





Maps API

Best Practices

or How To Be Awesome

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Overview

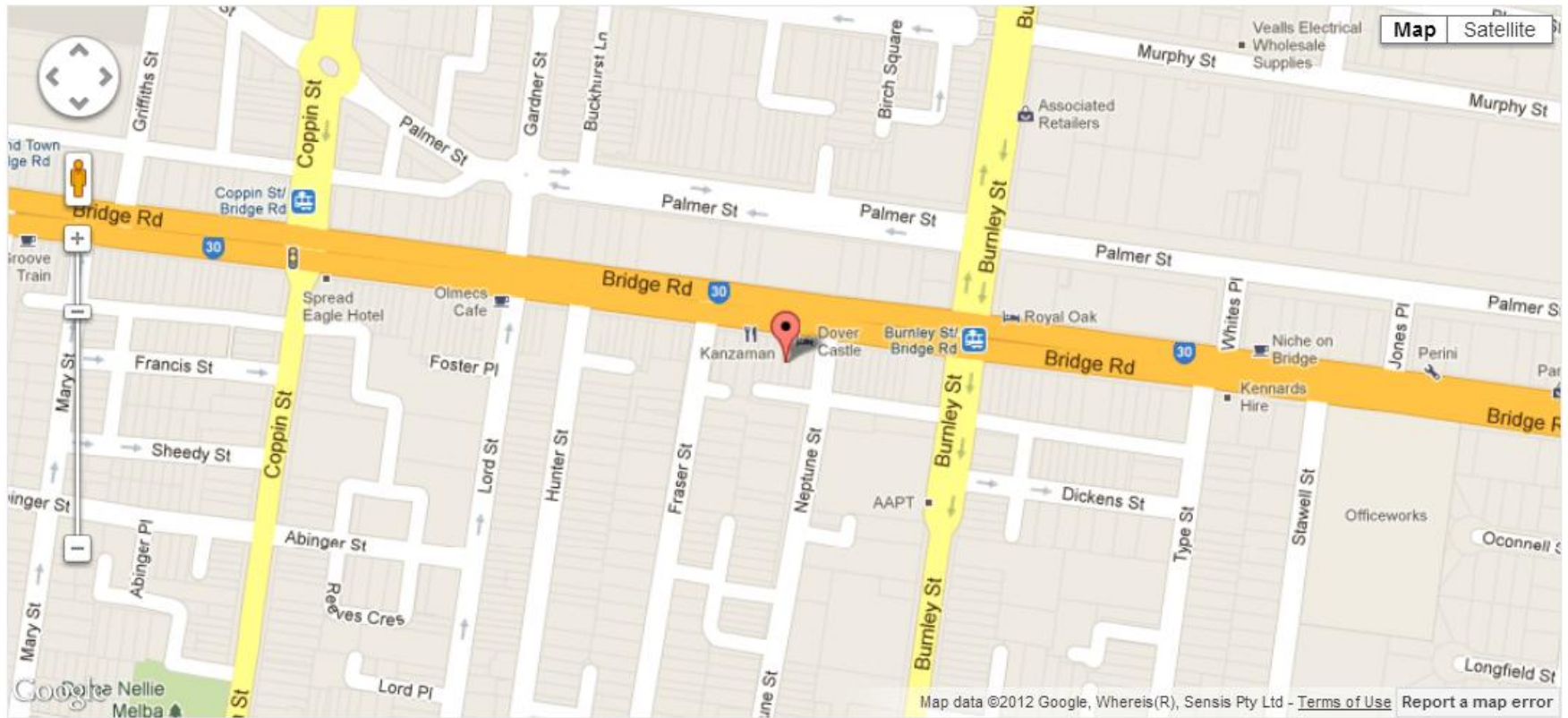
- Development tips (or: Be Smart)
- Simple improvements (or: Be Savvy)
- Advanced features (or: Be Awesome)



Be smart

Tools for maps development.

