HTML

Web workers and geolocation

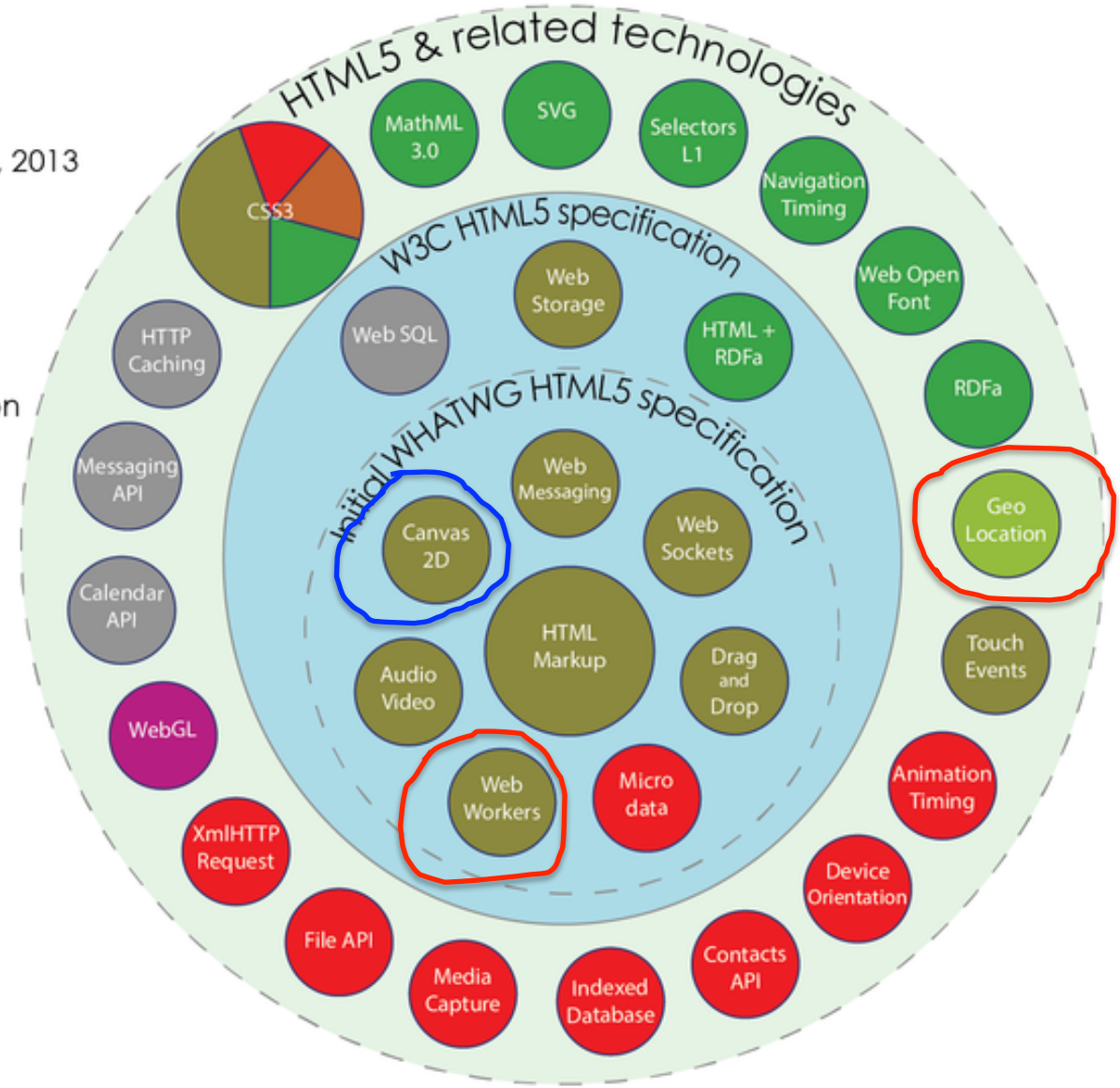
Overview

- Web Workers
  - Single-threaded woes
  - Web worker threads
    - Limitations
  - Examples
    - Fibonacci calculation
    - Mandelbrot set
- Geolocation
  - Sources of location information
  - Privacy issues
  - JavaScript API
  - Example pages

