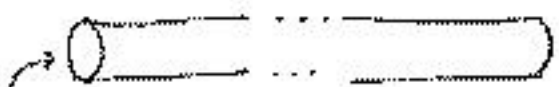
FACTS ABOUT NETWORK "LINKS" (= link, channel, line, connection, ...)

1. Not all links have the same qualities

- simplex vs duplex
- "pipe width" varies from link to link

Like water like fluid; width of pipe corresponds how many bits can enter per second.

- "velocity" varies from link to link



how long does it take for a bit entering to reach the other end? Depends on speed of bit

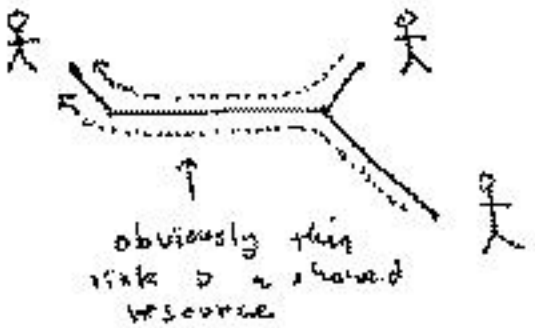
Also called:
- end-to-end delay
- latency

- reliability

how often / in what way do bits get lost or corrupted in a link?

- some are real (physical), some are virtual (logical)
- links can evolve (change characteristics over time)

2. Why Sharing links is necessary



links are scarcer than our desire to use them

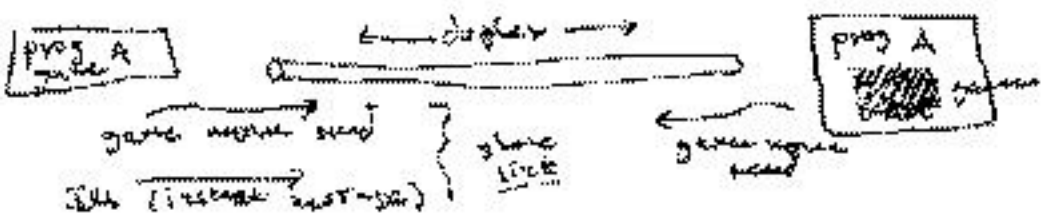
☆ Consequences
- use techniques (algorithms, technologies, protocols) for sharing
- use economic policies to manage sharing
- use scientific / mathematical theories to analyse, predict behaviour of shared links.

multiple users (end point hosts) shown above.

But, even a single link can motivate sharing:

multiple applications sharing a channel shown above.

But, even a single application on a single link can motivate sharing



3. Sharing has "friction"

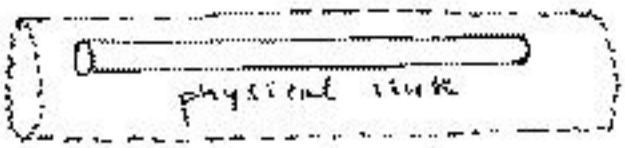
ie, all techniques for sharing a link add some overhead, reducing the link's theoretical capacity (reducing "pipe width" and/or increasing latency)

IDEAS FOR SHARING

- technologies (different radio frequencies, different wires, etc.)
- taking turns by time
- "bundling" data, as like mail trucks
- multiplexing ?

we'll use TCP/IP to illustrate this idea.

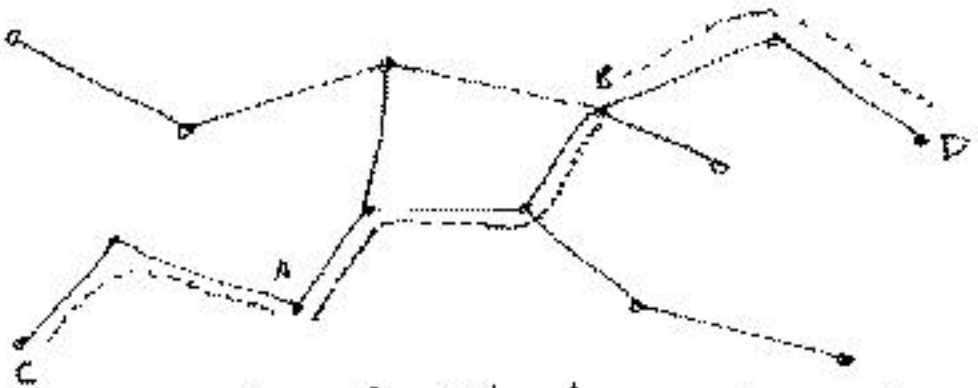
4. Many Networks use a "logical hierarchy" of links



