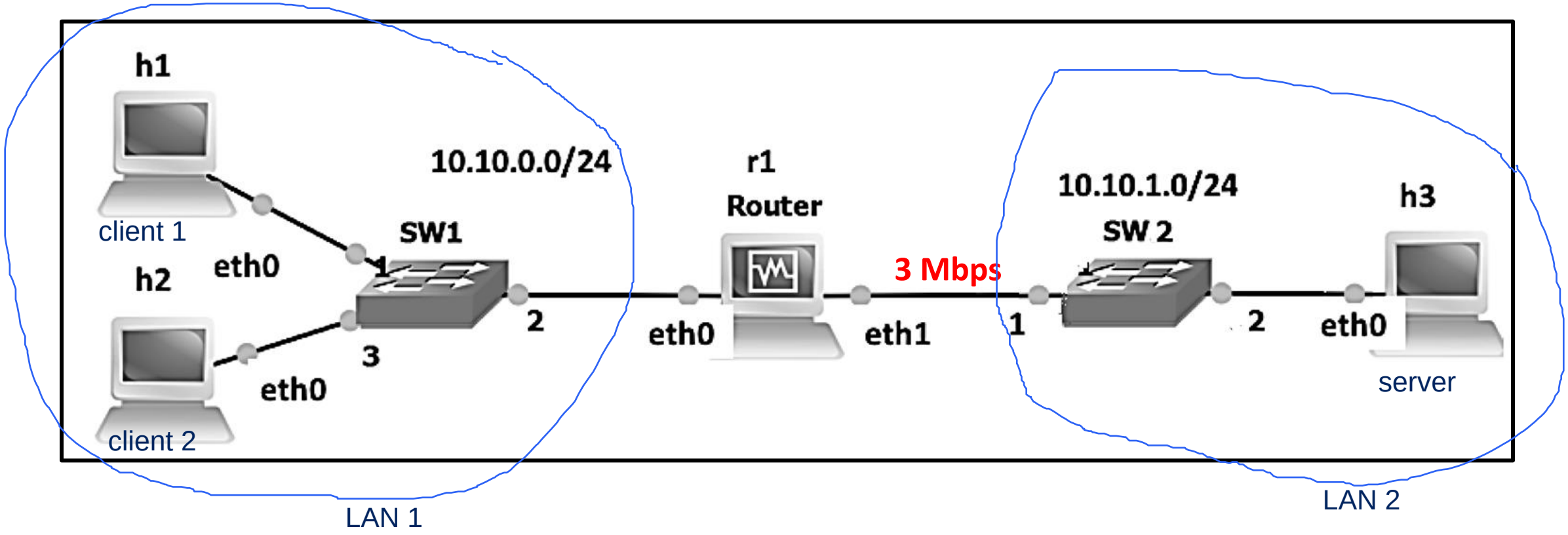
TCP & UDP

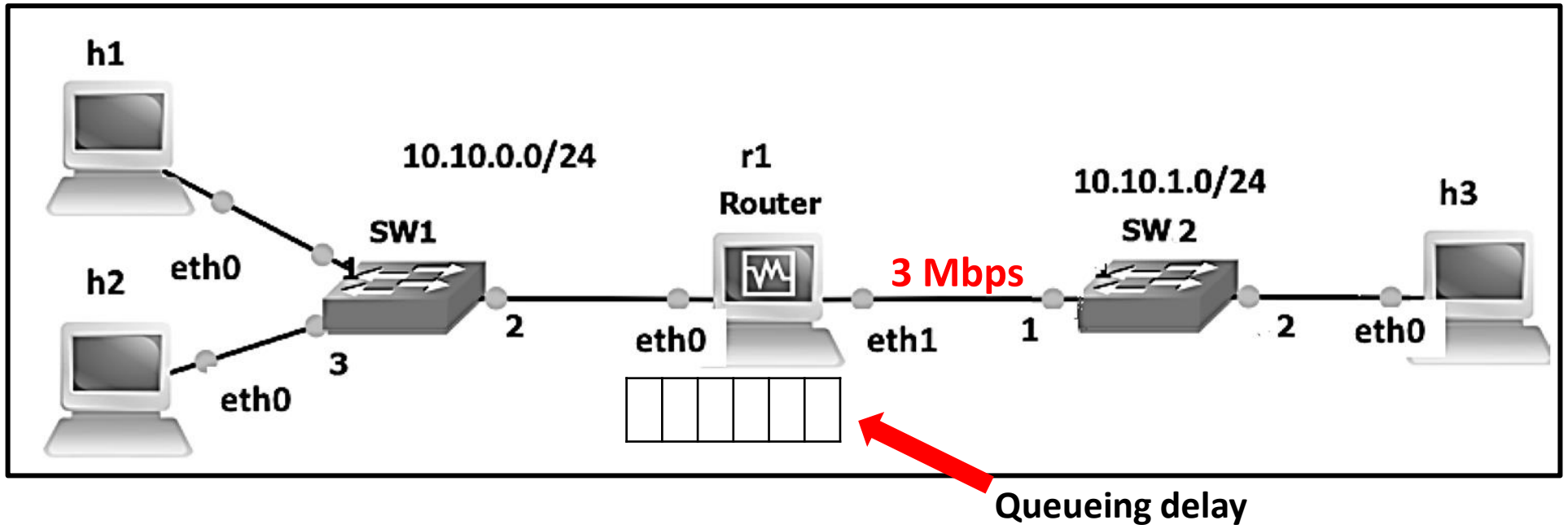
Previous scenario

- link_r1sw2.intf1.config(bw=3)