HTML5

Taxonomy & Status on January 20, 2013

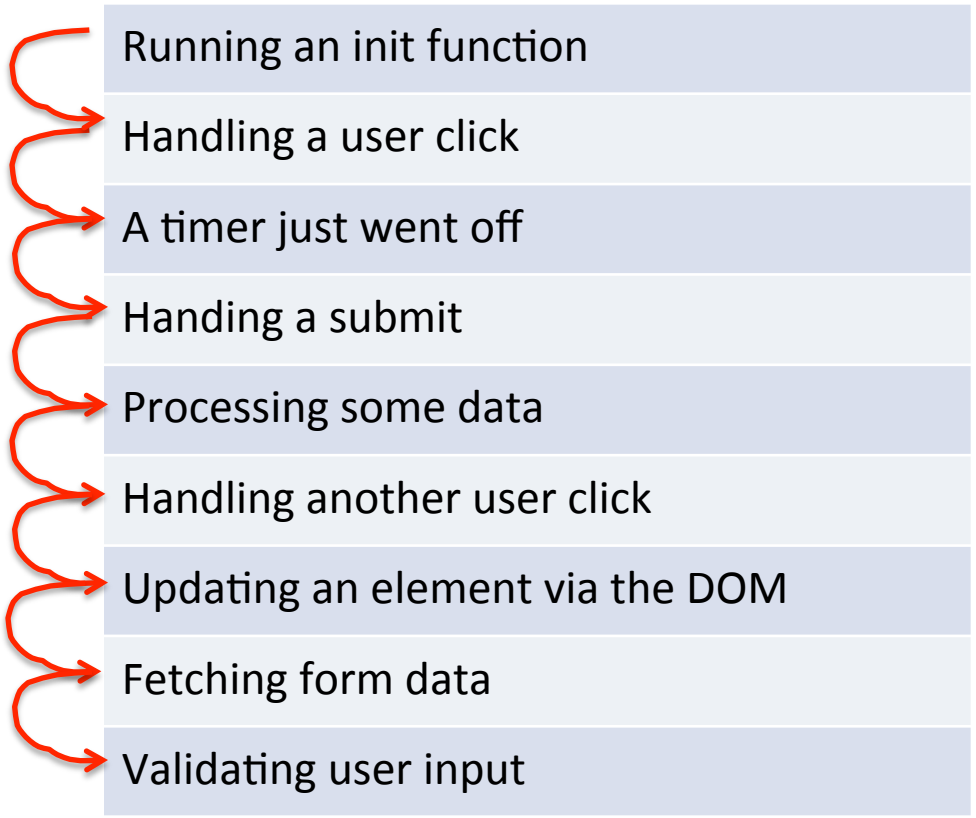
- W3C Recommendation
- Proposed Recommendation
- Candidate Recommendation
- Last Call
- Working Draft
- Non-W3C Specifications
- Deprecated



