CN-Basic
L15

HTTP Cacheing & Cookies

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HTTP Redirect

- Content type
  - accessing hello.html vs hello.txt
    - `Content-Type: text/html`
    - `Content-Type: text/plain`
- Location (i.e. URL Redirect)
  - `workshops.rprustagi.com` ->
    - `rprustagi.com/workshops/workshops.html`
- Access `google.com`
  - user browser or (`wget -d` <URL>)

Web Cache and Proxy

- A Good resource on Web Cache
  - https://www.mnot.net/cache_docs/
  - https://developers.google.com/web/fundamentals/performance/optimizing-content-efficiency/http-caching?hl=en
- Resources and acknowledgements
  - http://wps.pearsoned.com/ecs_kurose_compnetw_6/216/55463/14198700.cw/index.html

Conditional GET

- *Goal:* don't send object if cache has up-to-date cached version
  - No object transmission delay
  - Lower link utilization
- *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`

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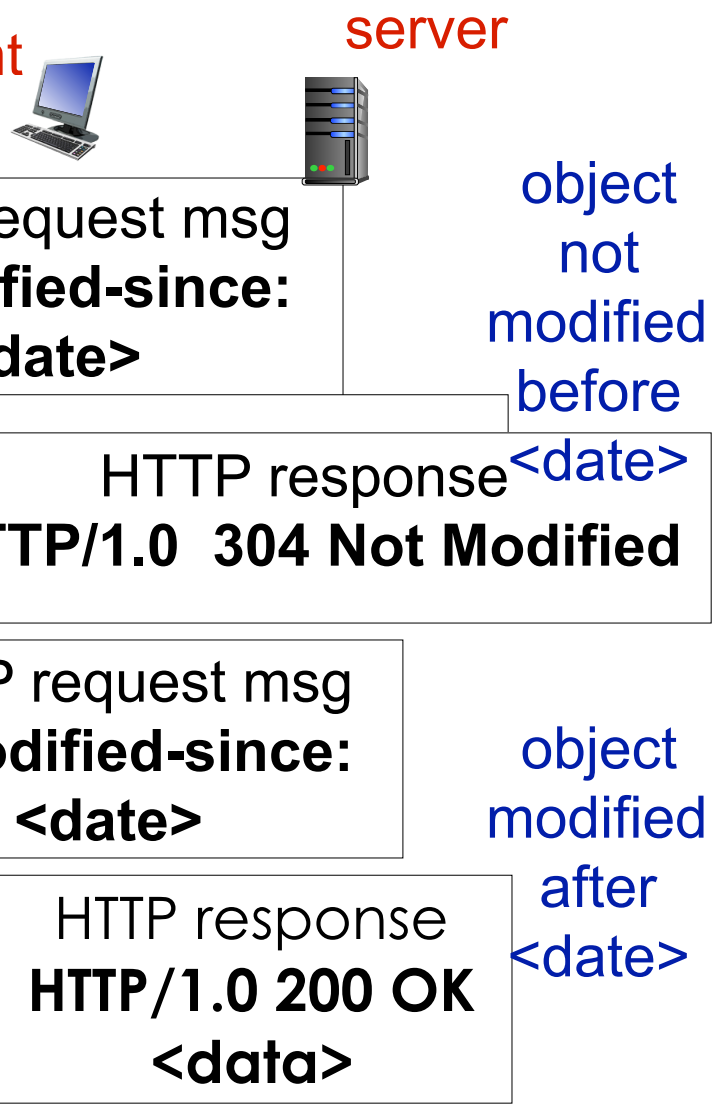
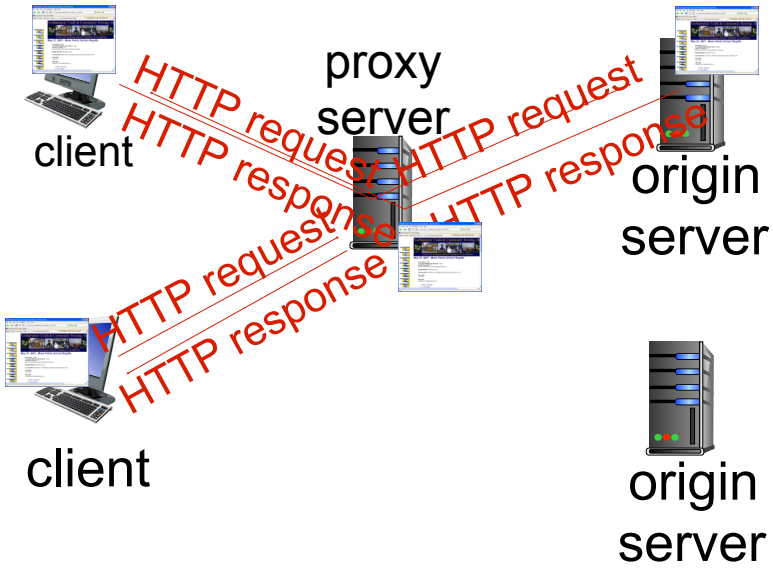
- *server:* response contains no object if cached copy is up-to-date:
  - `HTTP/1.0 304 Not Modified`



