Caching

Disk

10 ~~100~~

~~100/sec~~
1000/sec

1000/sec

100/sec

`C(Cache) + Pr(miss)C(miss)`

0.1 ms   10 ms

~~0.9~~   0.1

Locality of reference

1.1 ms

Caching

Disk

10 ~~10~~ 100

1/.0011
≈ 900

1000/sec

~~100/sec~~
900/sec

~~100/sec~~
1000/sec
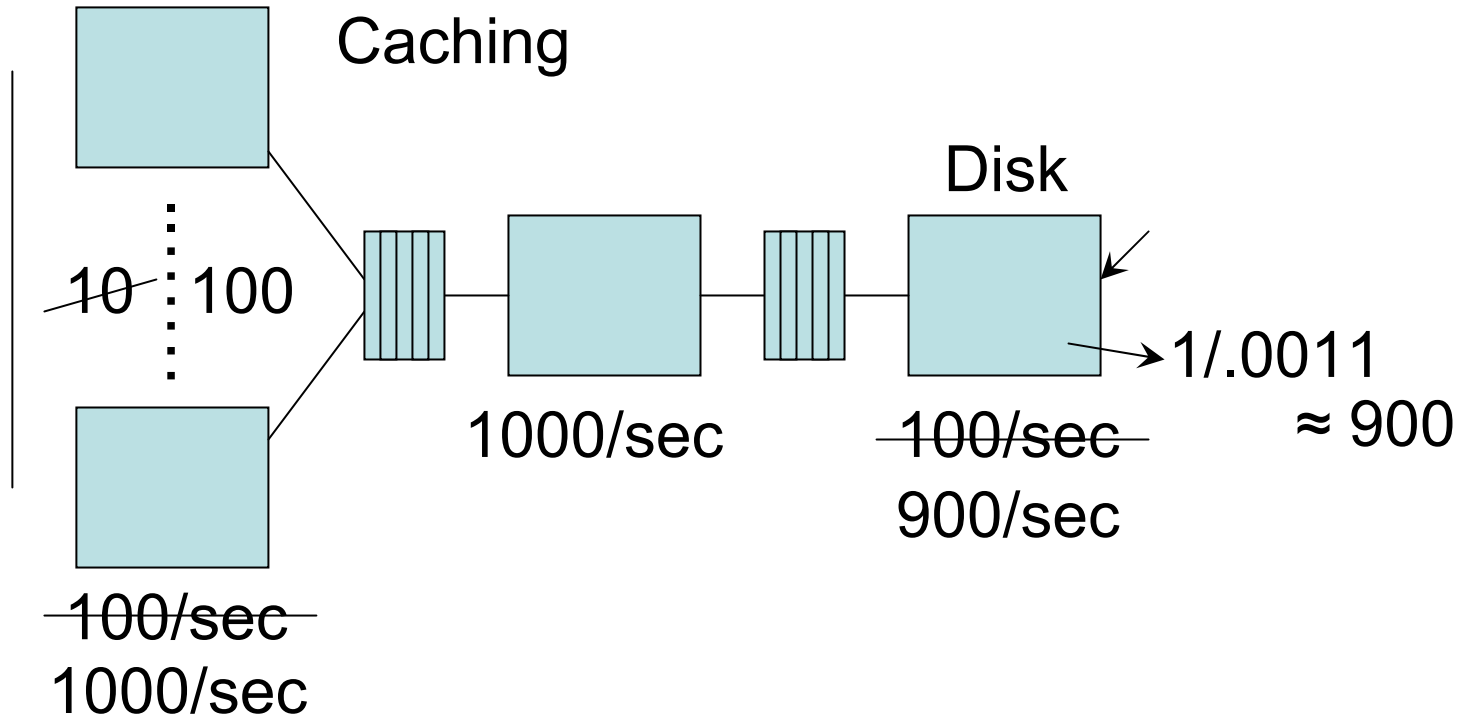
Page Removal Policy