by Sergey Mavrody (cc) BY · SA

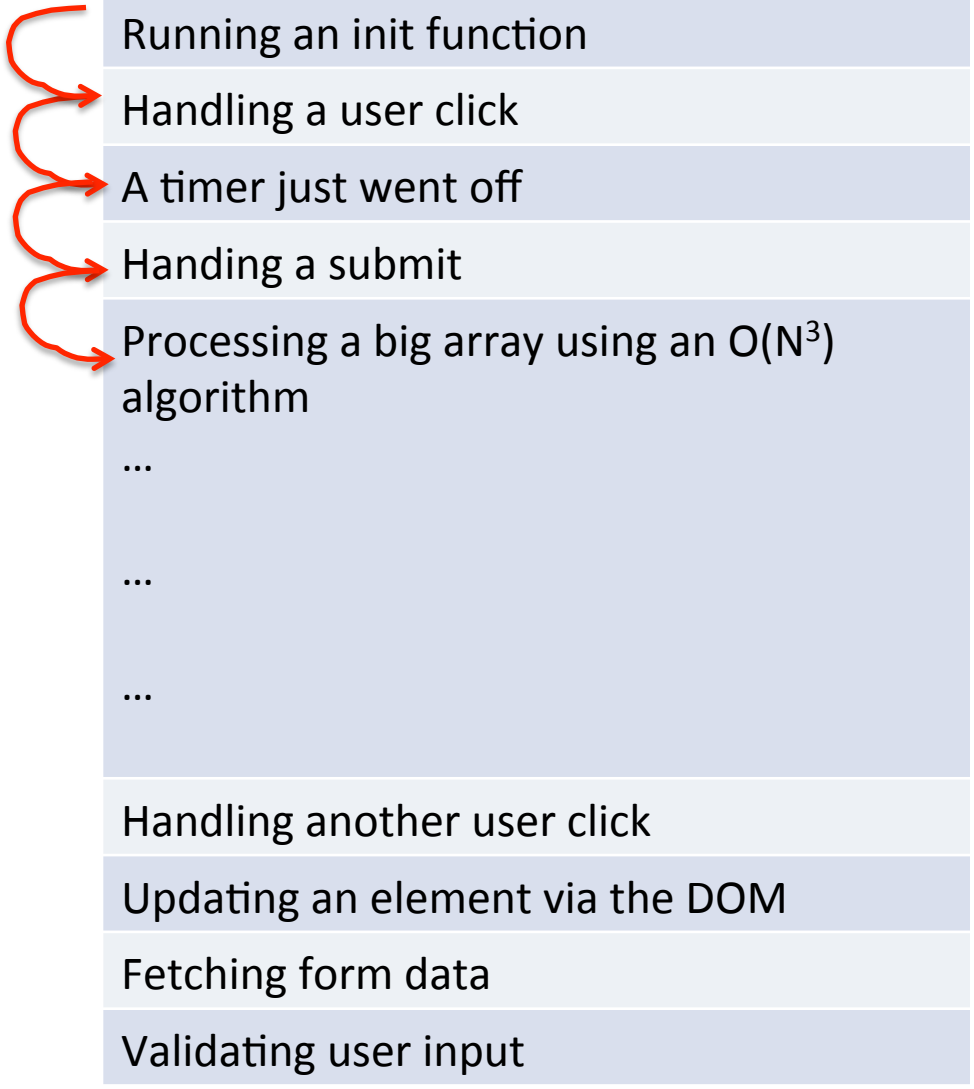
One thread to rule them all

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



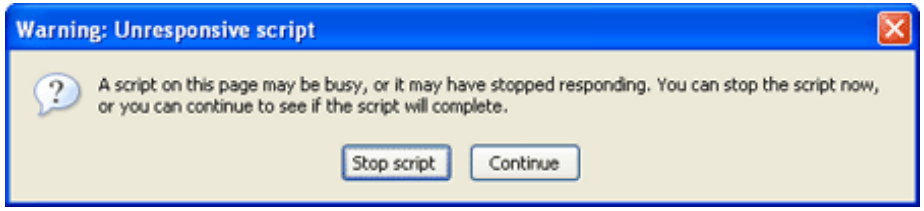
One thread to rule them all

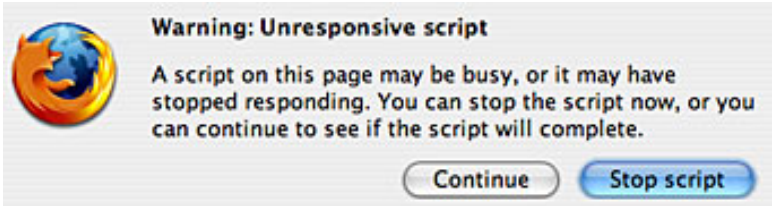
- Problem: Time consuming / blocking task

