Application Layer
Web/HTTP

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(Based on slide deck of Computer Networking, 7th ed., Jim Kurose and Keith Ross.)

Web and HTTP: An overview

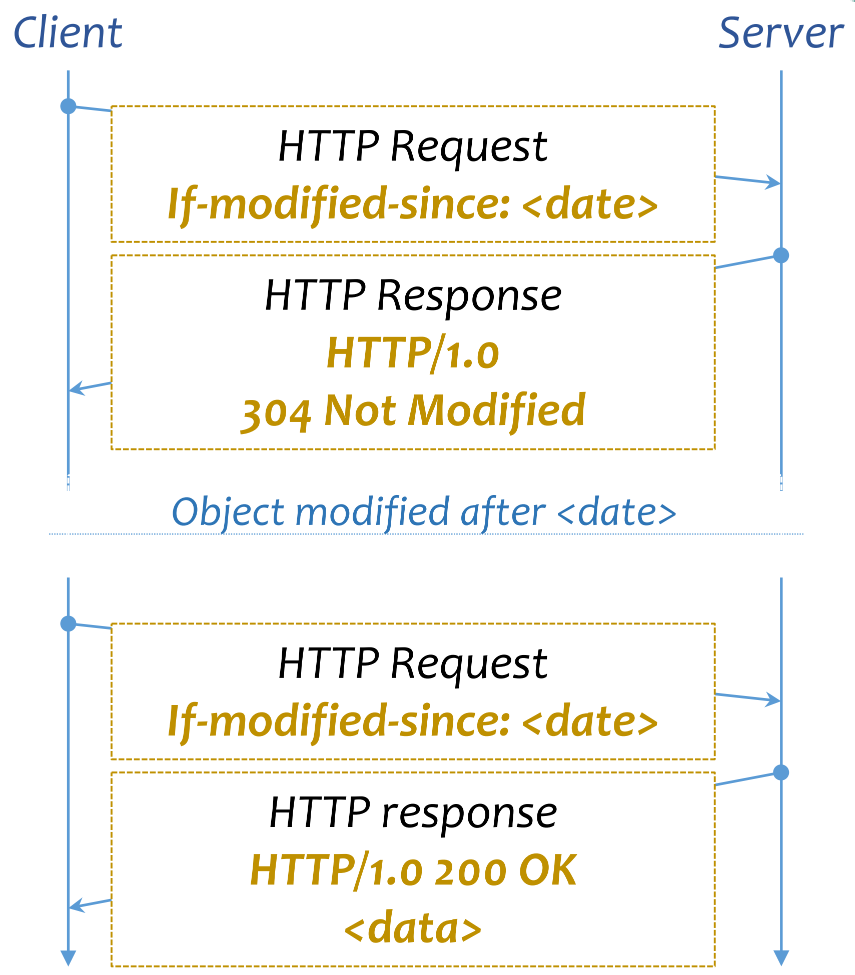
- ***Web page*** consists of ***objects***
- Objects?
  - *E.g., HTML file, JPEG image, audio file, …*
- Web page consists of ***base HTML-file*** which includes several ***referenced objects***
- Each object is addressable by a ***URL***
  - *E.g., https://www.mpi-inf.mpg.de/inet/*

User-Server Interaction: Conditional GET

- ***Goal***
  - Don’t send object if client has up-to-date stored ***(cached)*** version
- Client
  - Specify date of cached copy in http request