Web caches (proxy server)

- user sets browser: Web accesses via proxy server
- browser sends all HTTP requests to cache
- cache requests object from origin server, then returns object to client
  - object in cache: cache returns object

goal: satisfy client request without involving origin server



More about Web caching

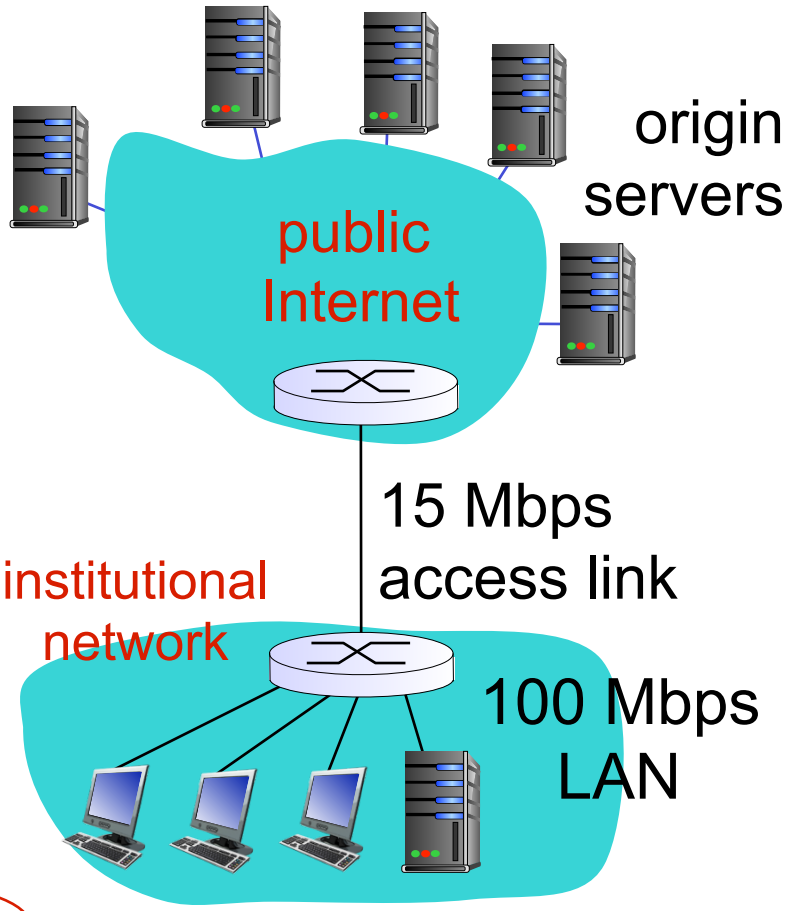
- Proxy server acts as both client and server
  - server for original requesting client
  - client to origin server
- typically proxy server is installed by ISP (university, company, residential ISP)

- *why Web caching?*
- reduce response time for client request
- reduce traffic on an institution's access link
- Internet dense with caches: enables "poor" content providers to effectively deliver content (so too does P2P file sharing)

Caching example:

- *assumptions:*
- avg object size: 1M bits
- avg request rate from browsers to origin servers: 15/sec
- RTT from institutional router to any origin server: 2 sec (internet delay)
- access link rate: 15 Mbps
- *consequences:*
- LAN Traffic intensity =
  - 15*1Mb/100Mbps = 15%
- Access link traffic intensity
  - 15 * 1Mb/15Mbps = 100%
- total delay = Internet delay + access delay + LAN delay
- = 2s + minutes + μs

problem!