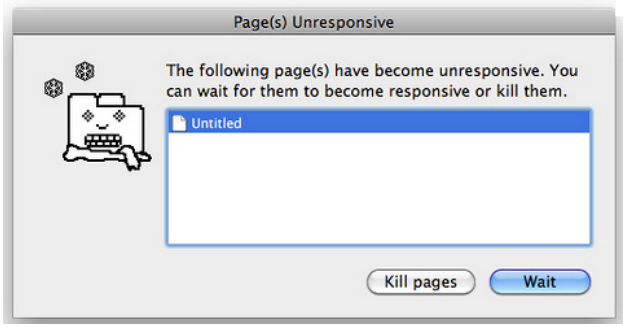


Single-threaded pros/cons

- 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





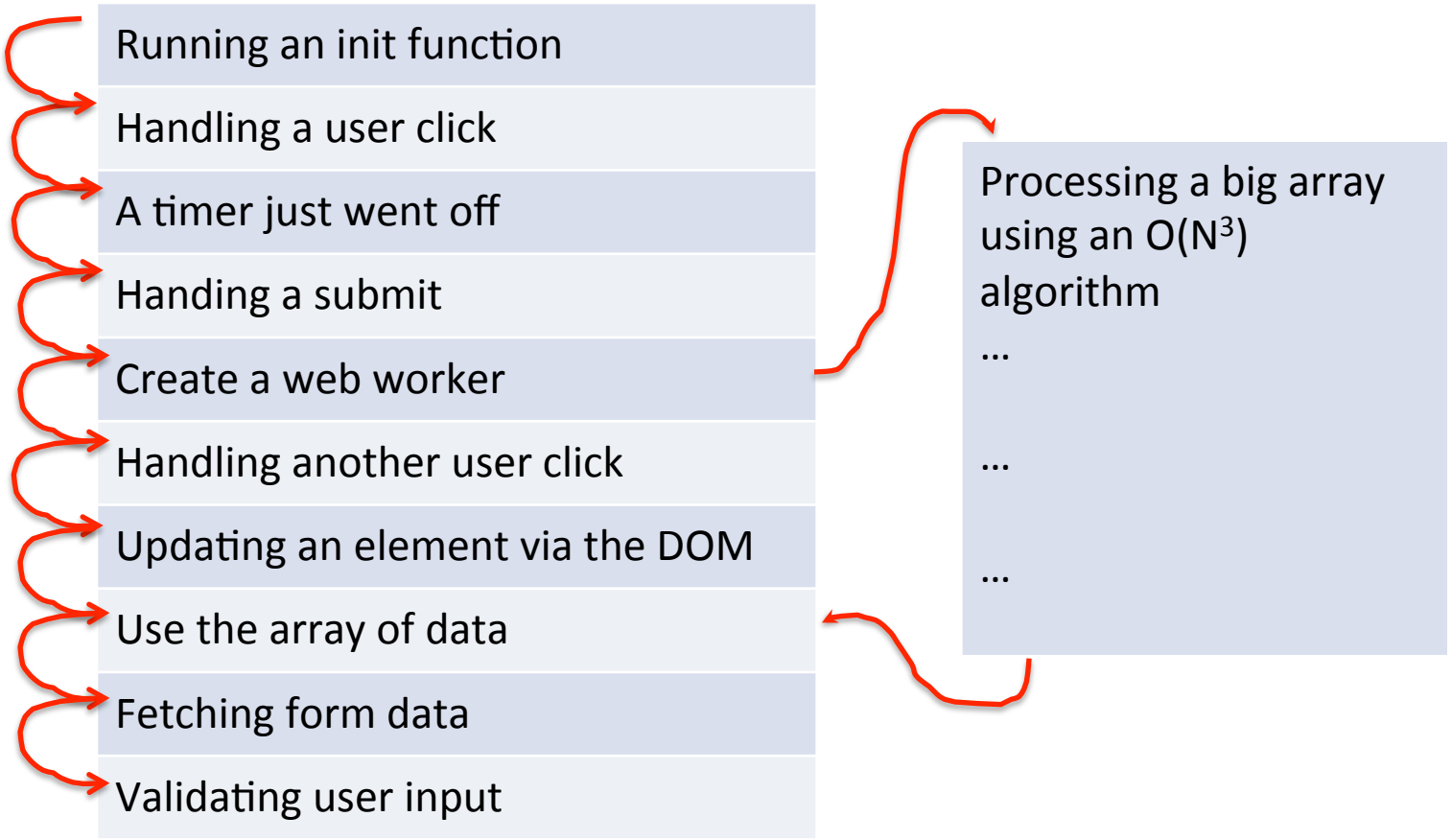


Web workers

- Multiple JavaScript threads running in browser