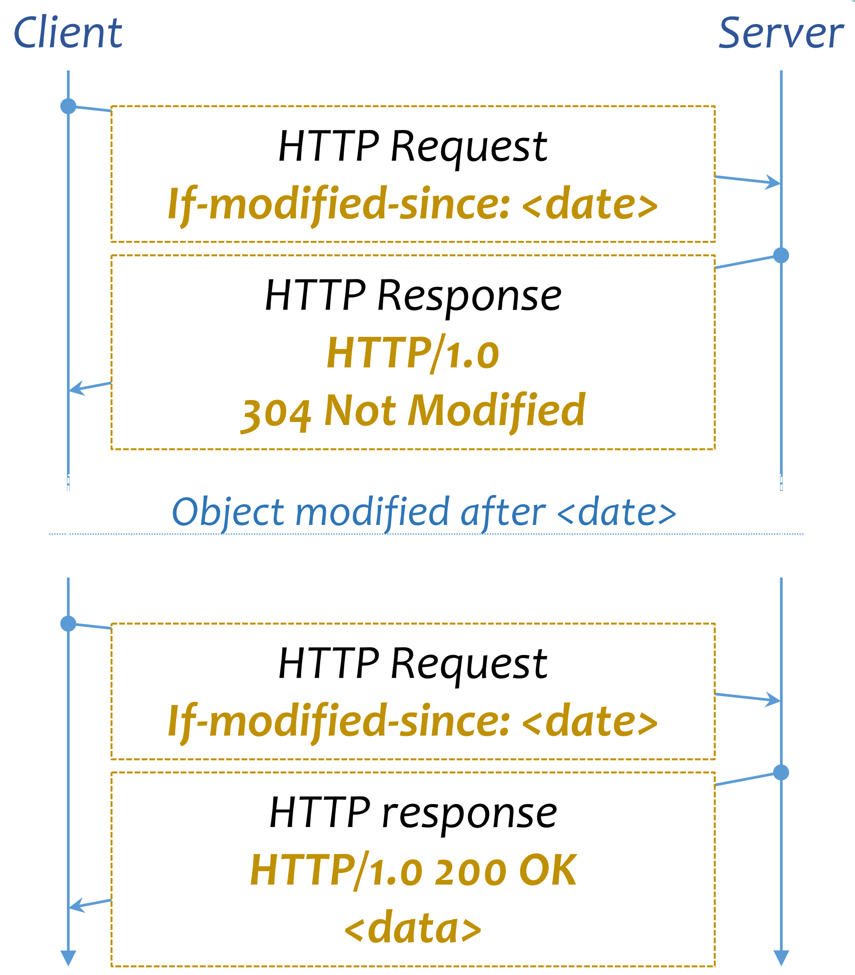
    If-modified-since: <date>
- Server
  - Response contains no object if cached copy up-to-date

    HTTP/1.0 304 Not Modified



Conditional GET

- ***Goal***
  - Don't send object if client has up-to-date stored ***(cached)*** version
  - Merits
    - No object transmission delay
    - Lower link utilization



Web Cache (Caching proxy server)

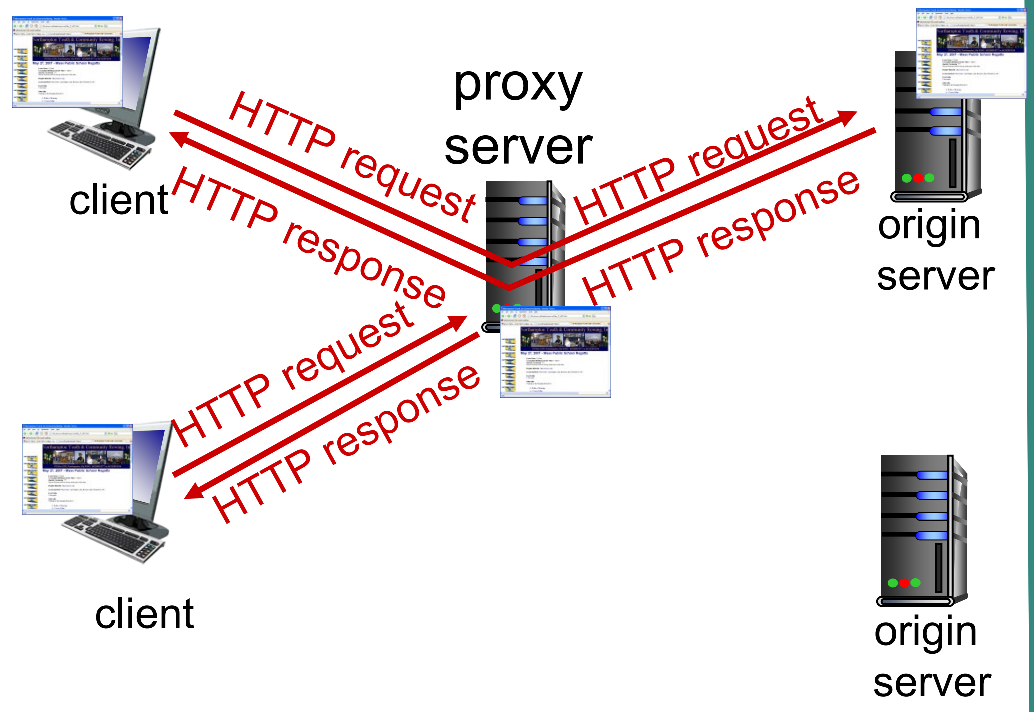
Goal

- Caching proxy server – middle box
- Satisfy client request without involving *origin* server