FIFO

LRU

1 ← 3
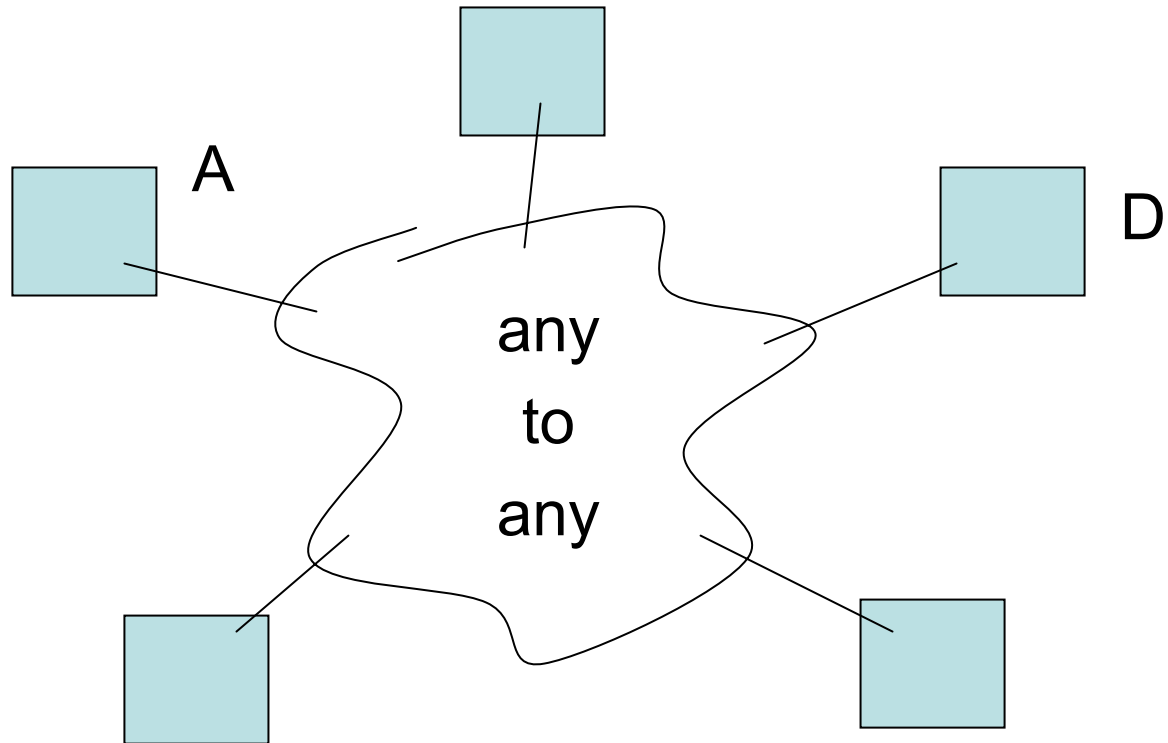
2

3̶

2

1

4 ←
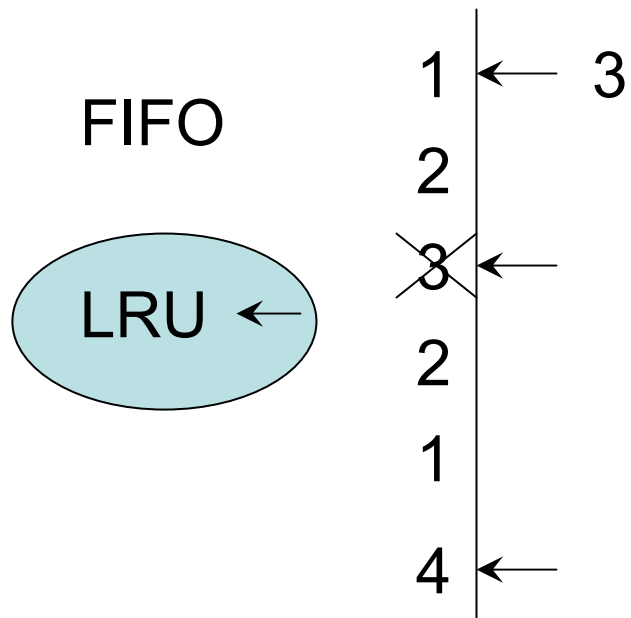
Computer Networks

Components of Systems
-       Overcome geographic limits
-       Access remote data
-       Separate client / server
Interesting System

