ECS 162
WEB PROGRAMMING

4/15

Weather Assignment

- Due Thurs April 25 10pm.

Using an API

- Goal 1 - Using a remote server with an API
- OpenWeatherMap Hourly Weather forecasts.
  We send a city, in a specially-formatted URL
  It sends back JSON-formatted data
- Need to register and get an API key to try it out. Free.
- Demo of request and response on assignment page.

Animation

- The doppler radar weather map is a combination of images, a topomap on the bottom, and partially transparent overlay images on top.
- The doppler radar changes ever ten minutes.
- We can combine a series of images to make an animation showing last two hours.
- Sadly, weather here is often boring.

Design

(see design slides)

Objects

- Objects organize collections of data (properties) and functions (methods) that act on that data.
- Organization of code and data is part of the eternal battle against bugs.
- In object-oriented programming, almost all data is in objects and code is in object methods.
- Virtually all of the systems we interact with in Web programming are object-orientes.

Object

```
let car = {
  "name": "tesla",
  "range": 310,
  "price": "$44,000"
};
```

- This defines the object by giving a literal – a text representation of its contents – and putting those contents into a variable.

Literal

- A literal is the string used for writing down a value. It is not the value itself.
  - '2' is a number literal let x = 2;
  - 'true' is a Boolean literal if (done == true) {}
  - ' "cow" ' is a string literal let x = "cow";
  - '{"cow":2}' is an object literal let x = {"cow":2};

Accessing properties

```
let car = {
  "name": "tesla",
  "range": 310,
  "price": "$44,000"
};
```

- We access the properties as usual, with the dot, eg. car.name

Adding properties

- Properties have a key and a value (eg. "name" is a key and "tesla" is a property).
- Keys are always strings, but values can be anything.
- To add a new property, just give it a value:

```
car.dateAvailable = "Jan 15, 2019"
```

Adding properties

```
car.dateAvailable = "Jan 15, 2019"
```

- This is so much easier than C++!
- Adding a method with a function expression:

```
car.getRange =
    function (temp) { return 200+temp; }
```

What are objects "really"?

- A Javascript object is …
  - a Python dictionary!
  - A C or C++ hashtable!
  - a dictionary data structure that lets you look up data using a string.
- Can use Python dictionary notation for properties:

  car["name"] = "tesla"
- How is this different from a struct in C? A class in C++ or Java?

Hierarcical objects

```
var weatherForecast = {
   "description": "sunny",
      "temp": {
        "high": 76,
        "low": 48,
        "hourly": [48, 53, 65, 76, 66, 63]
        }
   };
```

Hierarchical objects

```
let weatherForecast = {
   "description": "sunny",
      "temp": {
        "high": 76,
        "low": 48,
        "hourly": [48, 53, 65, 76, 66, 63]
        }
   };

let temp2 = weatherForecast.temp.hourly[2];
```

The DOM is a hierarchical object

```
let par = document.getElementById("caption");
par.textContent = "Bananas, 1968";
```

- What are the types of par? document? getElementById? textContent?

The DOM is a complex object

```
let par = document.getElementById("caption");
par.textContent = "Bananas, 1968";
```

- What are the types of par? document? getElementById? textContent?
- document is an object, getElementById is a method, par is a object (which is also part of document), and textContent is a string property of par.

```
let a = '{ "veg": "beet", "color": "purple" }'
```

- What is the data type of a?

```
var a = '{ "veg": "beet", "color": "purple" }'
```

- What is the data type of a?

String! The string contains an object literal, but it is still just a string. This turns out to be so useful, it has a name: JSON.

JSON

- JSON is a widely popular was to pass data between the different computers involved in a Web application.
- That is, they transmit strings back and forth.
- It's a concise and very flexible format.
- Early days XML, which was HTML-like, with tags, was used more, but JSON is now standard.

Details I am glossing over

- JSON cannot include methods.
- Also the strings in JSON have to be given with double quotes, although they can contain single quotes.
- So these object literals are not JSON:

```
{ "addOne": function (x) { return x+1;} }
{ 'car': 'tesla' }
```

JSON.parse method JSON->object

```
let aJSON = '{ "veg": "beet", "color": "purple" }'
let aObj = JSON.parse(aJSON);
```

- aJSON is a string, aObj is an object.
- JSON.parse() is a built-in function that takes JSON as input. Produces the corresponding object. What does "parse" mean?
- This it typically the first thing you do when you receive JSON data from another computer.
- You get easy access the parts of a complex object.

JSON.stringify for obj->JSON

- What do you do when you have a complex object and you want to pack it up into a JSON string to send to another computer?

```
bObj = {"cow": "herford", "num": 2 };
bJSON = JSON.stringify(bObj);
```

- JSON.stringfy() takes object as input. Produces the corresponding JSON string.

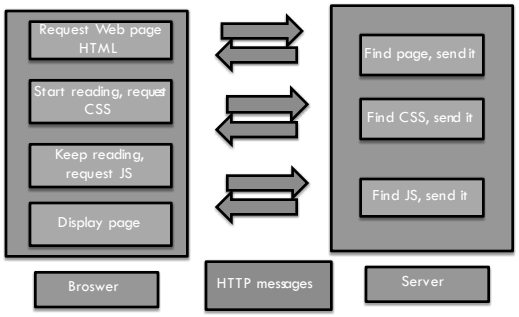
Demo CORS request, response

- XMLHTTPrequest object is Javascript's interface for sending an HTTP request to a server.
- Most often, a Web page makes requests, using Javascript, to the server from which the page was downloaded (same origin).
- CORS (Cross-Origin Resource Sharing) is a method for a browser to get data from a different server.
- Only some servers support CORS.

What is HTTP?

- HyperText Transfer Protocol
- The format of the messages that get passed from one computer to another on the WWW.
- Messages might be all text, or might contain binary data (eg. an image).
- Almost all communication is via HTTP messages.
- HTTP messages are either requests, or responses.

Typical traffic with server



HTTP request

HTTP response

URLs

- All are accessed via a URL.
- The URL is explicit when requesting the original Web page:

  web.cs.ucdavis.edu/~amenta/s19/ecs162.html
- It is implicit for the other types:

  <link rel="stylesheet" type="text/css" href="ecs162.css">

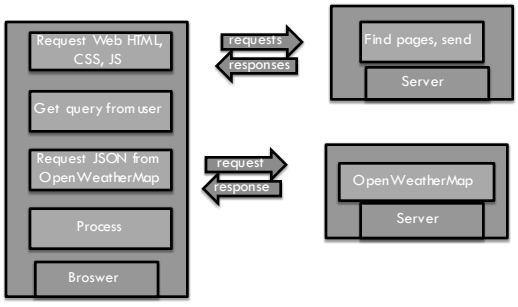
Produces:

web.cs.ucdavis.edu/~amenta/s19/ecs162.css

Accessing an API

- We also access the OpenWeatherMap API via URL

http://api.openweathermap.org/data/2.5/forecast/hourly?q=Davis,CA,US&units=imperial&APPID=xxx

- The part after the question mark is a query.
- It has three parameters, q (what kind of query), units (imperial means fahrenheit vs centigrade), and our API key.
- You need to register with OpenWeatherMap and get an API key

Network traffic