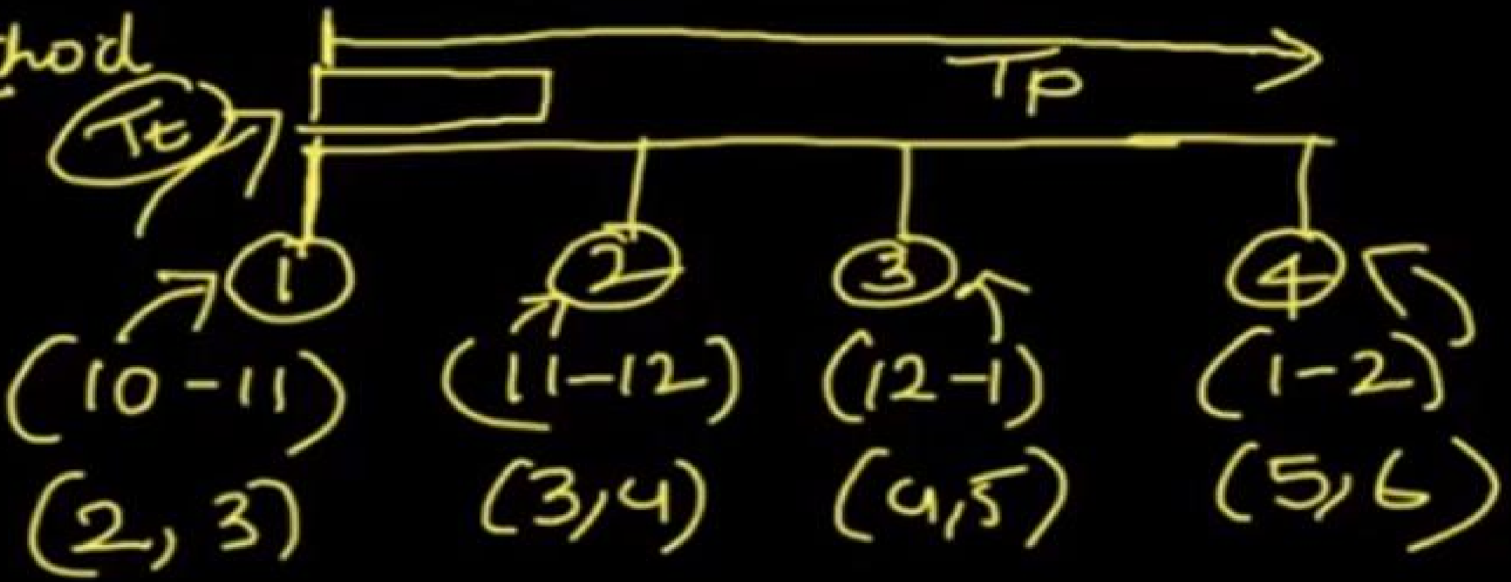
Allowing only one station at a time

Flow control:

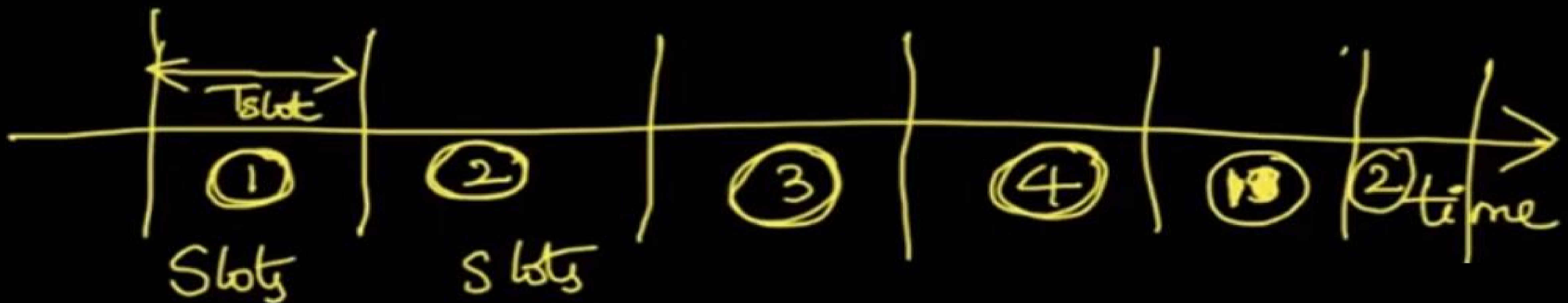


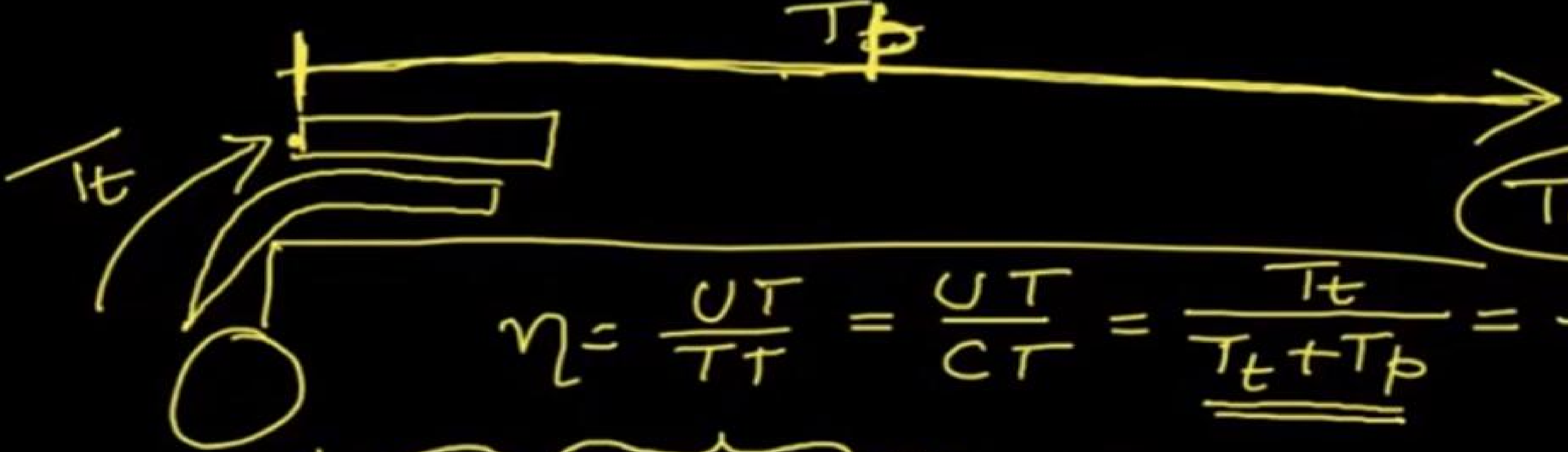
I AC method

TDM



Tslot ?





$T_p \rightarrow$ Prop

$$\eta = \frac{UT}{TT} = \frac{UT}{CT} = \frac{T_t}{T_t + T_p} = \frac{1}{1+a}$$

cycle $\rightarrow$ repeat

$L \rightarrow$ same

assumption is all host have same T_t

$T_t = 1ms$, $T_p = 1ms$, TDM $\eta = \underline{\ \ } 50\%$

$BW = \boxed{4\ mbps} \longrightarrow$ Throughput = ____ ?

$Th = BW \times \eta = 4 \times 0.5 = \boxed{2\ mbps}$

→ one station requires $\boxed{2\ kbps}$, then max no of statitions that can be connected to above N/w?

