

Building Mobile Apps with the ArcGIS API for JavaScript

Andy Gup, Lloyd Heberlie, Thomas Other

Agenda

Capabilities

Managing app life-cycle

Working with locally hosted builds

Working from JS frameworks

Debugging

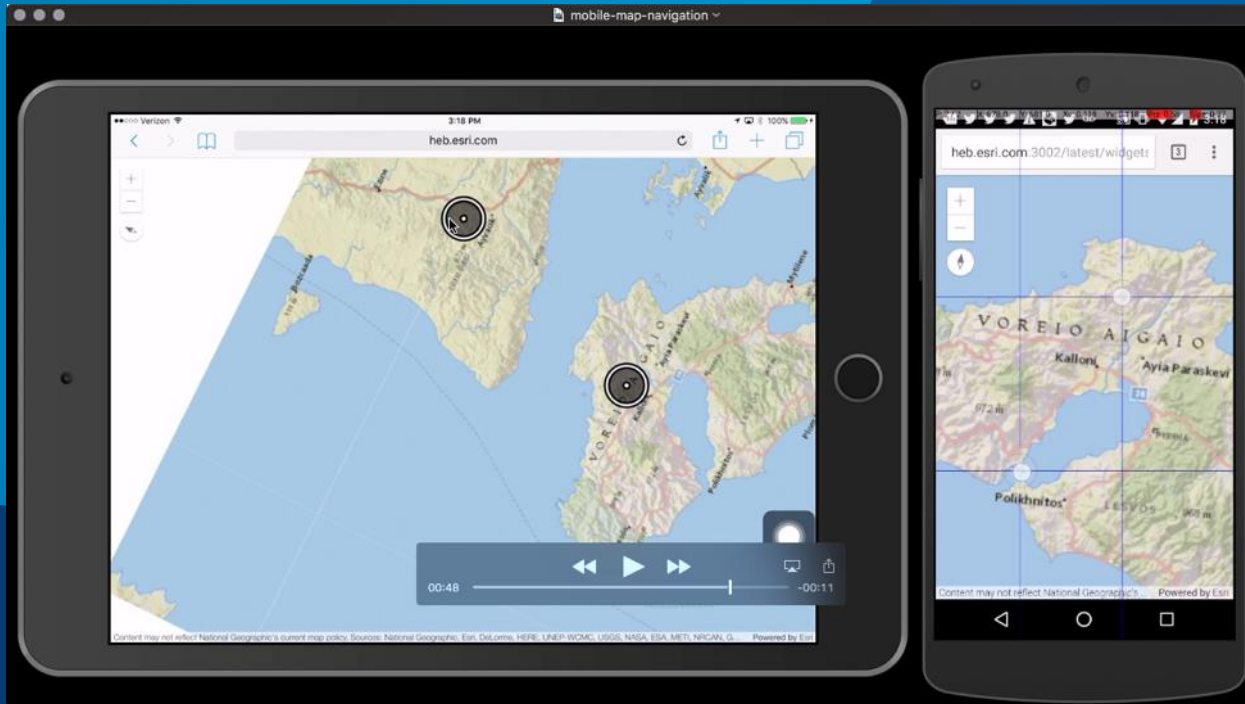
Working with 3D on Mobile

Expectations



Capabilities

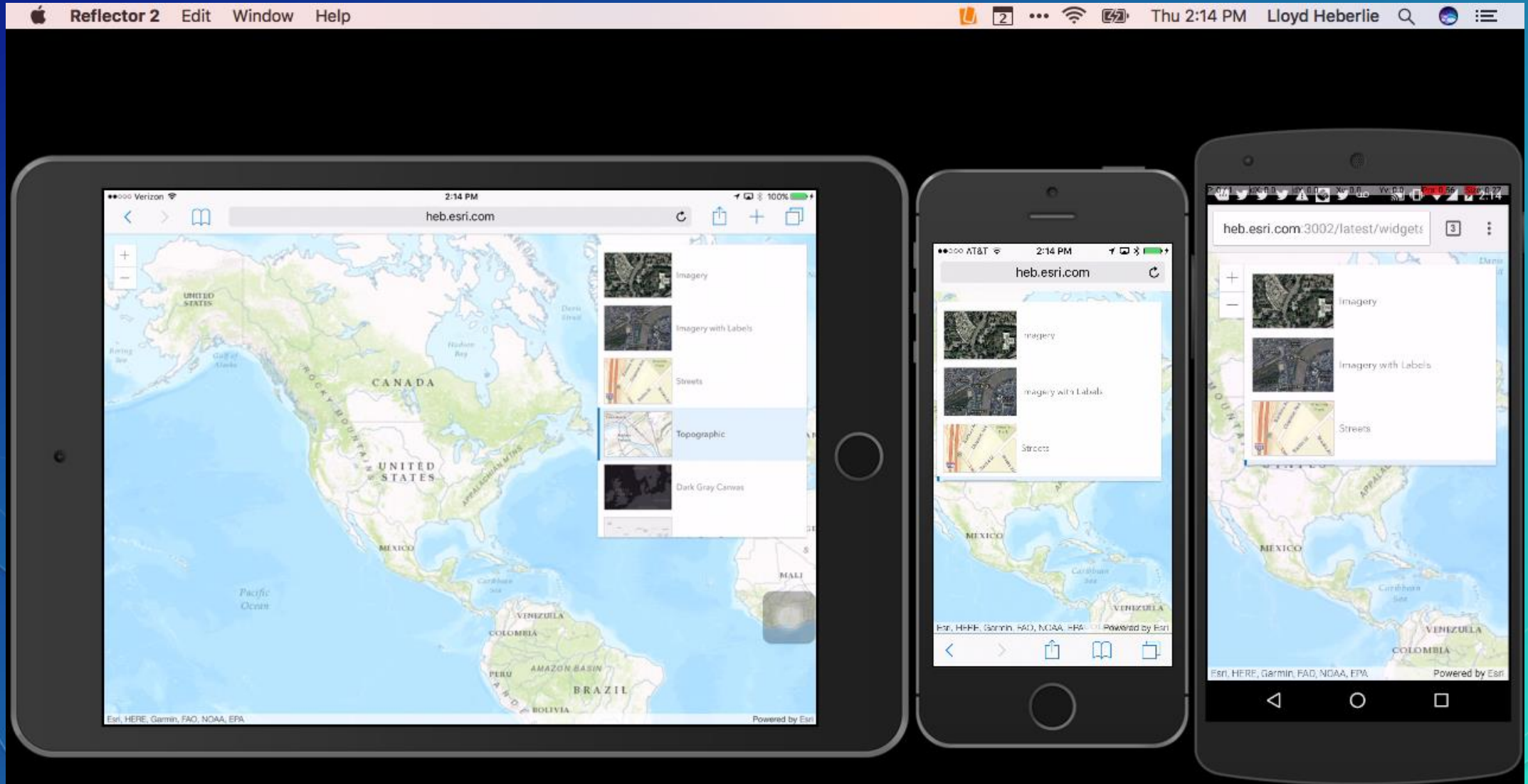
Lloyd Heberlie



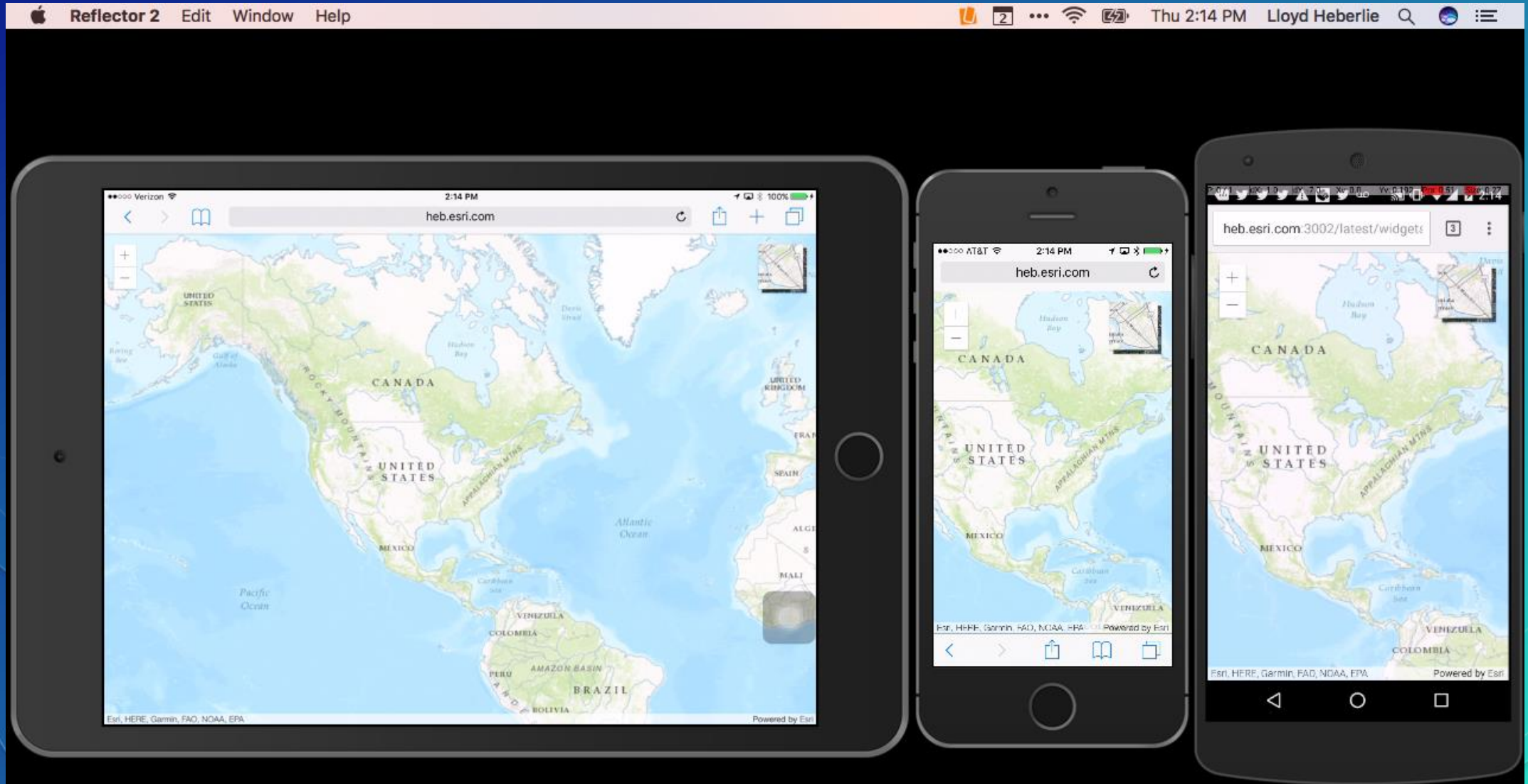
Touch

Demo

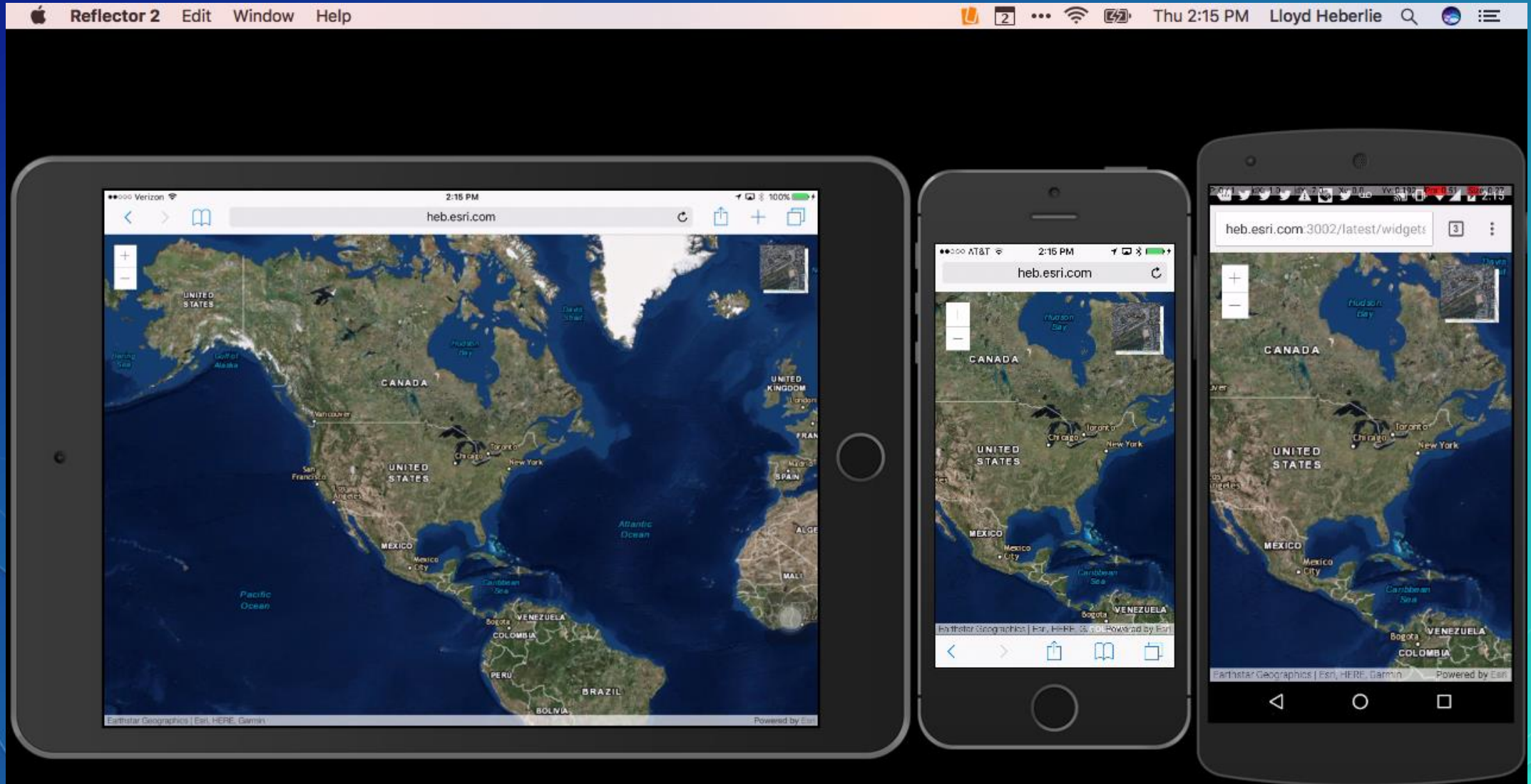
BasemapGallery



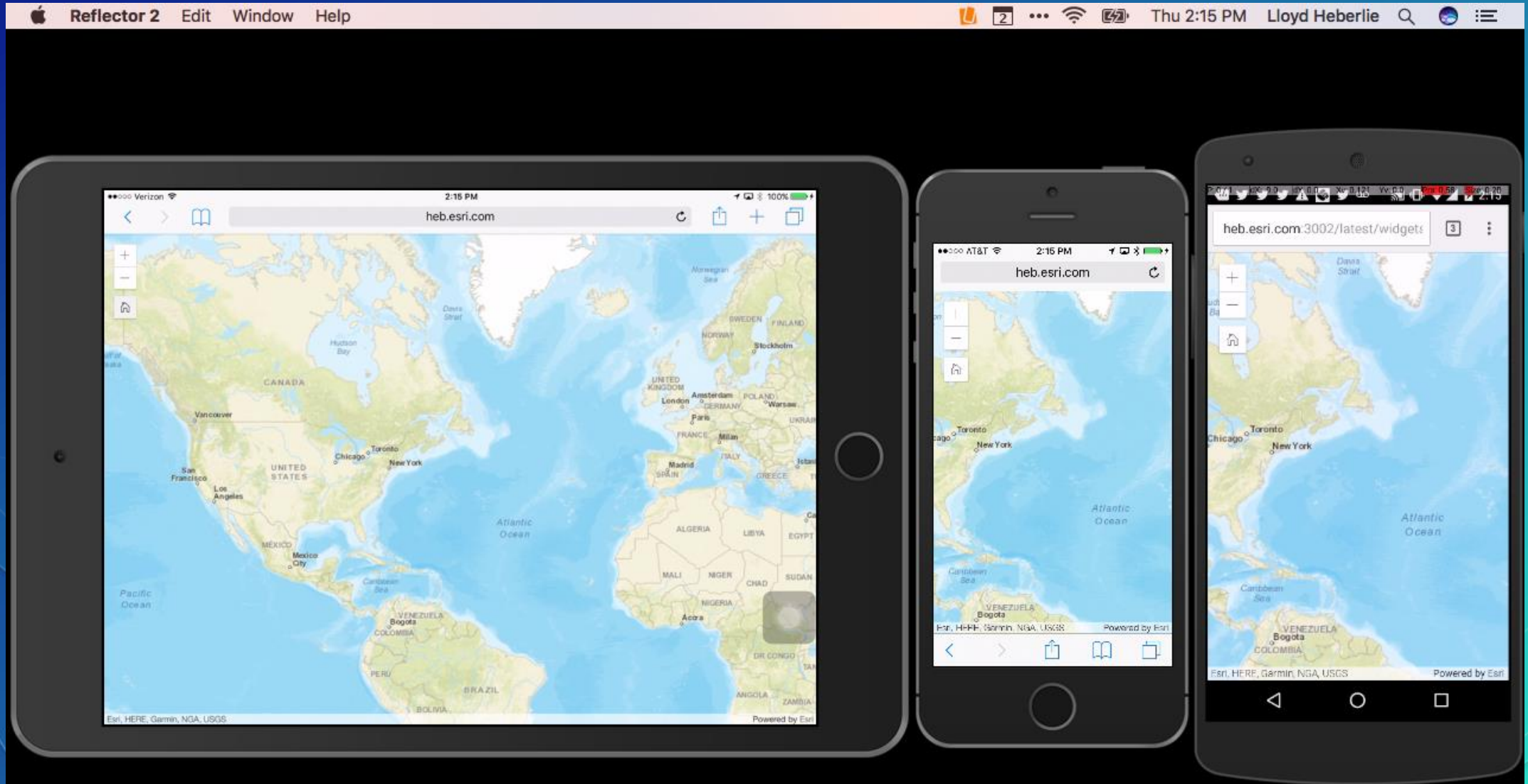
BasemapToggle



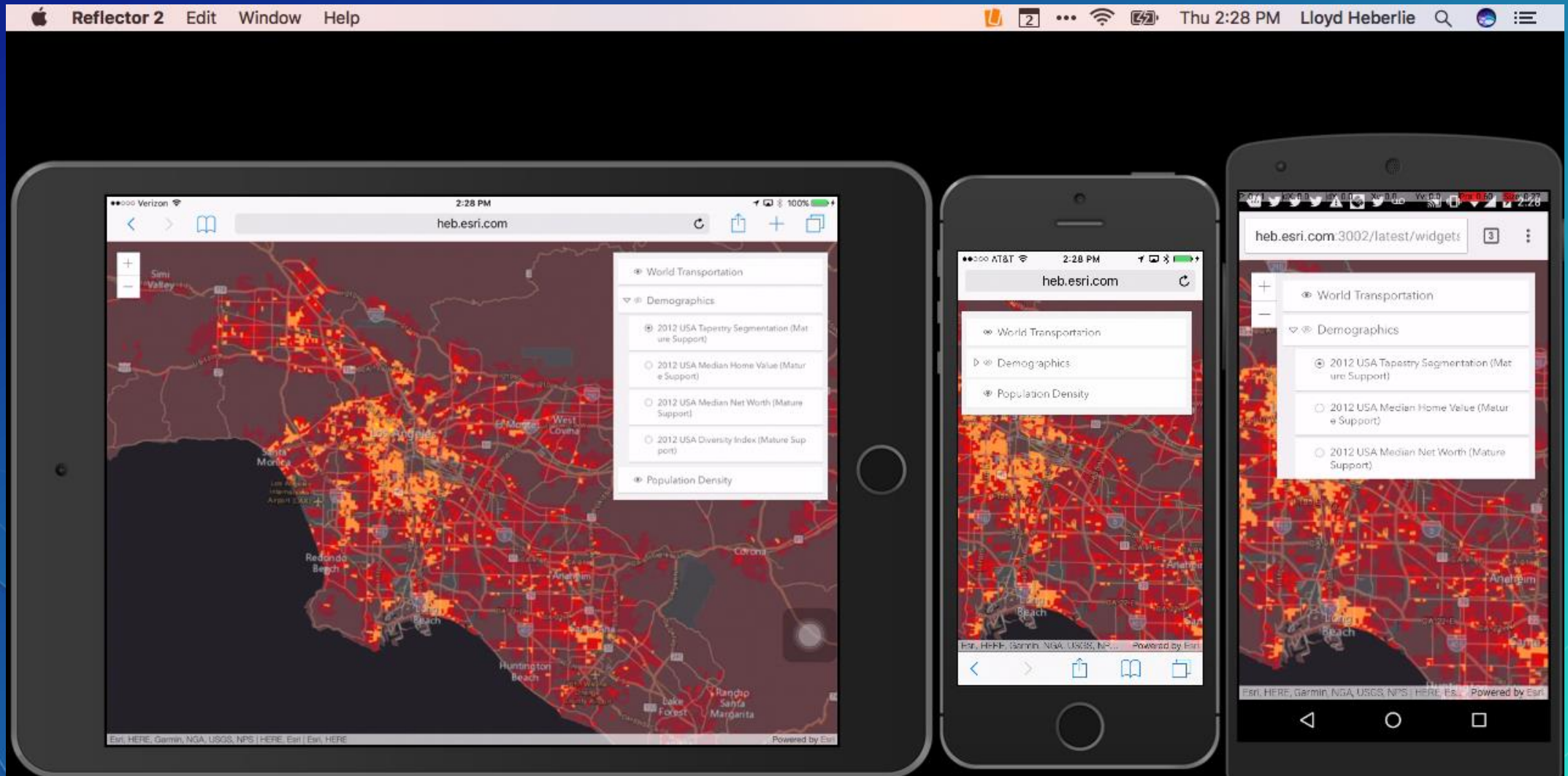
BasemapToggle



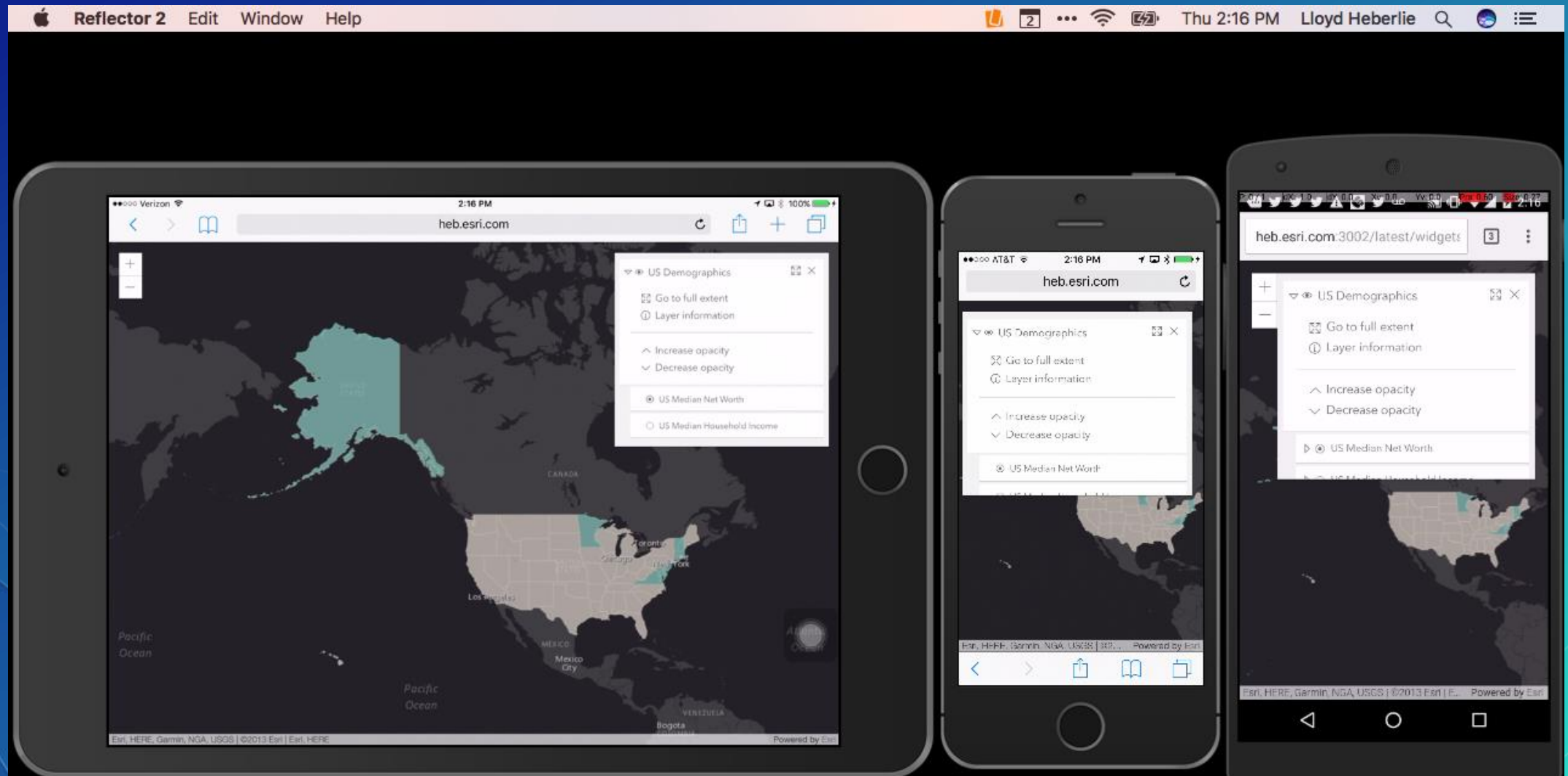
Home



