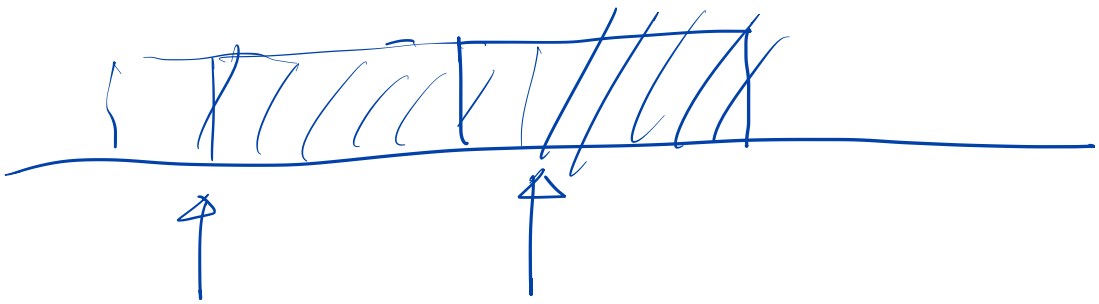
4/17

- MAC protocols
  - Ethernet
  - 802.11

problem

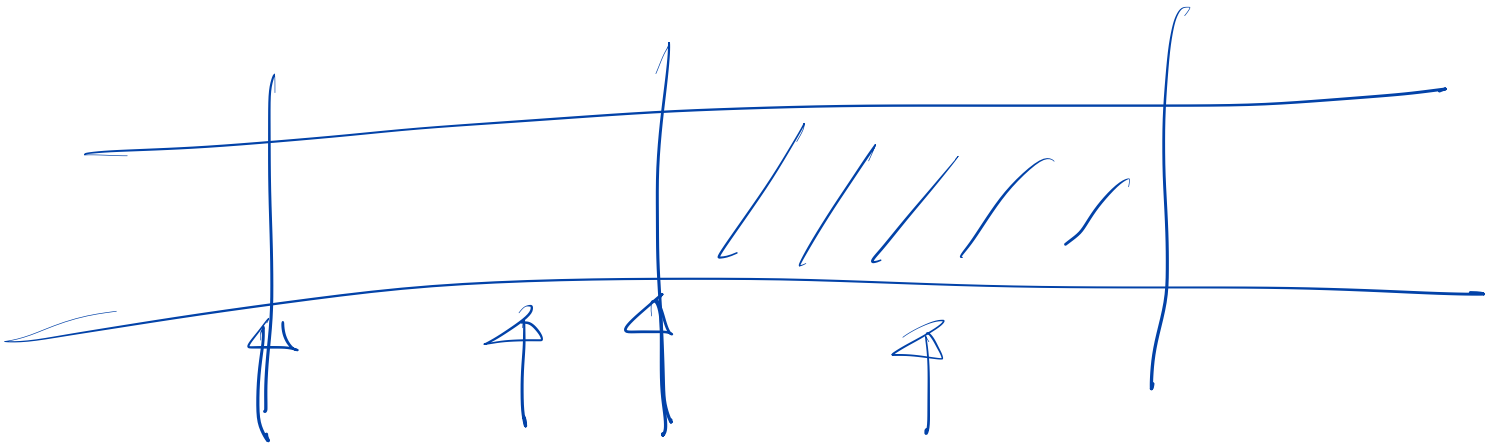
ALOHA

18%.



S-ALOHA

36%.