Maybe this is overkill



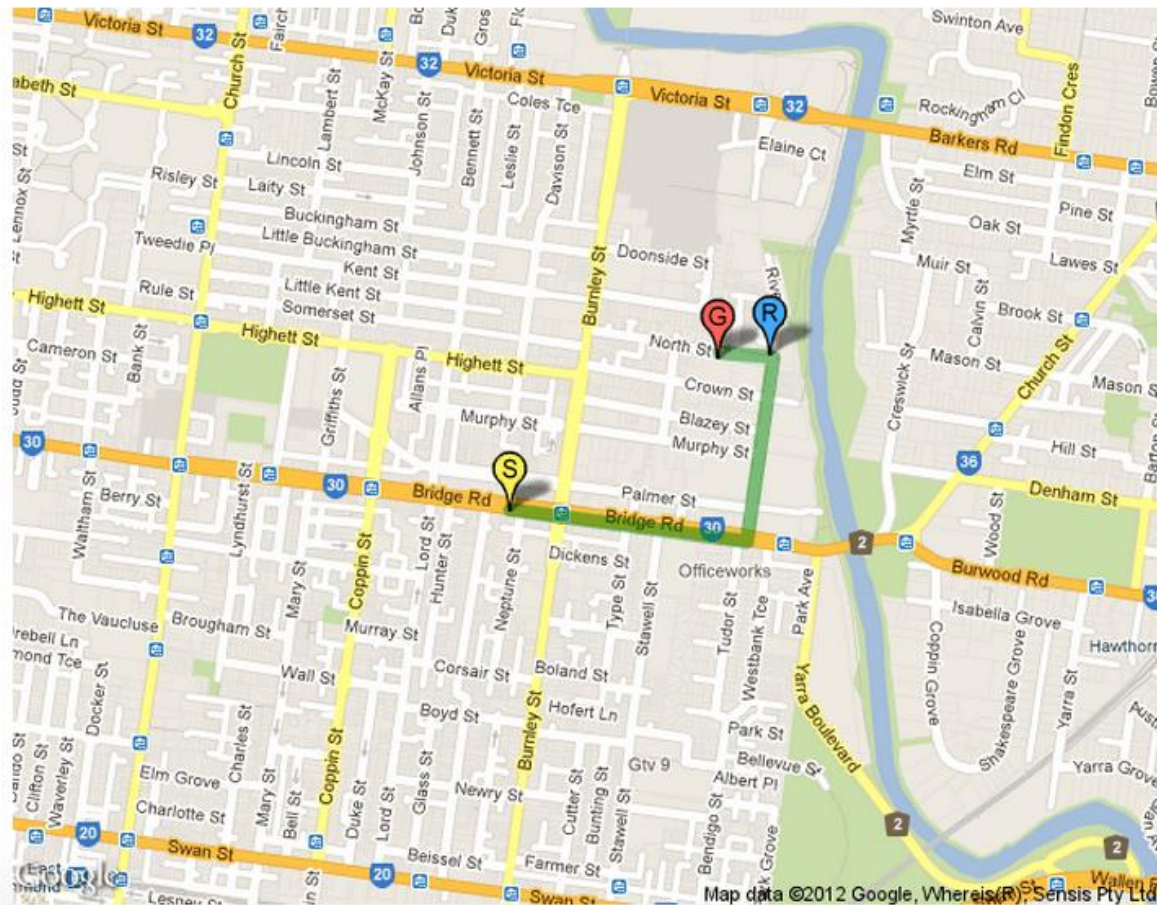
Static Maps

The Static Maps API may be all you need.

```
http://maps.googleapis.com/maps/api/staticmap  
?center=-37.819527,145.007102&zoom=17  
&markers=-37.819582,145.007062  
&size=1200x300&sensor=false
```



But I'm going on a beer crawl!

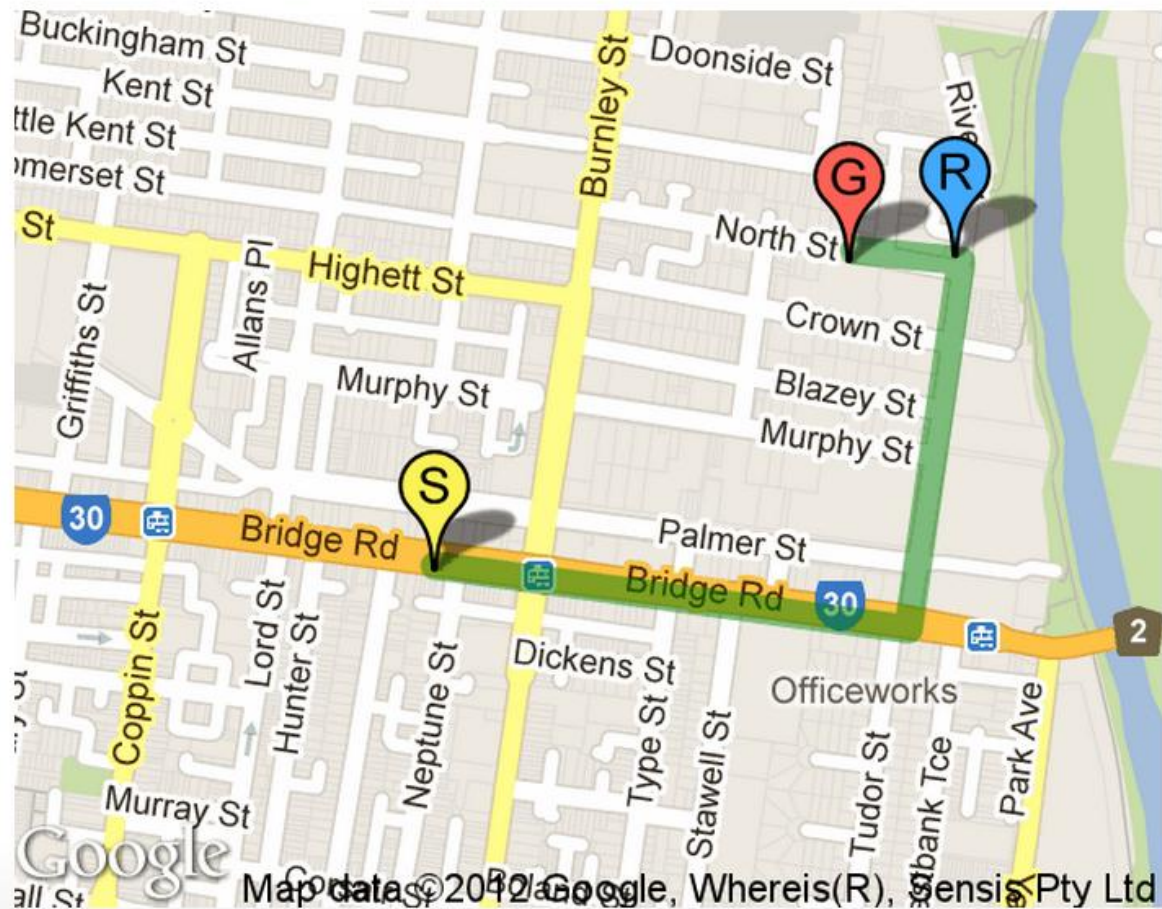


But I'm going on a beer crawl!

Static Maps support many visual elements

```
http://maps.googleapis.com/maps/api/staticmap?  
  center=-37.818429,145.008931&zoom=15&size=600x300  
  &markers=color:yellow|label:S|-37.819495,145.007077  
  &markers=color:red|label:G|-37.816582,145.012043  
  &markers=color:blue|label:R|-37.816531,145.013309  
  &path=color:0x00800080|weight:8  
    |-37.81943,145.00708|-37.82003,145.01274|-37.81655,145.01337|-37.81645,145.01209  
  &sensor=false
```


My smartphone has too many pixels!



My smartphone has too many pixels!