A. BW & Th & effective $BW = 2 \times 10^6\ bps$

$N \times 2 \times 10^3\ bps = 2 \times 10^6\ bps$

$\boxed{N = 1000}$

BW

m - 10^6

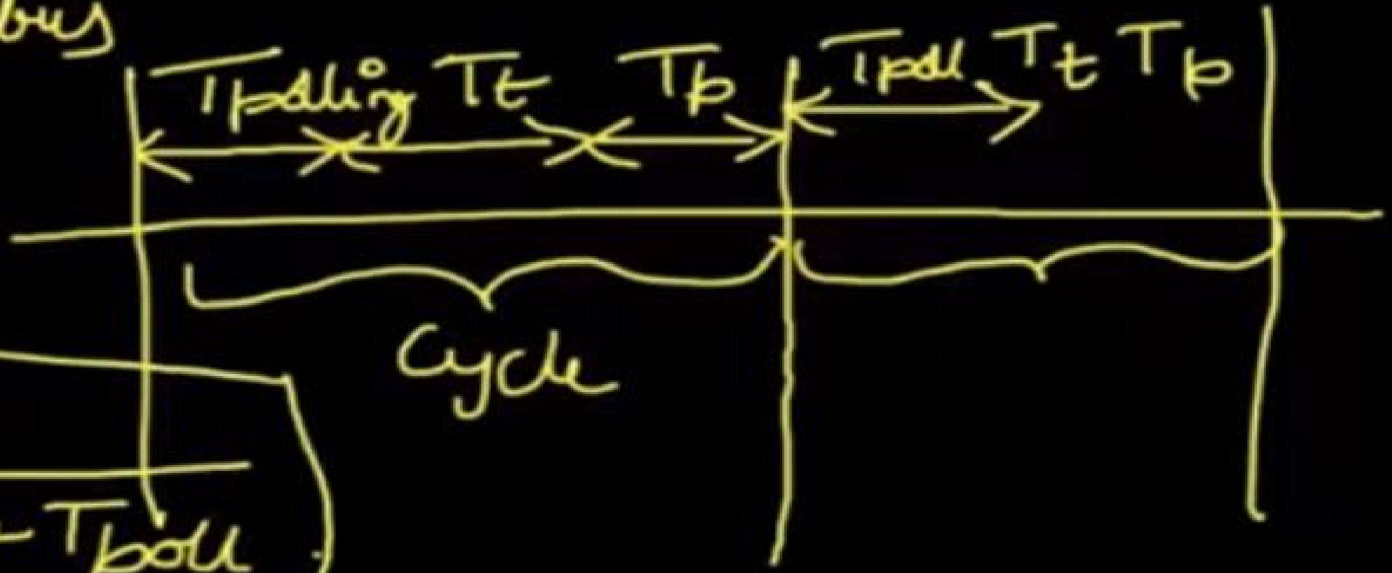
K - 10^3

Disadvantage of TDM

Polling: Polling algo will be used to determine who sends data next. → not in syllabus

But η is in syllabus

$\boxed{\text{NO gate questions.}}$



$$\boxed{\eta = \frac{UT}{CT} = \frac{T_t}{T_t + T_p + T_{poll}}}$$

If $T_t = T_p = T_{poll} = 1ms$; $\eta = 33\%$

33.33%

always 1 question ← CSMA/CD → most important

Carrier Sensing

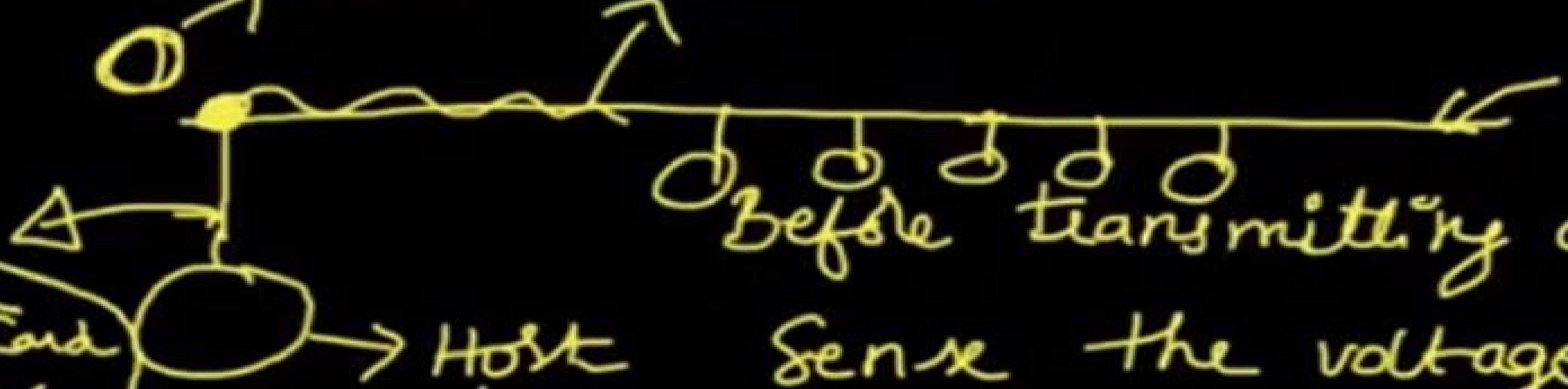
multiple Access

Collision Detection

CS:

Nodata

channel



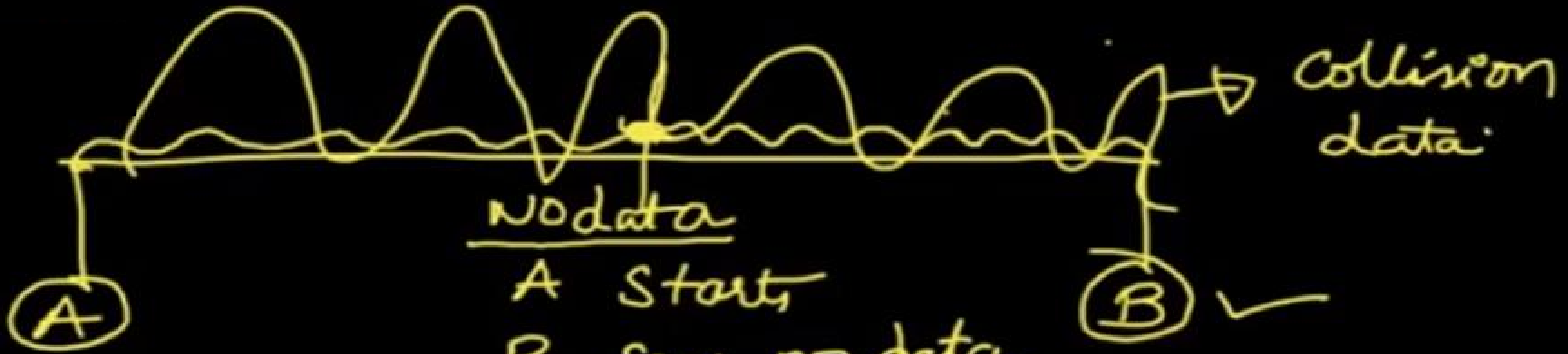
NIC

N/W Interface Card

Host

Before transmitting data

Sense the voltage.

