Cookies Overview and HTTP Proxies
What is a Cookie?

- Small piece of data generated by a web server, stored on the client’s hard drive.
- Serves as an add-on to the HTTP specification (remember, HTTP by itself is stateless.)
- Still somewhat controversial, as it enables web sites to track web users and their habits…
Why use Cookies?

- Tracking unique visitors
- Creating personalized web sites
- Shopping Carts
- Tracking users across your site:
  - e.g. do users that visit your sports news page also visit your sports store?
Example Cookie Use

- Website wants to track the number of unique visitors who access its site.
- If the website checks the HTTP Server logs, it can determine the number of “hits”, but cannot determine the number of unique visitors.
- That’s because HTTP is stateless. It retains no memory regarding individual users.
- Cookies provide a mechanism to solve this problem.
Tracking Unique Visitors

- Step 1: Person A requests the website.
- Step 2: Web Server generates a new unique ID.
- Step 3: Server returns home page plus a cookie set to the unique ID.
- Step 4: Each time Person A returns to the website, the browser automatically sends the cookie along with the GET request.
Cookie Notes

- Created in 1994 for Netscape 1.1
- Cookies cannot be larger than 4K
- No domain (e.g. netscape.com, microsoft.com) can have more than 20 cookies.
- Cookies stay on your machine until:
  - they automatically expire
  - they are explicitly deleted
- Cookies work the same on all browsers.
Cookie Standards

- **Version 0 (Netscape):**
  - The original cookie specification
  - Implemented by all browsers and servers
  - We will focus on this Version

- **Version 1**
  - A proposed standard of the Internet Engineering Task Force (IETF)
  - Not very widely used (hence, we will stick to Version 0.)
Cookie Anatomy

- Version 0 specifies six cookie parts:
  - Name
  - Value
  - Domain
  - Path
  - Expires
  - Secure
Cookie Parts: Name/Value

- **Name**
  - Name of your cookie (Required)
  - Cannot contain white spaces, semicolons or commas.

- **Value**
  - Value of your cookie (Required)
  - Cannot contain white spaces, semicolons or commas.
Cookie Parts: Domain

- Only pages from the domain which created a cookie are allowed to read the cookie.
- For example, amazon.com cannot read yahoo.com’s cookies (imagine the security flaws if this were otherwise!)
- By default, the domain is set to the full domain of the web server that served the web page.
  - For example, myserver.mydomain.com would automatically set the domain to .myserver.mydomain.com
Note that domains are always prepended with a dot.
  This is a security precaution: all domains must have at least two periods.
You can however, set a higher level domain
  For example, myserver.mydomain.com can set the domain to .mydomain.com. This way hisserver.mydomain.com and herserver.mydomain.com can all access the same cookies.
No matter what, you cannot set a domain other than your own.
Cookie Parts: Path

- Restricts cookie usage within the site.
- By default, the path is set to the path of the page that created the cookie.
- Example: user requests page from mymall.com/storea. By default, cookie will only be returned to pages for or under /storea.
- If you specify the path to / the cookie will be returned to all pages (a common practice.)
Cookie Parts: Expires

- Specifies when the cookie will expire.
- Specified in Greenwich Mean Time (GMT):
  - Wdy DD-Mon-YYYY HH:MM:SS GMT
- If you leave this value blank, browser will delete the cookie when the user exits the browser.
  - This is known as a *session cookies*, as opposed to a *persistent cookie*. 
Cookie Parts: Secure

- The secure flag is designed to encrypt cookies while in transit.
- A secure cookie will only be sent over a secure connection (such as SSL.)
- In other words, if a cookie is set to secure, and you only connect via a non-secure connection, the cookie will not be sent.
**User-server interaction: cookies**

- Server sends “cookie” to client in response msg
  
  \[\text{Set-cookie: 1678453}\]

- Client stores & presents cookie in later requests
  
  \[\text{cookie: 1678453}\]

- Server matches presented-cookie with server-stored info
  
  - Authentication
  - Remembering user preferences, previous choices

**Diagram:**

```
client

```

```
server

```

```
usual http response msg

```

```
usual http request msg

```

```
Set-cookie: #

```

```
usual http response msg

```

```
Set-cookie: #

```

```
usual http request msg

```

```
cookie-specific action

```

```
cookie-specific action

```
Cookie example

telnet www.google.com 80

Trying 216.239.33.99...
Connected to www.google.com.
Escape character is '^[].

GET /index.html HTTP/1.0

HTTP/1.0 200 OK
Date: Wed, 10 Sep 2003 08:58:55 GMT
Set-Cookie: PREF=ID=43bd8b0f34818b58:TM=1063184203:LM=1063184203:S=DDqPgTb56Za88O2y; expires=Sun, 17-Jan-2038 19:14:07 GMT; path=/; domain=.google.com

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Web Caches (proxy server)

**Goal:** satisfy client request without involving origin server

- user sets browser: Web accesses via web cache
- client sends all http requests to web cache
  - if object at web cache, web cache immediately returns object in http response
  - else requests object from origin server, then returns http response to client
More about Web caching

- Cache acts as both client and server
- Cache can do up-to-date check using `If-modified-since` HTTP header
  - Issue: should cache take risk and deliver cached object without checking?
  - Heuristics are used.
- Typically cache 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
HTTP servers use the property name specified by the http-equiv attribute to create an [RFC822]-style header in the HTTP response.

The following sample META declaration:

```
<META http-equiv="Expires" content="Tue, 20 Aug 1996 14:25:27 GMT">
```

will result in the HTTP header:

```
Expires: Tue, 20 Aug 1996 14:25:27 GMT
```

This can be used by caches to determine when to fetch a fresh copy of the associated document.
References

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- Representation and Management of Data on the Internet (67633), Yehoshua Sagiv, The Hebrew University - Institute of Computer Science.
- Java Network Programming and Distributed Computing, Reilly & Reilly.