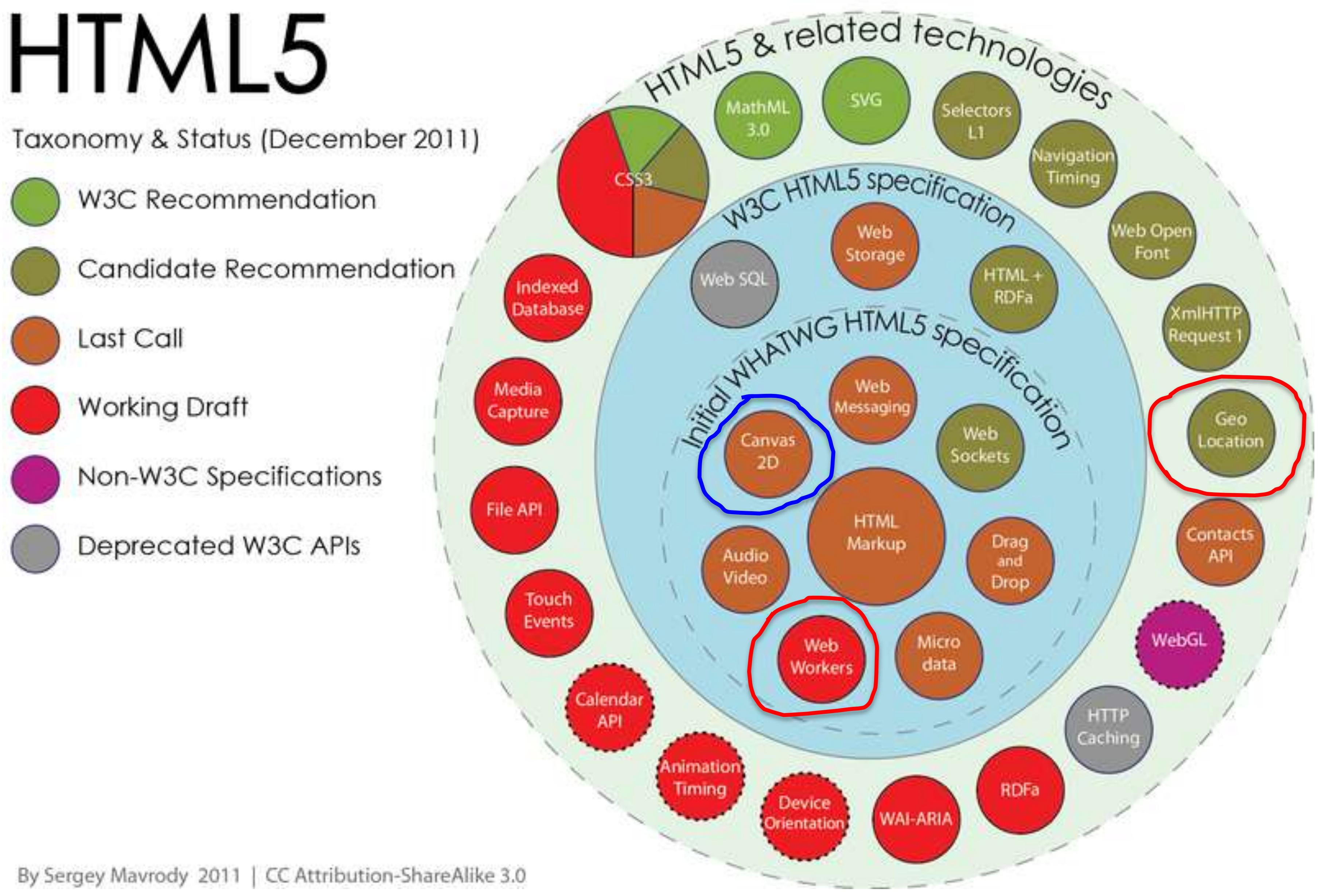
HTML

Web workers and geolocation

Overview

- Web Workers
  - Single-threaded woes
  - Web worker threads
    - Limitations
  - Example 1: Fibonacci calculation
  - Example 2: Mandelbrot set
- Geolocation
  - Sources of location information
  - Privacy issues
  - JavaScript API
  - Example: geo1-4.html