  - Offload 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

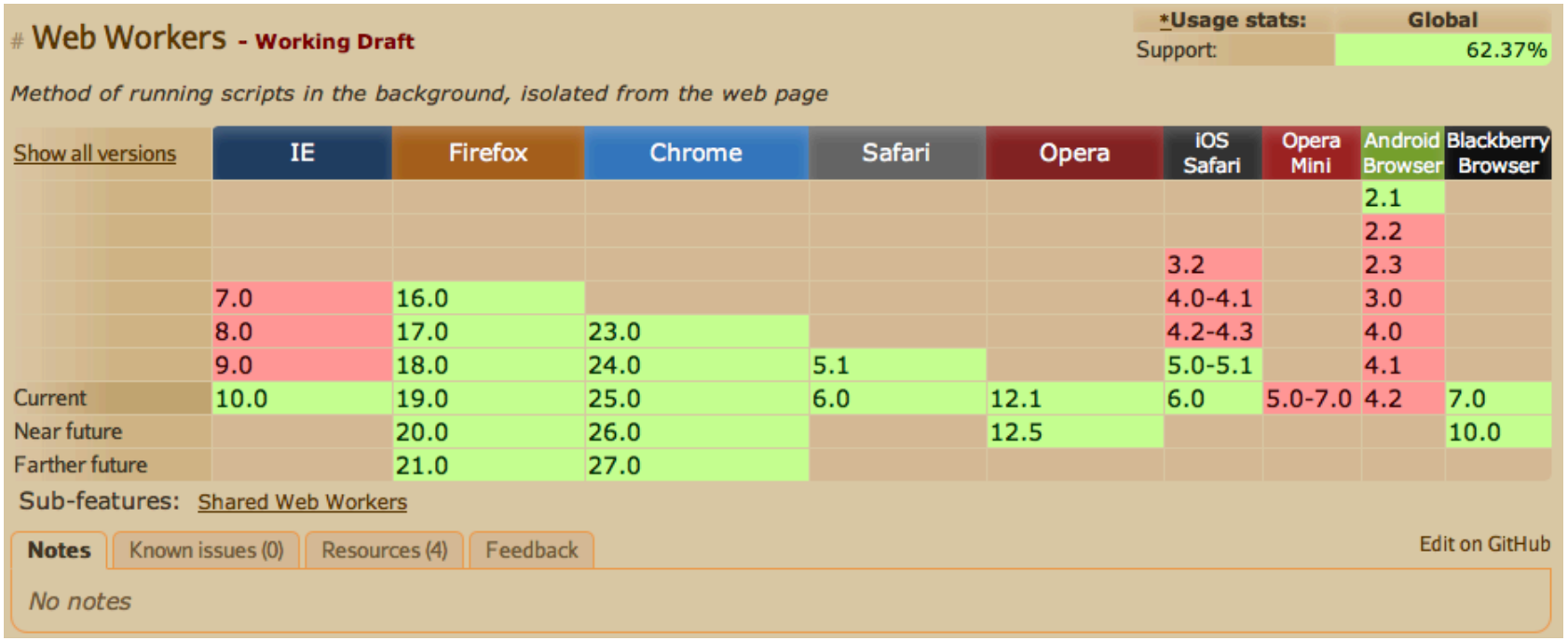
One thread to rule them all

- Problem: Time consuming / blocking task



Web workers

- How well are they supported?



