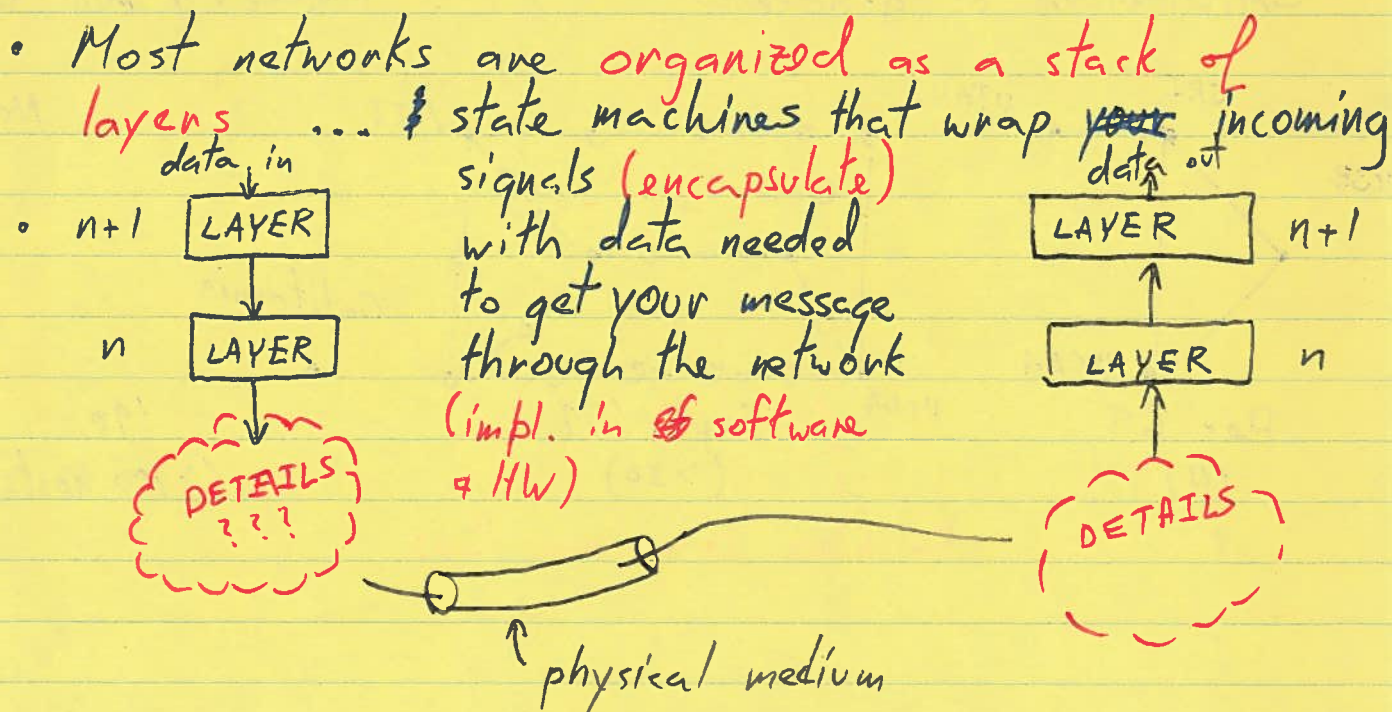


# L2: Basic Internet

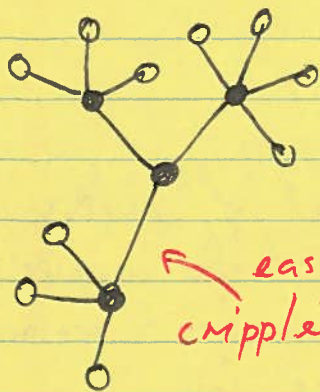
(1)

- **Internetwork**: network of networks
- Harder to get different types of networks to talk than you may (now) think
- Internet achieves this by:
  - 1) Working with a hierarchical set of rules (**layered protocol structure**) ← opt. for complexities specific to certain fn.
  - 2) Using the most basic set of rules for finding nodes and guiding info through networks
    - **best-effort datagram service**
    - **internet protocol (IP)**
    - i.e. there are many functions for a network to carry of, IP is the simplest for the "network function"