Competing UDP Flows

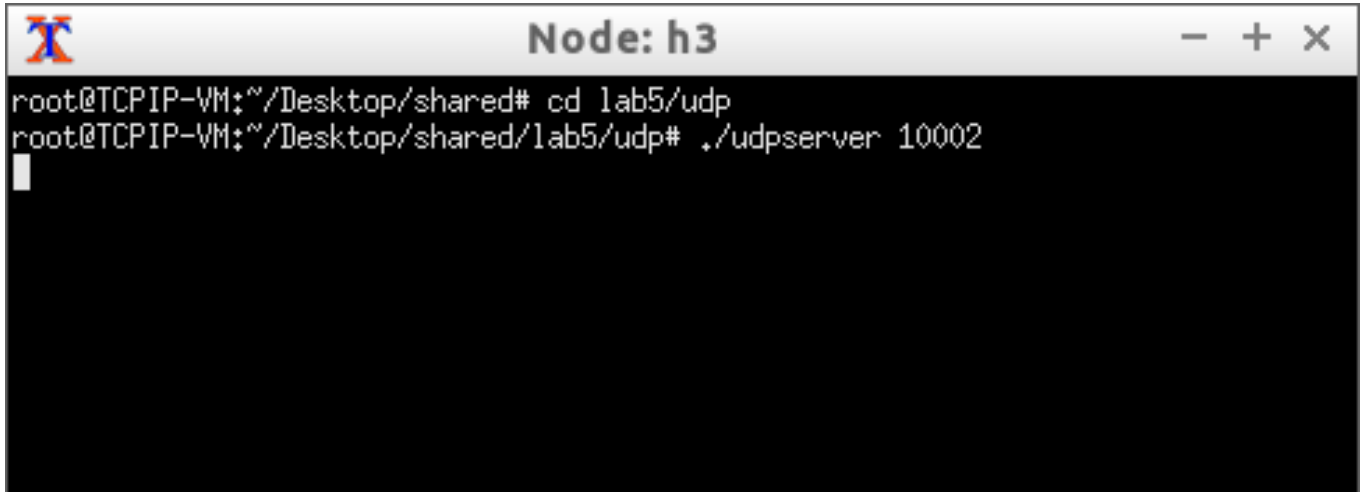
Scenario	h1 (UDP)	h2 (UDP)
1	1 Mbps	1 Mbps
2	1 Mbps	2 Mbps
3	1 Mbps	4.5 Mbps