Web Workers - Working Draft

*Usage stats: Global
Support: 62.37%

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

Show all versions	IE	Firefox	Chrome	Safari	Opera	iOS Safari	Opera Mini	Android Browser	Blackberry Browser
								2.1	
								2.2	
						3.2		2.3	
	7.0	16.0				4.0-4.1		3.0	
	8.0	17.0	23.0			4.2-4.3		4.0	
	9.0	18.0	24.0	5.1		5.0-5.1		4.1	
Current	10.0	19.0	25.0	6.0	12.1	6.0	5.0-7.0	4.2	7.0
Near future		20.0	26.0		12.5				10.0
Farther future		21.0	27.0						

Sub-features: Shared Web Workers

Notes | Known issues (0) | Resources (4) | Feedback | Edit on GitHub

No notes

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

JavaScript code to test if browser supports 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 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

NOTE:
This is a stupendously inefficient way to calculate this!

fib2.html
Web Worker version

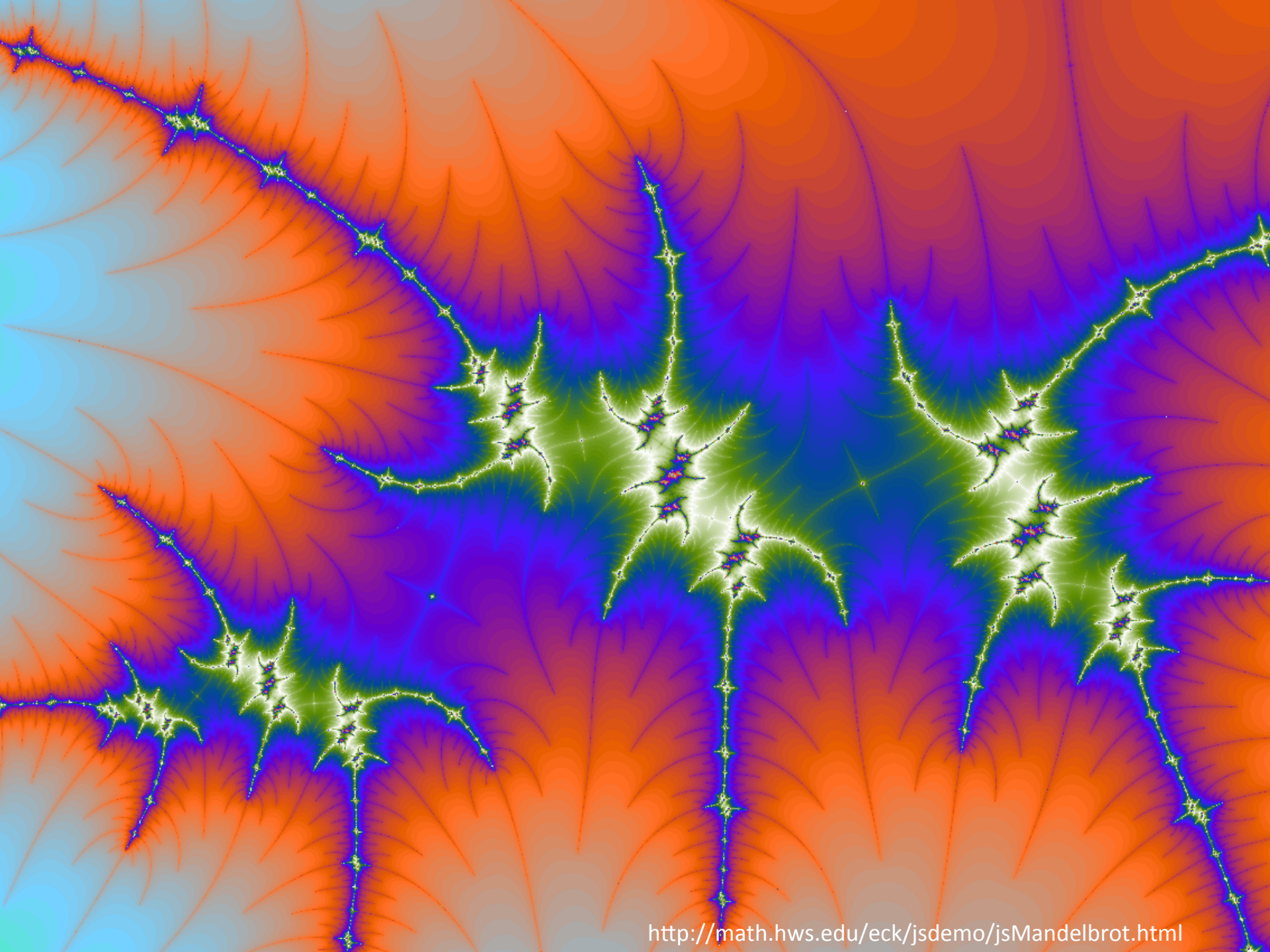
```
<script>
  function goButton()
  {
    if (!window["Worker"])
    {
       alert("No support for web workers!");
       return;
    }

    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

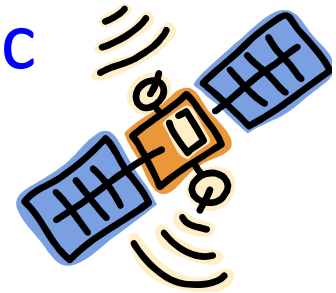
```
onmessage = startWork;