## 2.1 Original Proposal

- U.S. military wanted more robust network than PSTN (50's)



easy to cripple

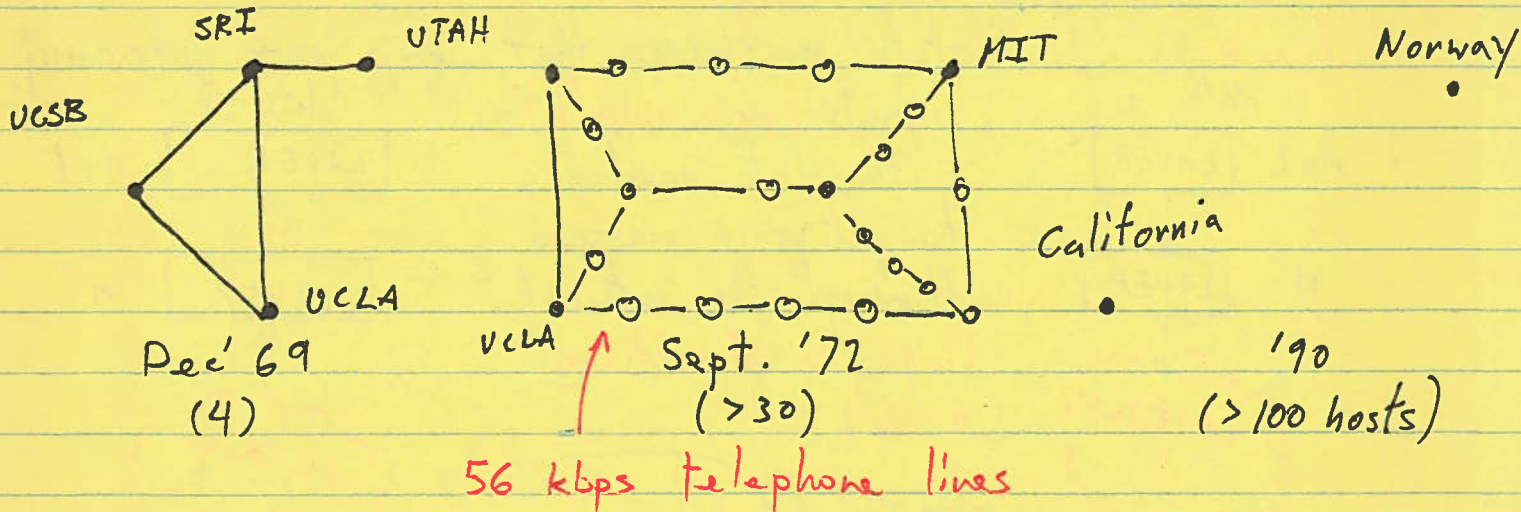


RAND (Paul Baran) proposed distributed network

(AT & T rejected proposal to build prototype)

## 2.2 ARPANET

- With ARPA backing (under Sputnik pressure & growing interest to link growing compute centres)
  - i.e. link growing numbers of mini-comps.
- Implemented by academics