Ethernet

CSMA / CD

Carrier Sense

Multiple Access

Collision Detect

802.3 Xmitter

when ∃ data to send

sense channel (CS)

if free, send immediately
(1- persistent)

if busy

wait until free

xmit when free

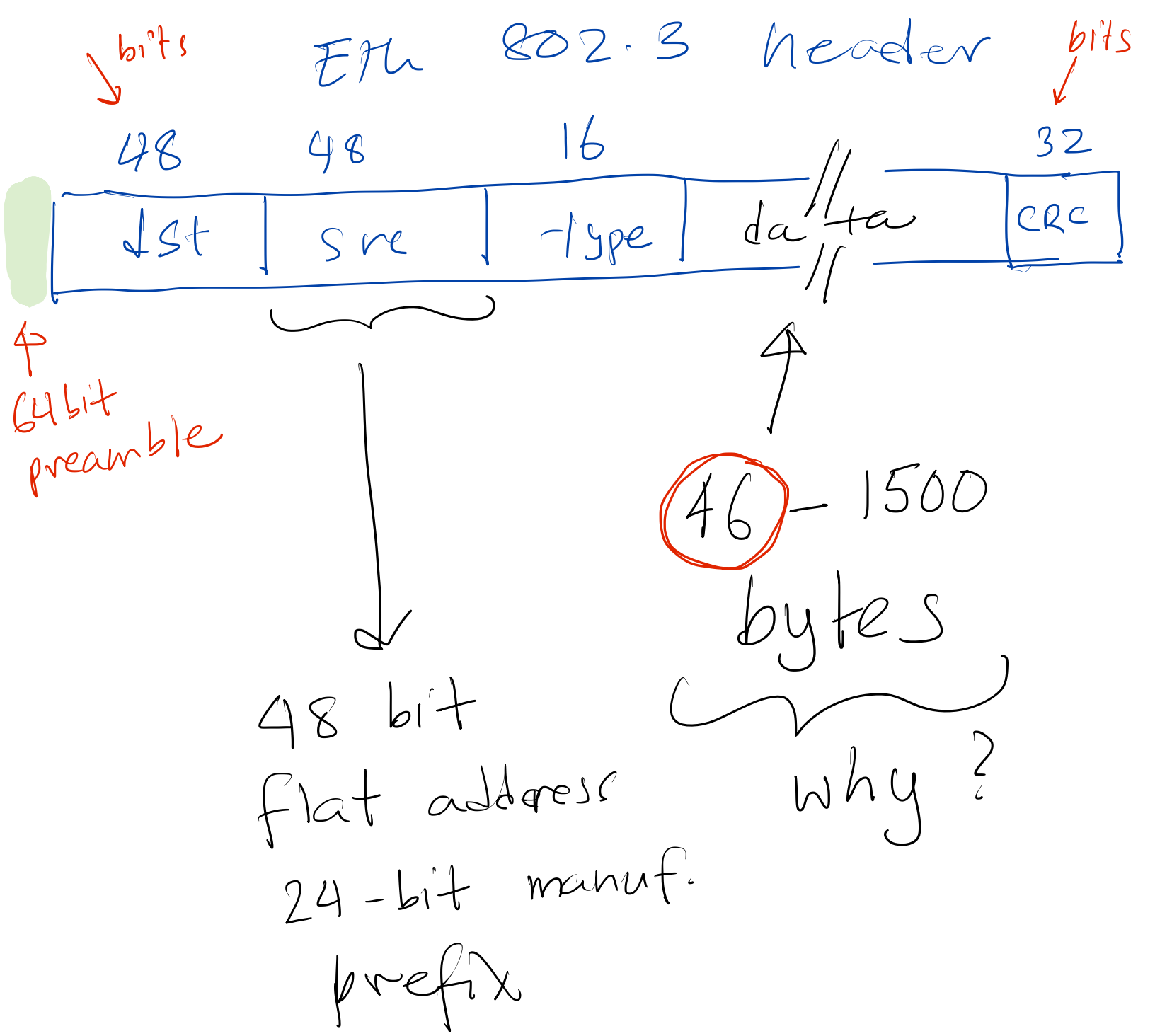
Multiple Senders may xmit simultaneously (MA)

if transmissions collide } send & listen at the same time

send jamming signal

(Collision Detect CD)