HTML5
Taxonomy & Status (December 2011)
W3C Recommendation
Candidate Recommendation
Last Call
Working Draft
Non-W3C Specifications
Deprecated W3C APIs
HTML5 & related technologies
W3C HTML5 specification
Initial WHATWG HTML5 specification
CSS3
MathML 3.0
SVG
Selectors L1
Navigation Timing
Web Open Font
XmlHTTP Request 1
Geo Location
Contacts API
WebGL
HTTP Caching
RDFa
WAI-ARIA
Device Orientation
Animation Timing
Calendar API
Touch Events
File API
Media Capture
Indexed Database
Web SQL
Web Storage
HTML + RDFa
Web Messaging
Web Sockets
Canvas 2D
HTML Markup
Audio Video
Drag and Drop
Web Workers
Micro data
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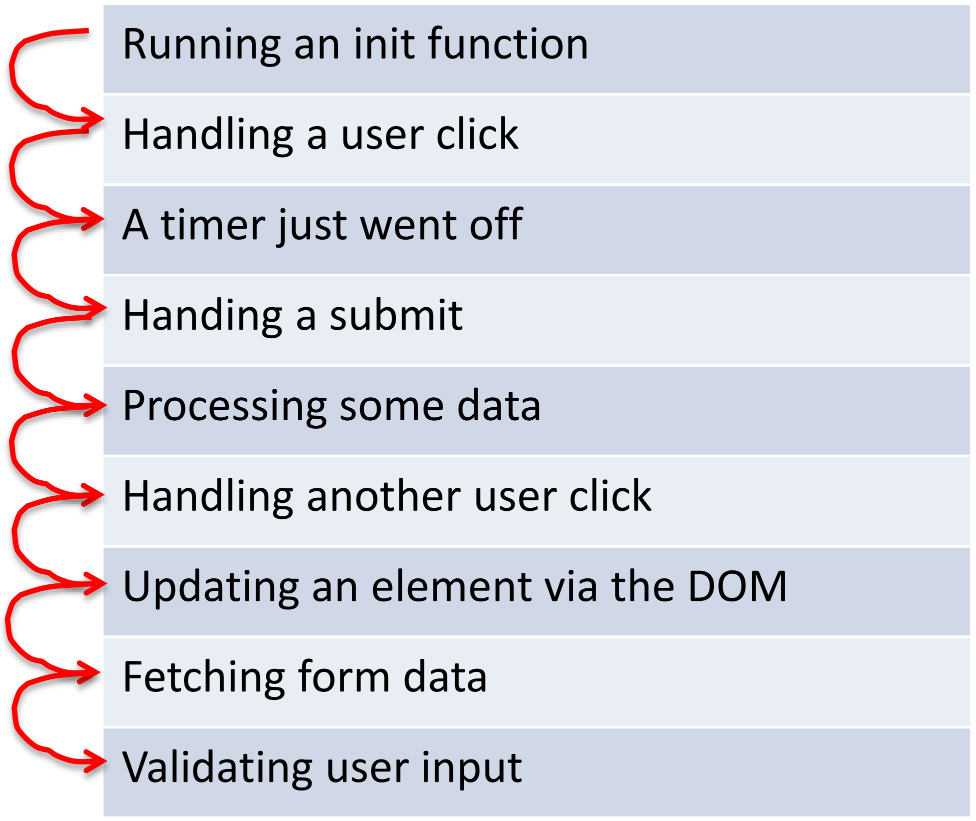
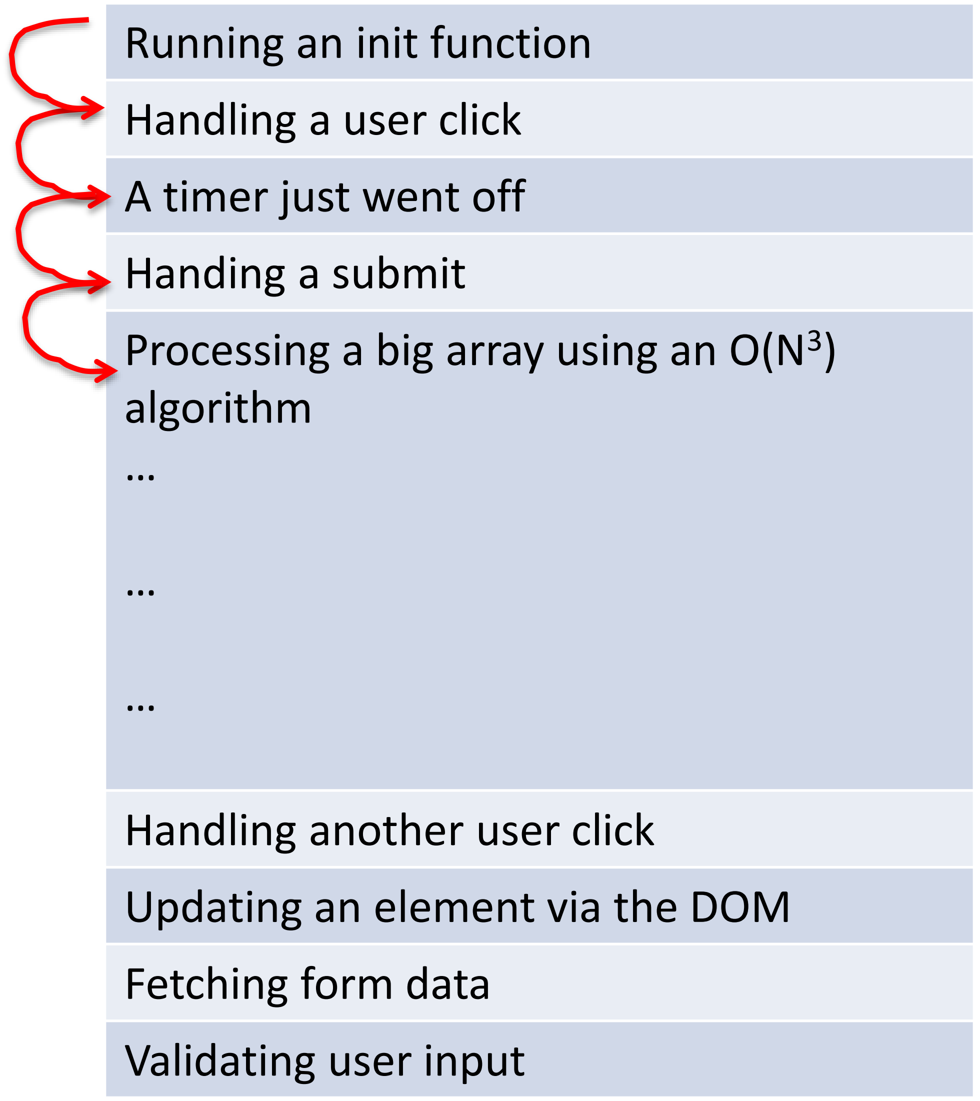
One thread to rule them all