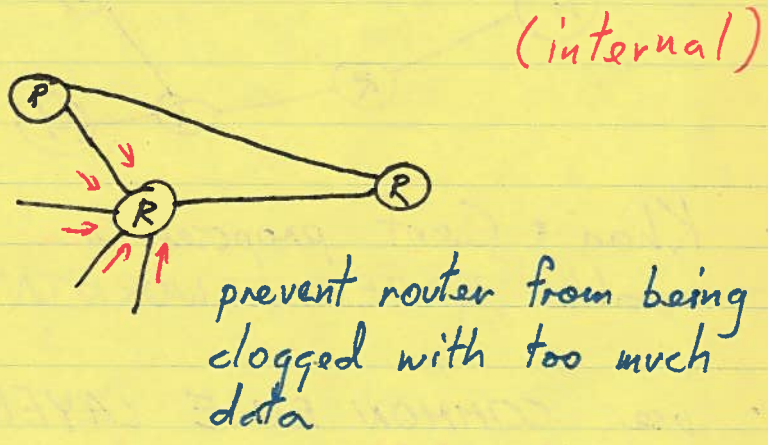


56 kbps telephone lines

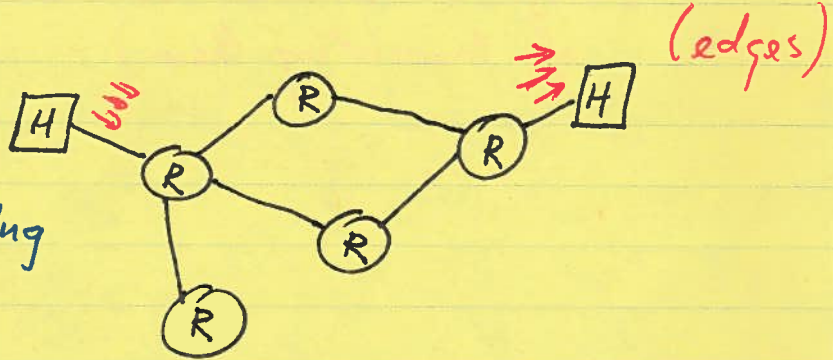
190 (>100 hosts)

### 2.3 ARPANET Characteristics

- ~~connectionless~~ not quite message switching
- packet switching (like telegraph) } datagram service
- connectionless } datagram service
- distributed routing algorithm (neighbours talk to each other to get global network picture)
- error control - means of recognizing packet errors & correcting them
- congestion control



- flow control
- prevent fast host from swamping a slow host

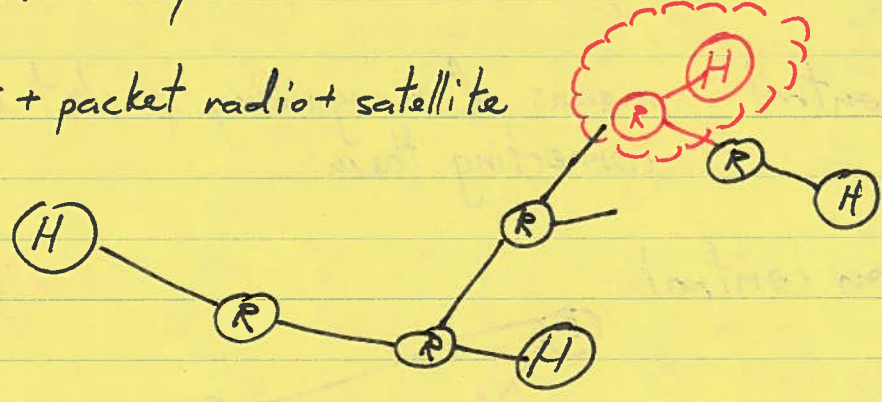


- apps like email  
remote login  
ftp } first implemented in ARPANET

## 2.4 Internetworking

- ARPANET was a great WAN
- But failed to link different types of networks together very well

ARPANET + packet radio + satellite

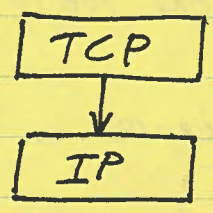


- Khan & Cerf proposed new set of rules to enable INTERNETWORKING in '73
- use COMMON RULE LAYER  
(hide differences between networks instead of translating them)