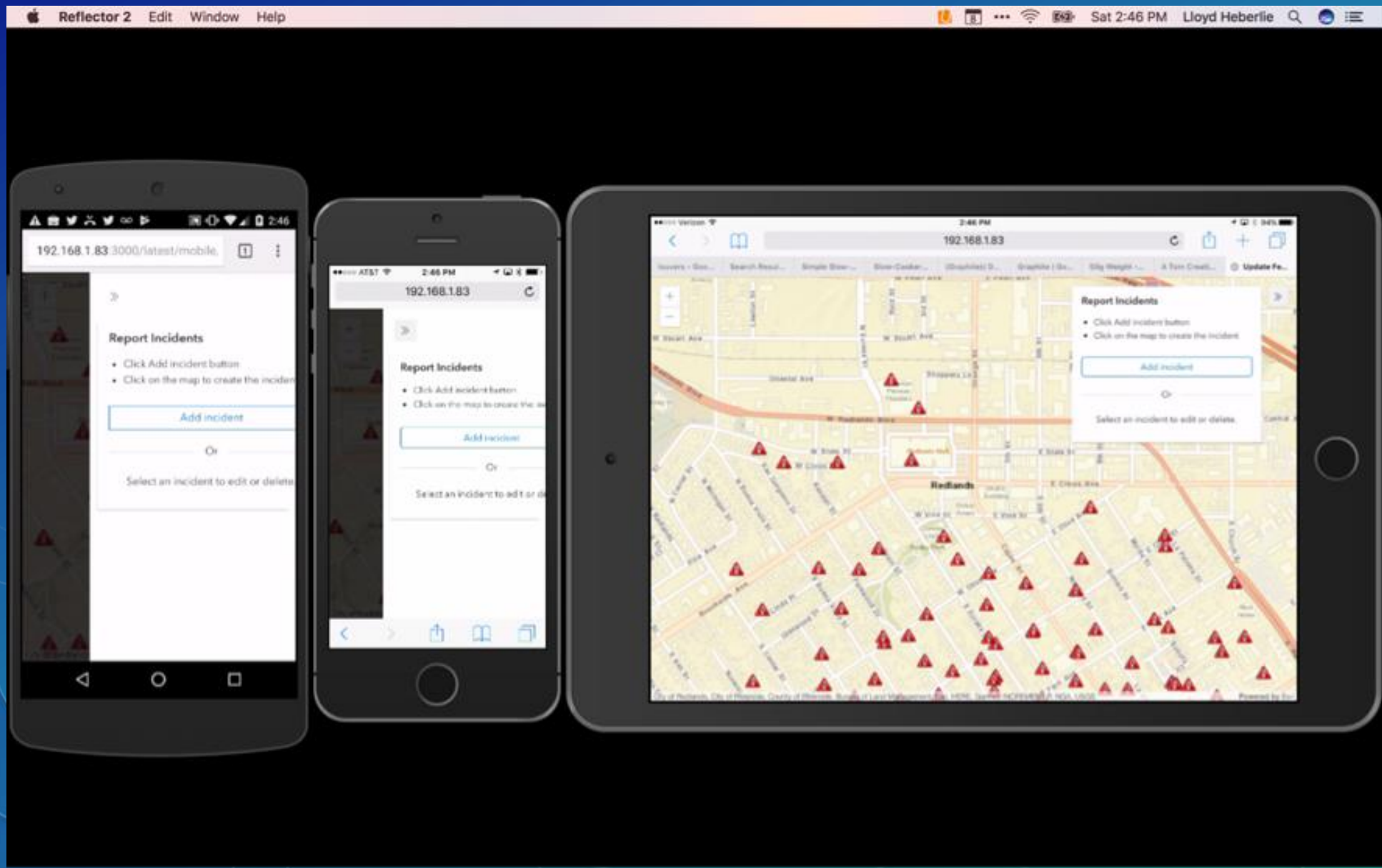
LayerList



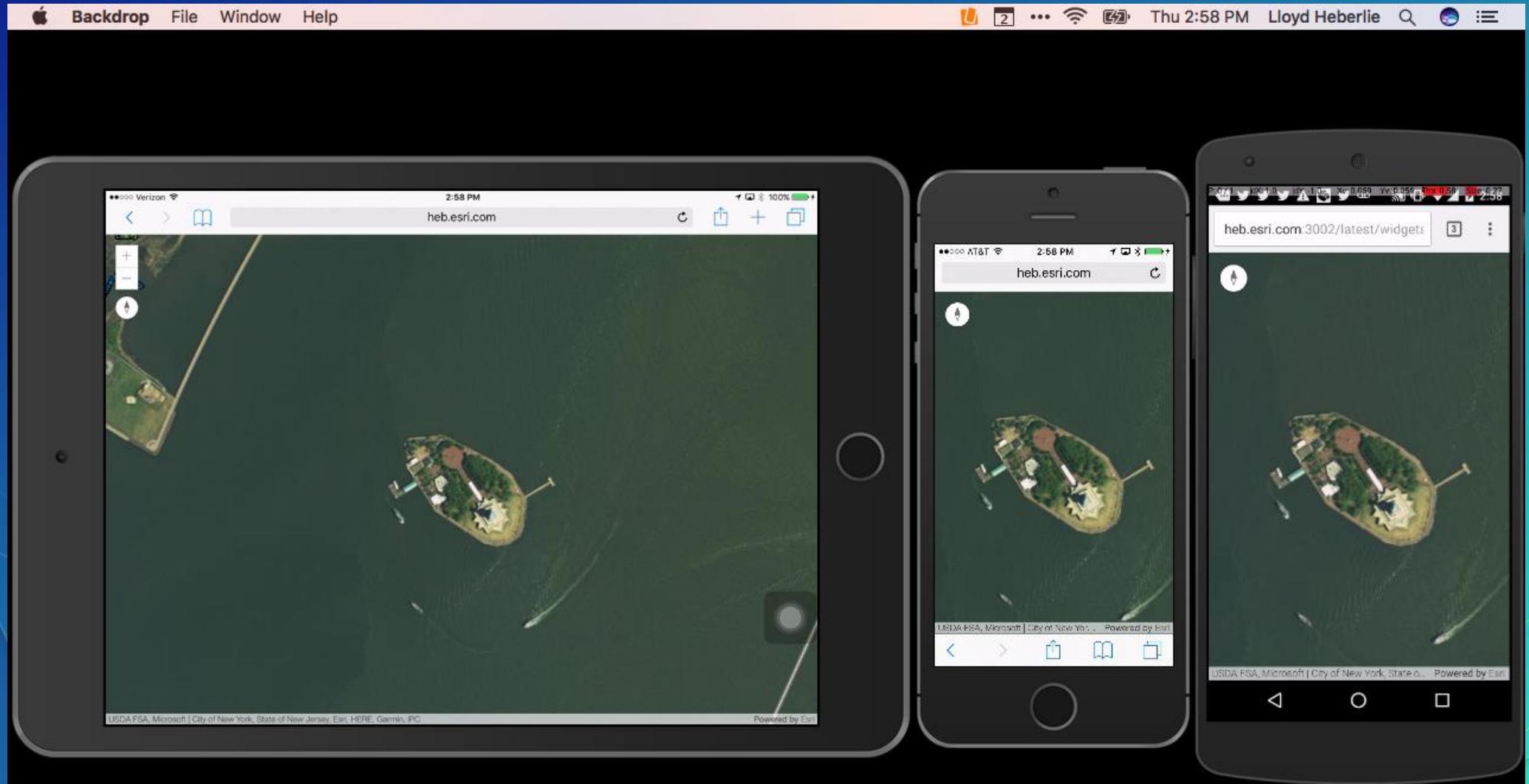
LayerList action



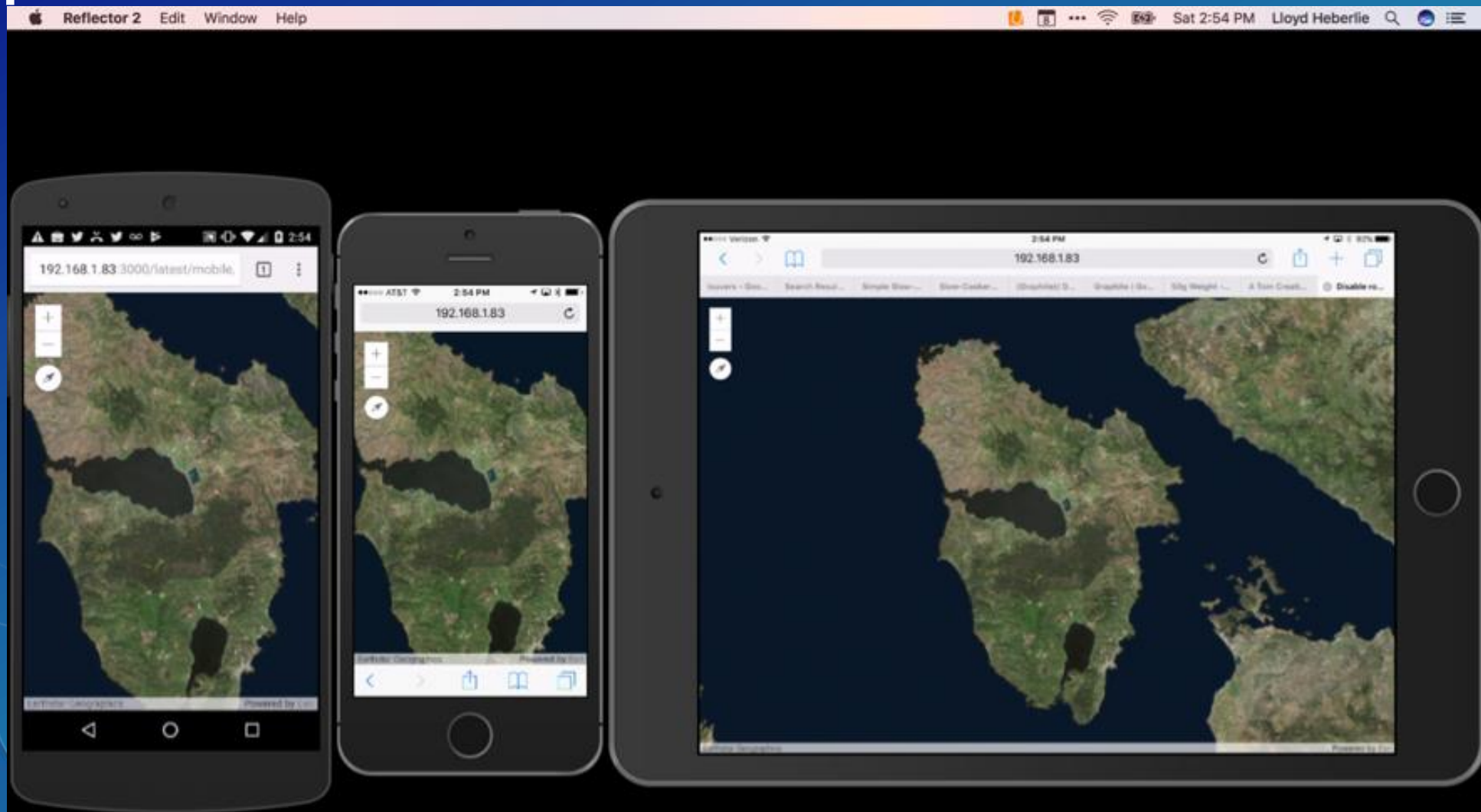
Expand

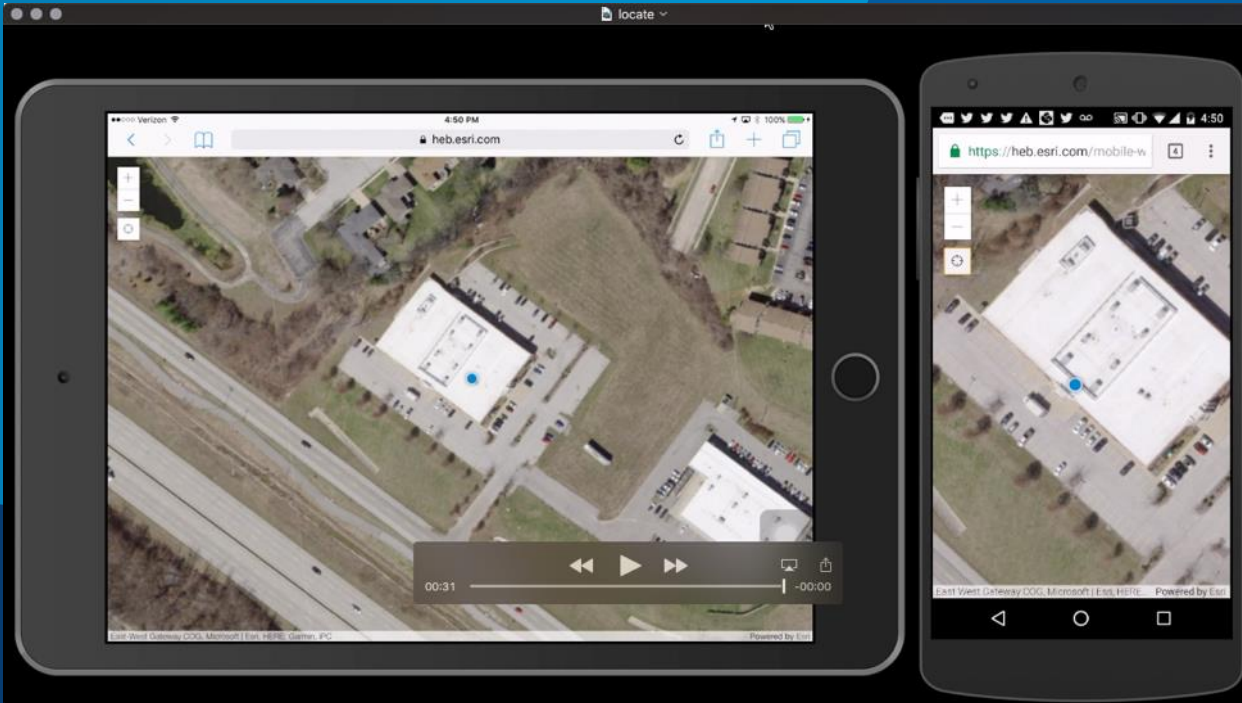


Compass



Compass

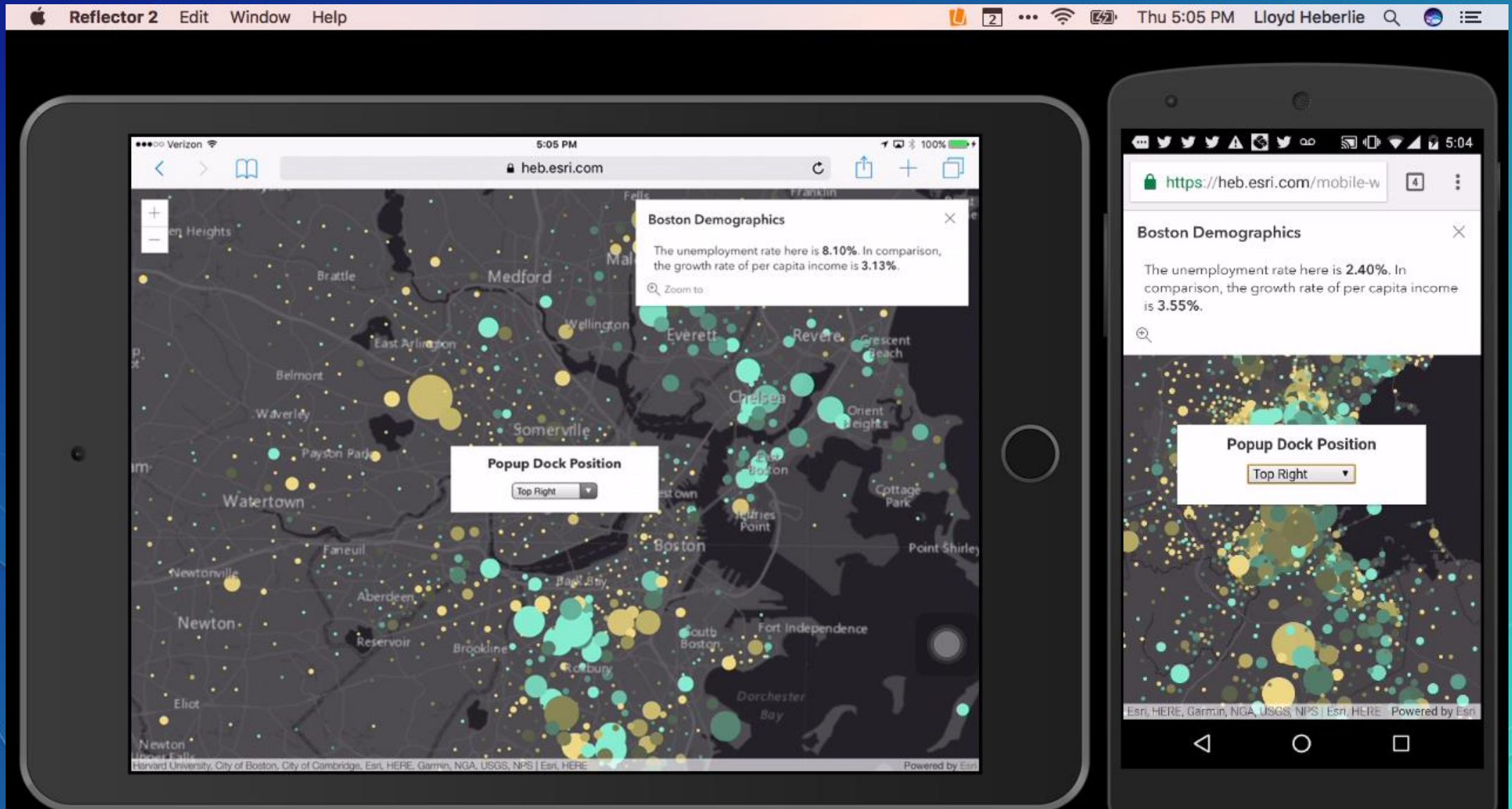




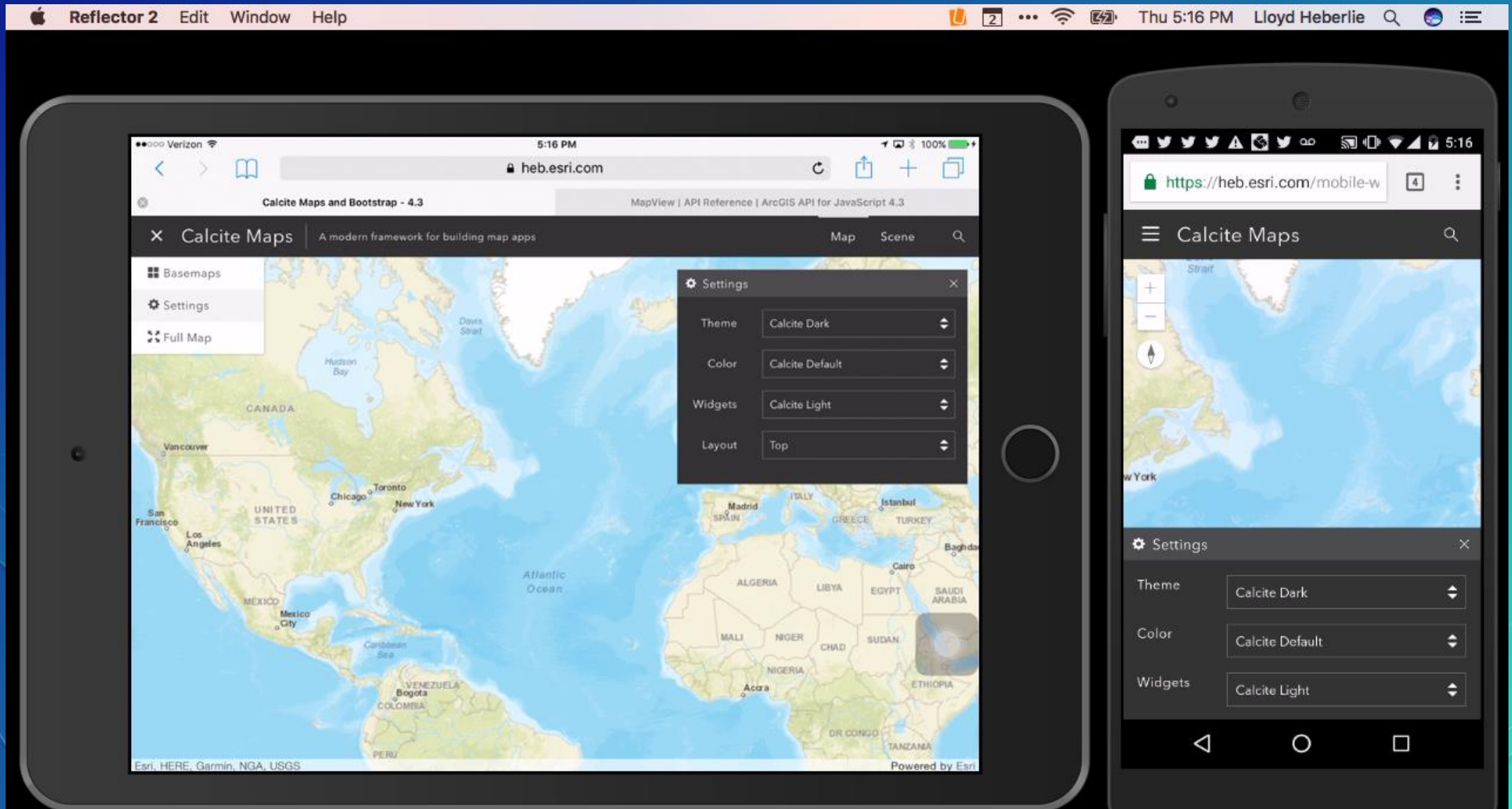
Locate

Demo

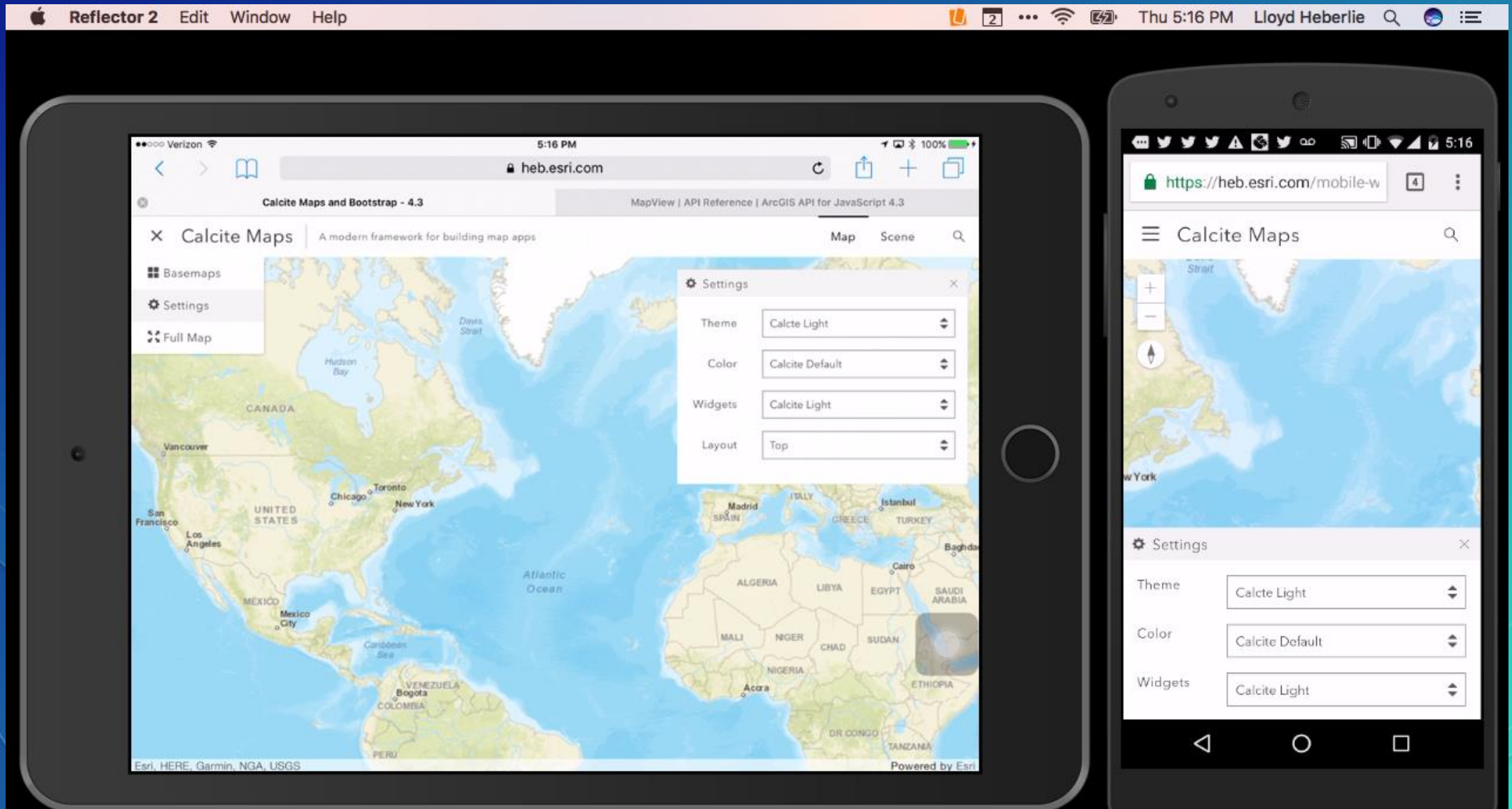
Popups



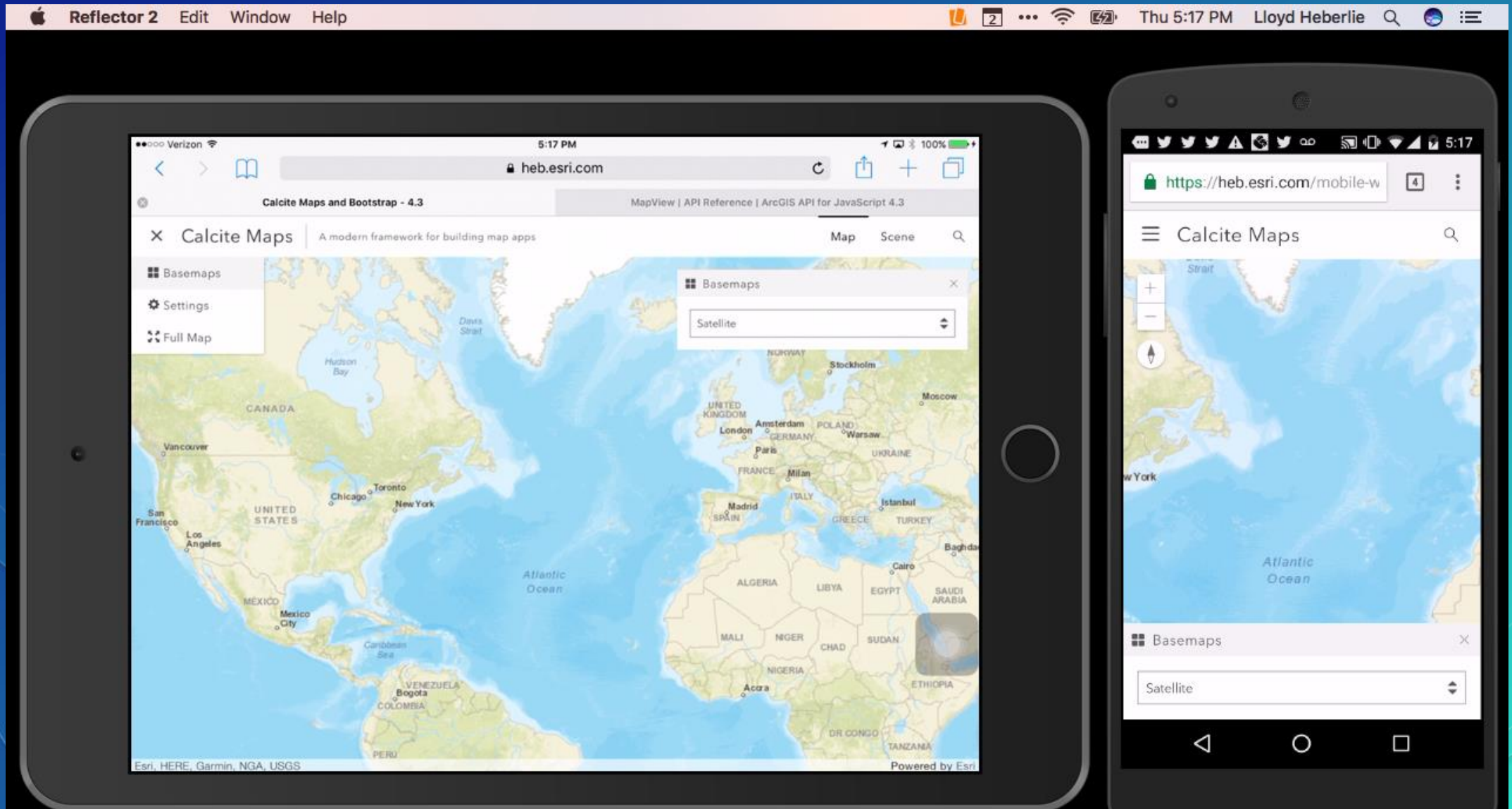
Calcite Maps - Settings



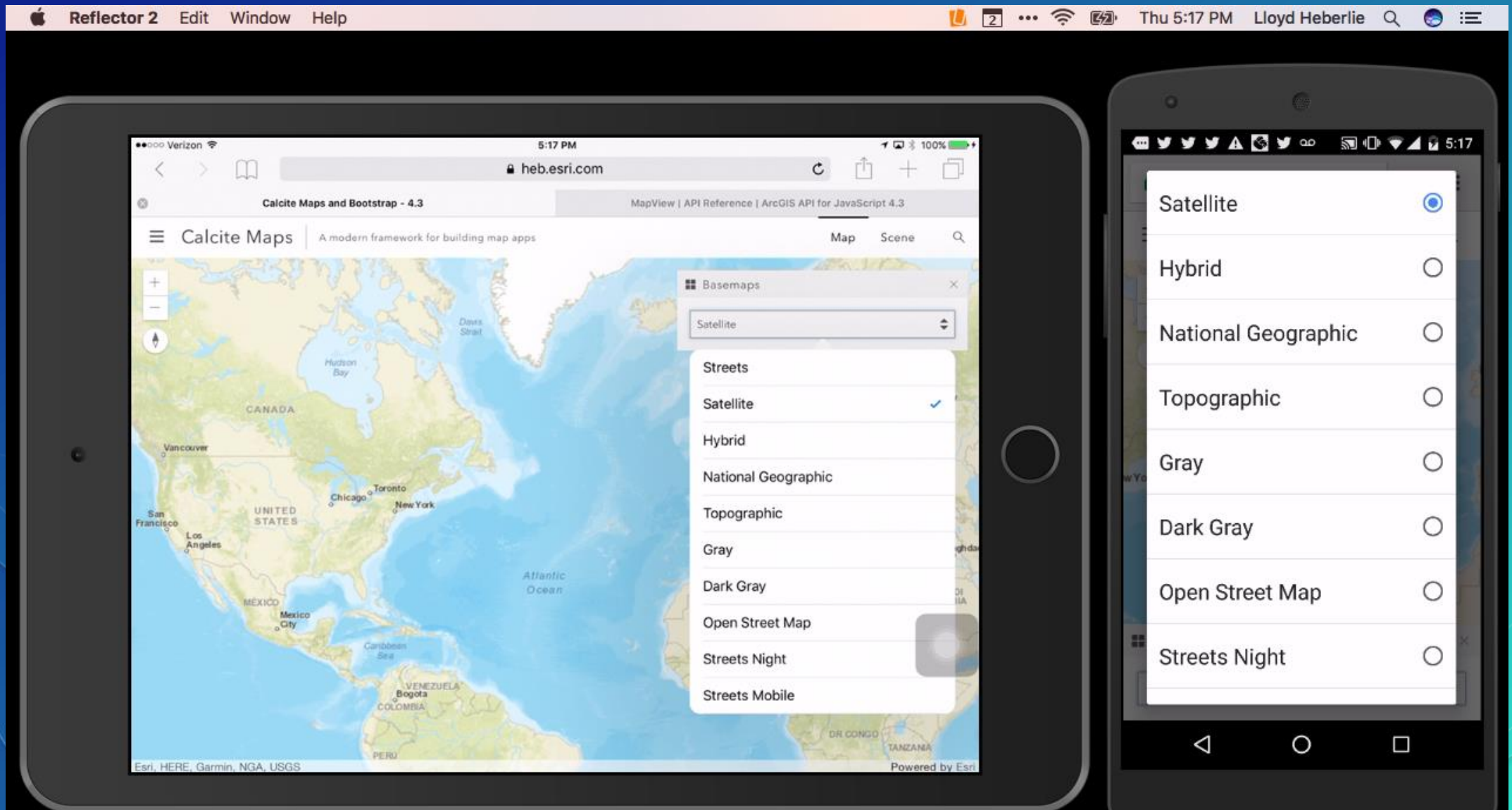
Calcite Maps - Settings



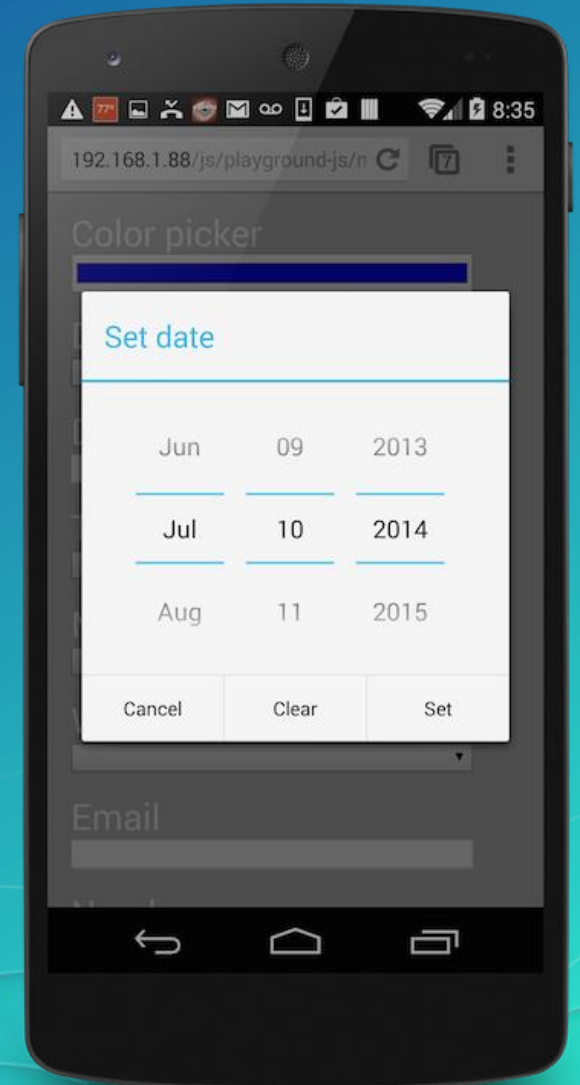
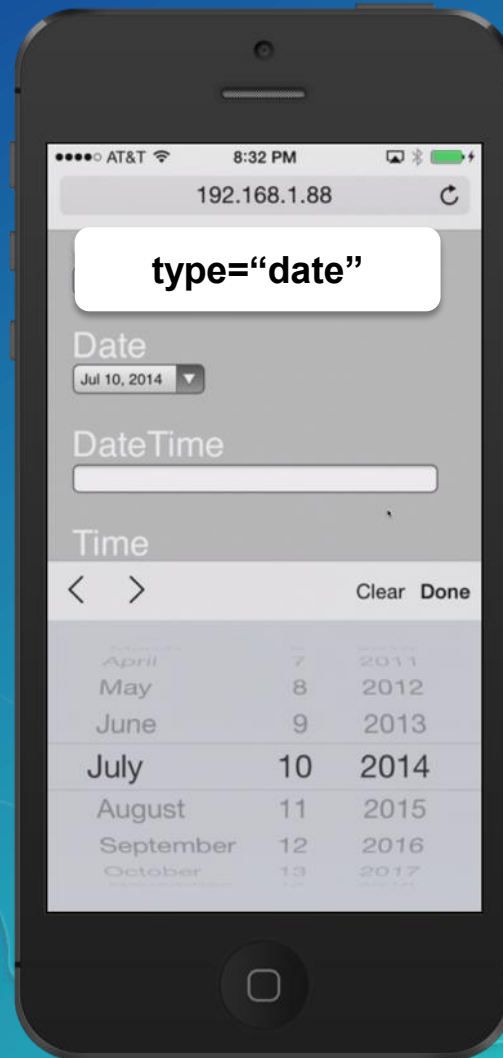
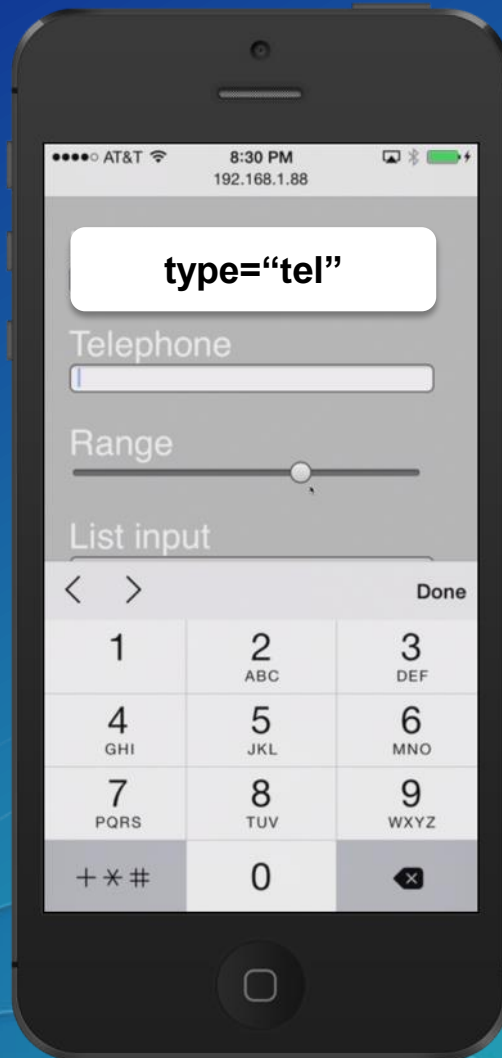
Calcite Maps - Basemaps