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

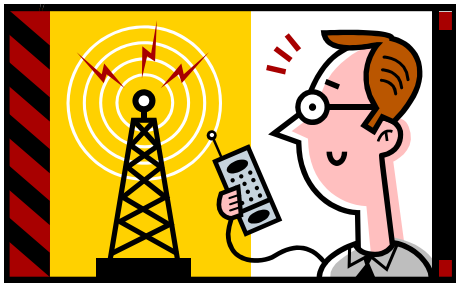
- Killing a worker
  - `worker.terminate()` from main program
  - Worker can stop itself, close()
- Importing other JavaScript files:
  - Workers must use `importScripts()`
  - Also used for JSONP (JSON with padding)
    - Cross-domain Ajax
    - Like our language tutor application
- Workers can also: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


http://math.hws.edu/eck/jsdemo/jsMandelbrot.html

Geolocation



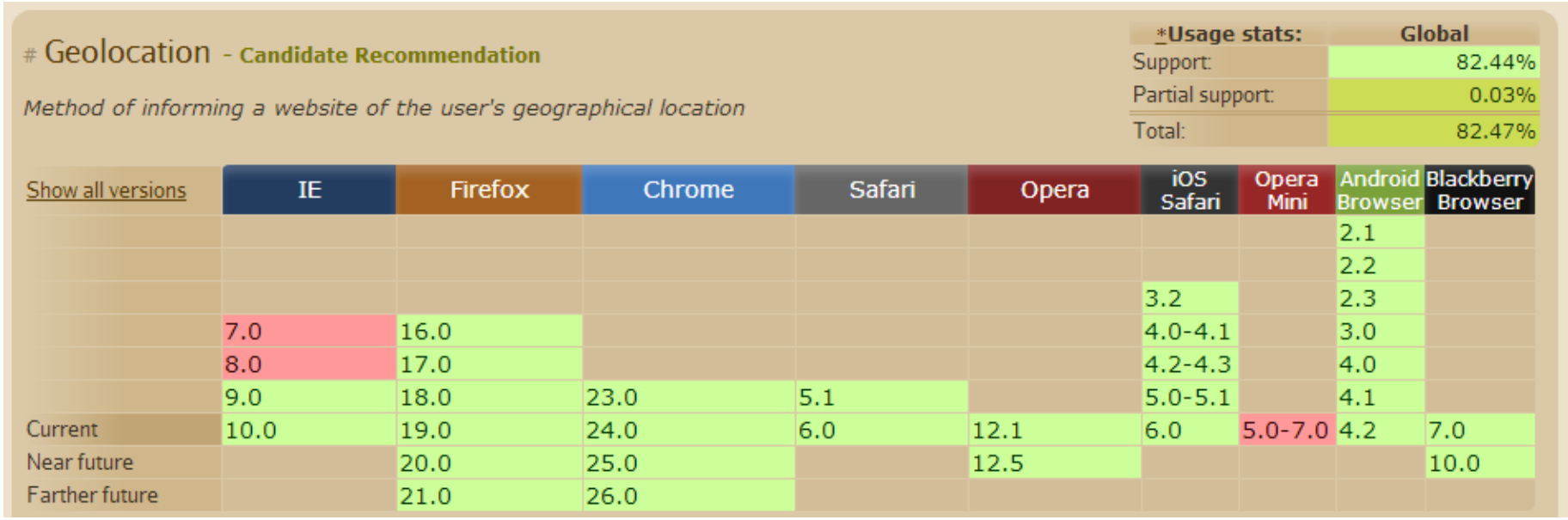
- Actually not part of W3C HTML5 spec
  - But W3C standard
  - Widely supported
- High-level interface to device location info
  - Global Positioning System (GPS)
  - Or location inferred from network signal
    - IP address
    - RFID
    - WiFi, Bluetooth
    - GSM/CDMA cell IDs
    - User input



- 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