- Prior to HTML5:
  - Single JavaScript thread running your page



One thread to rule them all

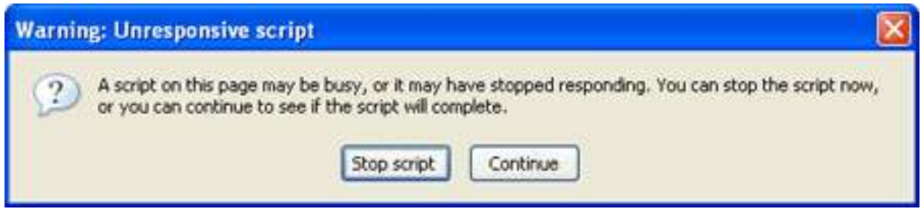
- Problem: Time consuming / blocking task



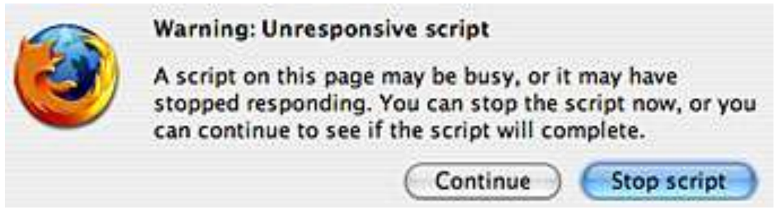
Running an init function
Handling a user click
A timer just went off
Handing a submit
Processing a big array using an $O(N^3)$ algorithm … … …
Handling another user click
Updating an element via the DOM
Fetching form data
Validating user input

Single-threaded pros/cons

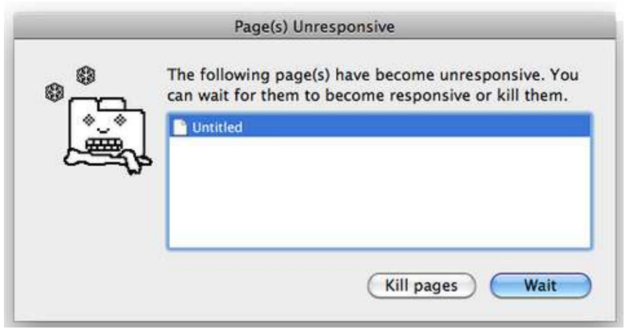
- Prior to HTML5:
  - Single-thread running your JavaScript
  - Advantages:
    - Easy to code and understand
    - No potential for concurrency issues
  - Disadvantages:
    - Page can become unresponsive to user


Warning: Unresponsive script

A script on this page may be busy, or it may have stopped responding. You can stop the script now, or you can continue to see if the script will complete.


Warning: Unresponsive script

A script on this page may be busy, or it may have stopped responding. You can stop the script now, or you can continue to see if the script will complete.


Page(s) Unresponsive

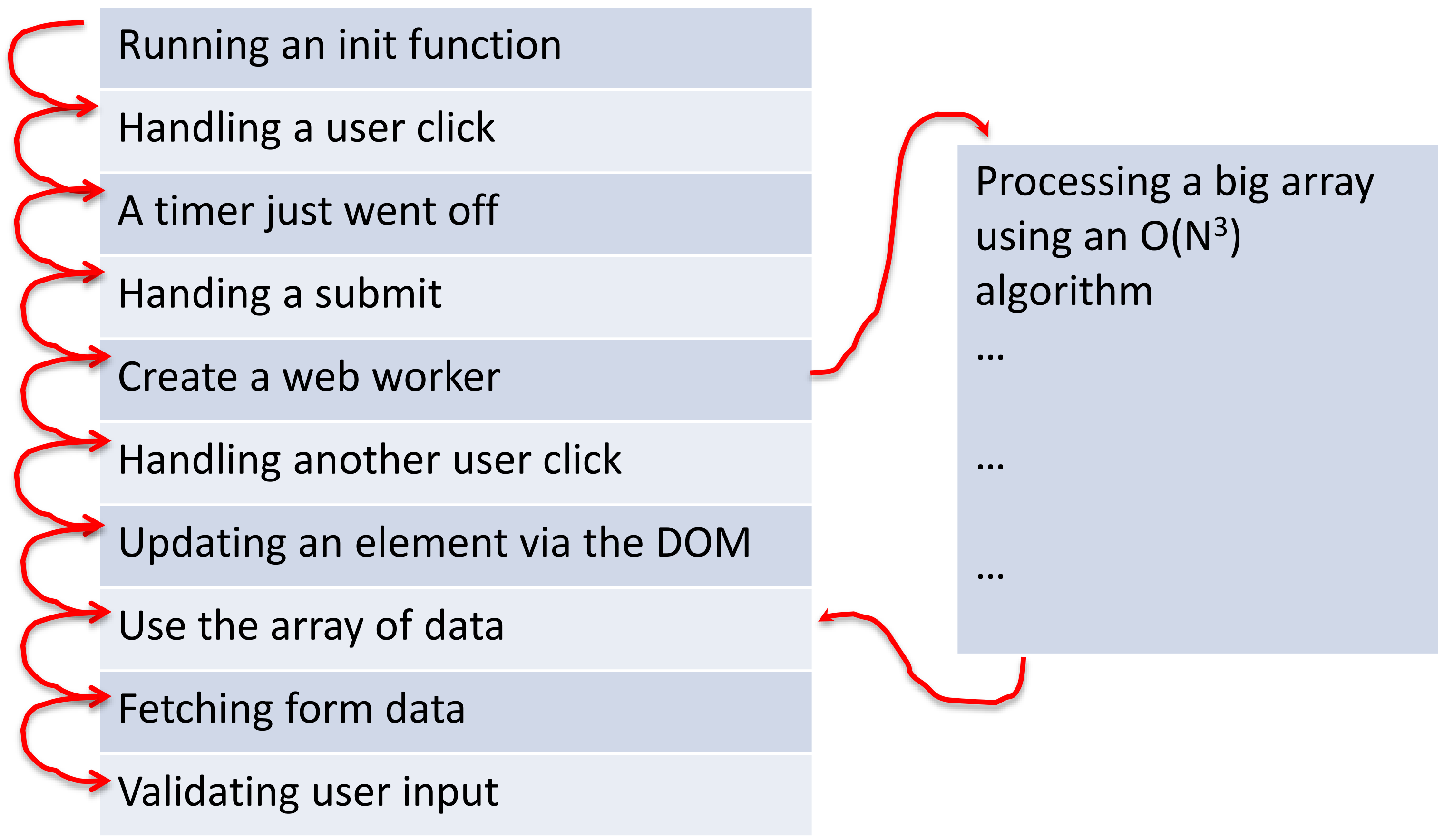
The following page(s) have become unresponsive. You can wait for them to become responsive or kill them.