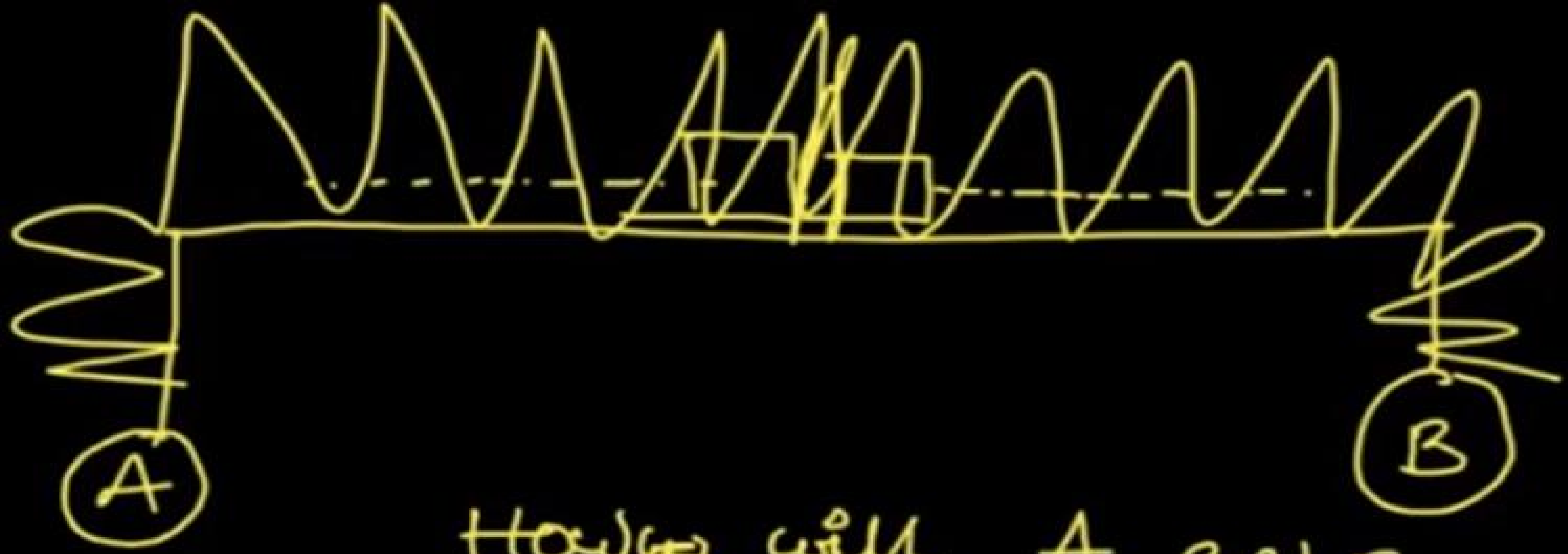


A Starts

B sees no data

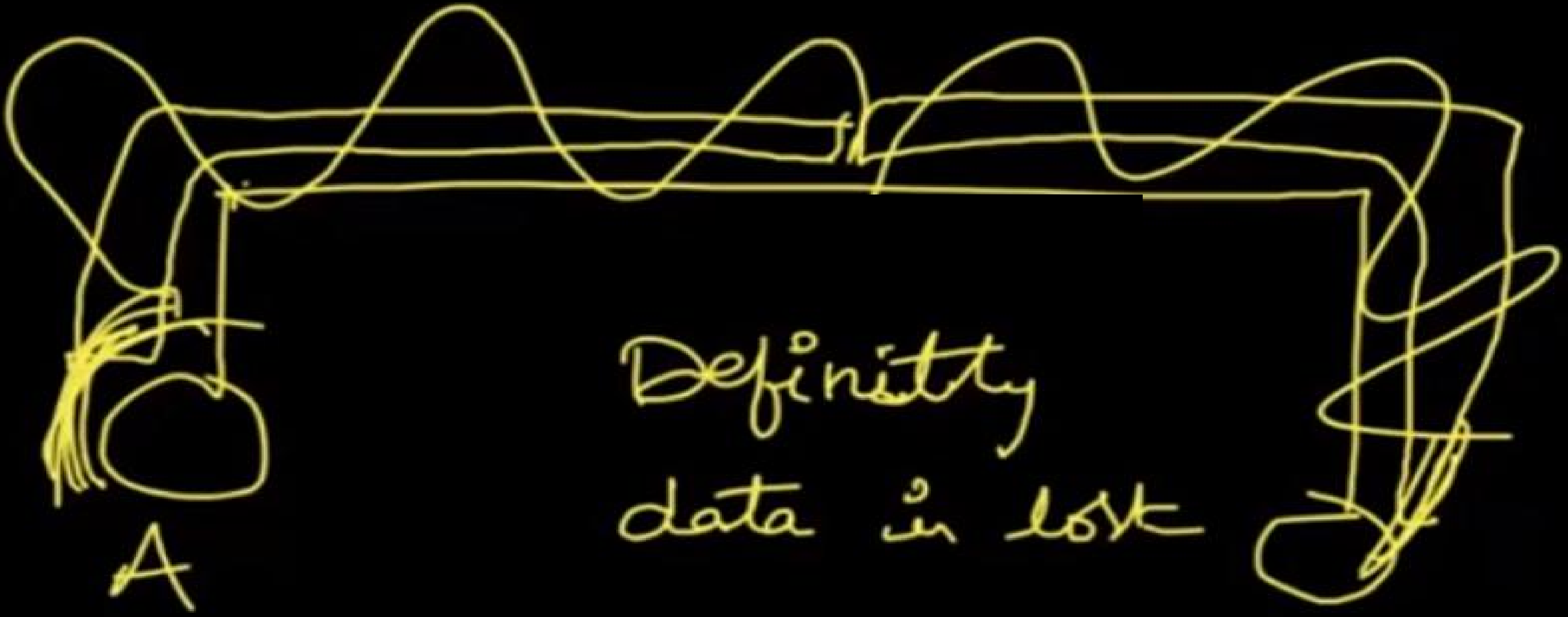
B starts

Collision happens → ? detect your data is lost.

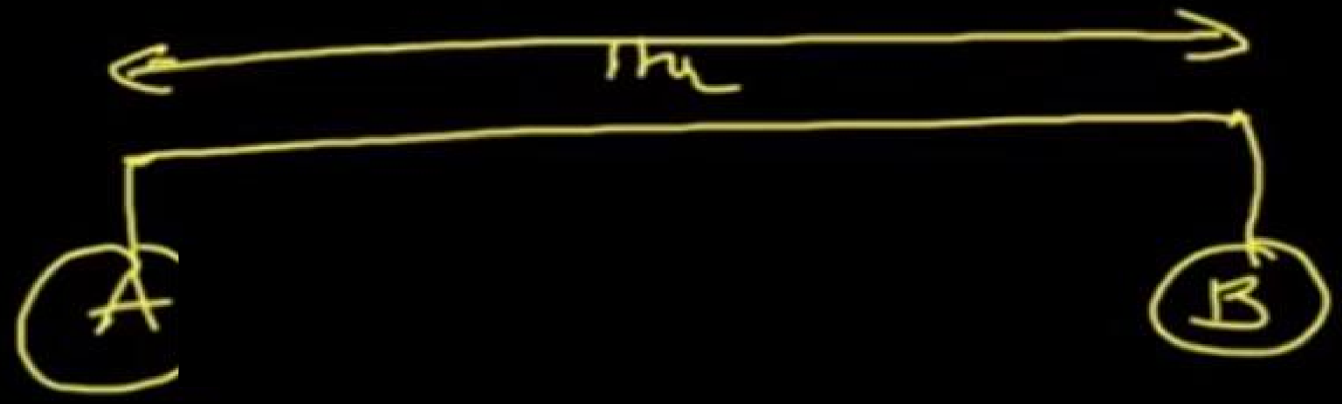


How will A and B know that its own data is lost.

