Introduction

a) Transmission Rate = $\frac{L}{R}$ $\frac{\text{bits}}{\text{sec.}}$ 10 Mbps
of a link.

b) Packet

Nuts & Bolts View.

c) Packet Switch

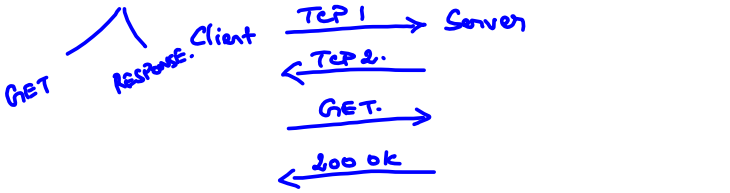
d) ISP

e) Internet Protocol [IP]

Services View

Protocol

HTTP - Hyper Text Transfer Protocol. [#80]



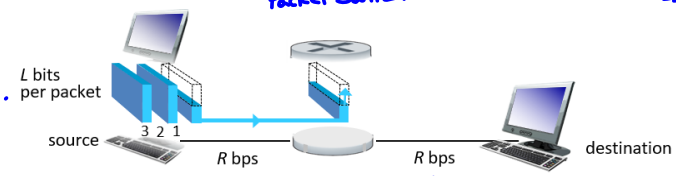
Packet Switching

Store and Forward Communication – Routers & Switches [Packet Switch]

Packets – measured in bits.

Transmission Delay in Packet Switched N/w.

Packet Switch.



Link 1

L/R

Link 2.

L/R

Sec. $\text{Delay} = \frac{L}{R}$ bits / bits/sec

Total time for 1 Packet from (Delay) Source to Destination

$D = \frac{2L}{R}$

Delay for all the 2 Packets ? $\frac{4L}{R}$

$d_{end\text{-}to\text{-}end} = N\frac{L}{R}$, where N is going to be no. of links.

TDM

File size of 640,000 bits. All the links use TDM with 24 slots, has a bit-rate of 1.536 Mbps. How much time does it take to transmit the file?

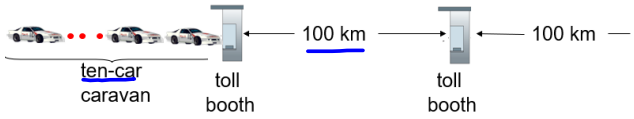
$$\text{Delay} = \frac{L}{R} \quad \frac{\text{Size}}{\text{Rate}}$$

$$\text{Each circuit will have a transmission rate} = \frac{1.536 \text{ Mbps}}{24 \text{ slots}} \quad (10^6) = 64 \text{ Kbps}.$$

$$\text{Time or Delay} = \frac{640{,}000}{64 \text{ Kbps}} = 10 \text{ Sec}.$$

Delay in Packet Switched Networks

Caravan analogy



1) Cars accelerate at a speed of 100 km/hr.

2) Cars are serviced at 12 sec per car.

Transmission Delay $d_{trans} = \frac{L}{R} = \frac{10 \text{ cars}}{5 \text{ cars/minute}} = 2 \text{ minutes}$ (120 sec)

Propagation Delay $d_{prop} = \frac{d}{s} = \frac{100 \text{ km}}{100 \text{ km/hr}} = 1 \text{ hr or } 60 \text{ minutes}$

d_{nodal} or $d_{end\text{-}to\text{-}end} = d_{prop} + d_{trans} = 62 \text{ minutes}$

Another Scenario

1) Cars accelerate at 1000 km/hr.

2) " are serviced at 1 car/minute.

$d_{trans} = \frac{10 \text{ cars}}{1 \text{ car/minute}} = 10 \text{ minutes}$

$d_{prop} = \frac{100}{1000 \text{ km/hr}} = \frac{1}{10} \text{ hr} = 6 \text{ minutes}$

$d_{nodal} = 16 \text{ minutes}$