Add the `scale` parameter.

```
http://maps.googleapis.com/maps/api/staticmap?  
  center=-37.818429,145.008931&zoom=15&size=600x300  
  &markers=color:yellow|label:S|-37.819495,145.007077  
  &markers=color:red|label:G|-37.816582,145.012043  
  &markers=color:blue|label:R|-37.816531,145.013309  
  &path=color:0x00800080|weight:8  
    |-37.81943,145.00708|-37.82003,145.01274|-37.81655,145.01337|-37.81645,145.01209  
  &scale=2  
  &sensor=false
```

But I really want Street View



But I really want Street View

The Street View Image API allows static views of SV Imagery.

```
http://maps.googleapis.com/maps/api/streetview  
?size=600x500&location=-37.816537,145.012565  
&heading=-174.47667368404316  
&pitch=-3.7044103524331756  
&fov=70  
&sensor=false
```




HTTP Performance

My maps application needs to fetch a bunch of data.

```
var xhr = new XMLHttpRequest();  
for (var i = 0; i < breweries.length; ++i) {  
  breweryId = breweries[i];  
  xhr.open('GET', breweryId + '.xml', false);  
  xhr.send();  
  myData.xml = xhr.responseXML;  
}
```

JAVASCRIPT

HTTP Performance

Loading the breweries data one-by-one can be problematic.

Name	Method	Status	Type	Initiator	Size	Time	Timeline	37ms	55ms	73ms	91ms	110ms	128ms
part1.xml	GET	Success	text/x...	markers.html:4	698B	37ms							
part0.xml	GET	Success	text/x...	markers.html:5	695B	35ms							
part2.xml	GET	Success	text/x...	markers.html:6	698B	38ms							
part3.xml	GET	Success	text/x...	markers.html:7	698B	37ms							
part4.xml	GET	Success	text/x...	markers.html:8	703B	36ms							
part5.xml	GET	Success	text/x...	markers.html:9	698B	38ms							
part6.xml	GET	Success	text/x...	markers.html:10	703B	63ms							
part7.xml	GET	Success	text/x...	markers.html:11	700B	64ms							
part8.xml	GET	Success	text/x...	markers.html:12	693B	73ms							
part9.xml	GET	Success	text/x...	markers.html:13	698B	73ms							
part10.xml	GET	Success	text/x...	markers.html:15	698B	75ms							
part11.xml	GET	Success	text/x...	markers.html:16	703B	82ms							
part12.xml	GET	Success	text/x...	markers.html:17	698B	91ms							
part13.xml	GET	Success	text/x...	markers.html:18	698B	101ms							
part14.xml	GET	Success	text/x...	markers.html:19	690B	92ms							
part15.xml	GET	Success	text/x...	markers.html:20	703B	110ms							
part16.xml	GET	Success	text/x...	markers.html:21	698B	102ms							
part17.xml	GET	Success	text/x...	markers.html:22	698B	110ms							
part19.xml	GET	Success	text/x...	markers.html:23	693B	119ms							

HTTP Performance


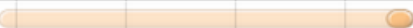
Better to have a handler that can bundle responses:

```
xhr = new XMLHttpRequest();
breweryIds = [];
for (var i = 0; i < breweries.length; ++i) {
  breweryIds.push(breweries[i]);
}
idString = breweryIds.join(',');
xhr.open('GET', 'breweryHandler?ids=' + idString, false);
xhr.send();
process(xhr.responseXML);
```

JAVASCRIPT

HTTP Performance

We can load everything with one request.

Name ▲	Method	Status	Type	Initiator	Size	Time ▼	Timeline	17ms	25ms	33ms	42ms
 all.xml	GET	Success	text/xml	markers.html:6	1.88KB	31ms					

HTTP Performance

Keep in mind:

- URL length
- Size of responses
- Processing on the server side

Closure Compiler

- Catches syntax and semantic errors
- Provides types for stricter programming guarantees
- Optionally obfuscates code for smaller downloads

Closure Compiler Example

JAVASCRIPT

```
function MyApp(one, two) {  
  this.values_ = {  
    un: one,  
    deux: too,  
  };  
}  
window['app'] = MyApp();
```

broken.js:5: ERROR - Parse error. Internet Explorer has a non-standard interpretation of trailing commas. Arrays will have the wrong length and objects will not parse at all.

```
};  
^
```

1 error(s), 0 warning(s)

Closure Compiler Example

JAVASCRIPT

```
function MyApp(one, two) {  
  this.values_ = {  
    un: one,  
    deux: too  
  };  
}  
window['app'] = MyApp('a');
```

broken.js:4: ERROR - variable too is undeclared

```
    deux: too  
         ^
```

broken.js:2: WARNING - dangerous use of the global this object

```
  this.values_ = {  
  ^
```

1 error(s), 0 warning(s)

Closure Compiler Example

JAVASCRIPT

```
/**
 * @param {string} one The first parameter.
 * @param {number} two The second parameter.
 * @constructor */
function MyApp(one, two) {
  this.values_ = {un: one, deux: two};
}
window['app'] = MyApp('a');
```

broken.js:7: WARNING - Constructor function (new:MyApp, string, number): undefined should be called with the "new" keyword

```
window['app'] = MyApp('a');
                  ^
```

broken.js:7: WARNING - Function MyApp: called with 1 argument(s). Function requires at least 2 argument(s) and no more than 2 argument(s).

```
window['app'] = MyApp('a');
                  ^
```

0 error(s), 2 warning(s), 100.0% typed

Closure Compiler Example

JAVASCRIPT

```
/**  
 * @param {string} one The first parameter.  
 * @param {number} two The second parameter.  
 * @constructor  
 */  
function MyApp(one, two) {  
  this.values_ = {un: one, deux: two};  
}  
window['app'] = new MyApp('a', 2);
```

becomes

JAVASCRIPT

```
window.app=new function(){("a",2);
```

Closure Compiler and the Maps API

JAVASCRIPT

```
function init() {  
  var map = new google.maps.Map(document.getElementById('map'), {  
    center: new google.maps.LatLng(0, 0),  
    zoom: 3,  
    mapTypeId: google.maps.MapTypeId.ROADMAP  
  });  
}
```


Closure Compiler and the Maps API

```
> java -jar compiler.jar --js map-app.js --warning_level VERBOSE

map-app.js:2: WARNING - Property Map never defined on google.maps
  var map = new google.maps.Map(document.getElementById('map'), {
                        ^
map-app.js:2: WARNING - Property maps never defined on google
  var map = new google.maps.Map(document.getElementById('map'), {
                        ^
map-app.js:3: WARNING - Property LatLng never defined on google.maps
  center: new google.maps.LatLng(0, 0),
                        ^
map-app.js:3: WARNING - Property maps never defined on google
  center: new google.maps.LatLng(0, 0),
                        ^
map-app.js:5: WARNING - Property MapTypeId never defined on google.maps
  mapTypeId: google.maps.MapTypeId.ROADMAP
                        ^
map-app.js:5: WARNING - Property ROADMAP never defined on google.maps.MapTypeId
  mapTypeId: google.maps.MapTypeId.ROADMAP
                        ^
map-app.js:5: WARNING - Property maps never defined on google
  mapTypeId: google.maps.MapTypeId.ROADMAP
                        ^
0 error(s), 7 warning(s), 58.6% typed
```

Closure Compiler and the Maps API

Externs to the rescue!