Web workers

- Multiple JavaScript threads running in browser
  - Offload of time-consuming computational tasks
  - Better utilization of modern multi-core processors
  - Threading *may* model your problem better
- Type types
  - Dedicated workers
    - Linked to the creating page
  - Shared workers
    - Shared between all pages on a domain

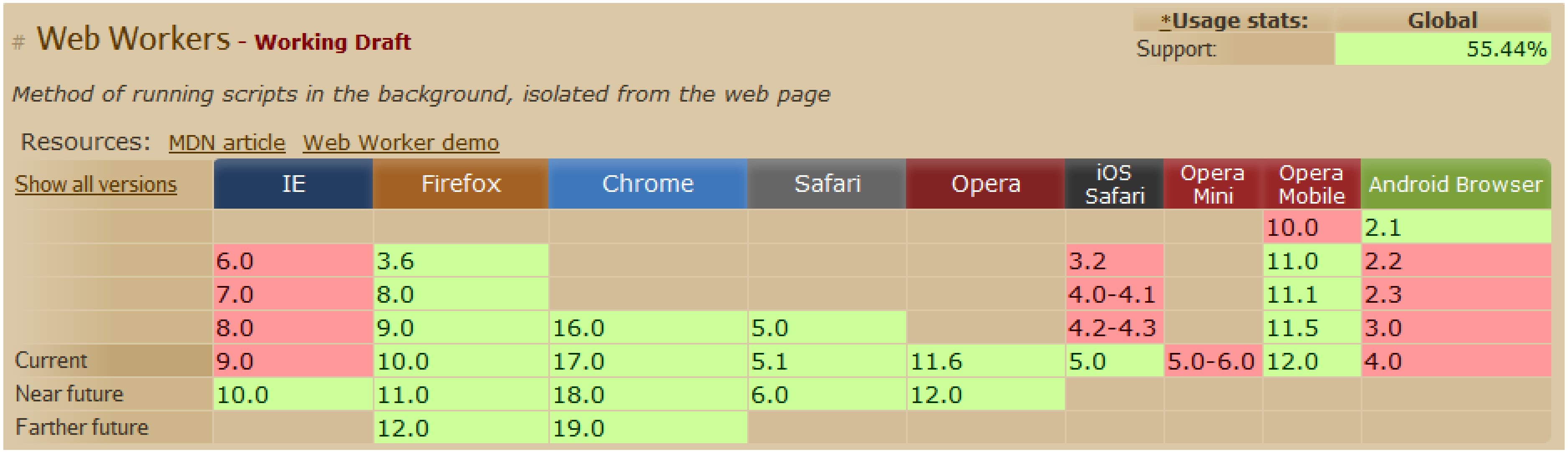
One thread to rule them all

- Problem: Time consuming / blocking task



Web workers

- How well are they supported?



# Web Workers - **Working Draft**

*Usage stats:	Global
Support:	55.44%

Method of running scripts in the background, isolated from the web page

Resources: MDN article Web Worker demo

Show all versions	IE	Firefox	Chrome	Safari	Opera	iOS Safari	Opera Mini	Opera Mobile	Android Browser
								10.0	2.1
	6.0	3.6				3.2		11.0	2.2
	7.0	8.0				4.0-4.1		11.1	2.3
	8.0	9.0	16.0	5.0		4.2-4.3		11.5	3.0
Current	9.0	10.0	17.0	5.1	11.6	5.0	5.0-6.0	12.0	4.0
Near future	10.0	11.0	18.0	6.0	12.0				
Farther future		12.0	19.0						

```
if (!window["Worker"])
{
   alert("No support for web workers!");
}
```

Web worker details

- Creating:
  - Worker is defined its own JavaScript file
- Limitations:
  - Workers don't have access to many things:
    - DOM
    - Variables or functions in main program
    - Many runtime objects, e.g. window, document, parent
- Process:
  - Main program sends message to worker
  - Worker does work
  - Worker sends message back with results