Goal: Universal Communication

A

D

any
to
any

Interesting Issues

Technological

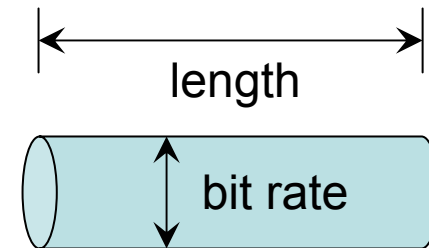   dtech/dt

                spd of light

     Limits

Shared Infrastructure

Technology

Heterogeneous 10^7 difference
Variations
    - bit rate
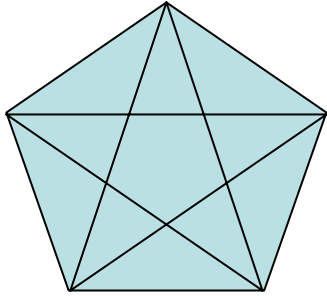   - propagation delay

length

bit rate

pipe

$$\text{Time to send} = \frac{\text{length}}{\text{spd light}} + \frac{\text{\# bits}}{\text{bits/sec}}$$
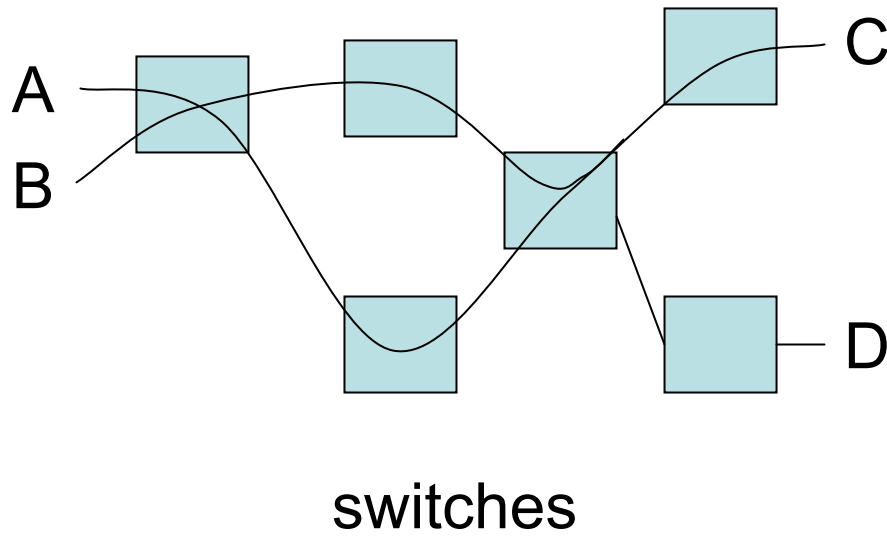
bits/sec/$ = Slow

