Sessions

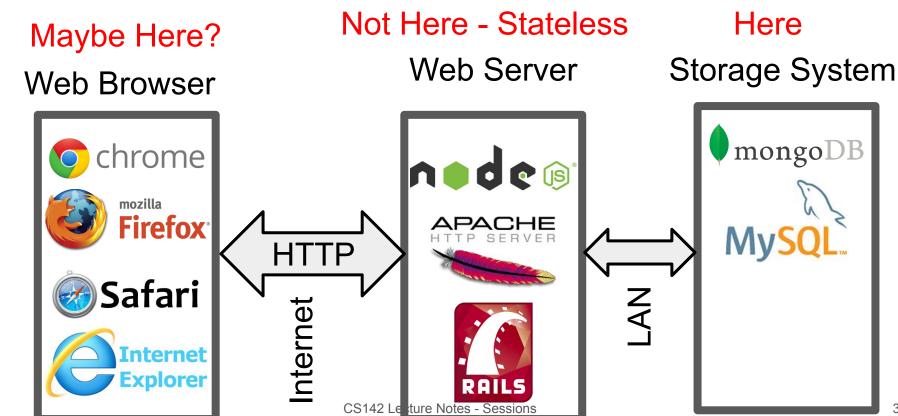
Mendel Rosenblum

How do we know what user sent request?

- Would like to authenticate user and have that information available each time we process a request.
- More generally web apps would like to keep state per active browser
 - Called session state
- Concretely:

```
expressApp.get('/user/:user_id', function (httpRequest, httpResponse) ...
   // Need to make a decision to accept the request or reject it
   var sessionState = GetSessionState(httpRequest);
```

Where could we get the session state from?



Session state lookup problem

- HTTP request just come into a web server
 - Not a lot information to uniquely identify "session"
- Solution: Include something in the request to tells us the session
 - Care must taken to avoid forgeries
- Early HTTP solution: Cookies
 - State set by web server that browser attaches to every request
 - Useful but with a checkered history
- Modern browser support local storage API

HTTP Cookies: Basic Idea

Web server adds Set-Cookie: to HTTP response header

```
Set-Cookie: cookie_name1=cookie_value1

Set-Cookie: cookie_name2=cookie_value2; expires=Sun, 16 Jul 2016 06:23:41 GMT

Each cookie is just a name-value pair.
```

Future requests from browser to same server should include the Cookie: header

```
Cookie: cookie_name1=cookie_value1; cookie_name2=cookie_value2
```

Cookie contents

- Cookie: name and data
 - Domain for this cookie: server, port (optional), URL prefix (optional)
 - The cookie is only included in requests matching its domain
 - Expiration date: browser can delete old cookies

Limits:

- Data size limited by browsers (typically < 4 KB)
- Browsers limit the number of cookies per server (around 50)

Cookies as web app storage

- User can:
 - View cookies
 - Modify/corrupt cookies
 - Delete cookies
 - Create cookies
 - Lose cookies to hackers
- Simply switching browsers looks like you deleted the app's cookies
 - o Cookies have been used in bad ways (more later in class): Users are suspicious of them
- Pretty unreliable web app storage
 - Limited to hint, shortcut, etc. that can be recovered if missing
 - While actively communicating with web app: Session cookies

Session state with cookies

- Early web frameworks (e.g. Rails) supported storing session state in cookies
 - Rails provided session, a JavaScript-like object, that you could store anything
 session[:user id] = "mendel"
- Rails packaged session into a cookie and added to HTTP response
 - Data will be available in all future requests from the same browser
- Rails automatically checks for a session cookie at the start of each request:
 - Cookie exists? use it to find session data
 - No cookie? Create new session, new cookie
- End of each request: save session data where it can be found by future requests. (where?)

Session state in cookies

- Early approach: Store session state in cookie
 - Since cookies can be viewed, changed, deleted, stolen, etc. care must be taken. Example:
 - session.user_id = "mendel";
 - session.password = "foobar";
 - Using cryptography you can:
 - Hide content from viewers, hackers
 - Detect forgeries and changes
 - Can't do much about deletions
- An alternative is to put a pointer to the session state in the cookie:

```
Set-Cookie: session=0x4137fd6a; Expires=Wed, 09 Jun 2012 10:18:14 GMT Less transfer overhead but still need to protect with cryptography
```

Options for storing session state

- Web server's memory
 - Fastest access
 - May be too large (many active users)
 - Makes load balancing across web servers hard

Storage system

- Easy shared across all the web servers
- May be overkill: Don't need the super reliability of storage system
- May be too much load for the storage system (Need on every request)

Specialized storage system

- Support fast fetching of small, short-lived data
- Example: memcache, redis in memory key-value stores

var session = require('express-session');

- ExpressJS has a middleware layer for dealing with the session state
 - Stores a sessionID safely in a cookie
 - Store session state in a session state store
 - Like Rails, handles creation and fetching of session state for your request handlers

Usage:

```
app.use(session({secret: 'badSecret'}));
    secret is used to cryptographically sign the sessionID cookie
app.get('/user/:user_id', function (httpRequest, httpResponse) ...
    httpRequest.session is an object you can read or write
```

Express session usage example

- Login handler route can store into httpRequest.session.user_id
- All other handlers read httpRequest.session.user_id
 - If not set error or redirect to login page
 - Otherwise we know who is logged in
- Can put other per-session state in httpRequest.session
- On logged out you will want to destroy the session

```
httpRequest.session.destroy(function (err) { } );
```

Express Session: Session Store

- Default session store is in the Node.js memory
 - OK for development but not production
- Has session store backends for many storage systems
- Hooking up to MongoDB via Mongoose

```
var MongoStore = require('connect-mongo')(express);
expressApp.use(session({
    store: new MongoStore({ mongooseConnection: mongoose.connection })
}));
```

Cookie replacement: Web Storage API

- sessionStorage Per origin storage available when page is open
- localStorage Per origin storage with longer lifetime
- Standard key-value interface:

```
localStorage.appSetting = 'Anything';
localStorage.setItem('appSetting', 'Anything');
sessionStorage['app2Setting'] = 2;
```

Limited space (~10MB) and similar reliability issues to cookies