Download Maps API externs from closure-compiler.googlecode.com.

```
> java -jar compiler.jar --js map-app.js --warning_level VERBOSE --externs google_maps_api_v3.js
```

Closure Compiler

Docs: developers.google.com/closure/compiler/

Testing

- This is important!
- Unit testing
 - Tests a single component in isolation.
- Automated integration testing
 - Tests the application as a whole.

Testing

Many good open-source tools:

- Unit testing
 - google-js-test
 - code.google.com/p/google-js-test
- Integration testing
 - Puppeteer
 - code.google.com/p/puppeteer



Be savvy

Going from good to great



Key-Value Observation

Centering the circle **without** MVCObject:

JAVASCRIPT

```
var marker = new google.maps.Marker({
  position: new google.maps.LatLng(-25, 133),
  draggable: true,
  map: map
});
var circle = new google.maps.Circle({
  radius: 1000000,
  map: map
});
google.maps.event.addListener(marker, 'position_changed', function() {
  circle.setCenter(marker.getPosition());
});
circle.setCenter(marker.getPosition());
```


Key-Value Observation using MVCOBJECT

- The MVCOBJECT class allow for easy key-value observation.
- Bind Circle's "center" to Marker's "position" to keep them in sync.

```
var marker = new google.maps.Marker({  
  position: new google.maps.LatLng(-25, 133),  
  draggable: true,  
  map: map  
});  
var circle = new google.maps.Circle({  
  radius: 1000000,  
  map: map  
});  
circle.bindTo('center', marker, 'position');
```

JAVASCRIPT



Autocomplete Widget

Who has seen an address entry form like this?

Street address	<input type="text"/>	<input type="text"/>	Alley <input type="button" value="v"/>
City	<input type="text"/>		
State	<input type="text"/>	Post code	<input type="text"/>
Country	<input type="text"/>		

Autocomplete Widget

Isn't this better?

Street address

City

State

Post code

Country

LatLng

Formatted address

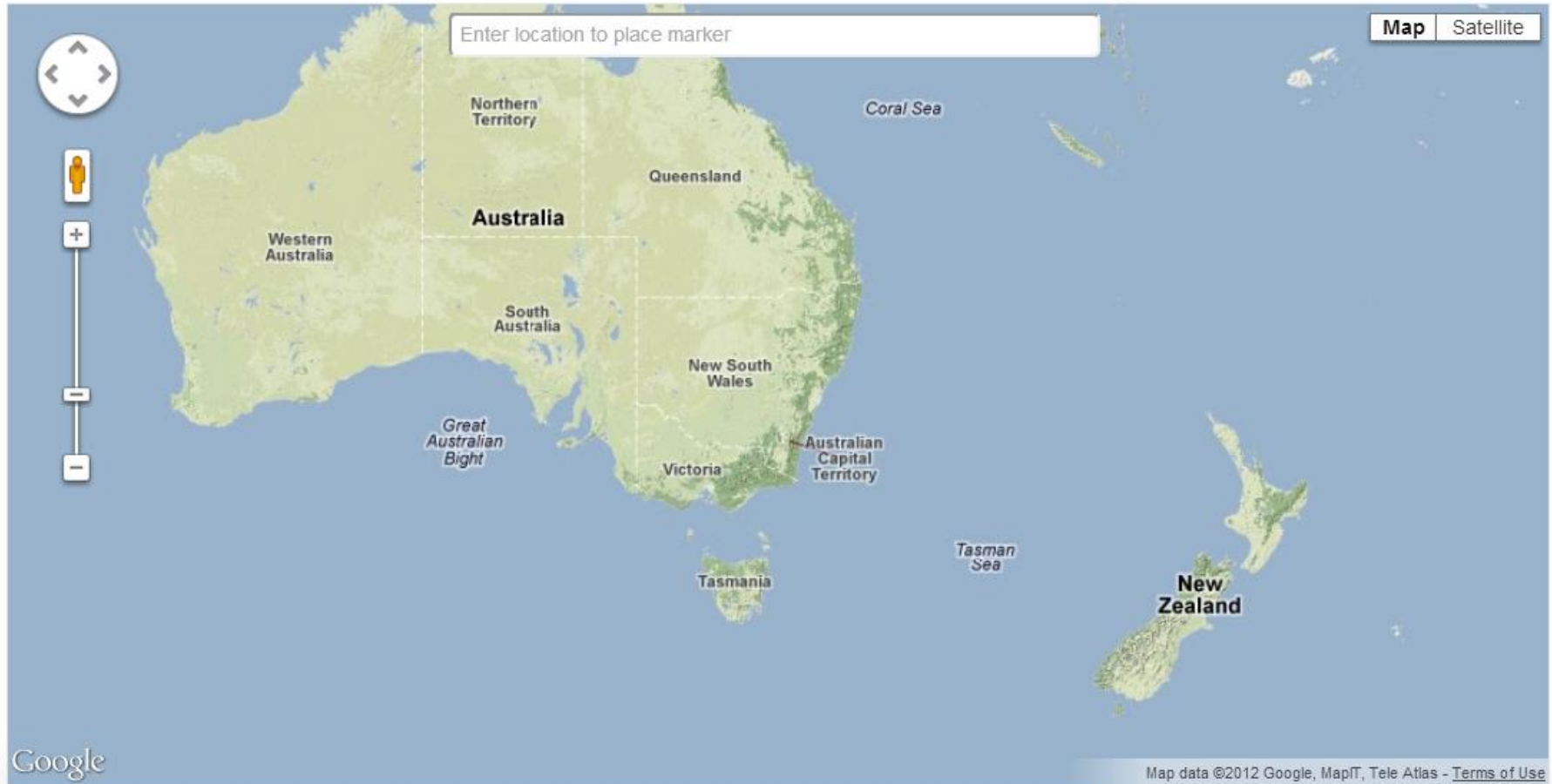
Autocomplete Widget

- Need to include the places library.

```
var autocomplete = new google.maps.places.Autocomplete(inputElement);
google.maps.event.addListener(autocomplete, 'place_changed', function() {
  var place = autocomplete.getPlace();
  ...
});
```