logical link
= "value added" packaging, maybe some sharing techniques

⇒ logical links (virtual links) are built out of physical ones

Better example

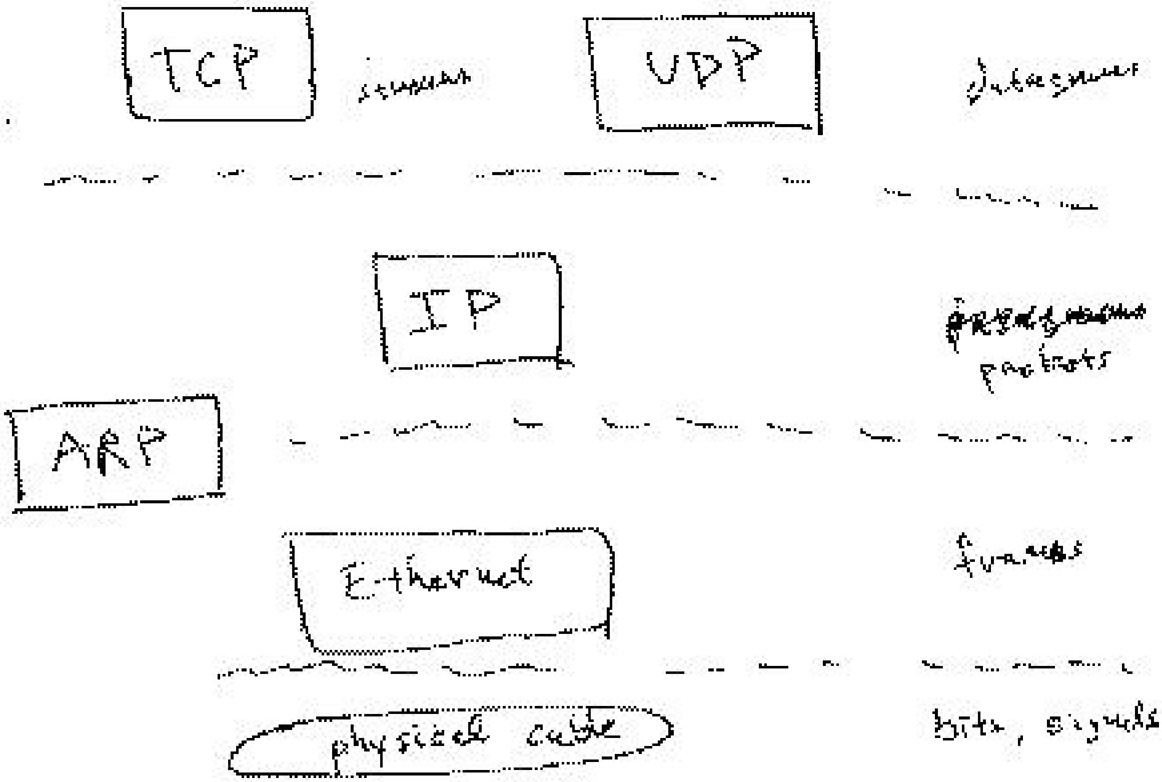


Logical link from A to B built out of three physical ones

Logical links: C - A , B - D

Now logical link C - D built out of logical links A - C, A - B, B - D —— three level hierarchy !

TCP/IP logical hierarchy.
— just a political, arbitrary network design.



1. Ethernet makes a logical link from a physical one
2. IP makes a multiplexed link from Ethernet (or in general, it could be from another type different from Ethernet)
3. UDP makes an application-oriented link from IP
4. TCP makes a value-added (reliable) link from IP