- Why?
  - Improve response times
  - Reduce load on the origin server
  - Reduce bandwidth demands

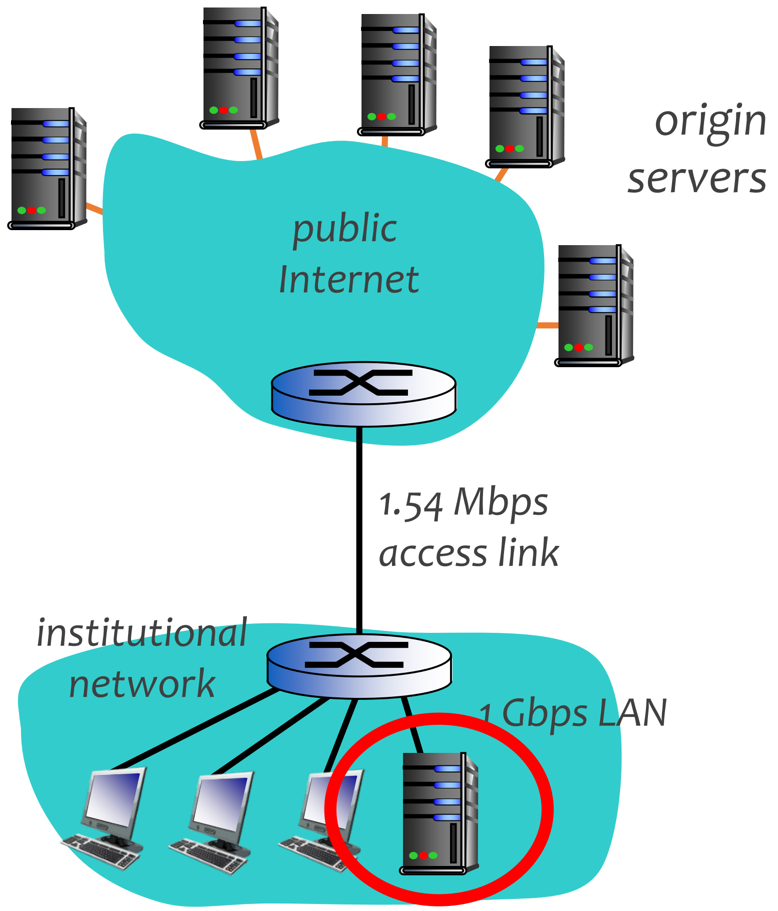
Web Cache (Caching proxy server)

- 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



Web Caching: Why?

- ***Assumption***
  - *Cache is "close" to client*
    (e.g., in same network)
- Smaller response time
  - Cache "closer" to client
- Decrease traffic to distant servers
  - Link out of institutional/local ISP network often bottleneck