JAVASCRIPT

Autocomplete + Maps



Geocoding

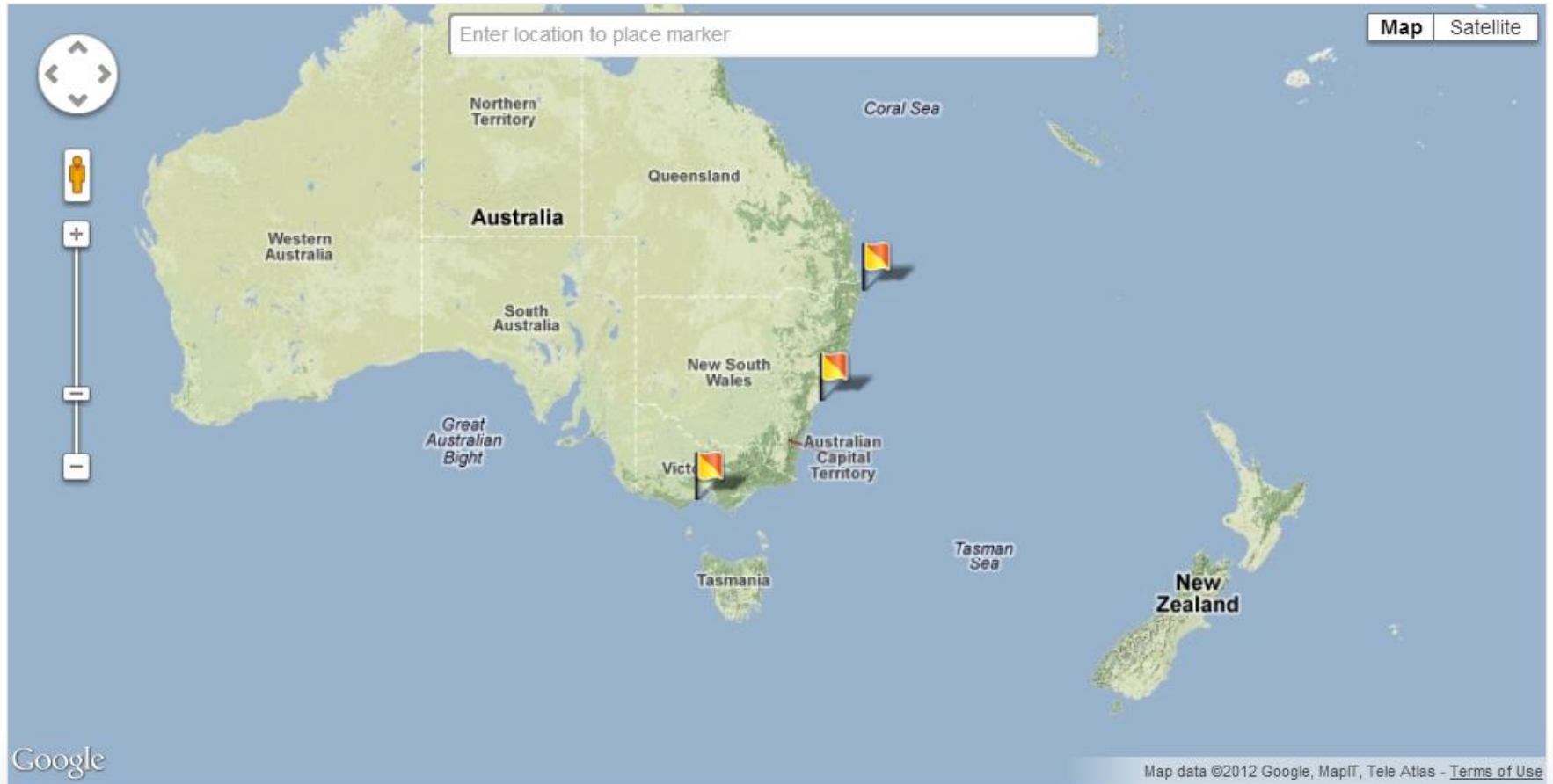
When geocoding a fixed set of addresses, you should use the Geocoding web service and cache these results instead of geocoding dynamically in the client.

```
http://maps.googleapis.com/maps/api/geocode/json?address=Bondi+Beach+Australia&sensor=false
```

```
http://maps.googleapis.com/maps/api/geocode/json?address=Byron+Bay+Australia&sensor=false
```

```
http://maps.googleapis.com/maps/api/geocode/json?address=Bells+Beach+Australia&sensor=false
```

