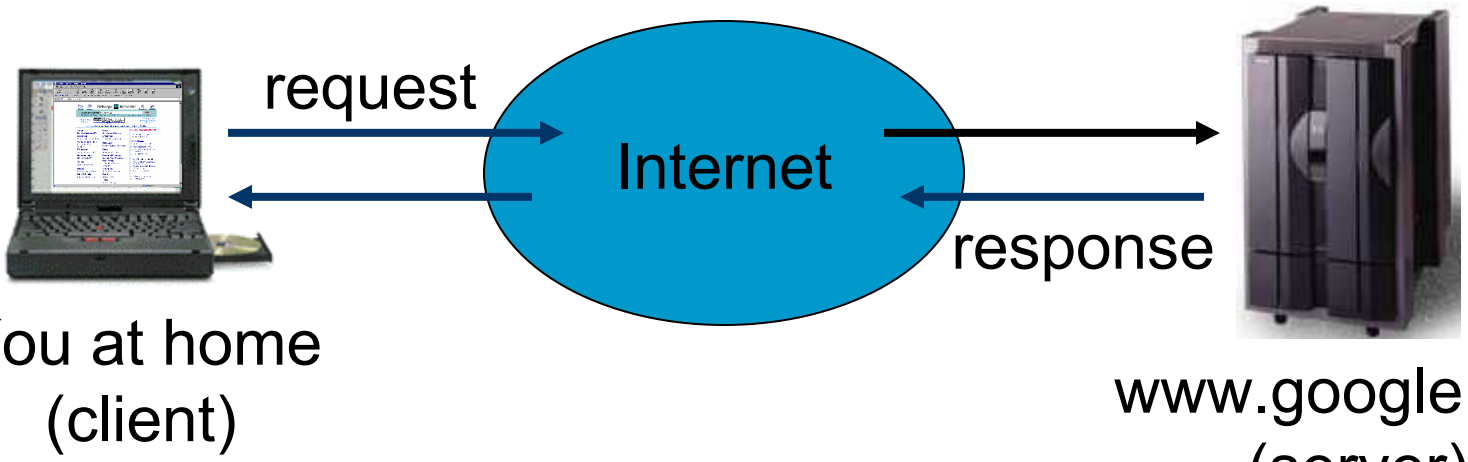
A Brief Tour of the Internet

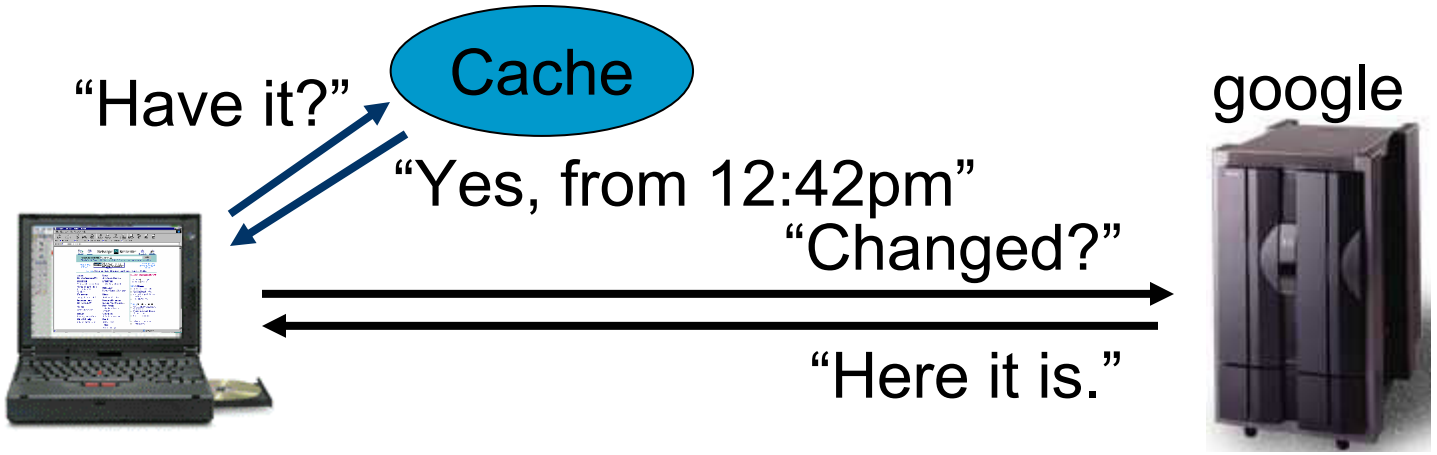
- What happens when you "click" on a web link?



