

**CSCI 491-01**

**Topics: Internet Programming**

**Fall 2008**

**Application Layer**

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September 10, 2008

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# Chapter 2: Roadmap

2.1 Principles of network applications

2.2 Web and HTTP

2.3 FTP

2.4 Electronic Mail

- SMTP, POP3, IMAP

2.5 DNS

2.6 P2P file sharing

2.7 Socket programming with TCP

2.8 Socket programming with UDP

2.9 Building a Web server

# Persistent HTTP

## Nonpersistent HTTP issues:

- Requires two RTTs per object
- OS must work and allocate host resources for each TCP connection
- Browsers often open parallel TCP connections to fetch referenced objects

## Persistent HTTP

- Server leaves connection open after sending response
- Subsequent HTTP messages between same client/server are sent over connection

## Persistent without pipelining:

- Client issues new request only when previous response has been received
- One RTT for each referenced object + its transmission time

## Persistent with pipelining:

- Default in HTTP/1.1
- Client sends requests as soon as it encounters a referenced object
- One RTT for all referenced objects + their transmission times

# HTTP Request Message

- Two types of HTTP messages: *request, response*
- **HTTP request message:**
  - ASCII (human-readable format)

request line  
(GET, POST,  
HEAD commands)

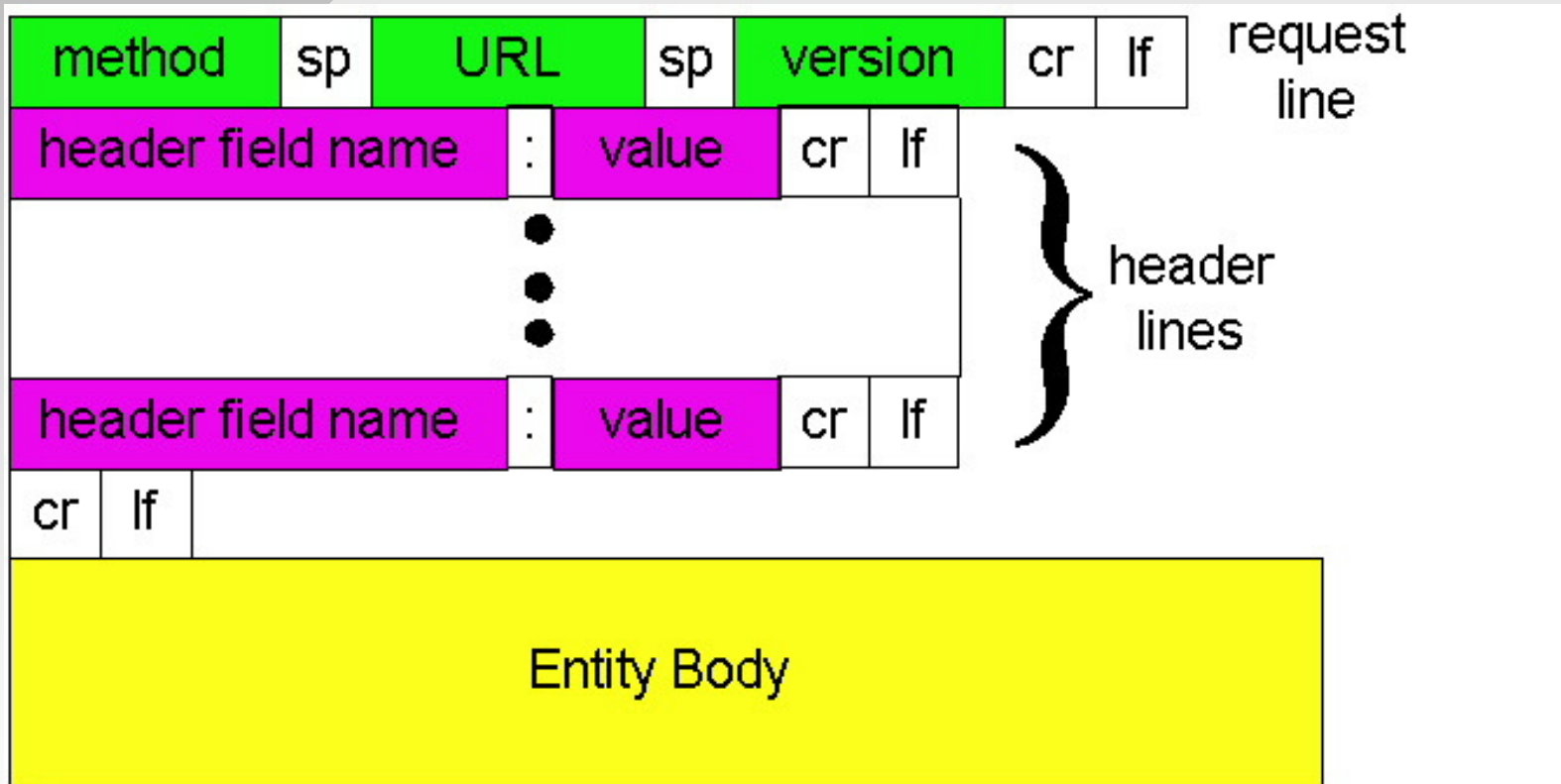
header  
lines

```
GET /somedir/page.html HTTP/1.1
Host: www.someschool.edu
User-agent: Mozilla/4.0
Connection: close
Accept-language: fr
```