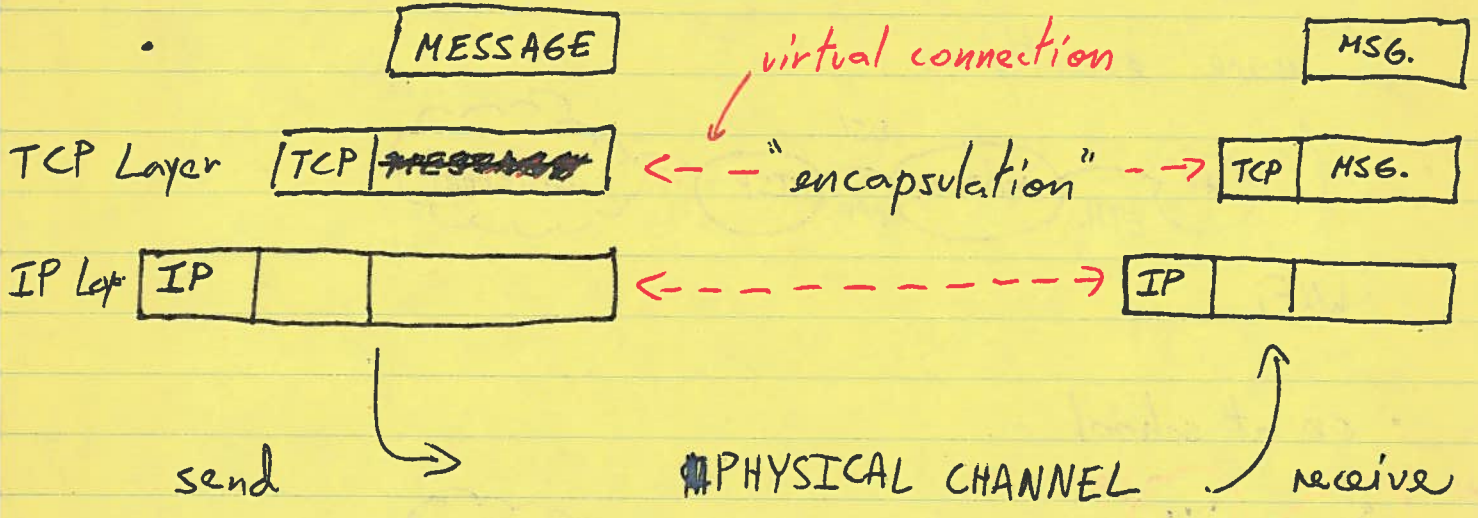
# 2.5 TCP/IP

- This layer was eventually separated into 2 protocols one hierarchically above the other implemented in your OS

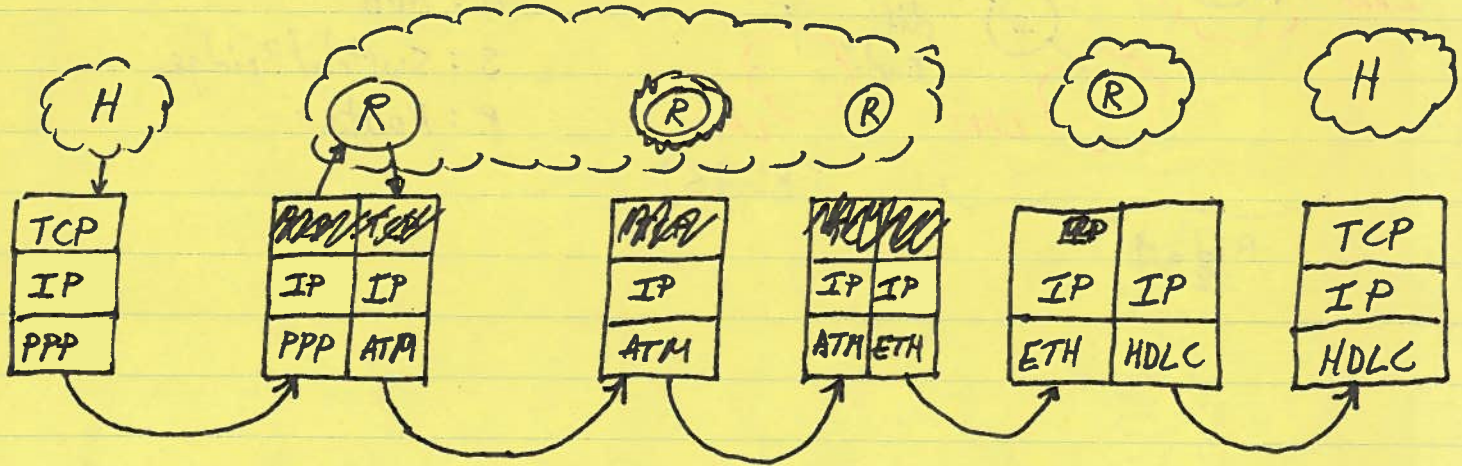
still packet switching



← a means of strengthening delivery guarantees between end-points (connection-oriented)  
 ← a means of getting messages moving over multiple links (connectionless)

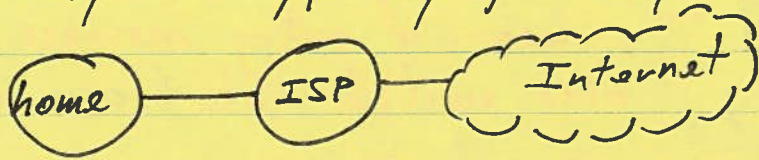


- with universally understood rules, hosts can talk to each other



# 2.6 Internet Today

- ~ 1 billion hosts (compare to > 4 billion mobile phones)
- maybe a million networks (no one really knows)
- we ~~try to~~ typically just experience ...