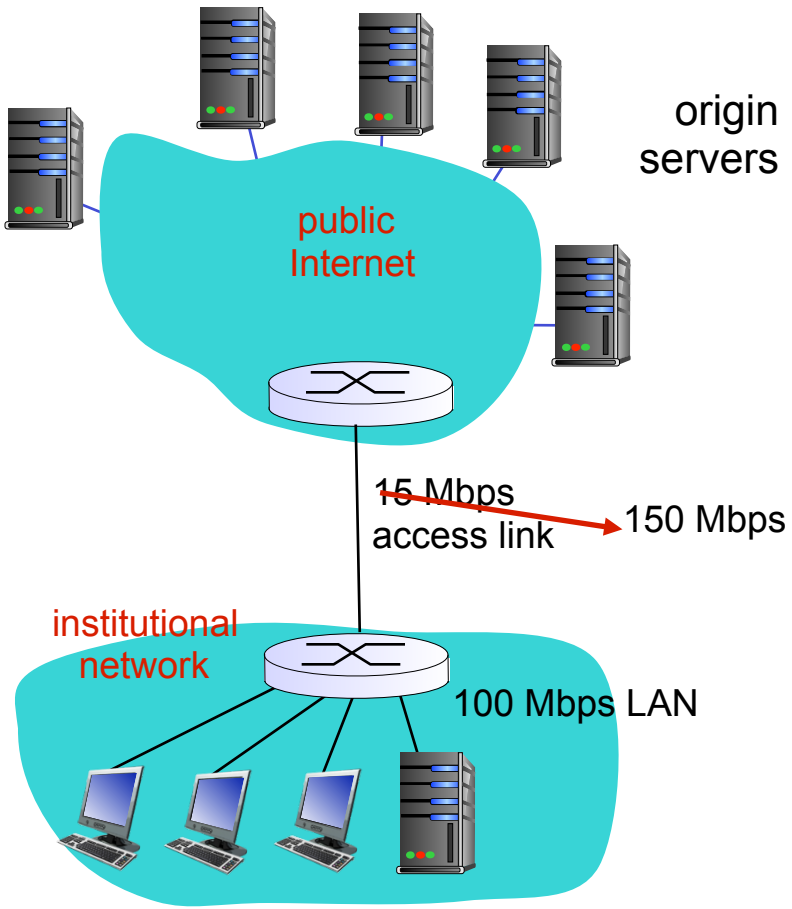
Caching example: fatter access link

assumptions:

- avg object size: 1M bits
- avg request rate from browsers to origin servers: 15/sec
- RTT from institutional router to any origin server: 2 sec
- access link rate: 15 Mbps

consequences:

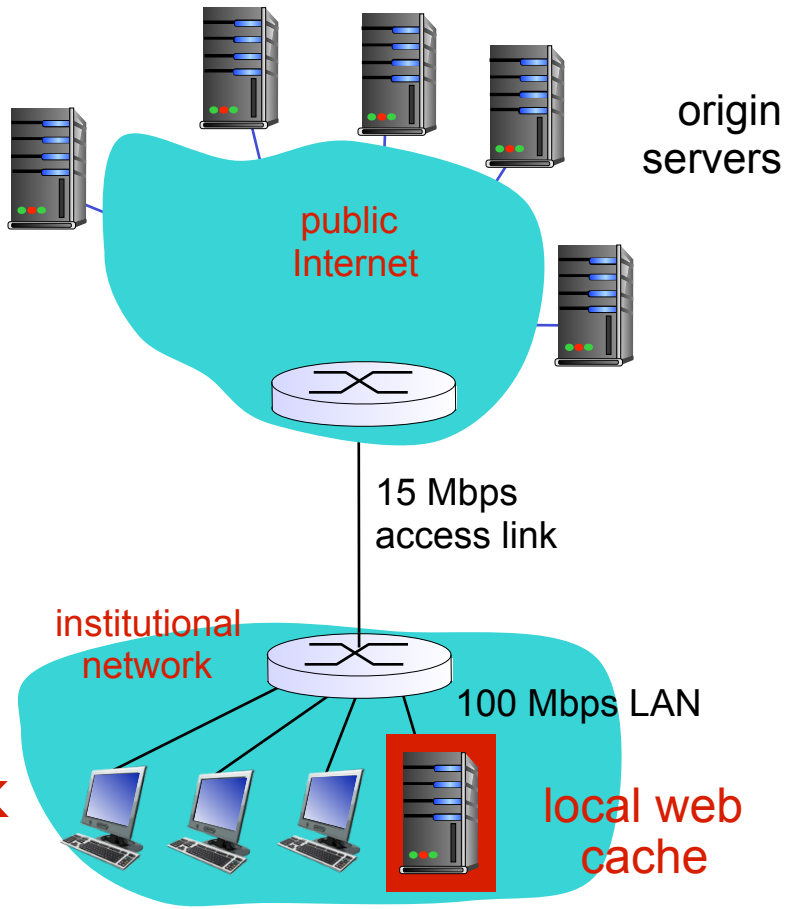
- LAN utilization: 15%
- access link utilization =100%
- total delay= Internet delay + access delay+ LAN delay
- = 2 sec + minutes + µs



Cost: increased access link speed (not cheap!)