<u>human costs</u>

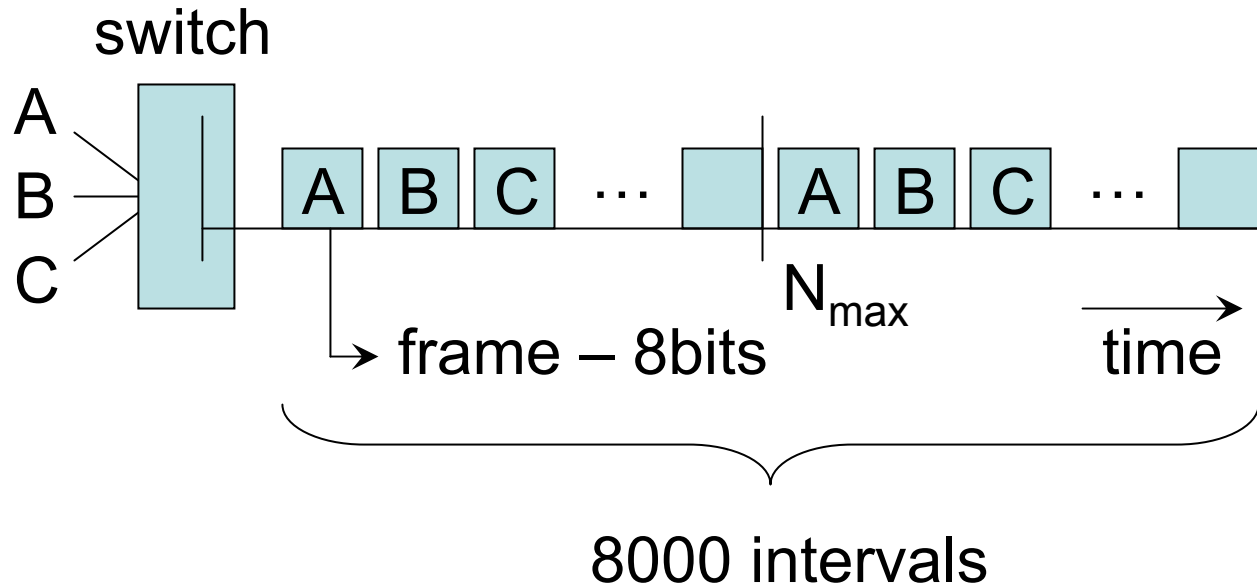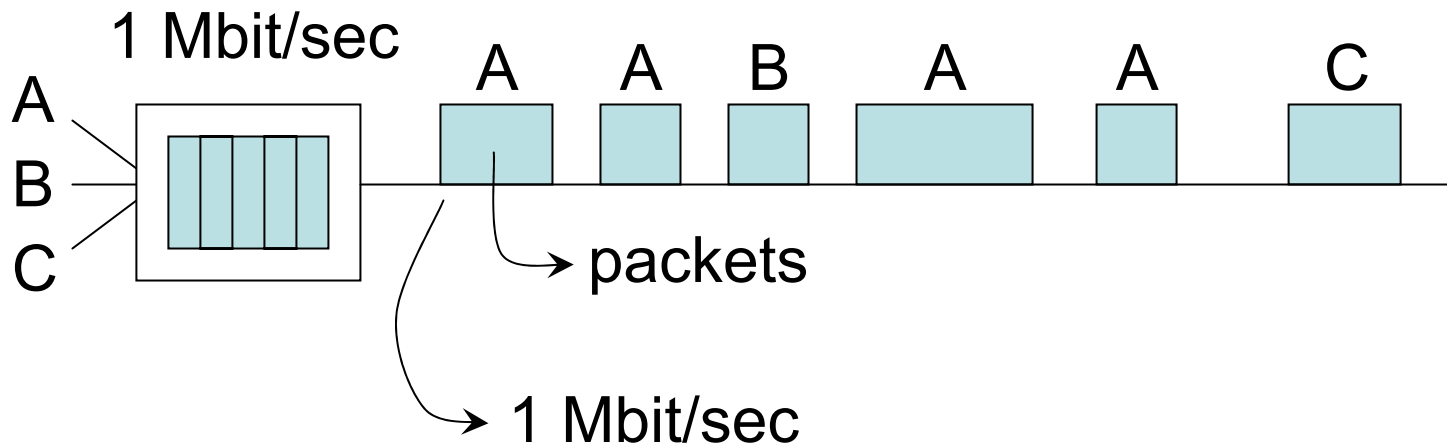# Sharing

n, n^2 wires

multiplexing

Routing

switches

Routing

Switching – Circuit
Packet

TDM – time division multiplexing

switch

A
B
C

A B C … A B C …

N_{max}

frame – 8bits

time

8000 intervals

Packet Switch – Unpredictable Rates

Asynchronous multiplexing

Queuing delay

Congestion
    └─────┐
          └─→ <u>drop data</u>

Best effort networking