Calcite Maps - Basemaps



HTML5 input types



Mobile media queries

2

```
<!DOCTYPE html>
<html data-browser="Mozilla/5.0 (Linux; Android 6.0; Nexus 5 Build/MRA58N) AppleWebKit/537.36
(KHTML, like Gecko) Chrome/59.0.3071.115 Mobile Safari/537.36">
<head>
  <meta charset="utf-8">
  <meta name="viewport" content="initial-scale=1,maximum-scale=1,user-scalable=no">
  <title> - 4.4</title>
</head>
<body>
  <script>
    // -----
    // js, sass - user-agent mixin
    // -----
    document.documentElement.setAttribute("data-browser", navigator.userAgent);
  </script>
</body>
</html>
```

1

Mobile media queries

The screenshot shows the Chrome DevTools 'Elements' panel with four different user agent strings highlighted in red boxes. Each box is labeled with the device name: macOS, Android, iPhone, and iPad. The user agent strings are as follows:

- macOS:** `<html class=" logged-out gr_heb_esri_com" data-browser="Mozilla/5.0 (Macintosh; Intel Mac OS X 10_12_3) AppleWebKit/537.36 (KHTML, like Gecko) Chrome/56.0.2924.87 Safari/537.36">`
- Android:** `<html class=" logged-out" data-browser="Mozilla/5.0 (Linux; Android 6.0.1; Nexus 5 Build/M4B30Z) AppleWebKit/537.36 (KHTML, like Gecko) Chrome/56.0.2924.87 Mobile Safari/537.36">`