- This is the view from 10,000 ft …

9,000 ft: Caching

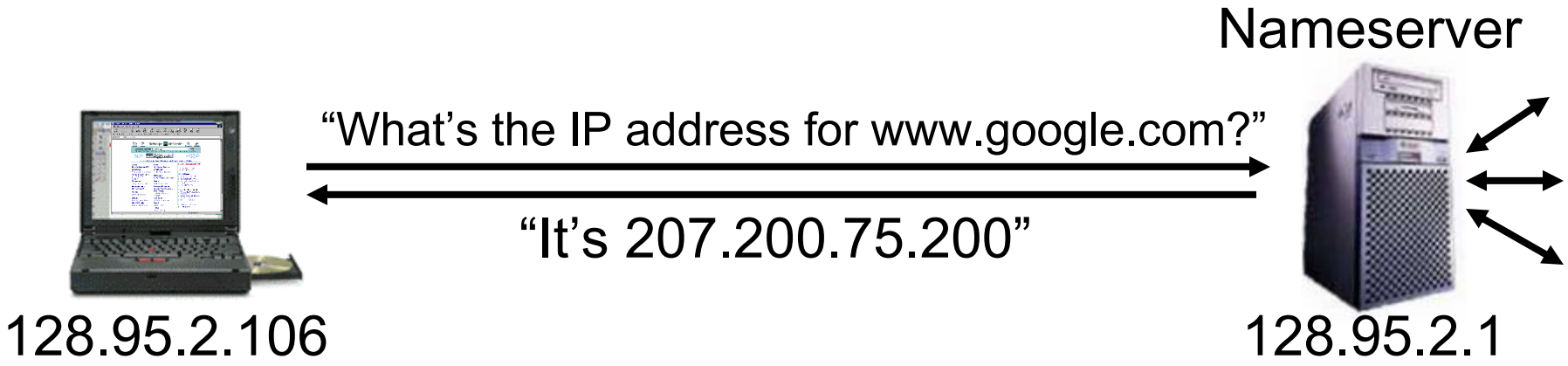
- Lookup a cache before making the full request



- Check cache (local or proxy) for a copy
- Check with server for a new version
- Question: what does caching improve?

8,000 ft: Naming (DNS)

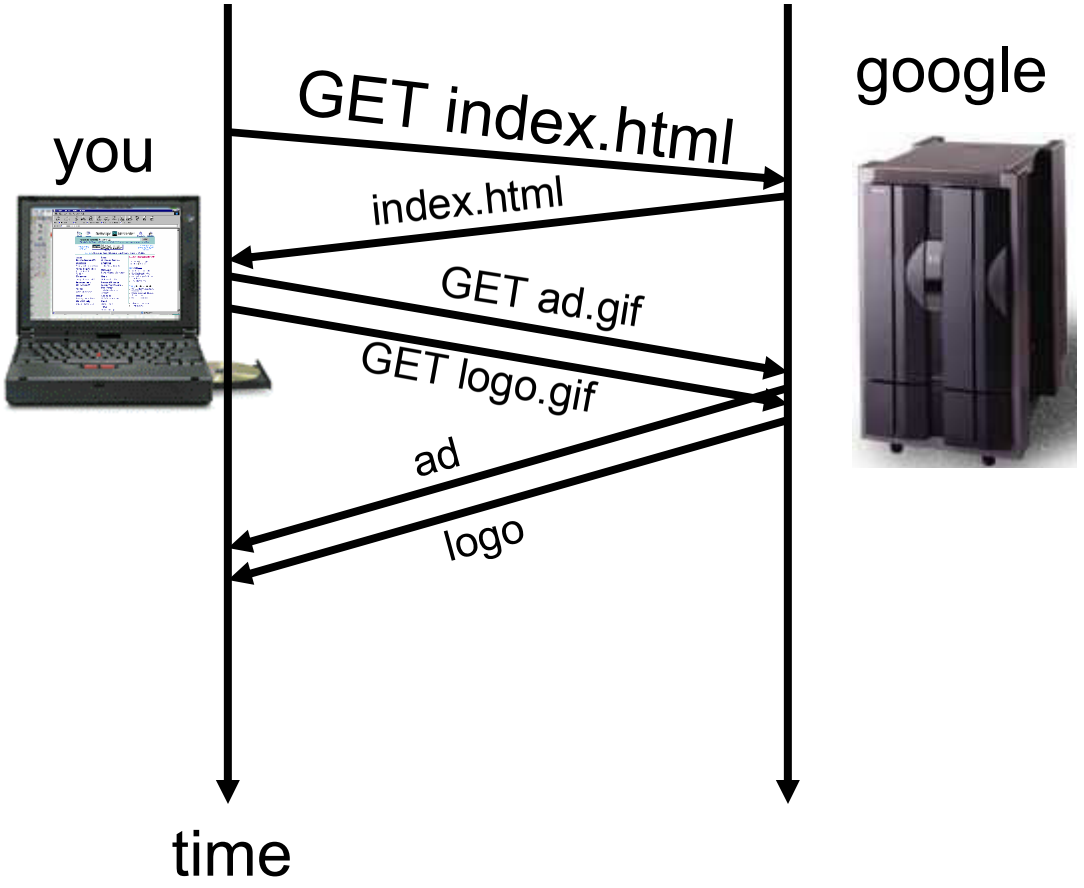
- Map domain names to IP network addresses