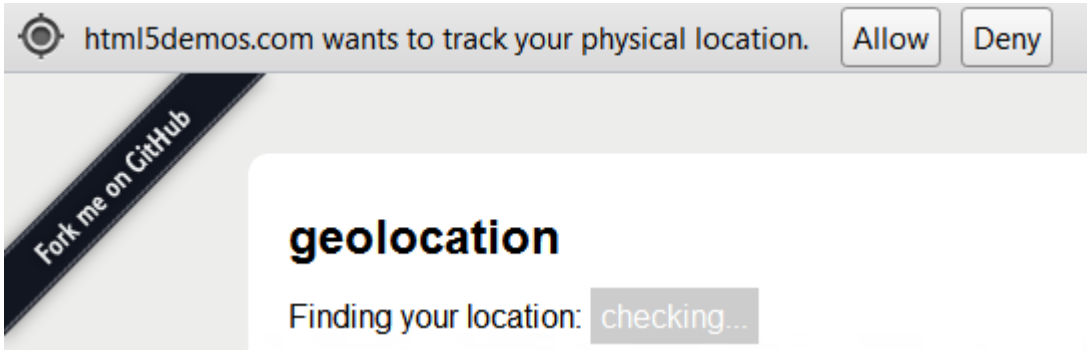
*Usage stats:	Global
Support:	82.44%
Partial support:	0.03%
Total:	82.47%

Show all versions	IE	Firefox	Chrome	Safari	Opera	iOS Safari	Opera Mini	Android Browser	Blackberry Browser
								2.1	
								2.2	
						3.2		2.3	
	7.0	16.0				4.0-4.1		3.0	
	8.0	17.0				4.2-4.3		4.0	
	9.0	18.0	23.0	5.1		5.0-5.1		4.1	
Current	10.0	19.0	24.0	6.0	12.1	6.0	5.0-7.0	4.2	7.0
Near future		20.0	25.0		12.5				10.0
Farther future		21.0	26.0						

http://caniuse.com/#feat=geolocation

Privacy issues

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



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

Geolocation

- Often combined with the Google Maps API:

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>
```

```
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
      - Especially without GPS
    - Location-based applications
    - Privacy issues