Sessions

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How do we know what user sent request?

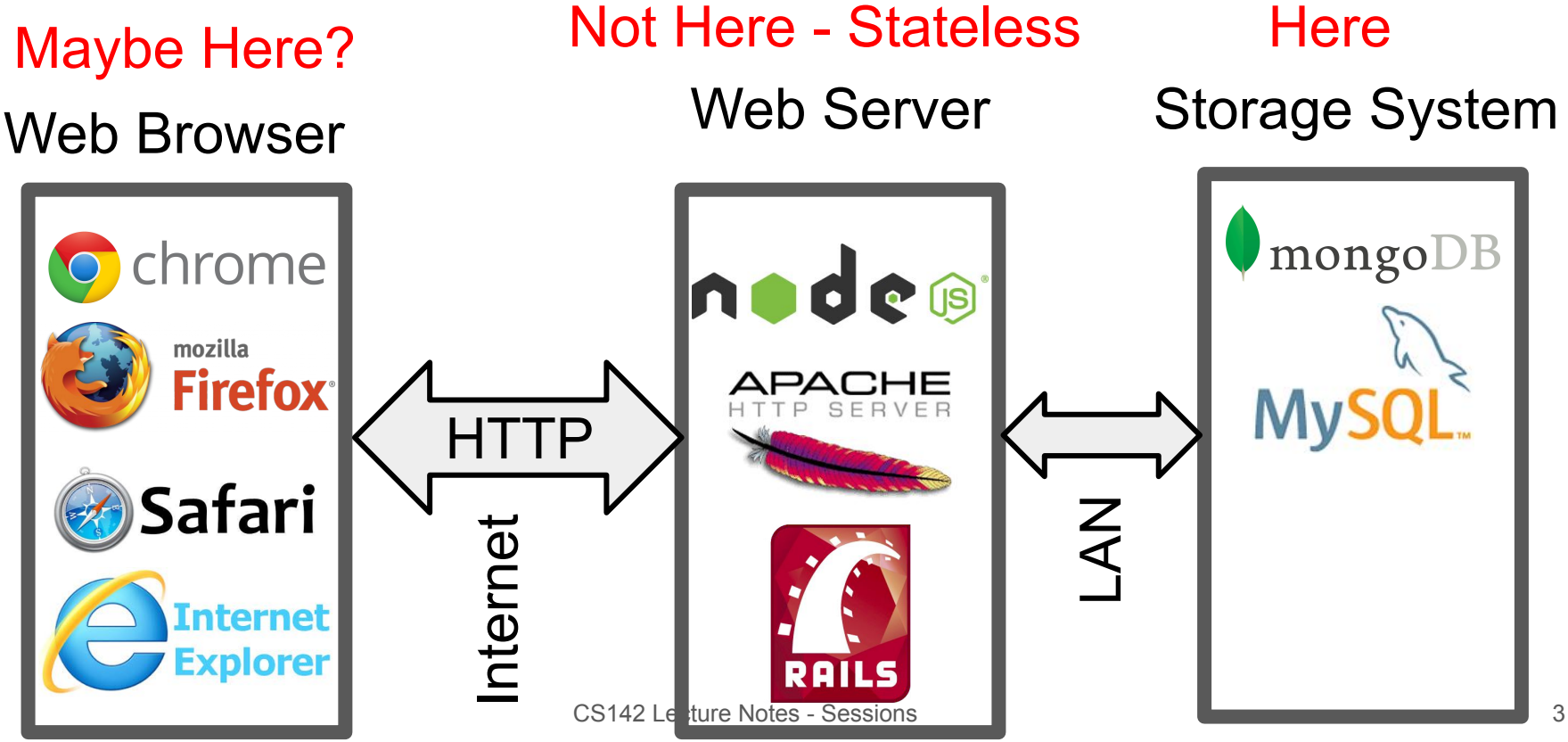
- Would like to **authenticate** user and have that information available each time we process a request.
- More generally web apps would like to keep state per active browser
  - Called **session state**
- Concretely:

```
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
  - 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