Carriage return,  
line feed  
indicates end  
of message

(extra carriage return, line feed)

# HTTP Request Message: General Format



# Uploading Form Input

## Post method:

- Web page often includes form input
- Input is uploaded to server in **entity body**
- Used for large amounts of data
  - Data is coded using tuples “field=value”, where + stands for space and & for the field separator

```
POST /path/script.cgi HTTP/1.0
From: frog@jmarshall.com
User-Agent: HTTPTool/1.0
Content-Type: application/x-www-form-urlencoded
Content-Length: 32
```

```
home=Cosby&favorite+flavor=flies
```

## Uploading Form Input (Cont'd)

### URL method:

- Uses the GET command
- Input is encoded in the URL field of request line
  - Append ? to the script path, followed by the URL-coded data
  - GET /path/script.cgi?field1=value1&field2=value2 HTTP/1.0
- For the previous example
  - GET /path/script.cgi?home=Cosby&favorite+flavor=flies HTTP/1.0

# Method Types

## HTTP/1.0

- GET
- POST
- HEAD
  - Asks server to leave requested object out of response

## HTTP/1.1

- GET, POST, HEAD
- PUT
  - Uploads file to path specified in URL field
- DELETE
  - Deletes file specified in the URL field

# HTTP Response Message

status line  
(protocol  
status code  
status phrase)

HTTP/1.1 200 OK

header  
lines

Connection: close

Date: Thu, 06 Aug 1998 12:00:15 GMT

Server: Apache/1.3.0 (Unix)

Last-Modified: Mon, 22 Jun 1998 ...

Content-Length: 6821

Content-Type: text/html

data, e.g.,  
requested  
HTML file

data data data data data ...

# HTTP Response Status Codes

- Status code is always in the first line of response
  - A few sample codes:

200 OK

- Request succeeded, requested object later in this message

301 Moved Permanently

- Requested object moved, new location specified later in this message (see field `Location:`)