- iPhone:** `<html class=" logged-out" data-browser="Mozilla/5.0 (iPhone; CPU iPhone OS 10_2_1 like Mac OS X) AppleWebKit/602.4.6 (KHTML, like Gecko) Version/10.0 Mobile/14D27 Safari/602.1">`
- iPad:** `<html class=" logged-out" data-browser="Mozilla/5.0 (iPad; CPU OS 10_2_1 like Mac OS X) AppleWebKit/602.4.6 (KHTML, like Gecko) Version/10.0 Mobile/14D27 Safari/602.1">`

```
html[data-browser*="Mobile"]
.detail-name
.icon-anchor
.icon-ui-link {
  /* - - - - - Positioning - - - - - */
  display: inline-block;
  /* - - - - - Box-model - - - - - */
  margin-left: -30px;
}
```

```
html[data-browser*="Mobile"]
.detail-name
.icon-anchor
.icon-ui-link:before {
  /* - - - - - Box-model - - - - - */
  padding-right: 0.5625rem;
}
```

```
.detail-name
.icon-anchor
.icon-ui-link {
  /* - - - - - Positioning - - - - - */
  display: none;
  /* - - - - - Appearance - - - - - */
  vertical-align: middle;
}
```

Mobile media queries

MapView | API Reference | ArcGIS

Secure <https://developers.arcgis.com/javascript/latest/api-reference/esri-views-MapView>

Constructors

- Back to Top
- Constructors
- Properties
- Methods
- Events

new MapView(properties?)

Parameter:

properties	Object
optional	

See the [properties](#) for a list of all the p

Example:

```
// Typical usage
var view = new MapView({
  // ID of DOM element containing the view
  container: "viewDiv",
  // Map/WebMap object
  map: new Map()
});
```

Verizon 4:18 PM developers.arcgis.com 75%

- Sample - view padding
- Sample - Geodesic Buffers (2D & 3D)
- SceneView
- Map
- ViewAnimation

Constructors

new MapView(properties?)

Parameter:

properties	Object
optional	

See the [properties](#) for a list of all the properties that may be passed into the constructor.

Example:

```
// Typical usage
var view = new MapView({
  // ID of DOM element containing the view
  container: "viewDiv",
  // Map/WebMap object
  map: new Map()
});
```

Property Overview

Any properties can be set, retrieved or listened to. See the [Working with Properties](#) topic.