Custom Markers



Custom Markers — Spriting

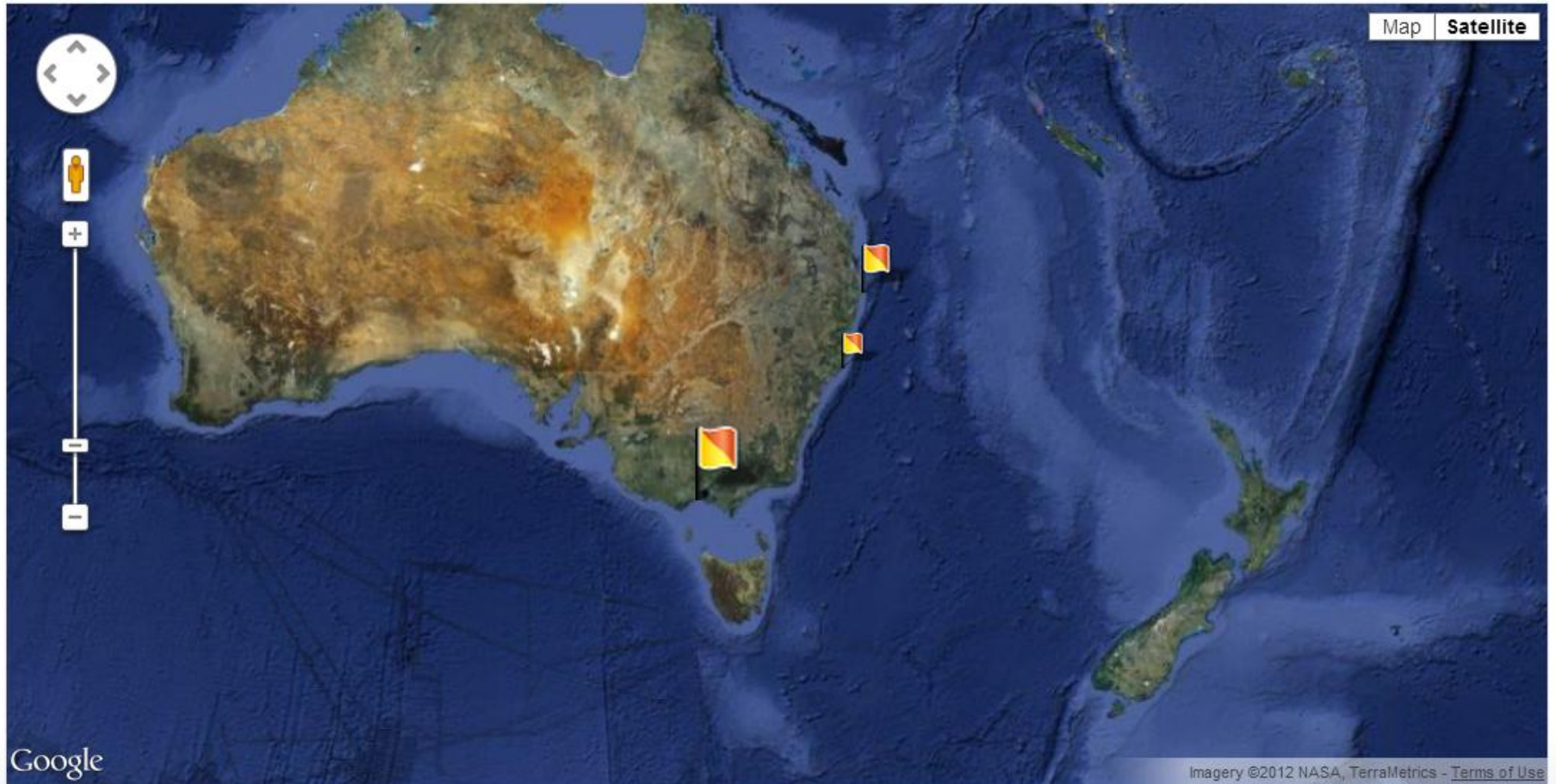
Improve performance by combining your images into one (a sprite).



JAVASCRIPT

```
var icon = new google.maps.MarkerImage(  
    'images/beachflag.png',  
    new google.maps.Size(20, 32),    // The size of the icon.  
    new google.maps.Point(0, 0),    // The icon is at an offset of (0,0) in the sprite.  
    new google.maps.Point(0, 32)    // The offset of the "tip" of the icon.  
);  
  
var shadow = new google.maps.MarkerImage(  
    'images/beachflag.png',  
    new google.maps.Size(35, 32),    // The size of the shadow.  
    new google.maps.Point(39, 0),    // The shadow is at an offset of (39,0) in the sprite.  
    new google.maps.Point(0, 32)    // The offset of the "tip" of the shadow.  
);
```

Custom Markers — Scaling



3 markers (with shadows); 1 image file.

Custom Markers — Scaling

Show the same image at different sizes.

JAVASCRIPT

```
var icon = new google.maps.MarkerImage(  
  'images/beachflag.png',  
  new google.maps.Size(20, 34),    // Original display size.  
  new google.maps.Point(0, 0),     // Offset within the sprite.  
  new google.maps.Point(10, 34)    // anchor  
);
```



```
var doubled = new google.maps.MarkerImage(  
  'images/beachflag.png',  
  new google.maps.Size(20 * 2, 34 * 2),    // Display size of image is doubled.  
  new google.maps.Point(0 * 2, 0 * 2),     // Offset in the sprite is doubled.  
  new google.maps.Point(10 * 2, 34 * 2),   // Anchor is doubled.  
  new google.maps.Size(57 * 2, 34 * 2)    // Entire size of image is doubled.  
);
```

Marker Symbols



Custom Overlays



Full control over the DOM elements. Redrawn only when required.



#io12

Custom Overlays

Inherits from `google.maps.OverlayView`.

Implements three methods:

- `onAdd` – adds element to the DOM using the `MapPanes`
- `draw` – positions the overlay by converting a `LatLng` to a coordinate within its pane
- `onRemove` – removes the element from the DOM

Custom Overlays

Constructor

```
function FlagMarker(label, icon, location) {  
  this.location_ = location;  
  this.icon_ = icon;  
  this.label_ = label;  
}  
FlagMarker.prototype = new google.maps.OverlayView();
```

JAVASCRIPT

Custom Overlays

onAdd()

```
FlagMarker.prototype.onAdd = function() {  
  this.element_ = document.createElement('div');  
  this.element_.className = 'flag';  
  this.element_.appendChild(document.createTextNode(this.label_));  
  
  this.getPanes().floatPane.appendChild(this.element_);  
};
```

JAVASCRIPT

Custom Overlays

draw()

```
FlagMarker.prototype.draw = function() {  
  // Convert from LatLng to coordinate within the map's pane.  
  var position = this.getProjection().fromLatLngToDivPixel(this.location_);  
  this.element_.style.top = Math.round(position.y) + 'px';  
  this.element_.style.left = Math.round(position.x) + 'px';  
};
```