- All messages are sent using IP addresses
  - So we have to translate names to addresses first
  - But we cache translations to avoid doing it next time (how do we check for consistency?)

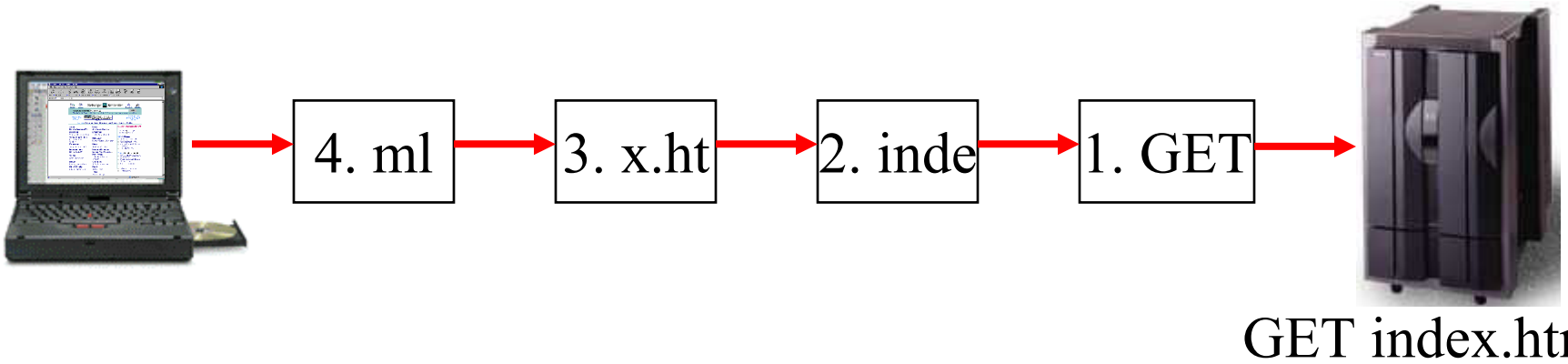
7,000 ft: Sessions (HTTP)

- A single web page can be multiple "objects"
- Fetch each "object" either sequentially or in parallel
- Parallel requests often called "pipelining"



6,000 ft: Packets (TCP)

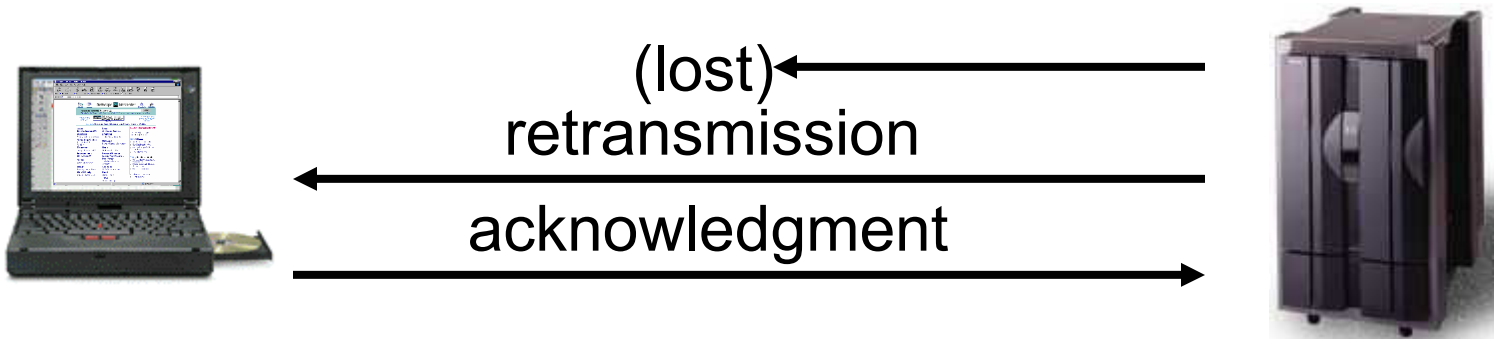
- Long messages are broken into packets
  - Maximum Ethernet packet is 1.5 Kbytes
  - Typical web page is 10 Kbytes