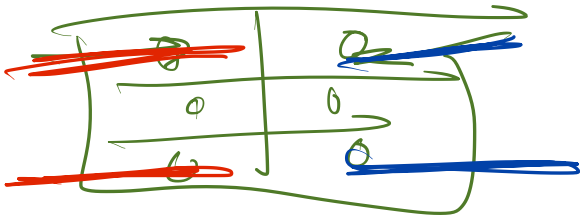
"vampire tap"


bits
Eth 802.3 header
bits
48
48
16
32
dst
src
type
data
CRC
64bit preamble
48 bit flat address
24-bit manuf. prefix
46 – 1500 bytes
why ?

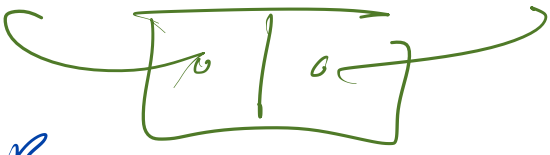
Terminology

- repeater

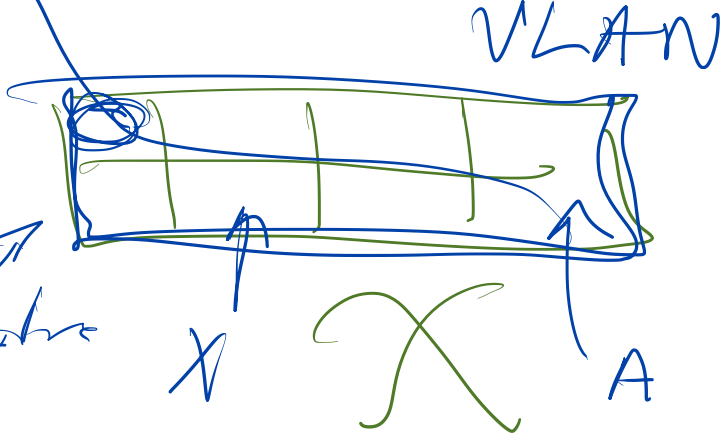
- hub



- bridge



- switch



- router

Why 46 bytes?

Speed of signal propagat in copper: 2×10^8 m/s

max. prop. delay: 51.2 μs

magic for now

512 bits at 10 Mbps

64 bytes

18

6 + 6 + 2 + 4 + 46

6: dst

6: src

2: type

4: crc

Eth Theoretical max segment

$2 \times 10^{8}\ m/s \times 51.2 \times 10^{-6}\ s \equiv 10^{4}\ m$

Standard

max.

500 m (individual segment)

—R—R—R—R—

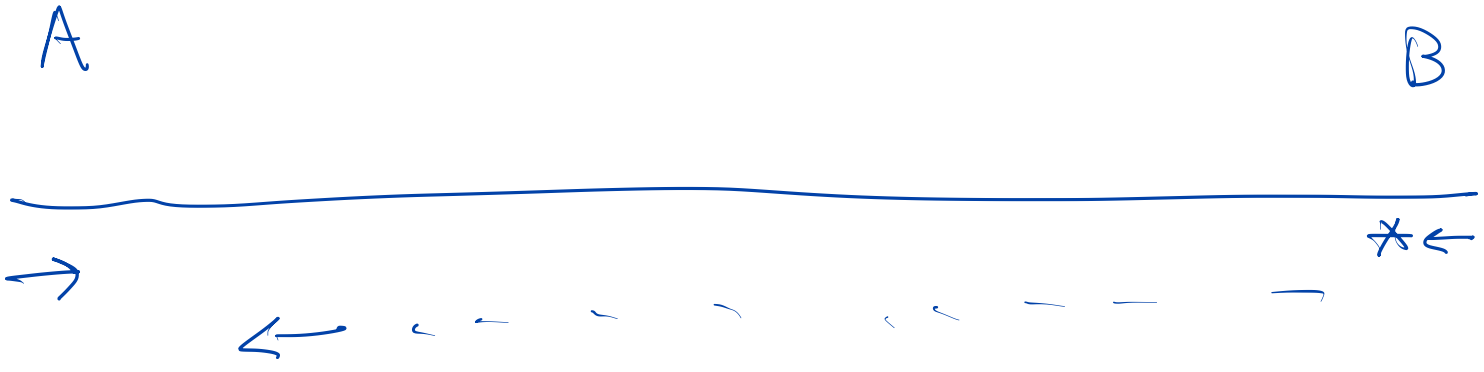
x 4 repeaters

= 2500 m (one way)