A is transmitting the data, while transmitting if A gets collision signal, then A's packet is lost



while transmitting, if we get the collision then data is lost



$T_p = 1\,hr$

At $t = 10:00$ am, A, B starts trans

At $t = 10:30$ am, → collision

At what time, will A, B → see collision

11:00 am

So → In this case → how long did it take from beginning till collision signal – 1hr

$\boxed{\text{Total} = 1 \text{ hour}}$

Worst Case:

$T_p = 1\,hr$

At 10:00 am → A starts

At 10:59:59:59 → B start

At ? → A will see coll → 12:00 → 2 hours

Collision signal → at ~~after~~ $\boxed{2*T_p}$ ✓

$$\boxed{T_t \geq 2*T_p}$$ ✓

Ethernet $\rightarrow$ CSMA/CD

min packet length

$$T_t \geq 2 * T_p.$$

$$\frac{L}{B} \geq 2 * T_p$$

$$\Rightarrow \boxed{L \geq 2 * T_p * B}$$

$\boxed{T_p = 1\,mS, \quad B = 4\ mbps}$ L_{min} in CSMA/CD

$$L = 2 * 1 * 10^{-3} * 4 * 10^{6} = 8000\ b$$
$$= \underline{1000\ B}.$$

In CSMA/CD → at least $\boxed{1000\ B}$ in this example

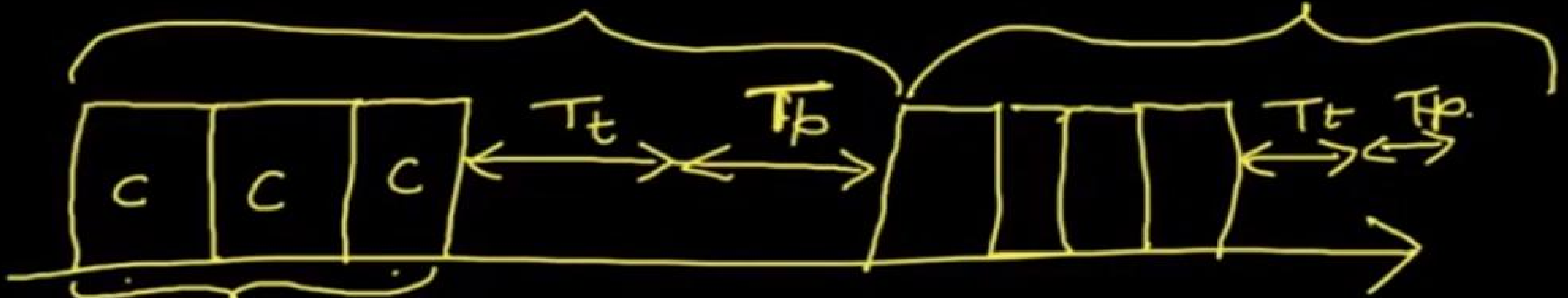
? $\underbrace{900B}_{D.}$ + $\underbrace{100\ \text{Dummy}}_{\text{Padding}}$

Break

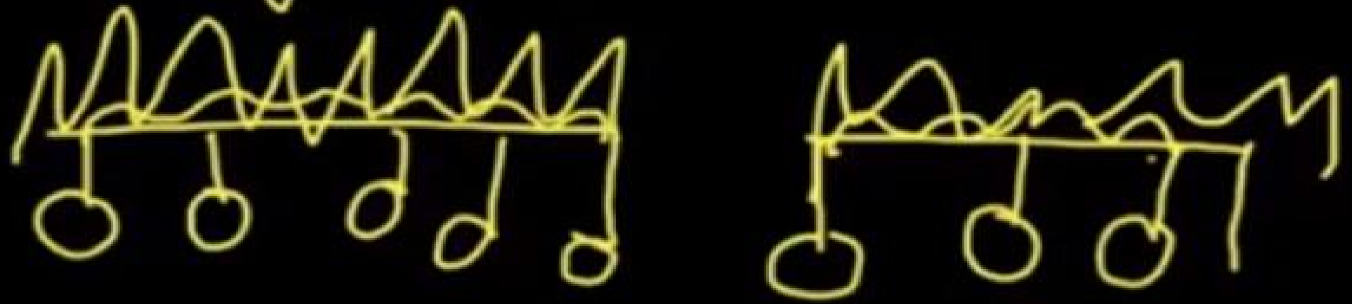
(5 min)

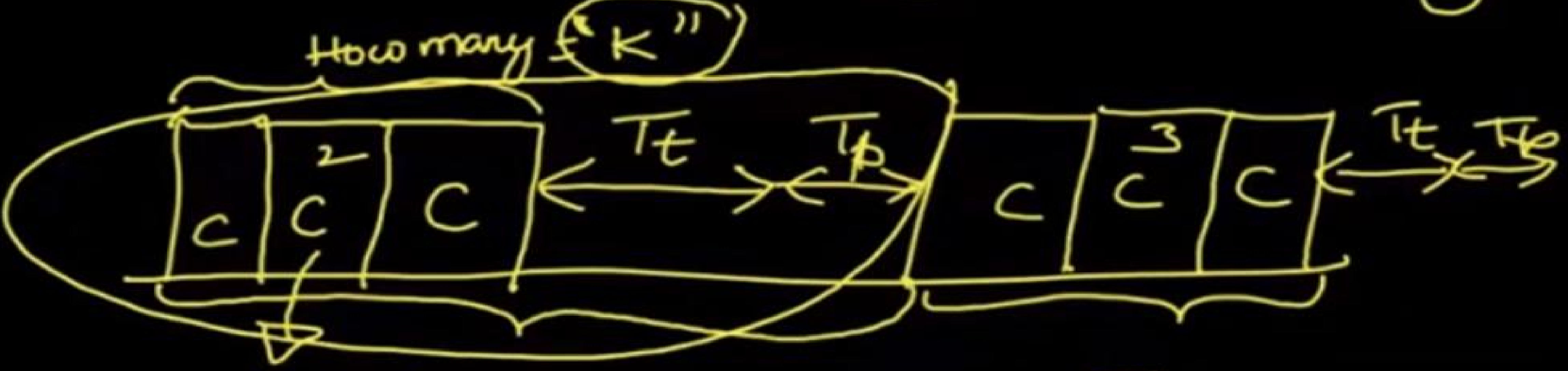
Efficiency of CSMA/CD:

Difficult to get formula directly.



how many → dont know





worst case time

$= 2 * T_p$

$$\eta = \frac{T_t}{K * 2 * T_p + T_t + T_p}$$

K

Probabilistic analysis to find 'K':

1) Let there be n stations, 'p' be the "prob" with which a station wants to send data.