Web worker example

- Goal:
  - Multithreaded Fibonacci calculator
  - Using simple (slow) recursive algorithm
  - User types number, hits button to start calculation
  - Results appear in <div> as they arrive
- Single threaded version
- Multi-threaded version

```
<!doctype html>
<html>
<head>
<meta charset="utf-8">
<title>Fibonacci calculator</title>
<script>
    function goButton()
    {
        var num = document.getElementById("num").value;
        result = fib(num);
        document.getElementById("results").innerHTML +=
           "fib(" + num + ") = " + result + "<br />";
    }
    function fib(n)
    {
        if (n == 0)
            return 0;
        if (n == 1)
            return 1;
        return fib(n - 1) + fib(n - 2);
    }
</script>
</head>

<body>
<input type="text" size="10" id="num" /><br />
<input type="button" value="Go" onClick="goButton();"/>
<div id="results"></div>
</body>
</html>
```

fib1.html
Single threaded version

fib2.html
Web Worker version

```
<script>
  function goButton()
  {
    if (!window["Worker"])
    {
       alert("No support for web workers!");
       return;
    }

    var num = document.getElementById("num").value;
    var worker = new Worker("fib.js");
    worker.onmessage = addResult;
    worker.postMessage(num);
 }
 function addResult(event)
 {
    document.getElementById("results").innerHTML +=
     "fib(" + event.data.num + ") = " +
     event.data.result + "<br />";
 }
</script>
```

fib.js
Worker JavaScript

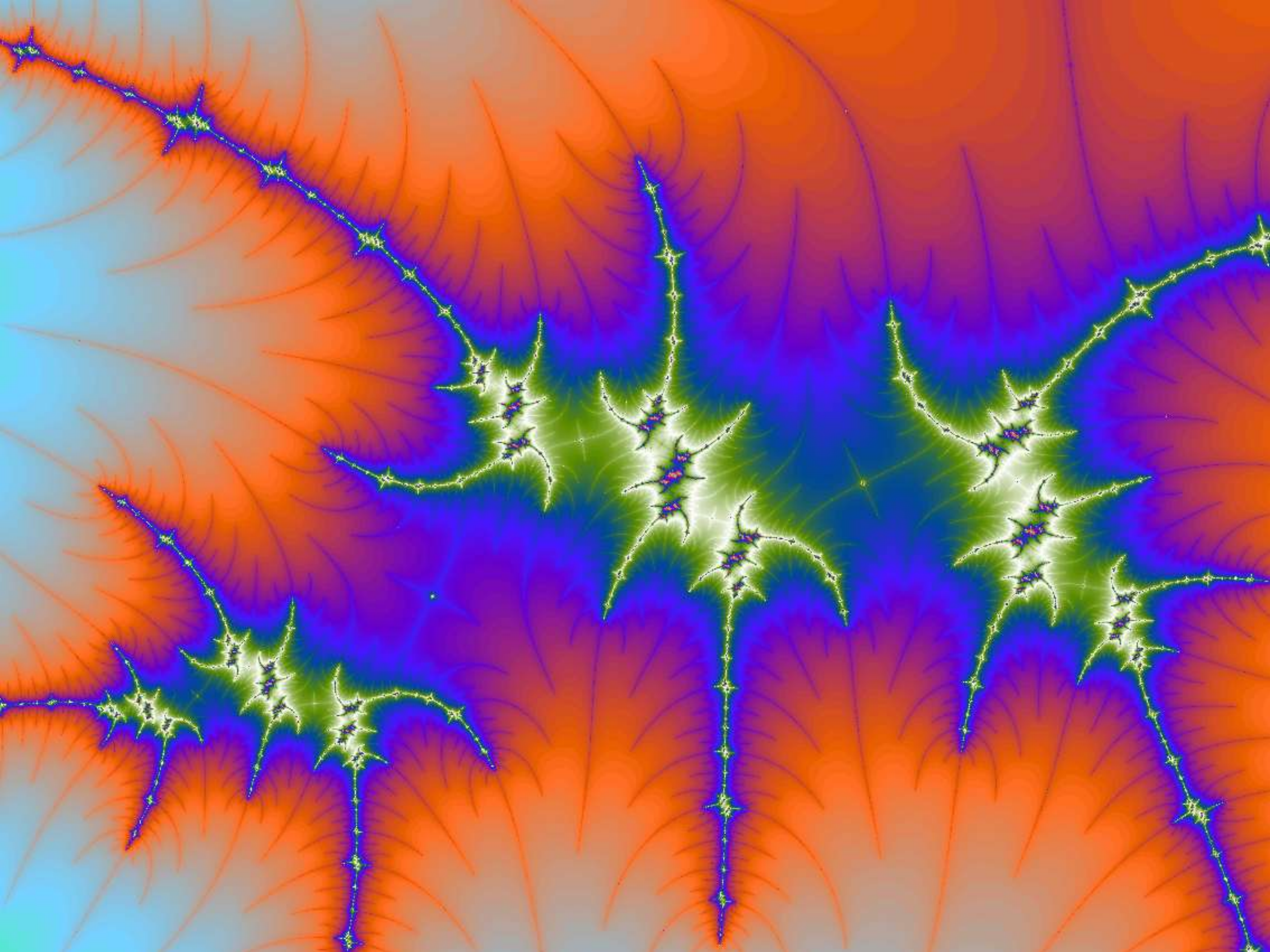
```
onmessage = startWork;

function startWork(event)
{
  var n   = event.data;
  var r   = fib(n);
  var msg = {num: n, result: r};
  postMessage(msg);
}

function fib(n)
{
  if (n == 0)
    return 0;
  if (n == 1)
    return 1;
  return fib(n - 1) +
    fib(n - 2);
}
```