JAVASCRIPT

Custom Overlays

onRemove()

```
FlagMarker.prototype.onRemove = function() {  
  this.element_.parentNode.removeChild(this.element_);  
  this.element_ = null;  
};
```

JAVASCRIPT

The beautiful sights of Sydney



Street View Orientation

Naive approach

```
var sydneyHarbour = new google.maps.LatLng(-33.849509, 151.213557);  
var panoramaOptions = {  
  position: sydneyHarbour,  
};  
var myPano = new  
  google.maps.StreetViewPanorama(document.getElementById("map"), panoramaOptions);  
myPano.setVisible(true);
```

JAVASCRIPT

Street View Orientation

Hard-coded approach

JAVASCRIPT

```
var sydneyHarbour = new google.maps.LatLng(-33.849509, 151.213557);
var panoramaOptions = {
  position: sydneyHarbour,
  pov: {
    heading: 190,
    pitch: 0,
    zoom: 1
  }
};
var myPano = new
  google.maps.StreetViewPanorama(document.getElementById("map"), panoramaOptions);
myPano.setVisible(true);
```

Street View Orientation

Automatically calculate the heading

JAVASCRIPT

```
var heading =  
    google.maps.geometry.spherical.computeHeading(origin, destination);  
myPano.setOptions({  
    position: origin,  
    pov: {  
        heading: heading,  
        pitch: 0,  
        zoom: 1  
    }  
});
```

Street View Orientation



Heading is taken from link data.

Street View Orientation

JAVASCRIPT

```
google.maps.event.addListener(myPano, 'links_changed', function() {  
  var links = myPano.getLinks();  
  var minDiff = 360;  
  var heading = 0;  
  for (var i = 0, link; link = links[i]; ++i) {  
    var diff = Math.abs(link.heading - targetHeading);  
    diff = Math.min(diff, 360 - diff)  
    if (minDiff > diff) {  
      heading = link.heading;  
      minDiff = diff;  
    }  
  }  
});
```

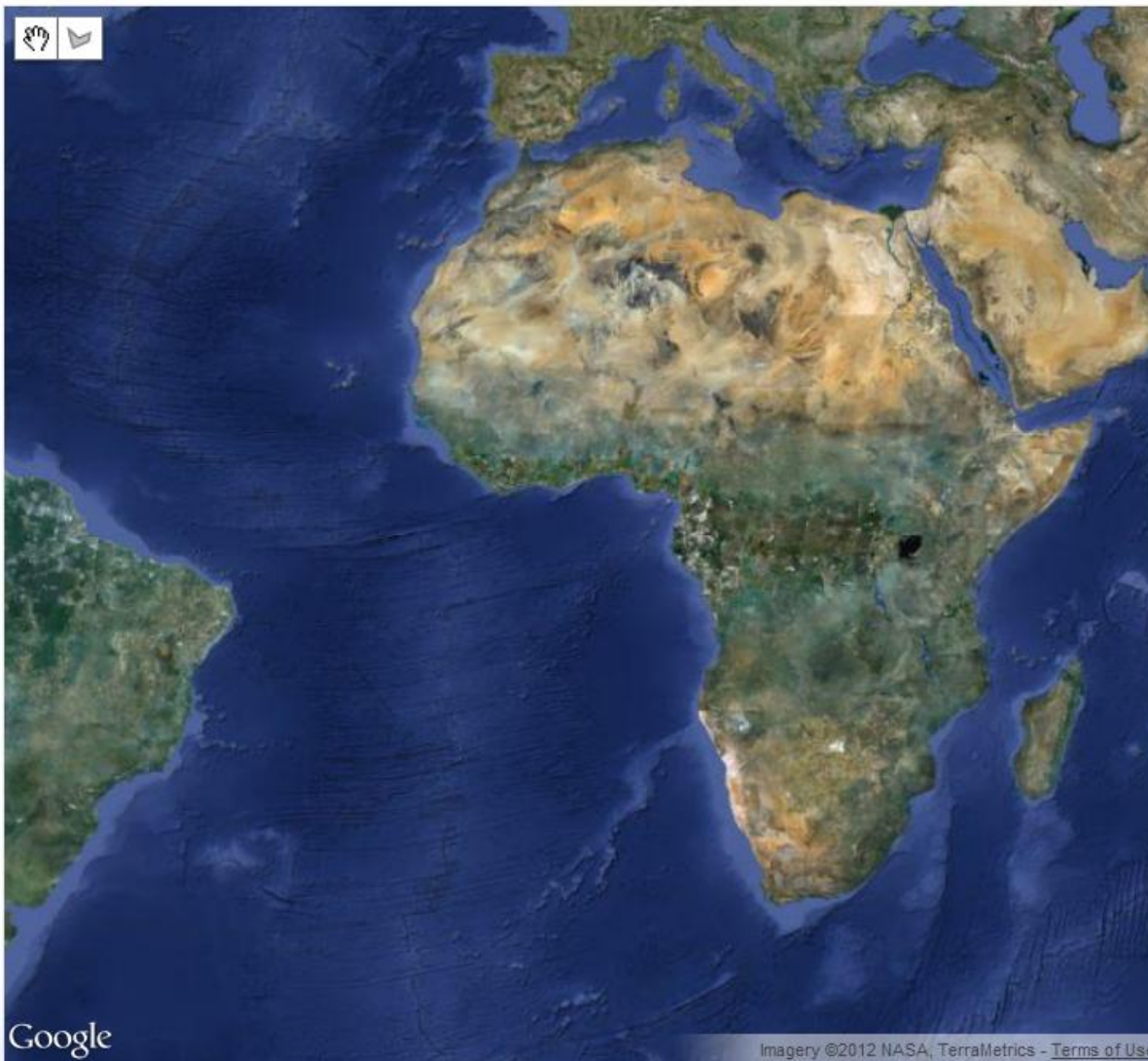



Be awesome

Building powerful applications.

James and his tin-foil roof





Enter a location

Trace a rooftop to get its area and perimeter.