0.1 10%

2) Prob for successful transmission

$$\left({}^{n}C_{1} * p^{1} * (1-p)^{n-1} \right) = P_{success}$$

$$P_{success} = {}^{n}C_{1} * p * (1-p)^{n-1}$$

$f(x)$

$f(x) \rightarrow \max$

$f(x) \rightarrow \max$

$$\frac{d}{dx} f(x) = 0$$

$x = \square$ ✓

$$\boxed{\frac{d}{dx}\left(f(x)\right) = 0}$$

$\rightarrow x = \square$ ✓

$$\cancel{\boxed{\frac{d^2}{dx^2} < 0}}$$

$$\boxed{P_{success}} = \boxed{{}^{n}C_{1} * p * (1-p)^{n-1}}$$

max:

$$\frac{dP_{success}}{dp} = 0 \Rightarrow p = 1/n \qquad p \to 1/n$$

$$P_{max} = n * \frac{1}{n} * \left(1 - \frac{1}{n}\right)^{n-1} = \left(1 - \frac{1}{n}\right)^{n-1}$$

Imagine there are large number of stations

$$\lim_{n \to \infty} P_{max} = \boxed{\lim_{n \to \infty} (1 - 1/n)^{n-1} = 1/e}$$

If 'p' is prob of getting a head then how many times should I toss b4 getting first head → poission distribut. - 1/p

0.1

10

e time try → e collisions

$$\eta = \frac{1}{e * 2 * T_p + T_t + T_p}$$

$$\eta = \frac{1}{1 + 6.44a}$$

$$\left(a = \frac{T_p}{T_t}\right)$$

$$\frac{1}{1 + 6.44 \times d \times \frac{B}{L}}$$

$\eta \downarrow$ ✓ $\eta \downarrow$

$L \uparrow$ $\eta \uparrow$

$d \uparrow$ $\eta \downarrow$ $\rightarrow$ WAN ✗

LAN ✓

$L \uparrow$ $\eta \uparrow$ $\rightarrow$ long ✓

small ✗

$B \uparrow$ $\eta \downarrow$ $\rightarrow$ low BW ✓

High BW ✗

Back off algolithm : (exponential Back off algolithm

5 min bleak

Back off algorithm:

Sub 0 - 10

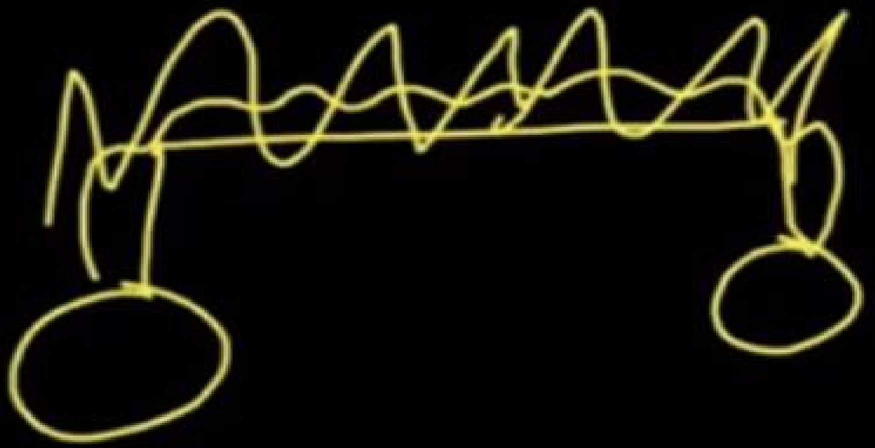
5

6

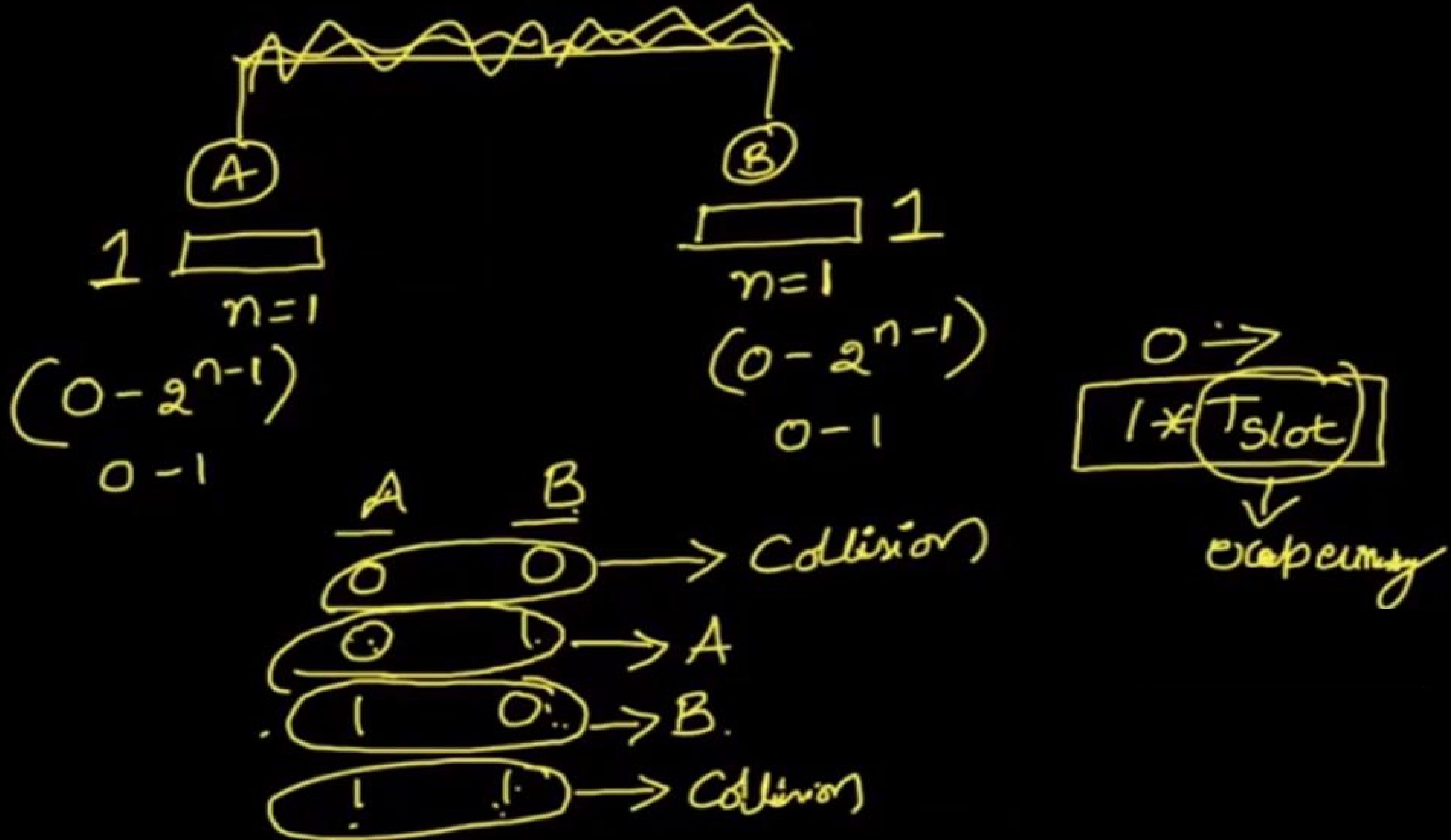
0 - 10 GF

2 → gf

8 → Shubam



$\boxed{\text{waiting time}}$ → Station should send.