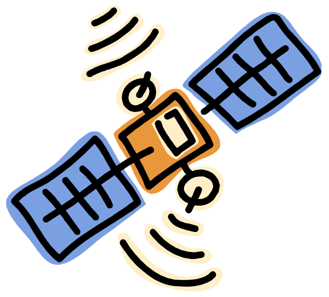
Other web worker details

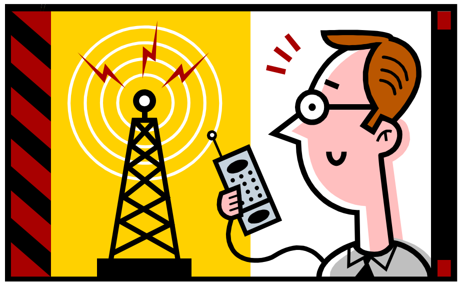
- Killing a worker
  - worker.terminate() from main program
  - Worker can stop itself, close()
- Importing other JavaScript files:
  - Workers must use importScripts()
  - Also used for JSONP (JSON with padding)
    - Cross-domain Ajax
    - Like our language tutor application
- Workers can also:
  - Spawn their own workers
  - Use setInterval() to schedule periodic work



Geolocation

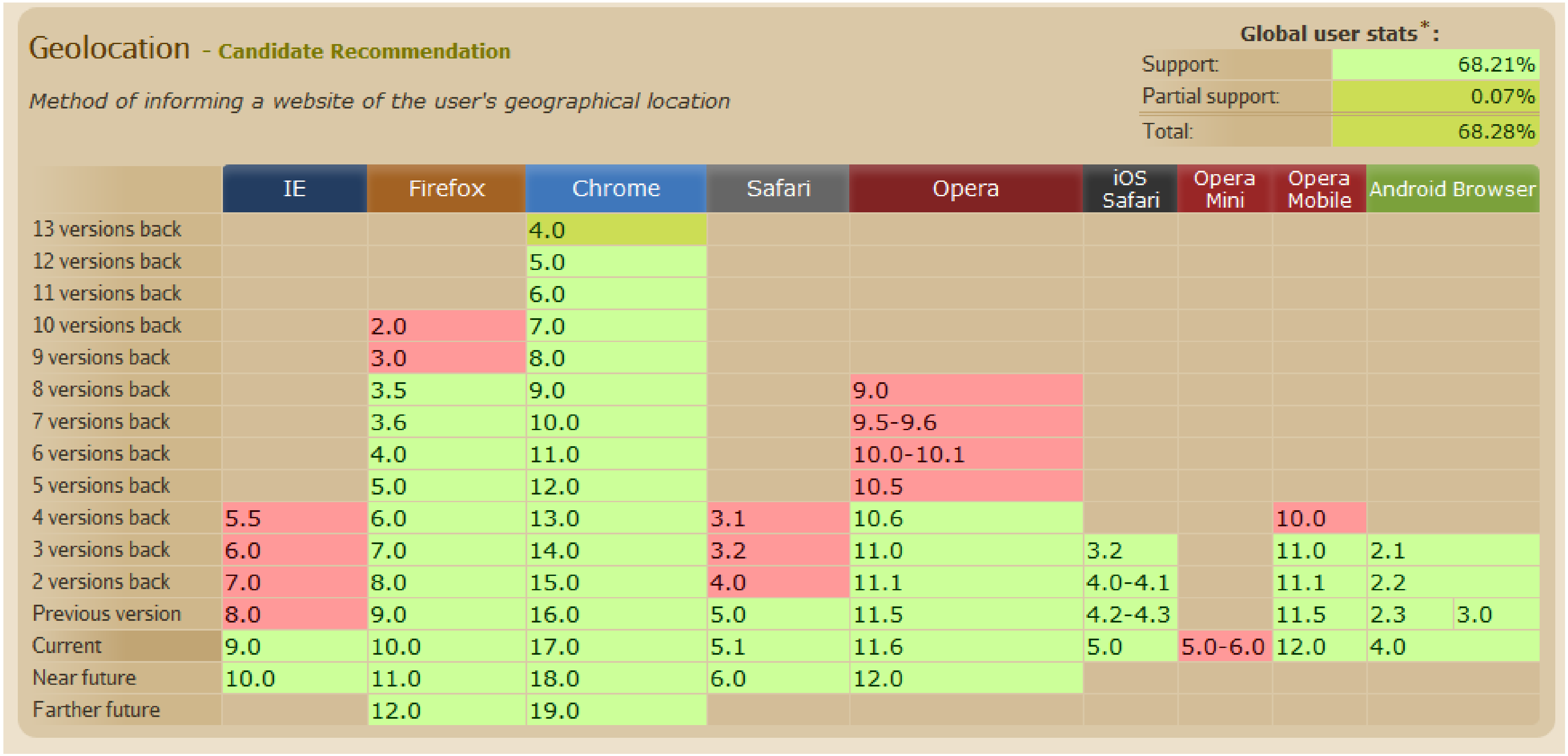
- Actually not part of W3C HTML5 spec
  - But W3C standard
  - Widely supported
- A high-level interface to device location information
  - Global Positioning System (GPS)
  - Located inferred from network signal
    - IP address
    - RFID
    - WiFi, Bluetooth
    - GSM/CDMA cell IDs
    - User input
- One shot requests or repeated updates