Caching example: install local cache

- *consequences:*
- LAN utilization: 15%
- access link utilization = 100%
- total delay =
  Internet delay ?
  + access delay ?
  + LAN delay
  = 2 sec + minutes + µs



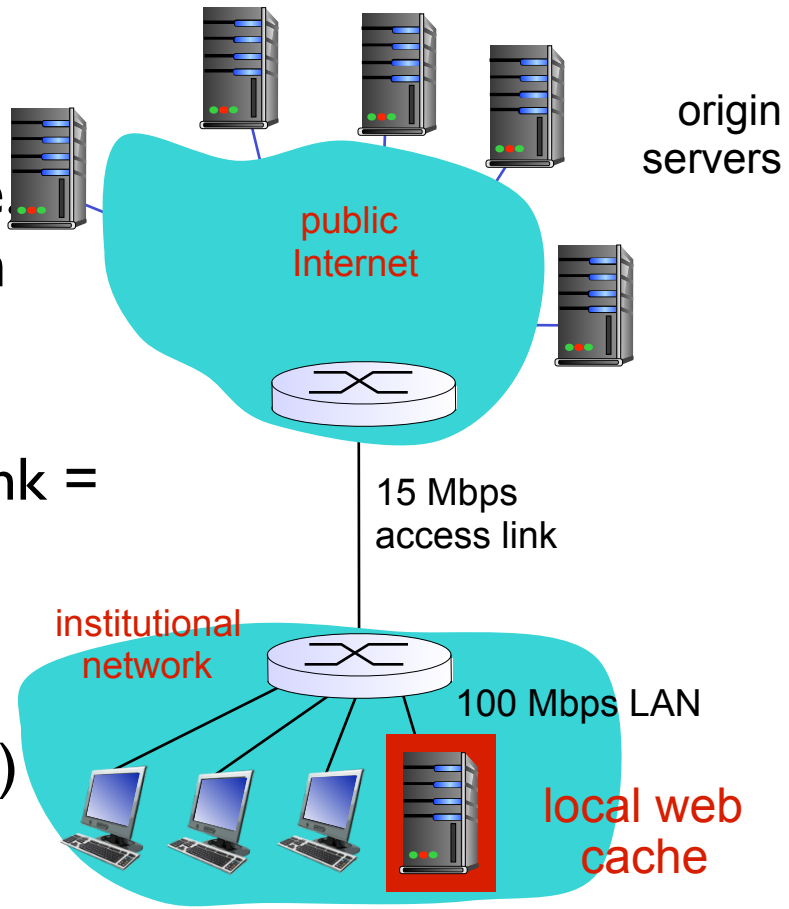
How to compute link utilization, delay?

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*15 Mbps = 9 Mbps
  - utilization = 9/15 = .6
- total delay
- = 0.6 * (delay from origin servers) +0.4 * (delay when satisfied at cache)
- = 0.6 (2.01) + 0.4 (~msecs)
- = ~ 1.2 secs
- less than with 150 Mbps link (and cheaper too!)