A
B
1
n=1
(0 - 2^n-1)
0 - 1
0 → 1 * T slot
A B
0 0 → Collision
0 1 → A
1 0 → B
1 1 → Collision

$n = 1$ $\quad$ $n = 1$

$(0 - 2^n - 1)$ $\quad$ $(0 - 2^n - 1)$

$0, 1$ $\quad$ $0, 1$

$0, 1$

$WT_A = 0$ ✓

$WT_B = 1 * T_{sbt}$

A	B	
0	0	— C
0	1	
1	0	
1	1	

$n = 1$ | $n = 1$

$(0 - 2^n - 1)$ | $(0 - 2^n - 1)$

0, 1 | 0, 1

0, 1

$WT_A = 0$

$WT_B = 1 * T_{slot}$

all cases possible

A	B	
0	0	C
0	1	A
1	0	B
1	1	C

$WT_A = 1 * T_{slot}$ ✓

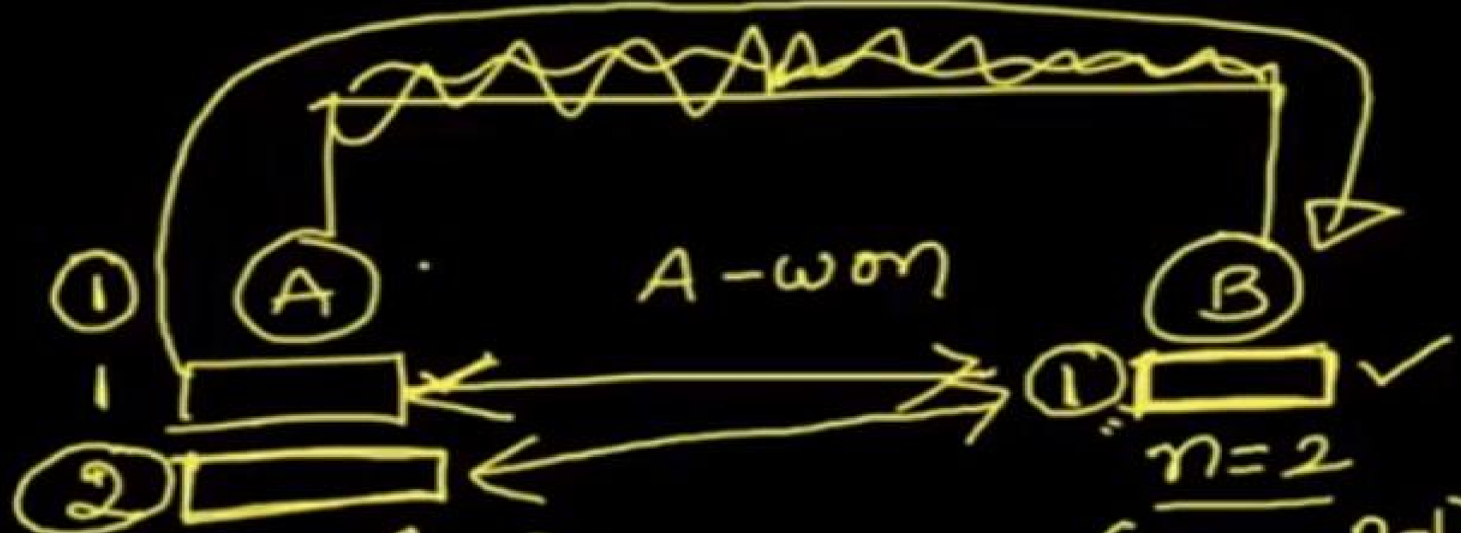
$WT_B = 1 * T_{slot}$ ✓

Ater one collision

$P(C) = 2/4$

$P(A) = 1/4$

$P(B) = 1/4.$



$n=2$

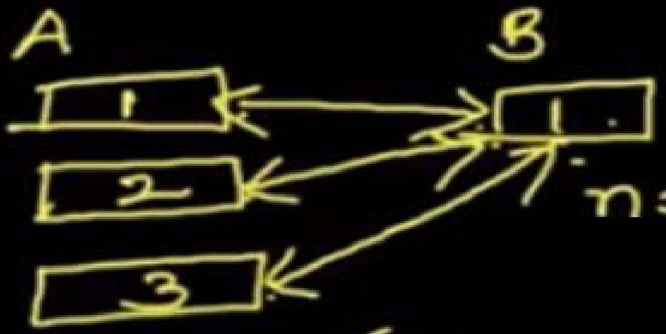
$(0-2^{n-1}) = (0,1,2,3)$

$n=1\ (0,1)$

A	B	
0	0	C
0	1	A
0	2	A
0	3	A

A	B	
1	0	B
1	1	C
1	2	A
1	3	A

$$\boxed{\begin{aligned} P(A) &= 5/8 \\ P(B) &= 1/8 \\ P(C) &= 2/8 \end{aligned}}$$



$n = 3 - (0,1,2,3,4,5,6,7)$

$(2^3 - 1)$

$P(C) =$
$P(A) =$
$P(B) =$

$n = 1 - (0,1)$

A	B	
0	0	— C
0	1	
0	2	
0	3	
0	4	
0	5	
0	6	
0	7	

A	B	
1	0	— B
1	1	— C
1	2	
1	3	
1	4	
1	5	
1	6	
1	7	

$$\boxed{\begin{aligned} P(A) &= 13/16 \\ P(B) &= 1/16 \\ P(C) &= 2/16 \end{aligned}} = 1/8 = 12.$$

Binary exponential backoff algo

disadv:

$P(A) = 1/4 \rightarrow 5/8 \rightarrow 13/16$ ↑ Capture effect → bad.

$P(B) = 1/4 \rightarrow 1/8 \rightarrow 1/16$ ↓ → bad.

$P(C) = 1/4 \rightarrow 2/8 \rightarrow 2/16$. → exponential decrease → good.

2 stations

Aloha: → once asked in gate $(\underbrace{\text{CN, TOC}}_{\text{vast subjects}})$

→

TOC → ∞ theories.

→ challenging to teach.

∞ problems → finite problems

TOC

possible

these

8-12

TOC

8-12

~~Aloha~~: Pure aloha:

→ Any station can send data anytime.

→ Collisions are possible

→ Acknowledgements are present (No need of collision detection)