- Number the segments for reassembly and loss detection

5,000 ft: Reliability (TCP)

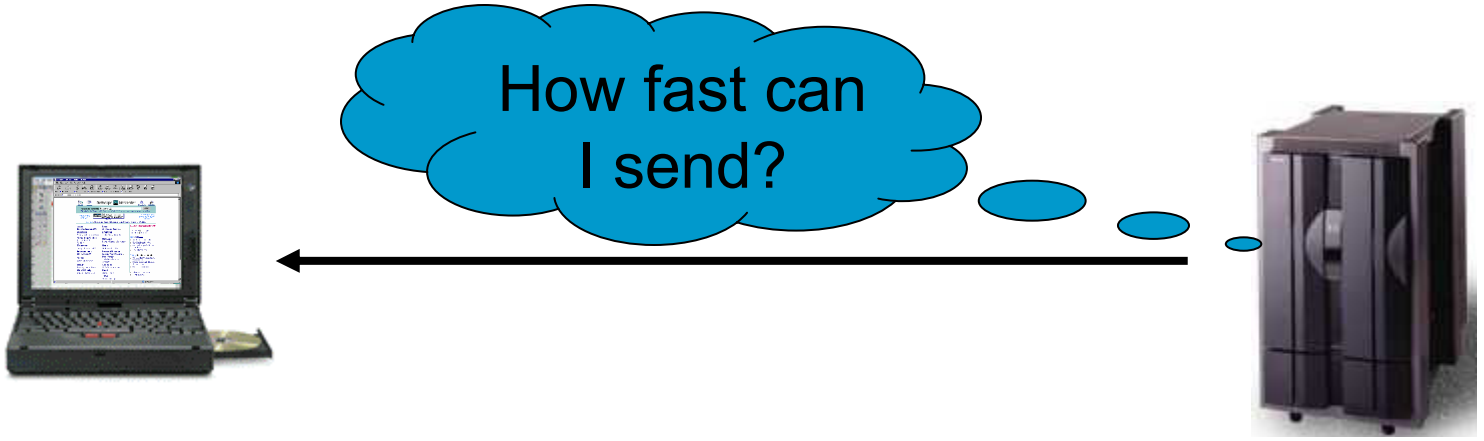
- Packets can (and do) get lost



- We acknowledge successful receipt and detect and retransmit lost messages (e.g., timeouts)
  - ACK vs. NACK

4,000 ft: Congestion (TCP)