Open a new terminal for h3

- mininet> xterm h3

external terminal



Competing UDP Flows

Scenario	h1 (UDP)	h2 (UDP)
1	X = 1 Mbps	Y = 1 Mbps
2	X = 1 Mbps	Y = 2 Mbps
3	X = 1 Mbps	Y = 4.5 Mbps

host flow / total flow

$$goodput_{h1} = \min\left(\left(\frac{X}{X+Y}\right) \times 3 \times \frac{1000}{1042}, X\right) Mbps$$

$$goodput_{h2} = \min\left(\left(\frac{Y}{X+Y}\right) \times 3 \times \frac{1000}{1042}, Y\right) Mbps$$

data / data + overhead =goodput UDP

پهنای باند گلوگاه

TCP flows Competing with UDP Flows

Scenario	h1 (UDP)	h2 (UDP)	h2 (TCP)
1	X = 1 Mbps	Y = 1 Mbps	Z
2	X = 1 Mbps	Y = 2 Mbps	Z
3	X = 1 Mbps	Y = 4.5 Mbps	Z

$$goodput_{h1} = \min\left(\left(\frac{X}{X+Y}\right) \times 3 \times \frac{1000}{1042}, X\right) Mbps$$

$$goodput_{h2,UDP} = \min\left(\left(\frac{Y}{X+Y}\right) \times 3 \times \frac{1000}{1042}, Y\right) Mbps$$

$$goodput_{h2,TCP} = \begin{cases} 0\ Mbps, & X+Y \geq 3 \times \frac{1000}{1042} \\ \left(3 - ((X+Y) \times \frac{1042}{1000})\right) \times \frac{1448}{1514}\ Mbps, & X+Y < 3 \times \frac{1000}{1042} \end{cases}$$

چون کنترل ازدحام داره در صورت شلوغی شبکه بسته نمیفرسته

bottleneck bandwidth

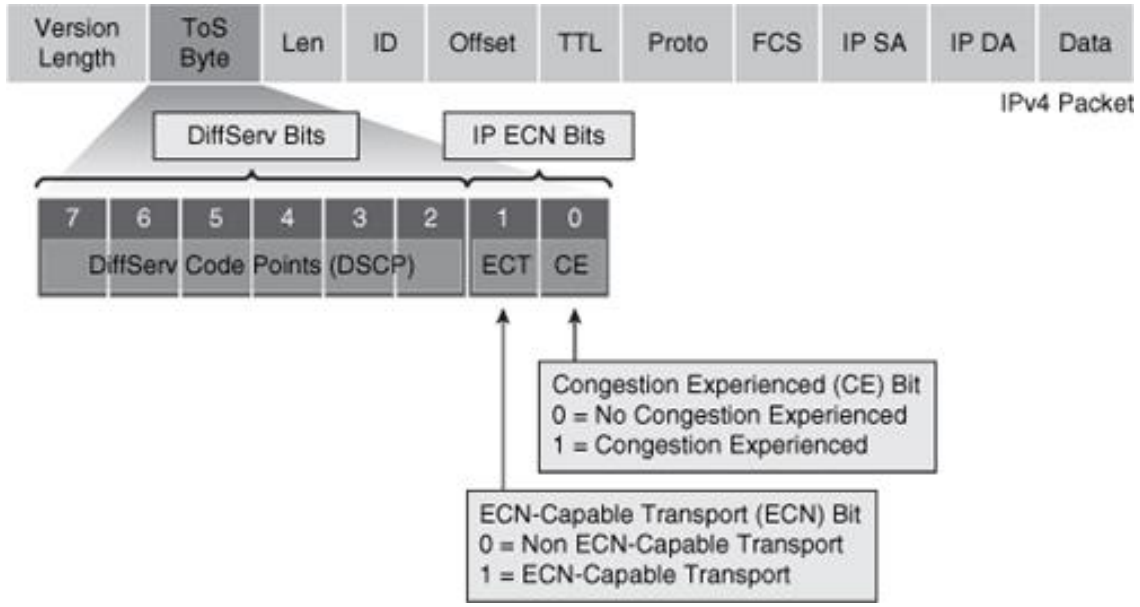
total flow of UDP

UDP goodput

TCP goodput

Explicit Congestion Notification (ECN)