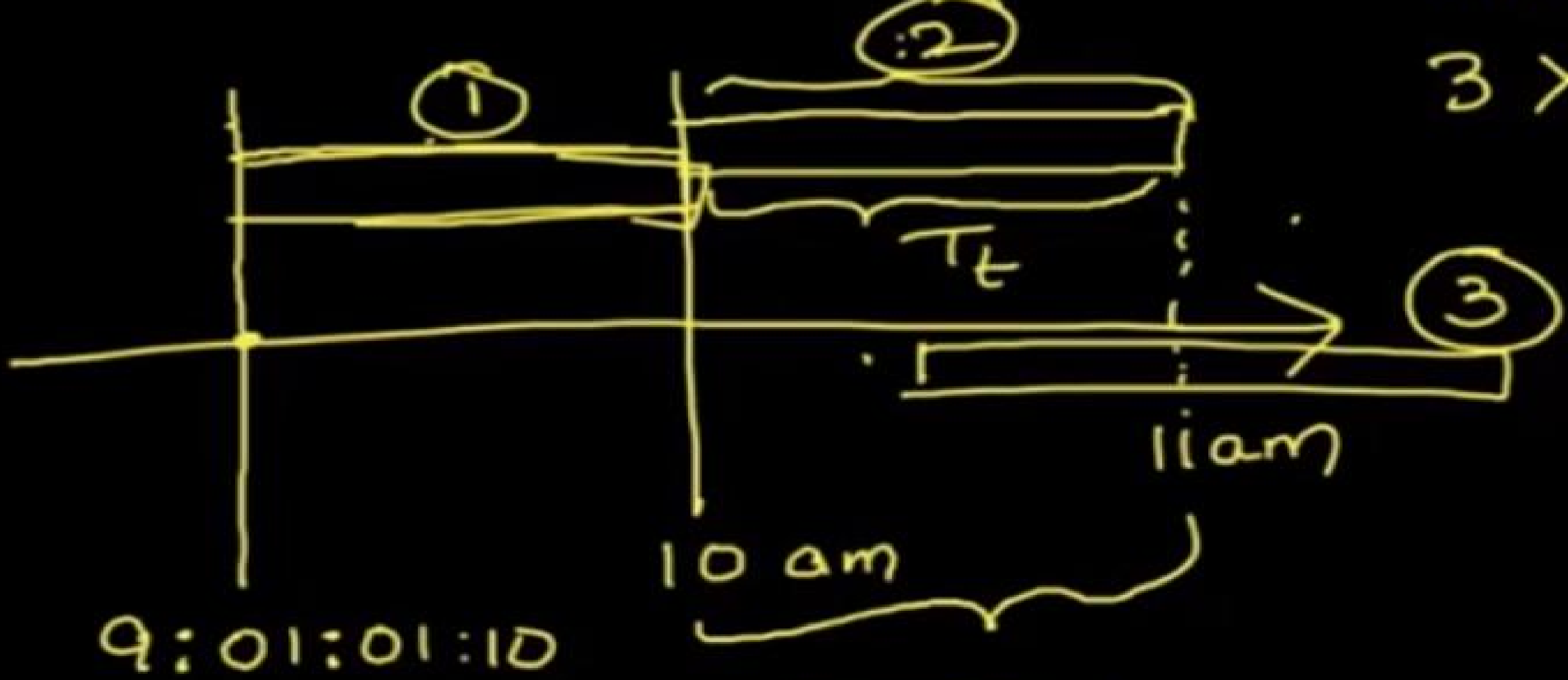
CSMA/CD → NO ACK → Collision detect.

→ Retransmit the packet that is lost.