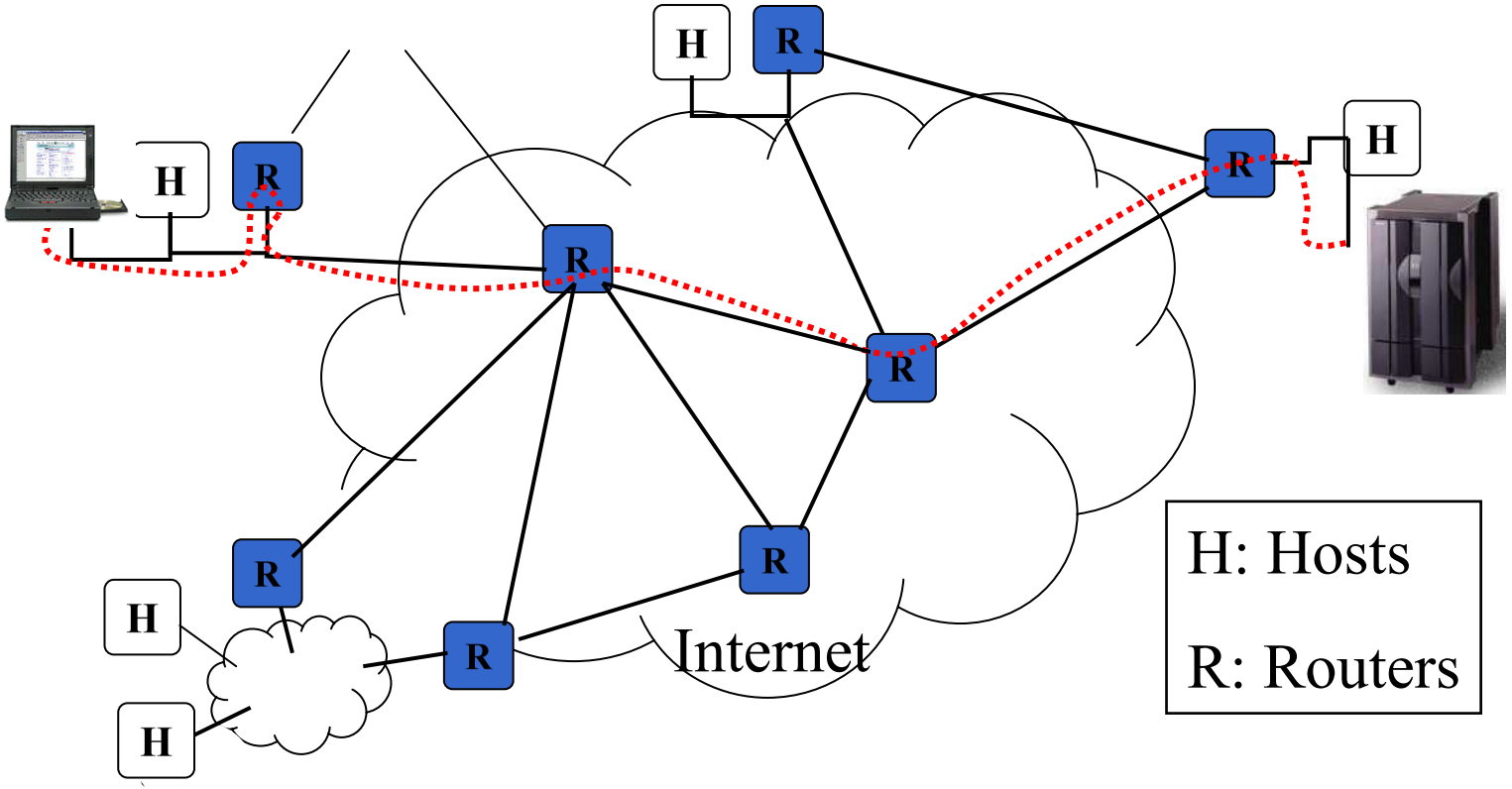
- Need to "allocate" bandwidth between users
  - The magic of *statistical multiplexing*
  - **Statistical Multiplexing**: key concept in networking
  - Queuing: alien concept in circuit switched networks



- Senders balance available and required bandwidths by probing network path and observing the response

3,000 ft: Routing (IP)

- Packets are directed through many routers
- "IP addresses" tell each packet its destination
- The maze is traversed using protocols like BGP



2,000 ft: Multi-access (e.g., 802.11)

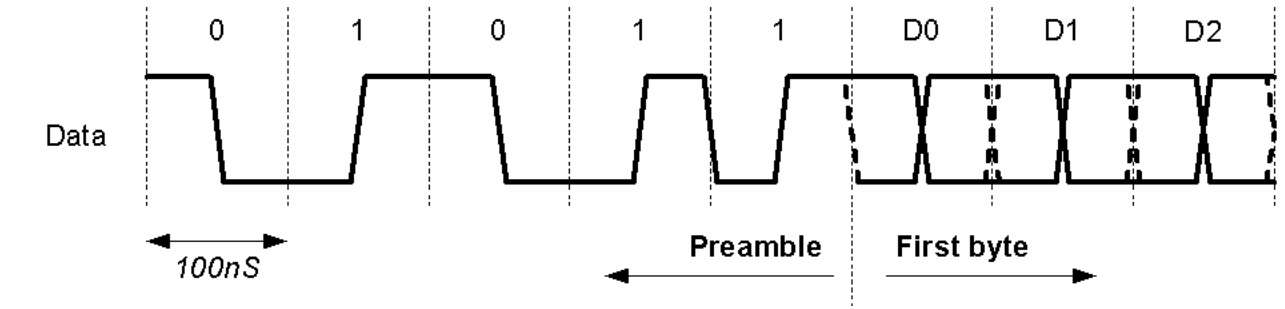
- May need to share links with other senders

- Send wireless "frame". Collisions can occur if more than one node sends at once.
- We need a way to get the senders to take turns, e.g., randomized schemes such as CSMA/CA

1,000 ft: Framing/Modulation

- Protect, delimit and modulate payload as signal

Sync / Unique	Header	Payload w/ error correcting code



E.g, for cable, take payload, add error protection (Reed-Solomon), header and framing, then turn into a signal