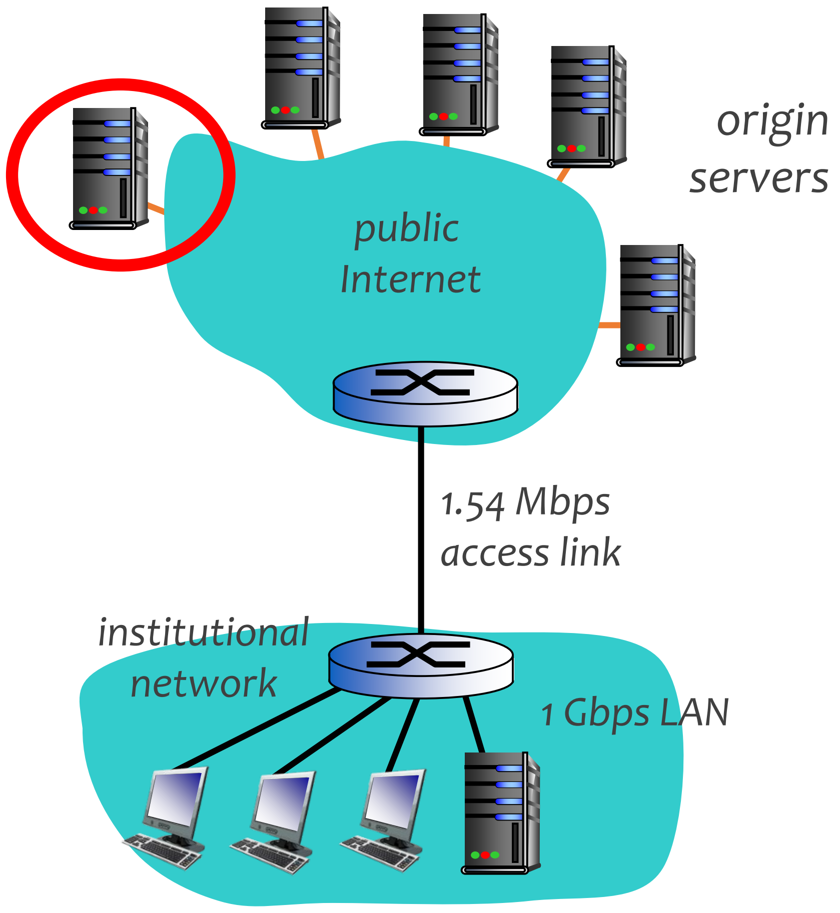


Web Caching: Why?

- ***Assumption***
  - *Cache is "close" to server*
    (e.g., in same network)

- Reduce load on application server
  - Often for
    - Static content
    - Dynamically generated content

  Caching controlled by application



Authentication?

Image credits: Pixabay, www.pexels.com

User-Server Interaction: Basic Authentication

- ***Authentication goal***
  - *Control access to server documents*
- ***Stateless***
  - Client must present authorization in each request
- ***Authorization***
  - Typically user name, password

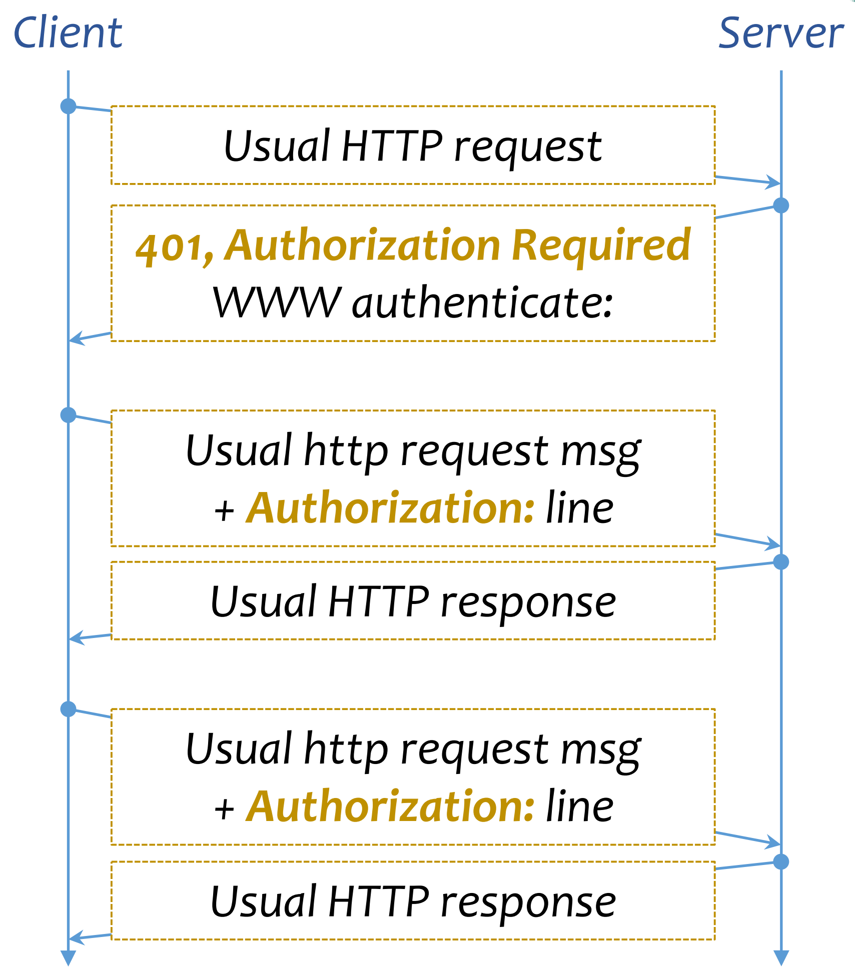
Authorization:

header line in request

If no authorization, server refuses access, sends

WWW authenticate:

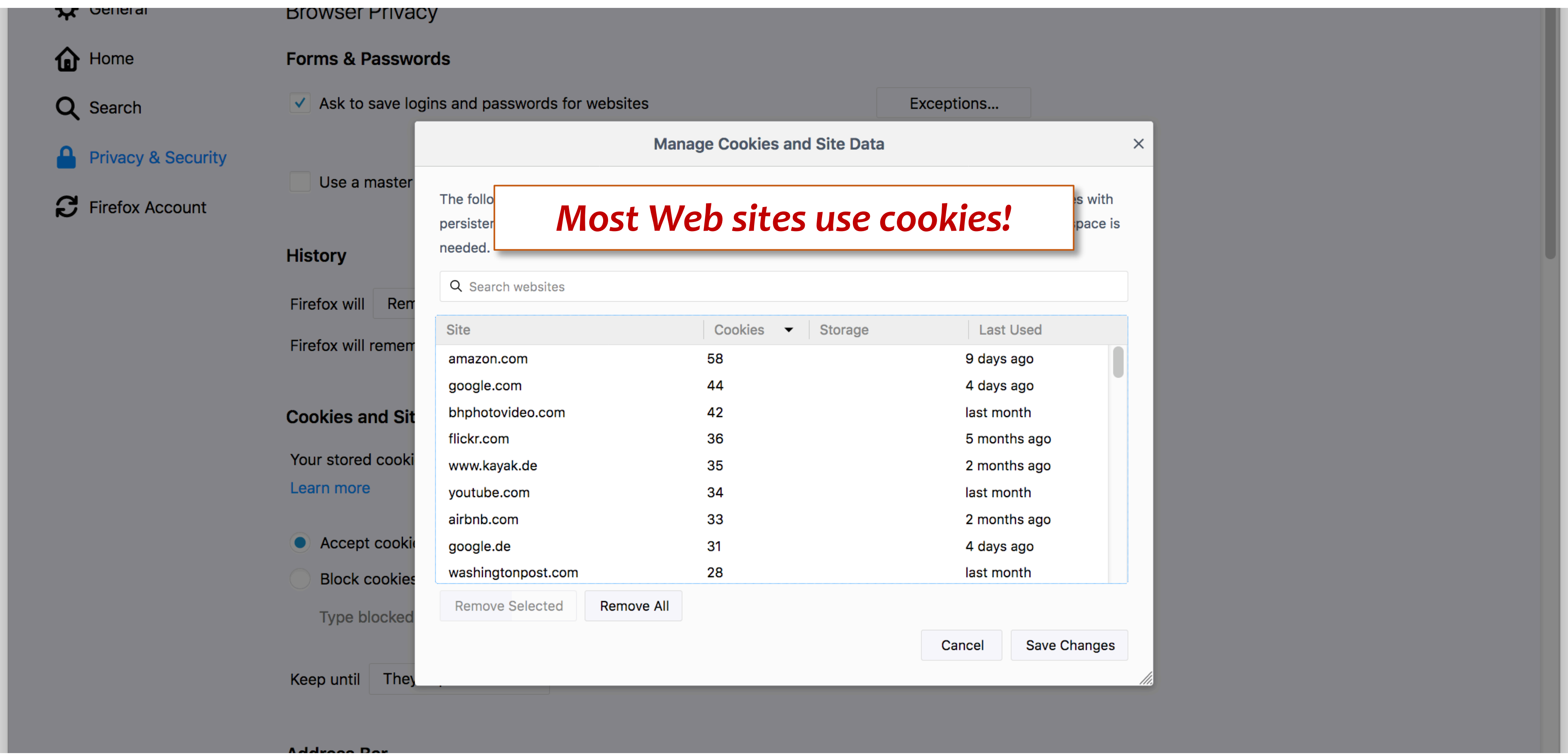
header line in response



Cookies?

Image credits: Oleg Magni, www.pexels.com

User-side State: Cookies



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Manage Cookies and Site Data

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Most Web sites use cookies!