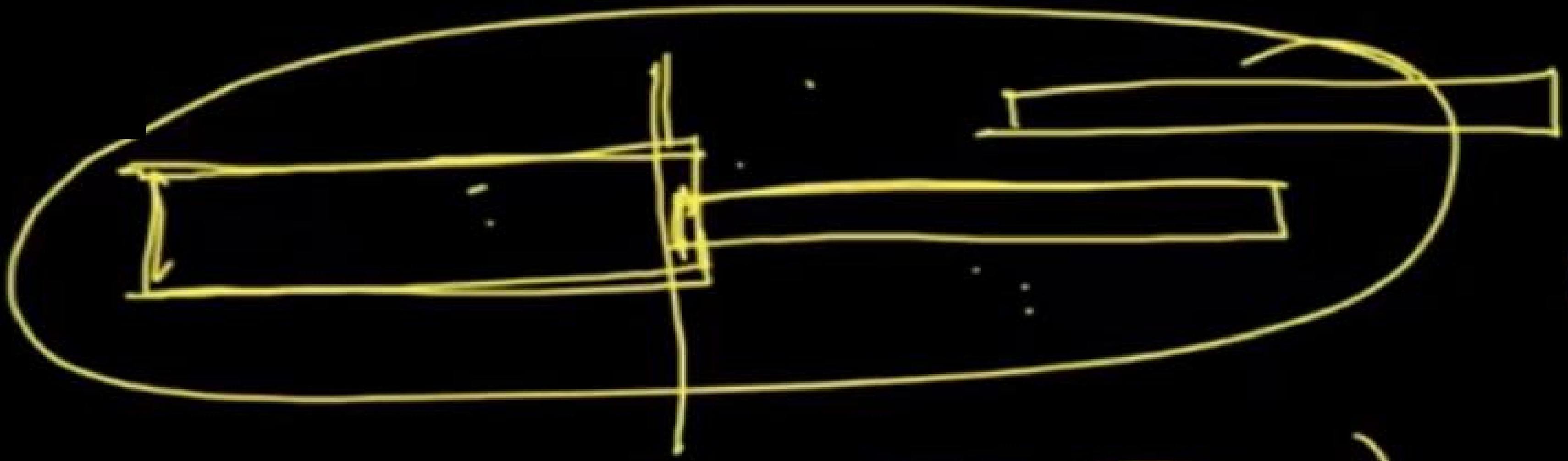
$T_t = 1\,hr \quad T_p = 0$

1×2

3×2



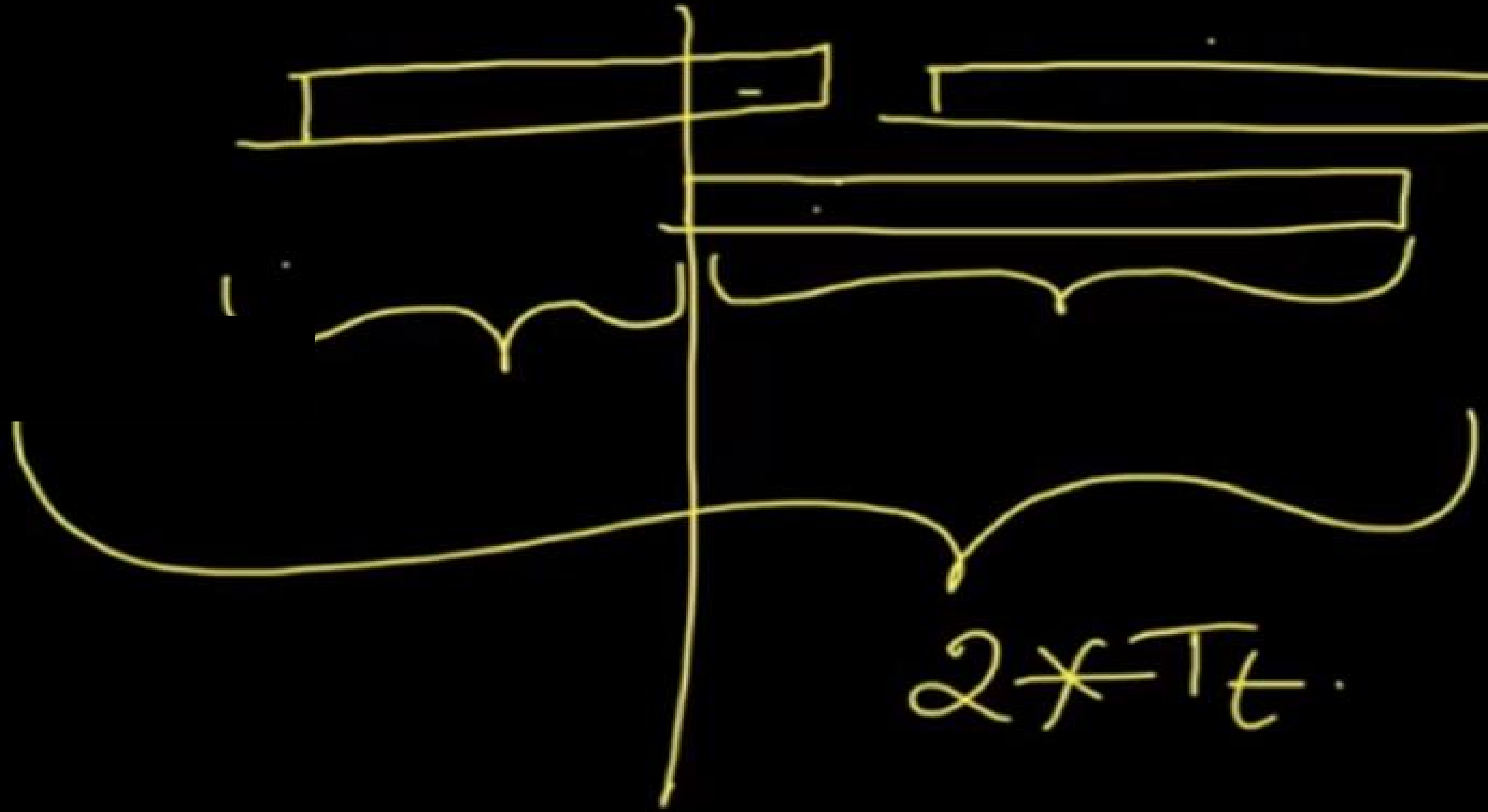
$9 - 10$



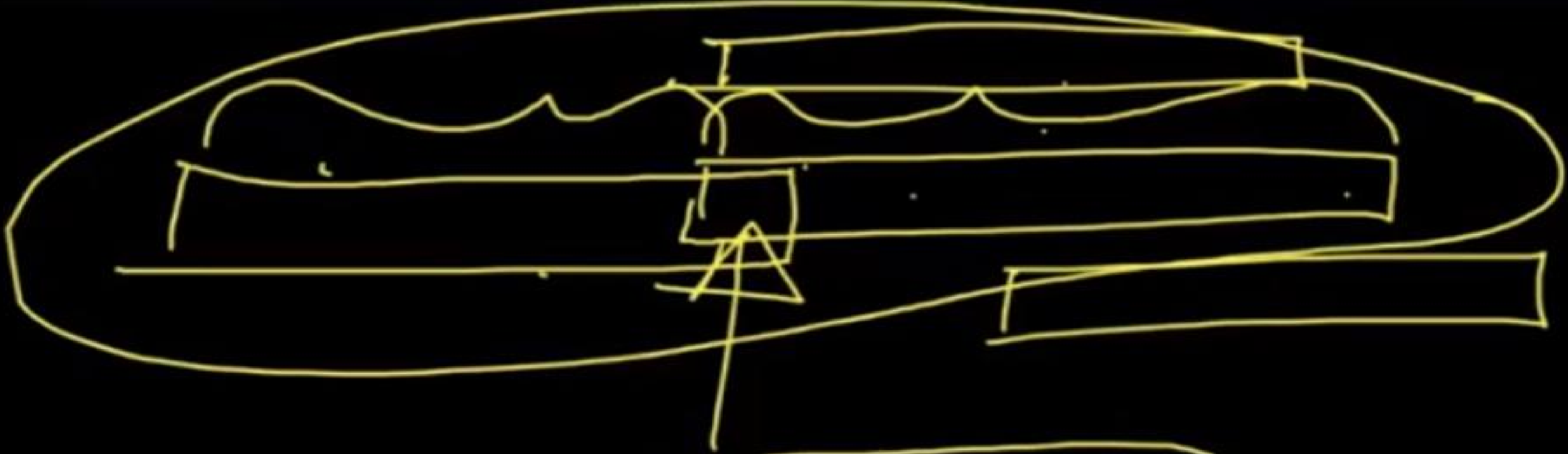
CSMA/CD

Collision

Vulnerable Time = $2 * T_{tt}$


2*Tt


2*Tt

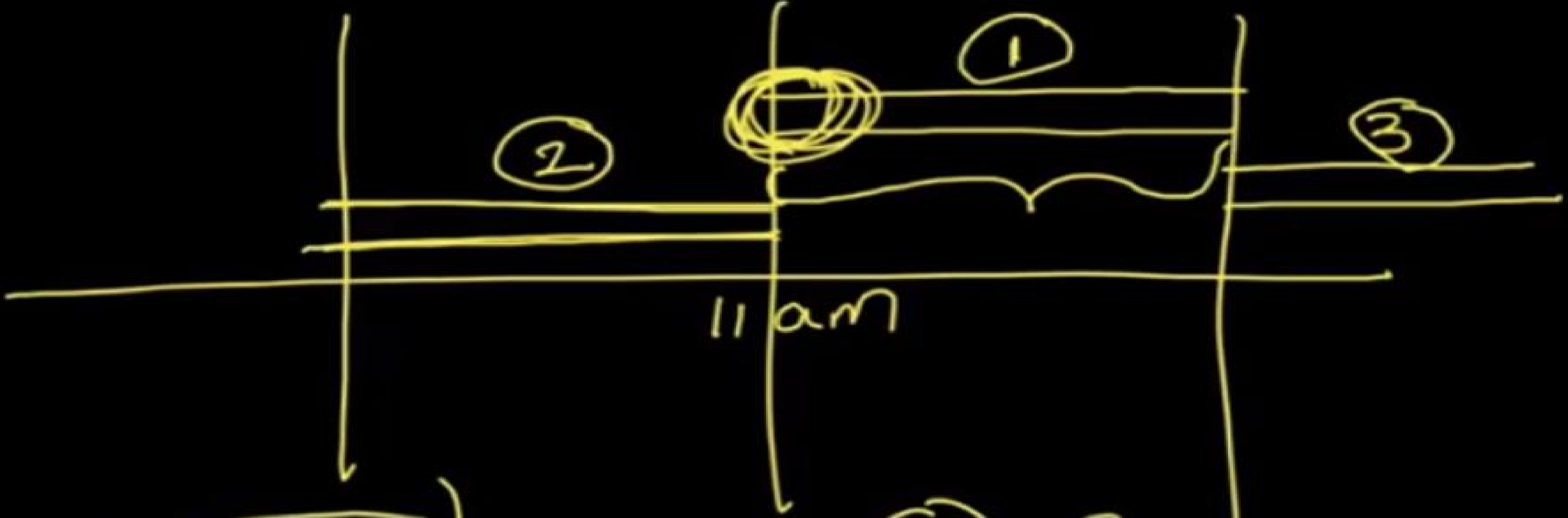


$VT = 2 * TT$

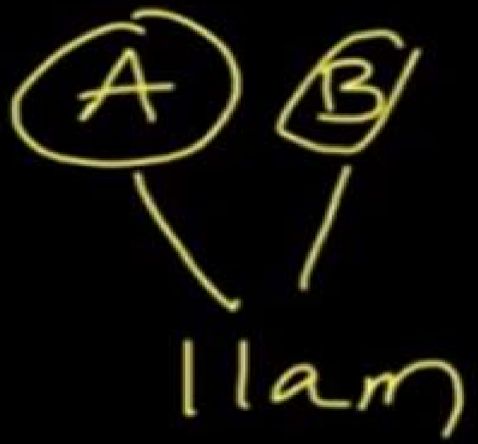
G → no of Stations who wants to transmit data in $1 T_t$

$1 T_t - \frac{1}{2}$ sta → $\eta \rightarrow$ max.

✓ $\boxed{2 T_t - 1 \text{ Station}}$ → 18.4%



$$\boxed{VT = T_t}$$



$VT = 1\ T.T$

$$\eta_{slot\ aloha} = G \times e^{-G}$$

$$\eta_{max} = 36.8\%$$

$VT = 1 \cdot T$

$$\eta_{\text{slot aloha}} = G \times e^{-G}$$

$$\eta_{max} = 36.8\%$$

$$\boxed{\frac{d\eta}{dG} = 0} \Rightarrow G = 1$$

T_t