Geolocation

- How well is it supported?
  - Almost every modern desktop/mobile browser



Geolocation - Candidate Recommendation

Method of informing a website of the user's geographical location

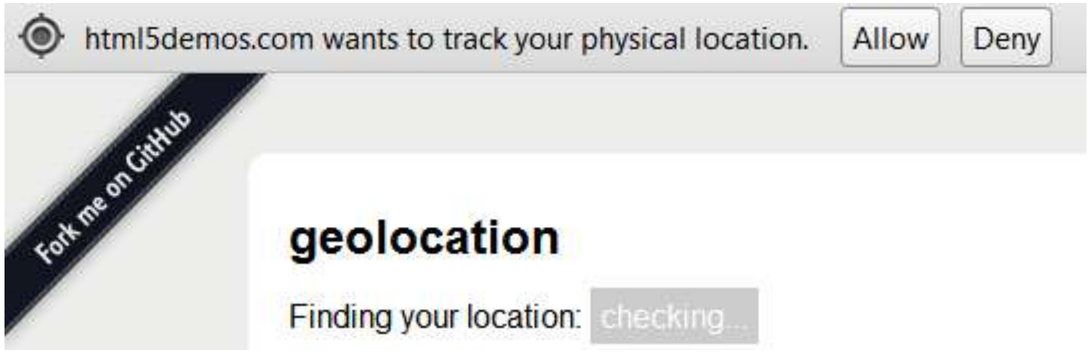
Global user stats*:

Support:	68.21%
Partial support:	0.07%
Total:	68.28%

	IE	Firefox	Chrome	Safari	Opera	iOS Safari	Opera Mini	Opera Mobile	Android Browser
13 versions back			4.0						
12 versions back			5.0						
11 versions back			6.0						
10 versions back		2.0	7.0						
9 versions back		3.0	8.0						
8 versions back		3.5	9.0		9.0				
7 versions back		3.6	10.0		9.5-9.6				
6 versions back		4.0	11.0		10.0-10.1				
5 versions back		5.0	12.0		10.5				
4 versions back	5.5	6.0	13.0	3.1	10.6			10.0	
3 versions back	6.0	7.0	14.0	3.2	11.0	3.2		11.0	2.1
2 versions back	7.0	8.0	15.0	4.0	11.1	4.0-4.1		11.1	2.2
Previous version	8.0	9.0	16.0	5.0	11.5	4.2-4.3		11.5	2.3 3.0
Current	9.0	10.0	17.0	5.1	11.6	5.0	5.0-6.0	12.0	4.0
Near future	10.0	11.0	18.0	6.0	12.0				
Farther future		12.0	19.0						

Privacy issues

- User permission required
  - Browser must have express permission from user



html5demos.com wants to track your physical location.

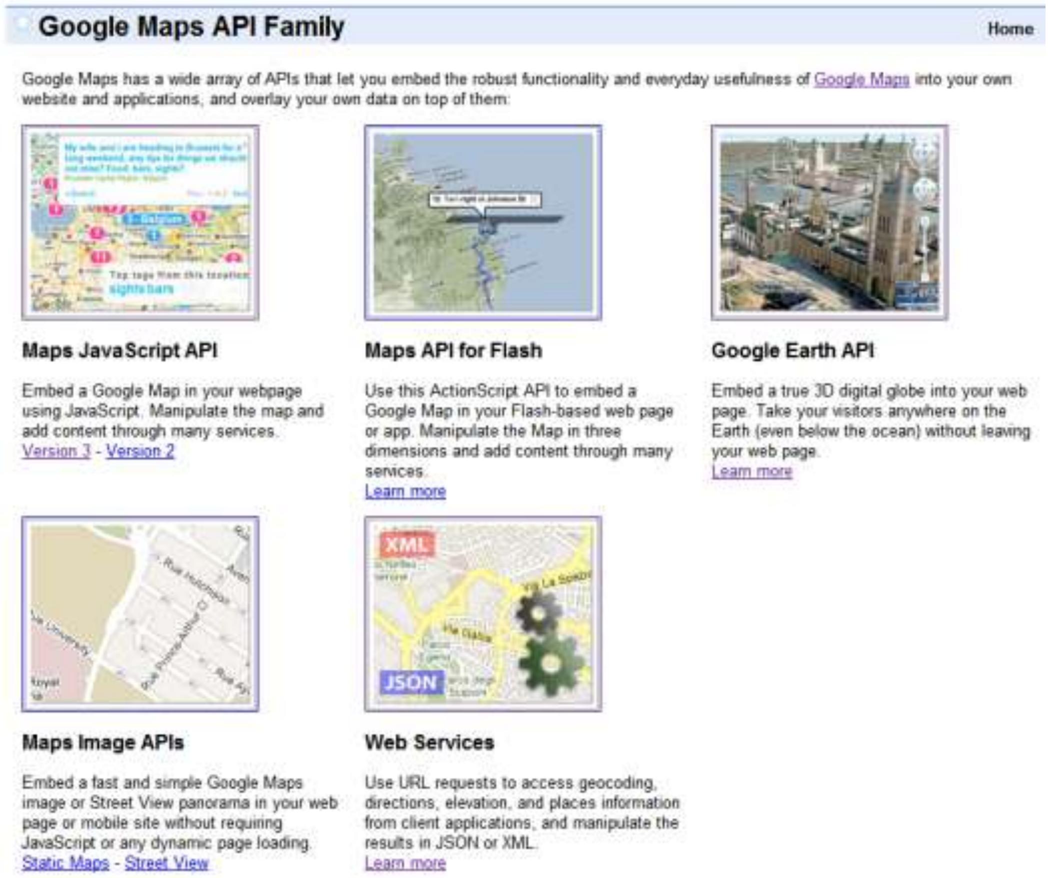
geolocation

Finding your location: checking...