Types of Cache

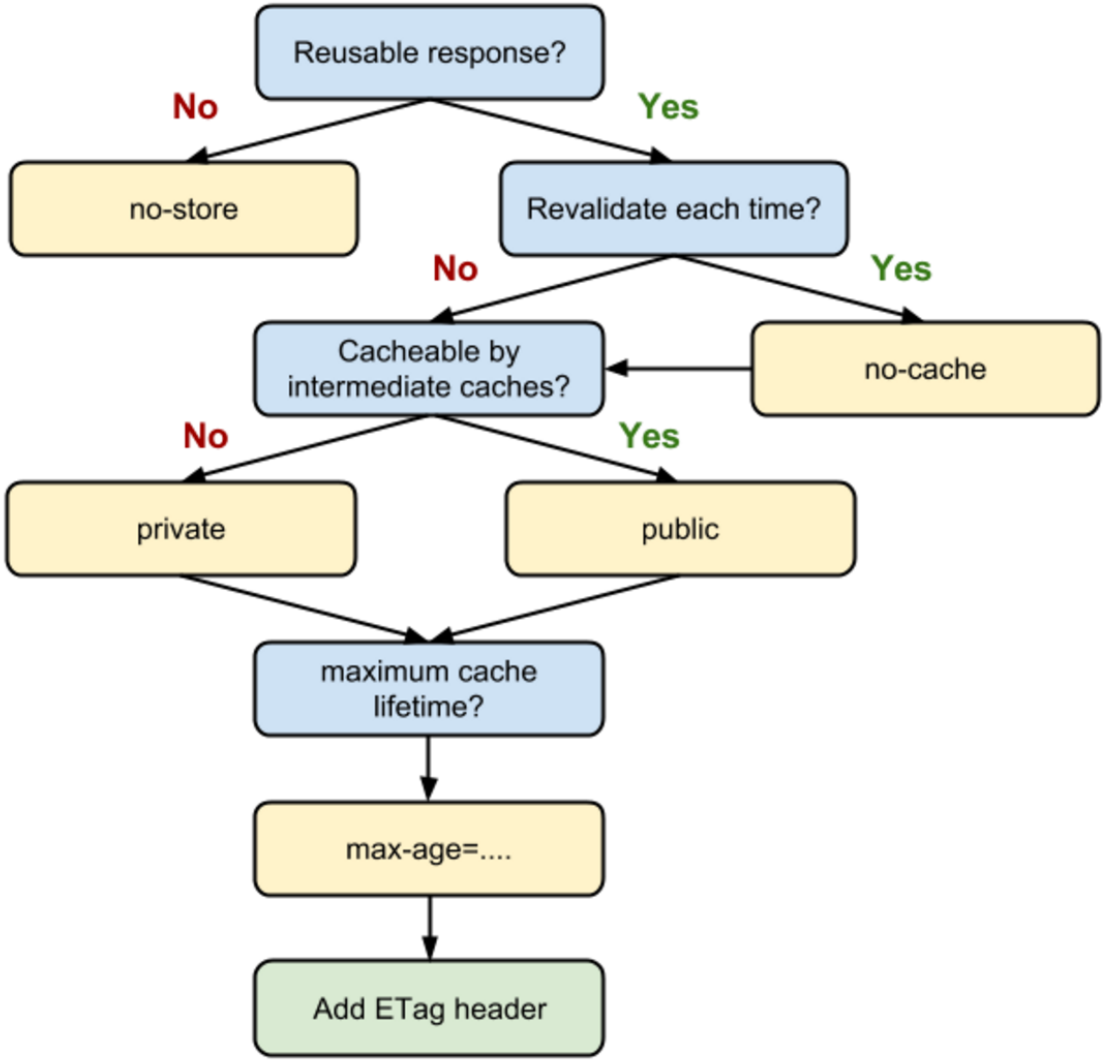
- private cache: Exclusive browser cache
- public cache
  - proxy cache
    - reduces bandwidth requirements
    - reduces delays
  - gateway cache : (aka reverse proxy cache)
    - deployed by web masters for scalability
    - examples: memcached, varnish

Cache Headers

- Last-modified
- If-modified-since / If-unmodified-since
- Etag
- If-none-match
- Vary
- Age
- Pragma directive
- Date
- Expires
- Cache-Control

Cache-control

src: https://developers.google.com/web/fundamentals/performance/optimizing-content-efficiency/http-caching?hl=en



User-server state: cookies

many Web sites use cookies

four components:

1) cookie header line of HTTP *response* message
2) cookie header line in next HTTP *request* message
3) cookie file kept on user's host, managed by user's browser
4) back-end database at Web site

- example:
- Susan always access Internet from PC
- visits specific e-commerce site for first time
- when initial HTTP requests arrives at site, site creates:
- unique ID
- entry in backend database for ID

Cookies: keeping "state" (cont.)

Cookies (continued)

- *what cookies can be used for:*
  - authorization
  - shopping carts
  - recommendations
  - user session state
    - (Web e-mail)

aside

- *cookies and privacy:*
- cookies permit sites to learn a lot about you
- you may supply name and e-mail to sites

- *how to keep "state":*
  - protocol endpoints: maintain state at sender/receiver over multiple transactions
  - cookies: http messages carry state

Cookie Settings

- https://developer.mozilla.org/en-US/docs/Web/HTTP/Headers/Set-Cookie
- Domain
  - domain and sub domain
- Path
  - covers sub paths
- Secure
  - only with HTTPS
- HttpOnly
  - Only web page access, not with javascript
- Max-Age, Expires
- SameSite

Cookies (continued)

- Examples
  rprustagi.com/workshops/web/cookie-expiry.php
  rprustagi.com/workshops/web/cookie-path.php
  rprustagi.com/workshops/web/cookie-secure.php
  - How browser stores it
    - Firefox: preferences→privacy→Cookies
      - Remove the cookie and re-access the page
    - Chrome: Settings→Advanced→privacy& Security→Site Settings→Cookies→See all cookies and site data

Summary

- HTTP Redirect
- HTTP Cookies
- HTTP Cacheing