Demo details

- `places.Autocomplete`
 - Adds suggest functionality to address entry fields and returns the `LatLng` of the selected address.
- `MaxZoomService.getMaxZoomAtLatLng`
 - Returns the zoom level of the best available satellite imagery at the specified `LatLng`.
- `drawing.DrawingManager`
 - Allows the user to draw a polygon, or other shapes, on the map.
- `geometry.spherical.computeArea`
 - Computes the area of the path drawn on the map.
- `geometry.spherical.computeLength`
 - Computes the length of the path drawn on the map.

Chris wants to ride his fixie to work



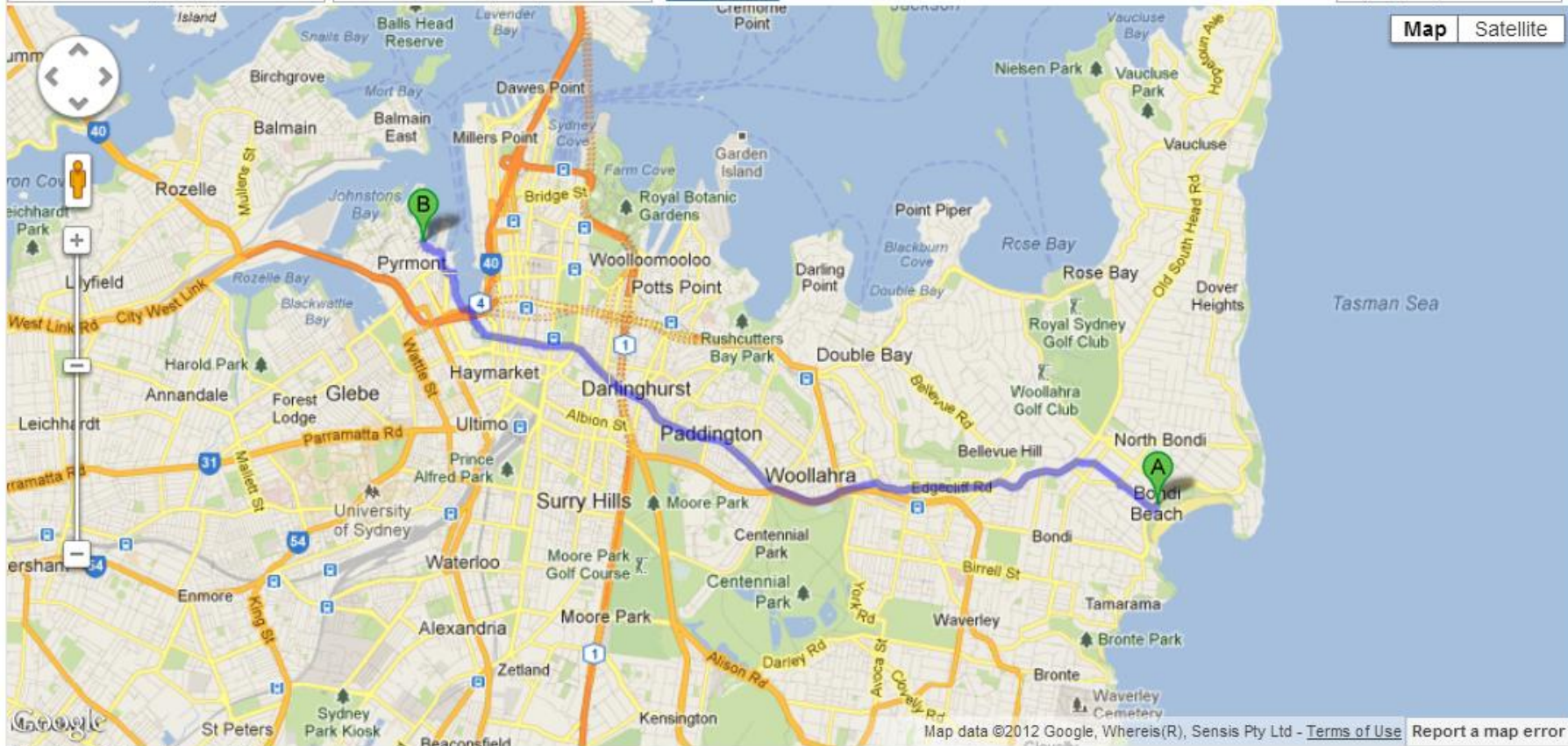
Bondi Beach, Sydney Australia

48 Pirrama Rd, Sydney Australia

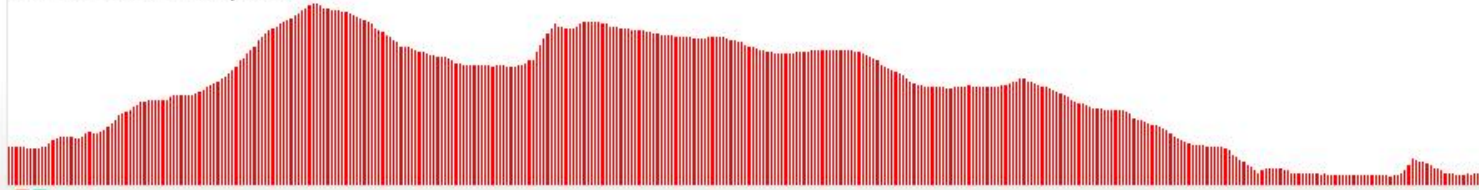
Elevate →

Share this page: <http://goo.gl/v2UB>

Map Satellite



Climb: 121m Drop: 135m



Demo details

- `places.Autocomplete`
 - Adds suggest functionality to address entry fields.
- `DirectionsService.route`
 - Returns driving directions between the two locations in the address fields.
- `DirectionsRenderer.setDirections`
 - Renders the route on the map.
- `ElevationService.getElevationAlongPath`
 - Returns information about the elevation at points along the path shown on the map.
- `MarkerImage`
 - Allows for customization of the marker icon.

Summary

- Follow good programming practices. (Yes, even in JS!)
- Create awesome apps: use features together.
- Every address field on the web should use Autocomplete!
- developers.google.com/maps

Thank You!



Jez Fletcher - Software Engineer, Google Maps API
Susannah Raub - Software Engineer, Google Maps API