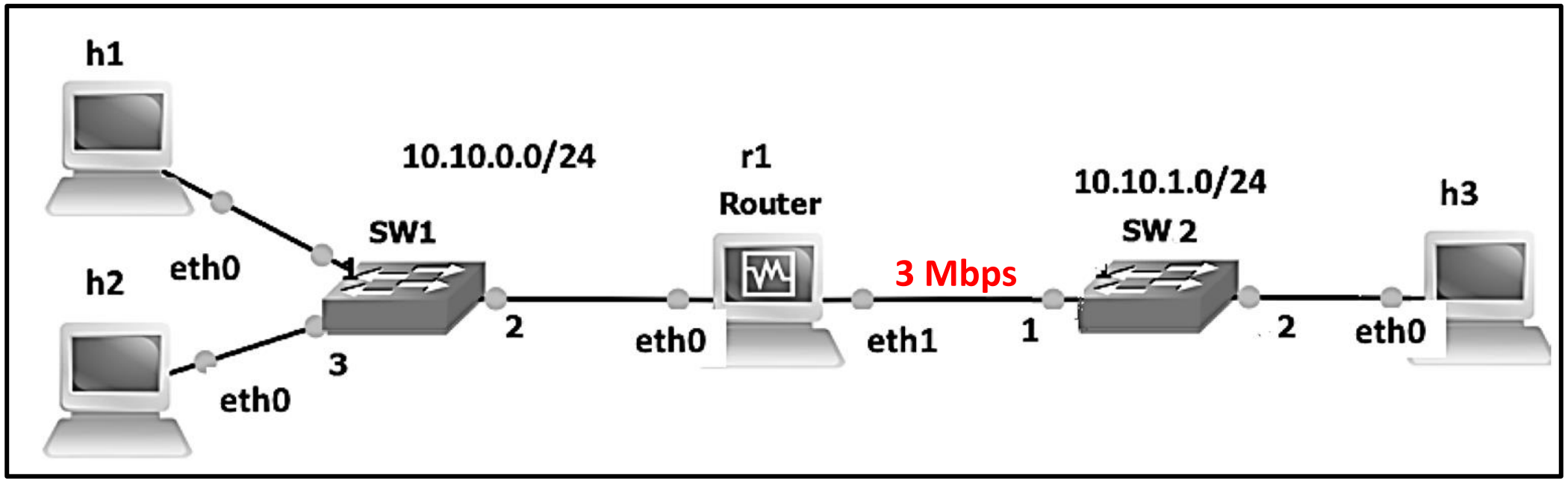
- An extension to the Internet Protocol (the network layer protocol)



این بیت ها در لایه شبکه هستند ولی کاربرد آنها در لایه ترنسپورت هست

1. link_r1sw2.intf1.config(bw=5, max_queue_size=1000, enable_ecn=False)
2. link_r1sw2.intf1.config(bw=5, max_queue_size=1000, enable_ecn=True)

Add delay to all packets going out of an interface



- (h3)# tc qdisc add dev h3-eth0 root netem delay 300ms

Fairness Between TCP Connections and Delay

Scenario	h1 (TCP)	h2 (TCP)	h2 (TCP)	h2 (TCP)
1	X	X	X	X

$$goodput_{h1} = \left(\frac{X}{4X}\right) \times 3 \times \frac{1448}{1514}\ Mbps$$

$$goodput_{h2} = \left(\frac{3X}{4X}\right) \times 3 \times \frac{1448}{1514}\ Mbps$$

bottleneck bandwidth

TCP goodput