Search websites

Site	Cookies	Storage	Last Used
amazon.com	58		9 days ago
google.com	44		4 days ago
bhphotovideo.com	42		last month
flickr.com	36		5 months ago
www.kayak.de	35		2 months ago
youtube.com	34		last month
airbnb.com	33		2 months ago
google.de	31		4 days ago
washingtonpost.com	28		last month

Remove Selected · Remove All

Cancel · Save Changes

User-side State: Cookies

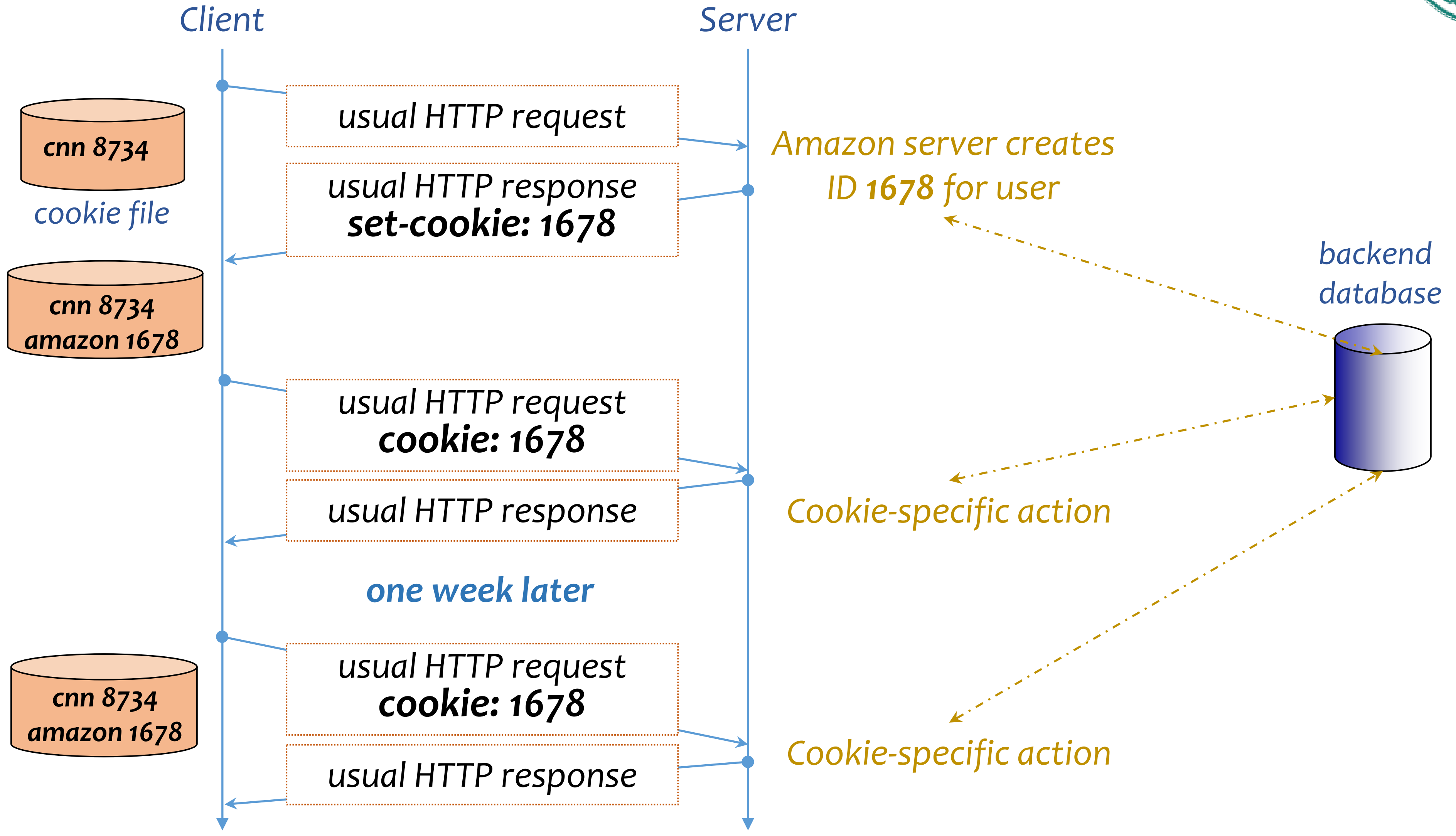
Four components:

- Cookie header line of *HTTP response* message
- Cookie header line in *HTTP request* message
- Cookie file kept on user's host, managed by user's browser
- Back-end database at Web site

Example:

- Susan access Internet always from same PC
- She visits a specific e-commerce site for *first* time
- When initial HTTP requests arrives at site, site creates a unique ID and creates an entry in backend database for ID

Cookies: Keeping "state"



Cookies: Debate

Merits?

- Authorization
- Shopping carts
- Recommendations
- User session state *(e.g., for Web eMail)*

Cookies and ***privacy***:

- Permit sites to learn a lot about you
- Advertising companies: obtain data across sites

Users can even be tracked if cookies are turned off!