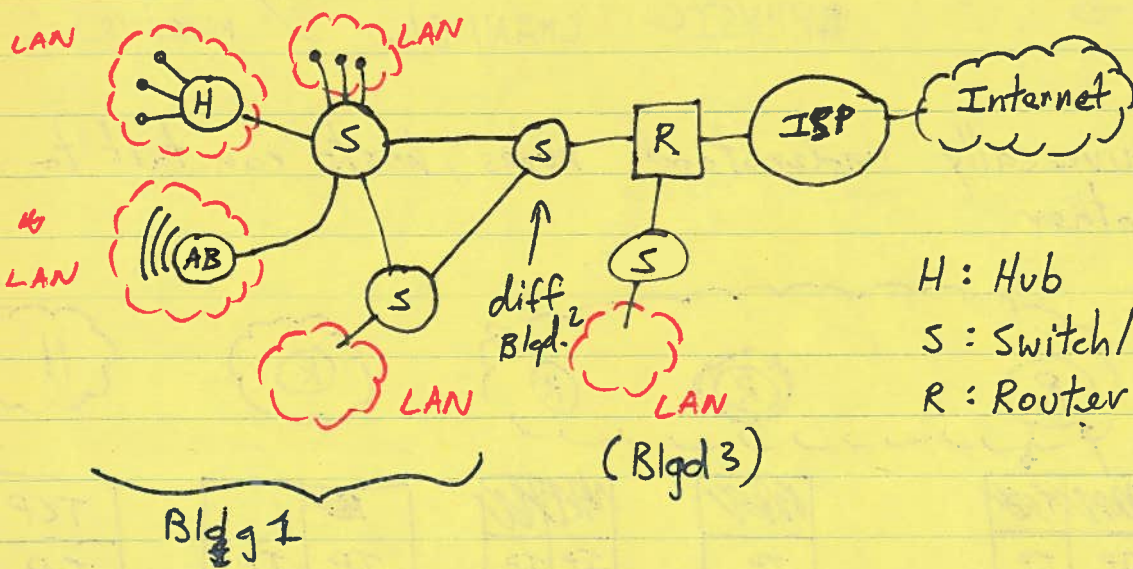


- more exactly



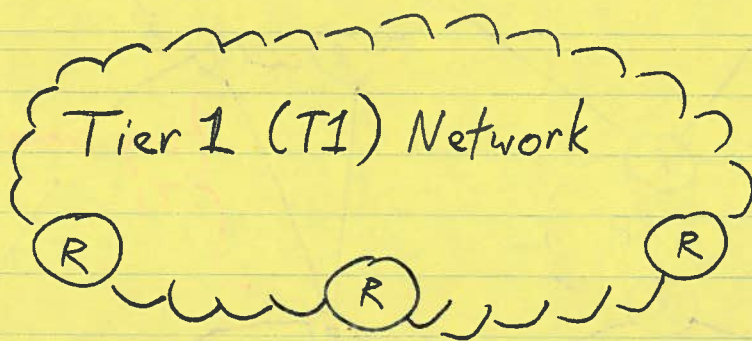
WiFi

- or at school



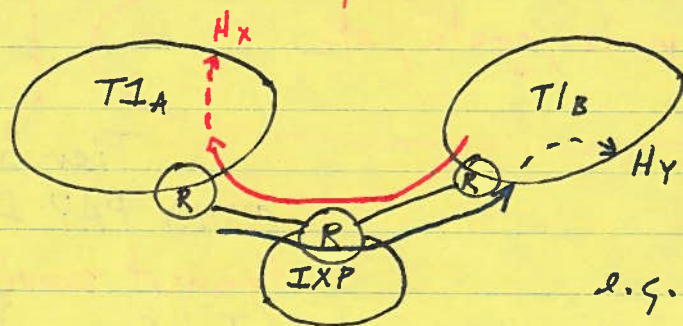
H : Hub  
 S : Switch/Bridge  
 R : Router

- general internet structure consists of different tiers of providers
- start from TOP



- networks of routers with global span
- Level 3, Global Crossing, Verizon
  - own fibre cables
  - perhaps lease lines (e.g. Level 3 leases some cables from Hibernia Networks)
- T1's don't pay anyone to send traffic across lines