= 5000 m RTT

2X (safety)

Collision Detection on max segment.



link latency: d

A xmits at t

hears collision at t + 2d

[A must still be xmitting to hear collision]

$\Rightarrow$ MSS

After collision

"exponential backoff"

1st reX : 0 or 51.2 μs

2nd reX : {0, 51.2 μs, 102.4 μs, 153.6 μs}

↑

one of

In general: nth ReX

choose $k \in (0 \ldots 2^n - 1)$

wait $k * 51.2\ \mu s$

$n \leq 10$

max 16 re-tries

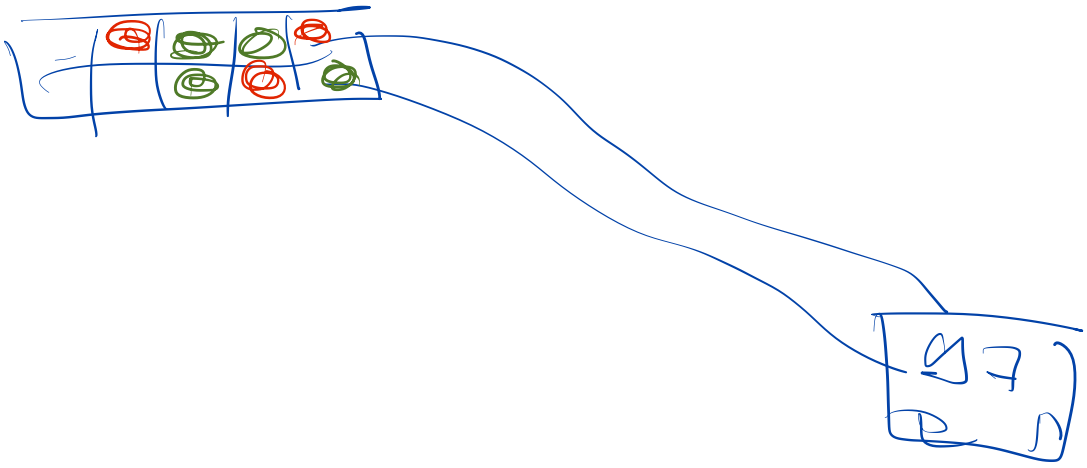
"Modern Ethernet"

