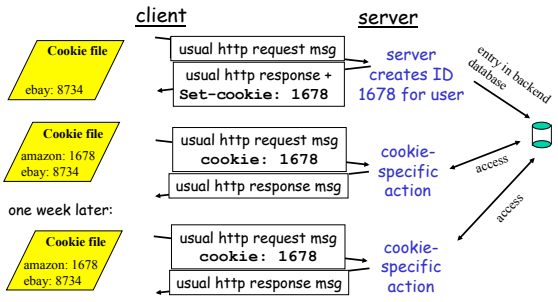
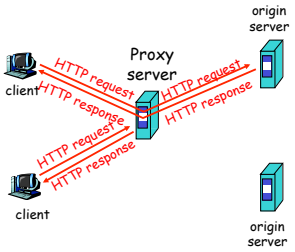
Cookies: keeping "state"



Web caches (proxy server)

Goal: satisfy client request without involving origin server

- user sets browser: Web accesses via cache
- browser sends all HTTP requests to cache
  - object in cache: cache returns object
  - else cache requests object from origin server, then returns object to client
- Reduce response time for client request
- Reduce traffic on an institution's access link
- Reduce load on origin servers



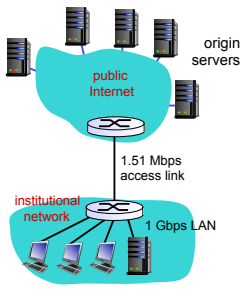
Caching example:

assumptions:

- avg object size: 100,000 bits
- avg request rate from browsers to origin servers:15/ sec
- avg data rate to browsers: 1.50 Mbps
- RTT from institutional router to any origin server: 2 sec
- access link rate: 1.51 Mbps

consequences:

- LAN utilization: 0.15%
- access link utilization = 99% *problem!*
- total delay = Internet delay + access delay + LAN delay
  = 2 sec + minutes + usecs



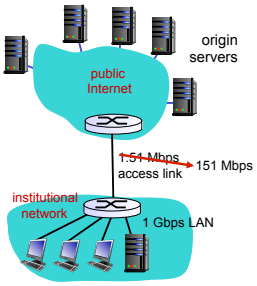
Caching example: fatter access link

assumptions:

- avg object size: 100K bits
- avg request rate from browsers to origin servers:15/ sec
- avg data rate to browsers: 1.50 Mbps
- RTT from institutional router to any origin server: 2 sec
- access link rate: ~~1.51 Mbps~~ → 151 Mbps

consequences:

- LAN utilization: 0.15%
- access link utilization = ~~99%~~ → 0.99%
- total delay = Internet delay + access delay + LAN delay
  = 2 sec + ~~minutes~~ → msecs + usecs



Cost: increased access link speed (not cheap!)

Caching example: install local cache

assumptions:

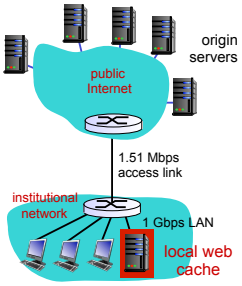
- avg object size: 100K bits
- avg request rate from browsers to origin servers:15/ sec
- avg data rate to browsers: 1.50 Mbps
- RTT from institutional router to any origin server: 2 sec
- access link rate: 1.51 Mbps

consequences:

- LAN utilization: 0.15%
- access link utilization = ?
- total delay = ?

How to compute link utilization, delay?

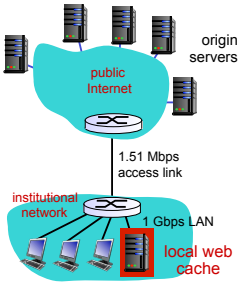
Cost: web cache (cheap!)



Caching example: install local cache

Calculating access link utilization, delay with cache:

- suppose cache hit rate is 0.4
  - 40% requests satisfied at cache, 60% requests satisfied at origin
- access link utilization:
  - 60% of requests use access link
- data rate to browsers over access link = 0.6*1.50 Mbps = .9 Mbps
  - utilization = 0.9/1.51 = .6
- total delay
  - = 0.6 * (delay from origin servers) +0.4 * (delay when satisfied at cache)
  - = 0.6 (2.7) + 0.4 (~usecs)
  - = ~ 1.6 secs
  - less than with 151 Mbps link (and cheaper too!)



Conditional GET

- Goal: don't send object if cache has up-to-date cached version
- cache: specify date of cached copy in HTTP request

  `If-modified-since: <date>`
- server: response contains no object if cached copy is up-to-date:

  `HTTP/1.0 304 Not Modified`