\[ C(\text{Cache}) + \Pr(\text{miss})C(\text{miss}) \]

0.1 ms \quad 10 \text{ ms}

0.9 \quad 0.1

Locality of reference

1.1 \text{ ms}
Caching

Disk

≈ 900
Page Removal Policy

FIFO

LRU

1
2
3
4
Computer Networks

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

Interesting System
Goal: Universal Communication

A

any
to
any

D
Interesting Issues

Technological
  \( \frac{d \text{tech}}{d \text{t}} \) spd of light
  Limits

Shared Infrastructure
Technology

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

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

\[ n, n^2 \text{ wires} \]

multiplexing
Switching – Circuit Packet

TDM – time division multiplexing

Switch

frame – 8bits

N_{max}

time

8000 intervals
Packet Switch – Unpredictable Rates

Asynchronous multiplexing

1 Mbit/sec

A

B

C

packets

1 Mbit/sec
Queuing delay

Congestion

→ drop data
Best effort networking