VLANs

virtual

software configurable b/c domains

switches and ports



10% Decomposition Doc. Due Nov 30 Wed. before midnight

20% Code progress check-in due Dec 5 Monday before midnight

PVLANs

private

Primary (promiscuous) → can talk to all

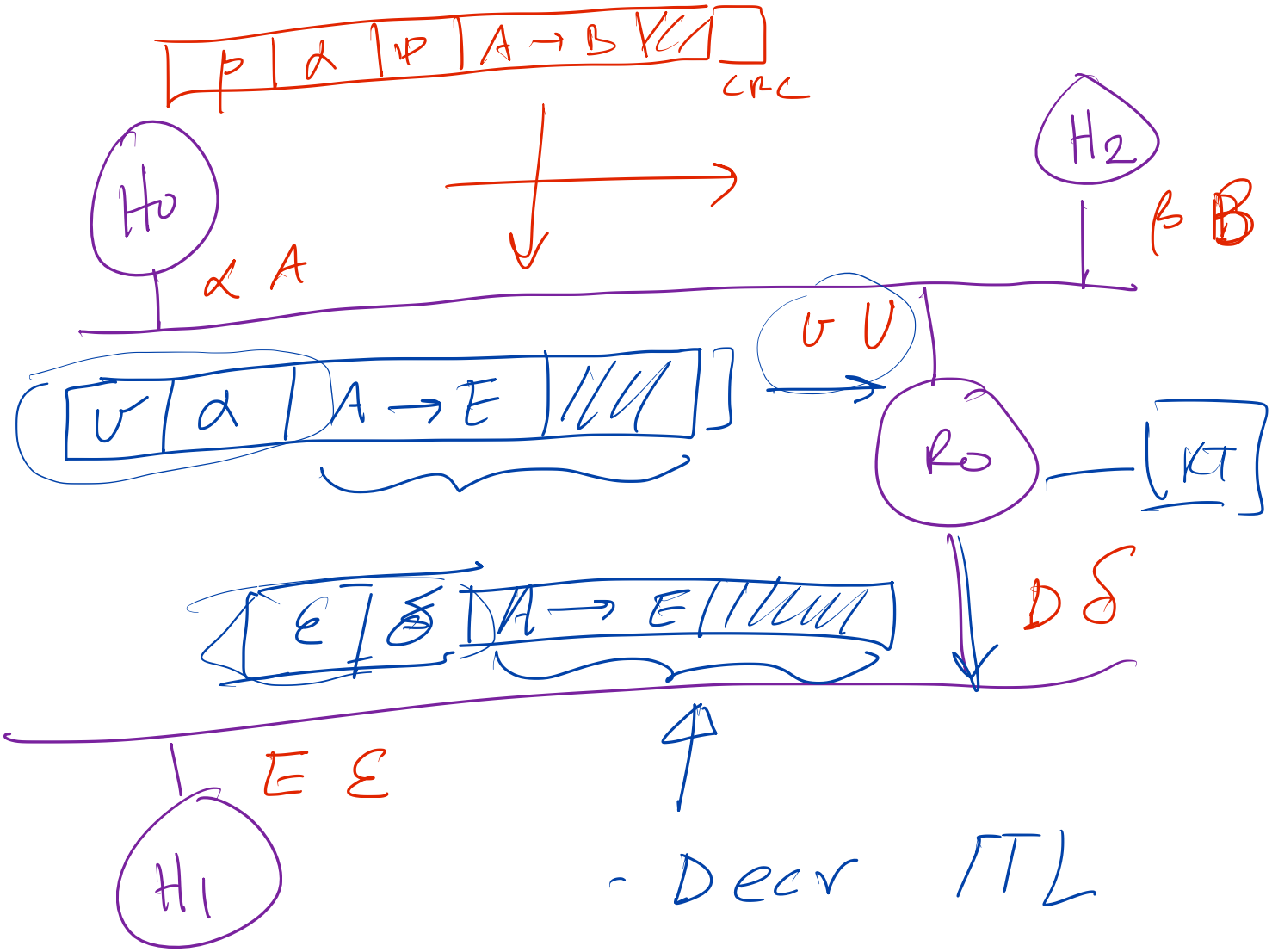
Secondary
- ↙ Isolated → can talk to primary only
- ↘ Community → can talk to primary & others in comm.