400 Bad Request

- Request message not understood by server

404 Not Found

- Requested document not found on this server

505 HTTP Version Not Supported

# User-Server State: Cookies

Many major Web sites use cookies

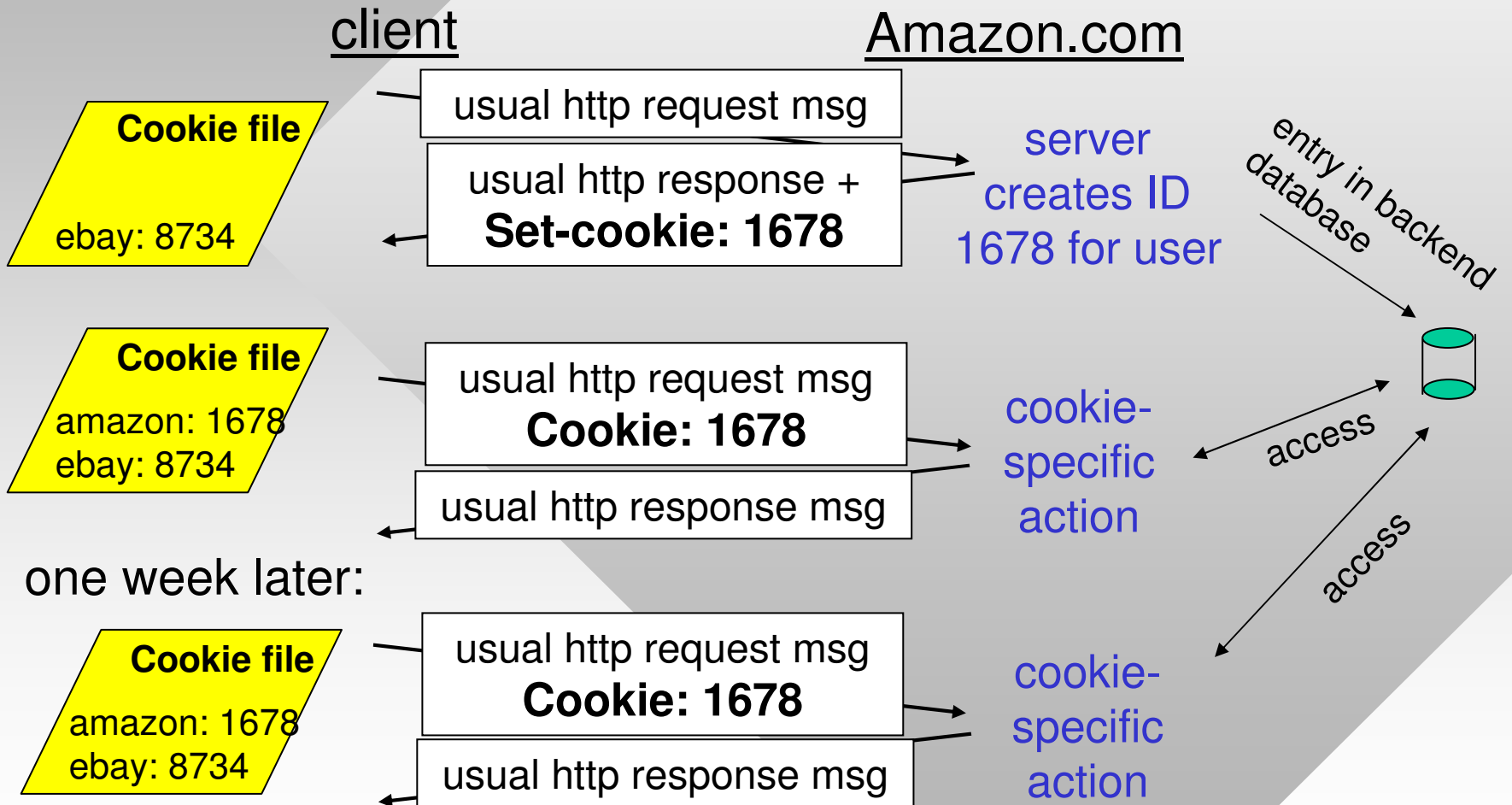
## Four components:

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

## Example:

- User visits the same web site multiple times
  - Doesn't want to type password or make selections each time
- Website remembers certain info about the user
  - TVguide.com remembers your area and cable channels
  - Weather.com

# Cookies: Keeping "State" (Cont.)



# Cookie Example

```
telnet irl.cs.tamu.edu 80
GET / HTTP/1.0
```

```
HTTP/1.1 200 OK
Connection: close
Date: Tue, 18 Sep 2007 18:47:25 GMT
Server: Microsoft-IIS/6.0
MicrosoftOfficeWebServer: 5.0_Pub
X-Powered-By: ASP.NET
Content-Length: 6916
Content-Type: text/html
Set-Cookie: ASPSESSIONIDACSRQCTQ=PIGHLBAAJICJONABJFINMLOA;
path=/
Cache-control: private
```

path prefix where  
cookie is valid

cookie value

caching not allowed

## Cookies (continued)

### What cookies can bring:

- Authorization
- Shopping carts
- Recommendations
- User session state (web e-mail)

### Cookie location:

- C:\Documents and Settings\\Cookies
  - Note: impersonation is possible by copying your cookies
- Other privacy issues
  - Websites may learn about user behavior, potentially share this information with others