  - User ask browser to remember permission for a given site
- WiFi access point databases
  - Send AP MAC / GPS / Cell IDs to central database
  - Apple, Google phones were storing history on the phone
  - Sometimes people's phones are an AP

Geolocation

- Not the Google Maps API, but often used with:



Google Maps API Family Home

Google Maps has a wide array of APIs that let you embed the robust functionality and everyday usefulness of Google Maps into your own website and applications, and overlay your own data on top of them:

Maps JavaScript API

Embed a Google Map in your webpage using JavaScript. Manipulate the map and add content through many services.
Version 3 - Version 2

Maps API for Flash

Use this ActionScript API to embed a Google Map in your Flash-based web page or app. Manipulate the Map in three dimensions and add content through many services.
Learn more

Google Earth API

Embed a true 3D digital globe into your web page. Take your visitors anywhere on the Earth (even below the ocean) without leaving your web page.
Learn more

Maps Image APIs

Embed a fast and simple Google Maps image or Street View panorama in your web page or mobile site without requiring JavaScript or any dynamic page loading.
Static Maps - Street View

Web Services

Use URL requests to access geocoding, directions, elevation, and places information from client applications, and manipulate the results in JSON or XML.
Learn more

http://gmaps-samples-v3.googlecode.com/svn/trunk/map_events/map_events.html

http://earth-api-samples.googlecode.com/svn/trunk/demos/drive-simulator/index.html

http://maps.googleapis.com/maps/api/streetview?size=600x600&location=40.720032,%20-73.988354&heading=235&sensor=false

http://maps.googleapis.com/maps/api/elevation/json?locations=39.7391536,-104.9847034&sensor=true_or_false

```
<!doctype html>
<html>
<head>
<meta charset="utf-8">
<title>Where am I?</title>
<script>

window.onload = getMyLocation;

function getMyLocation()
{
    if (navigator.geolocation)
        navigator.geolocation.getCurrentPosition(displayLocation,
                                                 displayError
                                                 {enableHighAccuracy: false,
                                                  timeout: Infinity,
                                                  maximumAge: 0});
    else
        alert("No geolocation support!");
}

...

</script>
</head>
<body>
<div id="location">
</div>
</body>
```

```javascript
function displayLocation(position)
{
    var lat              = position.coords.latitude;
    var long             = position.coords.longitude;
    var accuracy         = position.coords.accuracy;
    var timestamp        = position.timestamp;

    var altitude         = position.coords.altitude;
    var altitudeAccuracy = position.coords.altitudeAccuracy;
    var heading          = position.coords.heading;
    var speed            = position.coords.speed;

    var div  = document.getElementById("location");
    div.innerHTML  = "Latitude: "          + lat       + "<br />";
    div.innerHTML += "Longitude: "         + long      + "<br />";
    div.innerHTML += "Accuracy: "          + accuracy  + "<br /";
    div.innerHTML += "Timestamp: "         + timestamp + "<br /><br />";

    div.innerHTML += "Altitude: "          + altitude         + "<br />";
    div.innerHTML += "Altitude accuracy: " + altitudeAccuracy + "<br />";
    div.innerHTML += "Heading: "           + heading          + "<br />";
    div.innerHTML += "Speed: "             + speed            + "<br />";
}

function displayError(error)
{
    var errorTypes = {0: "Unknown error", 1: "Permission denied by user",
                      2: "Position is not available", 3: "Request timed out"};
    var errorMessage = errorTypes[error.code];
    if (error.code == 0 || error.code == 2)
       errorMessage = errorMessage + " " + error.message;
    var div = document.getElementById("location");
    div.innerHTML = errorMessage;
}
```

Other features

- How fast can we get our fix?
  - geo2.html
    - Asks for high accuracy
    - Will not accept cached result, maximumAge = 0
    - timeout = 10, increase by 10ms on timeout
- Updates whenever user moves
  - geo3.html

```
function getMyLocation()
{
    if (navigator.geolocation)
        navigator.geolocation.watchPosition(displayLocation,
                                            displayError,
                                            {enableHighAccuracy: true,
                                             timeout: Infinity,
                                             maximumAge: 0});
    else
        alert("No geolocation support!");
}
```

geo4.html: adding Google maps

```
...

<style>
div#map
{
            margin: 5px;
            width: 400px;
            height: 400px;
            border: 1px solid black;
}
</style>

<script src="https://maps.google.com/maps/api/js?sensor=true"></script>
<script>
...
var map = null;

function showMap(coords)
{
            var googleLatAndLong = new google.maps.LatLng(coords.latitude, coords.longitude);
            var mapOptions = {zoom: 10, center: googleLatAndLong, mapTypeId: google.maps.MapTypeId.HYBRID};
            var mapDiv = document.getElementById("map");
            map = new google.maps.Map(mapDiv, mapOptions);
}

function displayLocation(position)
{
    ...
    showMap(position.coords);
}
...
<div id="map"></div>
```

Conclusions

- HTML5 + other associated APIs
  - Enable new and different web apps
    - Location-based services
  - Making browser apps more like desktop apps
    - Threading now supported
- Possible paper topic:
  - Geolocation
    - Technical details about how it works
    - Location-based applications
    - Privacy issues