PVLAN example

P	I_1	I_2	C_0	C_0	C_2	C_1
P	P	C_0	C_1	C_1	C_0	C_2

	P	I_1	C_0	C_1	I_2
P	✓	✓	✓	✓	✓
I_1	✓	✓	X	X	X
C_0	✓	X	✓	X	X
C_1	✓	X	X	✓	X
I_2	✓	X	X	X	I_2

Putting it all together

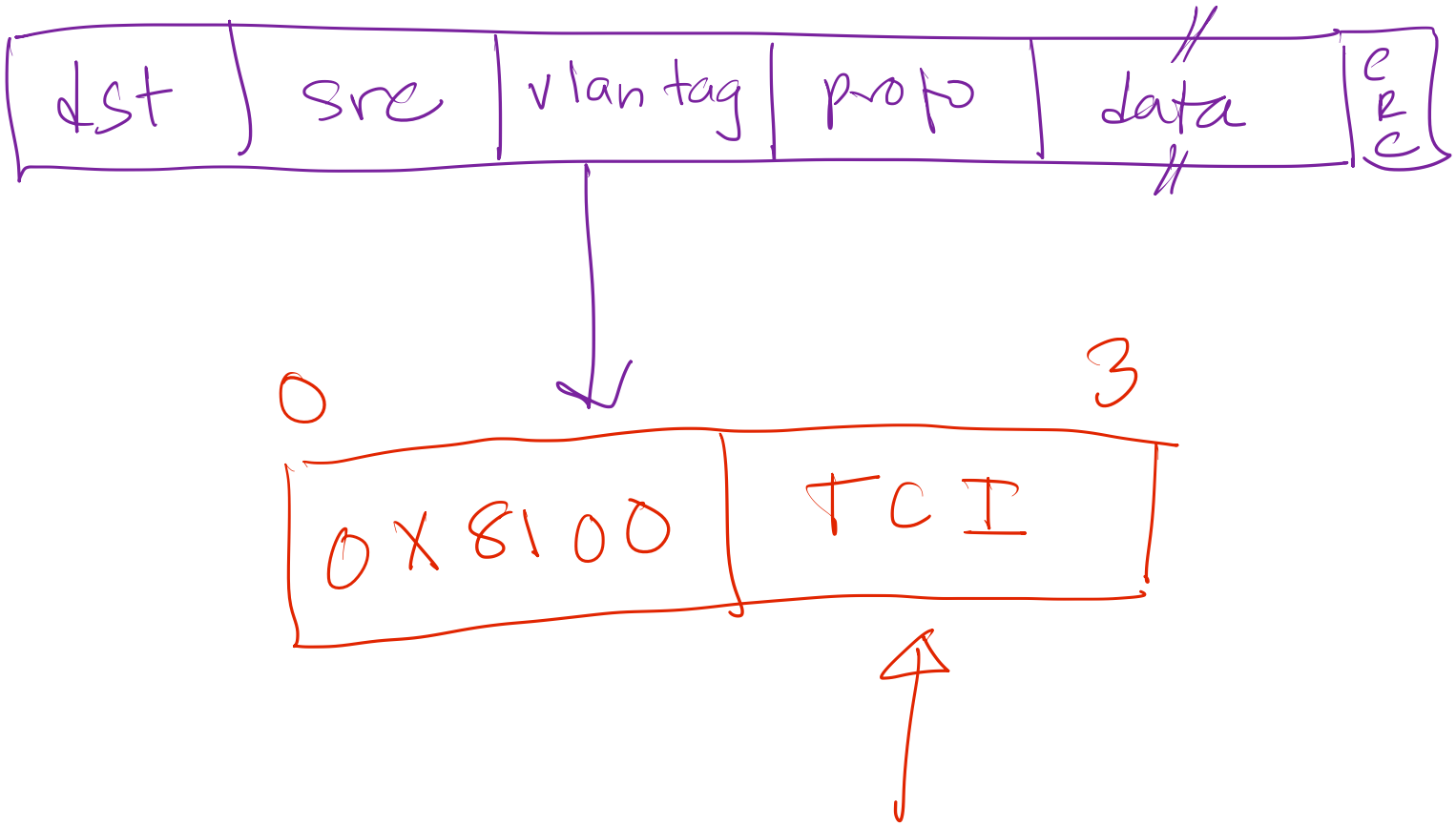


- Decr TTL
- update Hdr checksum

α, β, υ, δ : MAC

A B, U, D, : IP

VLAN switching (802.1q)



VxLAN (vpn)

RFC 7348