- T1's sometimes "peer" : sharing of networks (free of charge) at



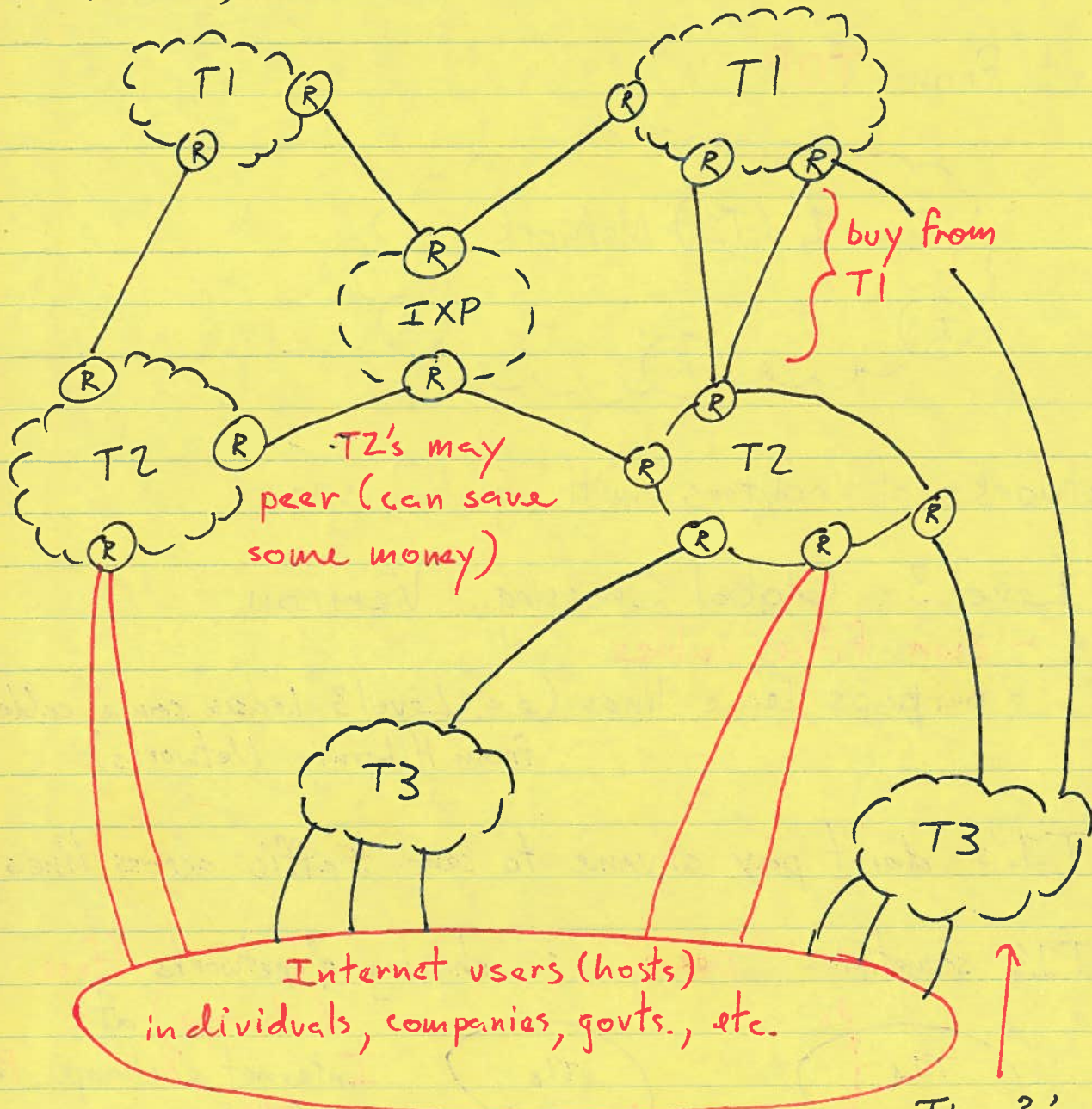
Internet eXchange Points (IXP)

e.g. T1A can get access to some Hy via T1B

-AND-

T1B can get access to some Hx via T1A

- Tier 2 networks use IXPs... but also buy from T1's (e.g. Bell)



Tier 3's that ONLY PAY for transit services (Tel Savvy)