Name	Type	Summary
		Collection containing a flat list of all the created LayerViews related to the MapView . more details

Mobile media queries

```
<!DOCTYPE html>
<html data-browser="Mozilla/5.0 (Linux; Android 6.0; Nexus 5 Build/MRA58N) AppleWebKit/537.36
(KHTML, like Gecko) Chrome/59.0.3071.115 Mobile Safari/537.36">
<head>
  <meta charset="utf-8">
  <meta name="viewport" content="initial-scale=1,maximum-scale=1,user-scalable=no">
  <title></title>
</head>
</head>
<body>
  <script>
    // -----
    // Tablet and phone viewports need a different CSS selector than desktop viewports.
    // -----
    var mqDesktop = window.matchMedia("(min-width: 1024px) and (max-width: 2560px)");
    var mqTablet = window.matchMedia("(min-width: 768px) and (max-width: 1023px)");
    var mqPhone = window.matchMedia("(max-width: 767px)");
    if (mqDesktop.matches){
      console.log("Desktop");
    }
    if (mqTablet.matches){
      console.log("Tablet");
    }
    if (mqPhone.matches){
      console.log("Phone");
    }
  </script>
</body>
</html>
```

Capabilities

Demos

Managing initial load times

Initial loading in a mobile browser

Often misunderstood

Many things happening

Vulnerable to timing issues

Consider user's experience



Initial loading in a mobile browser

CSS

3rd party libraries

Frameworks

Framework plugins

ArcGIS JS API

GIS queries

GET map tiles



Initial loading in a mobile browser

CSS

3rd party libraries

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GET map tiles



Initial loading in a mobile browser

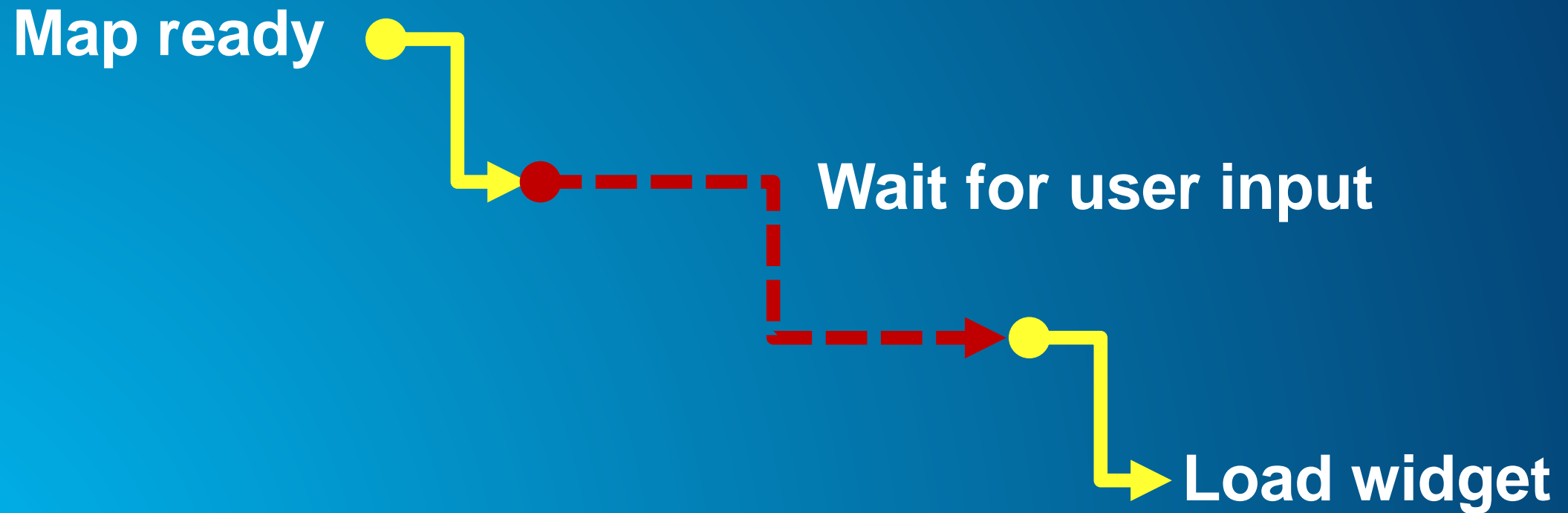
Wait for framework initialization

- In Angular: implements OnInit
- In Cordova: 'deviceready' event
- In ArcGIS: dojo/domReady!

Consider synchronous patterns



Lazy load modules and libraries



Lazy load demo

```
function lazyLoadPointCloudLayer(){
  require([
    "esri/layers/PointCloudLayer"
  ], function(PointCloudLayer) {
    var plc = new PointCloudLayer();
  });
}
```

[Demo](#)

Reserve async for after app load

Wait for framework initialization

- In Angular: implements OnInit
- In Cordova: 'deviceready' event
- In ArcGIS: dojo/domReady!

MapView ready?

The View has a Map
View container size is greater than zero
View has a spatial reference

[API Reference MapView.ready](#)

[Demo](#)



Loadable Patterns

Any resource that handles async data access

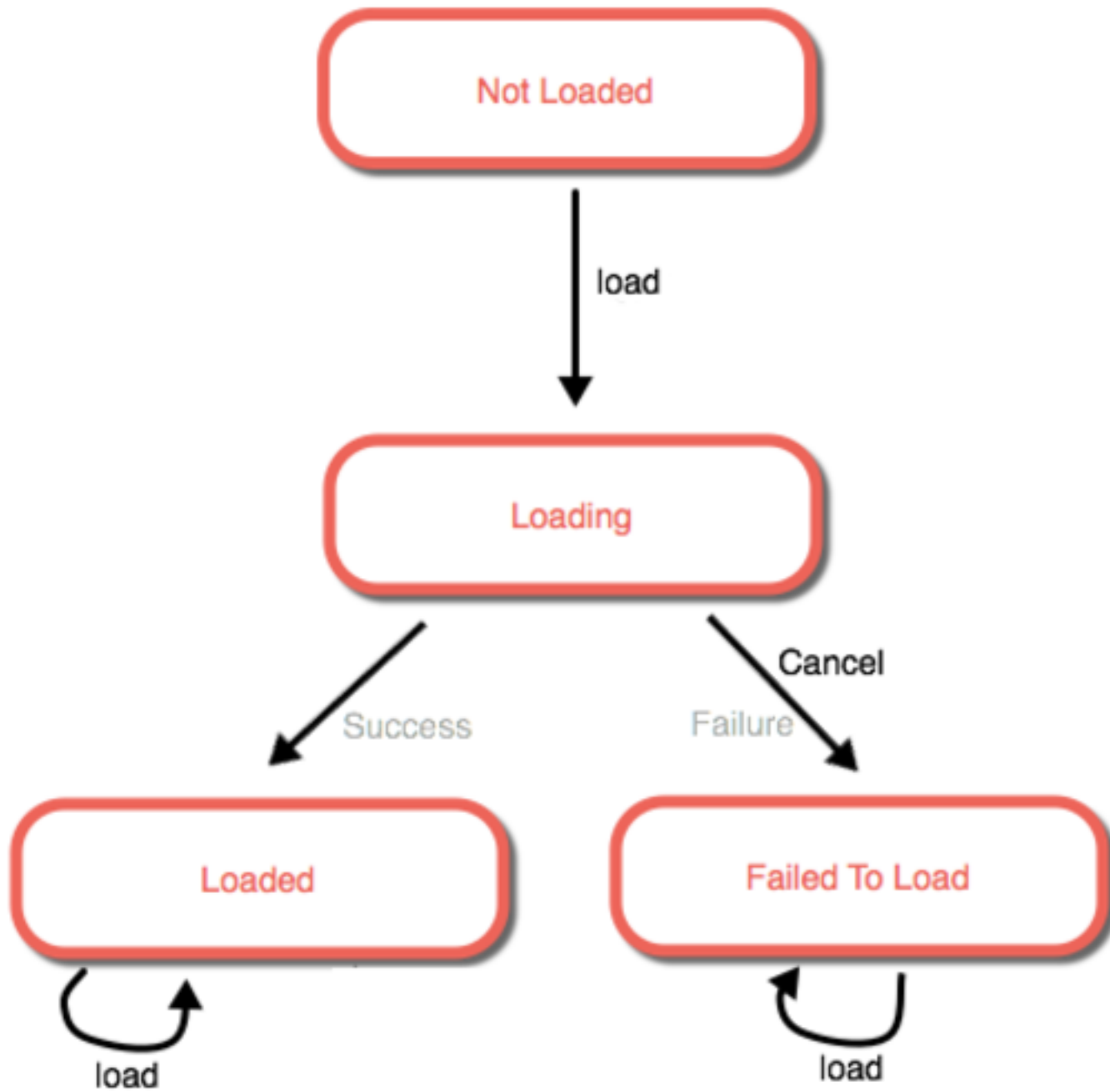
Examples: feature layers, tasks, web maps

not-loaded

loadStatus `String` `readonly`

Represents the status of a `load` operation.

Value	Description
<code>not-loaded</code>	The object's resources have not loaded.
<code>loading</code>	The object's resources are currently loading.
<code>loaded</code>	The object's resources have loaded without errors.
<code>failed</code>	The object's resources failed to load. See <code>loadError</code> for more details.



API reference
[WebMap.loadStatus](#)

load() example

```
var webmap = new WebMap({
  portalItem: { // autocasts as new PortalItem()
    id: "f2e9b762544945f390ca4ac3671cfa72"
  }
});

var view = new MapView({
  //map: webmap,
  container: "viewDiv"
});

webmap.load().then(function(r){
  view.map = webmap;
  console.log(r);
  console.log("Load Status: " + webmap.loadStatus)
}).otherwise(function(err){
  console.log("Problem loading webmap: " + error);
});
```

Demo

Splash Screens

Distract end user from long load times

Gives you control over when main app visible

Wait for `MapView.then()`

<https://github.com/andygup/splash-screen-js>

Using local builds

Lloyd Heberlie

Why?

More modules – more requests

Optimized build for app

Web application vs. Hybrid

Reduce http service calls for Hybrid apps

How to create custom builds?

ArcGIS API for JavaScript Web Optimizer – 3x

Bower

npm

Using local builds

Demo

More information

- Optimizing Your JavaScript App for Performance
 - **Thursday, March 8 - 10:30 - 11:30 am**
 - **Primrose A**

Working with Cordova and Ionic Native Mobile

Cordova/Phonegap

Wait for “deviceready” event

<https://github.com/Esri/quickstart-map-phonegap>

Ionic and loading ArcGIS JavaScript modules

Many helper libraries!

- [angular-esri-loader](#) (Angular 4+, wraps esri-loader)
- [esri-loader](#) (platform agnostic)
- [Ionic2-esri-map](#) (Sample app)
- [ArcGIS TypeScript definitions](#)

Working with Frameworks

Mobile browser-only

Other frameworks

- [Plain old Bootstrap](#)
- [calcite-maps](#)

- [ember-esri-loader](#)
- [esri-loader-react](#)
- [esri-system-js](#)

Debugging and testing

Lloyd Heberlie

Physical devices

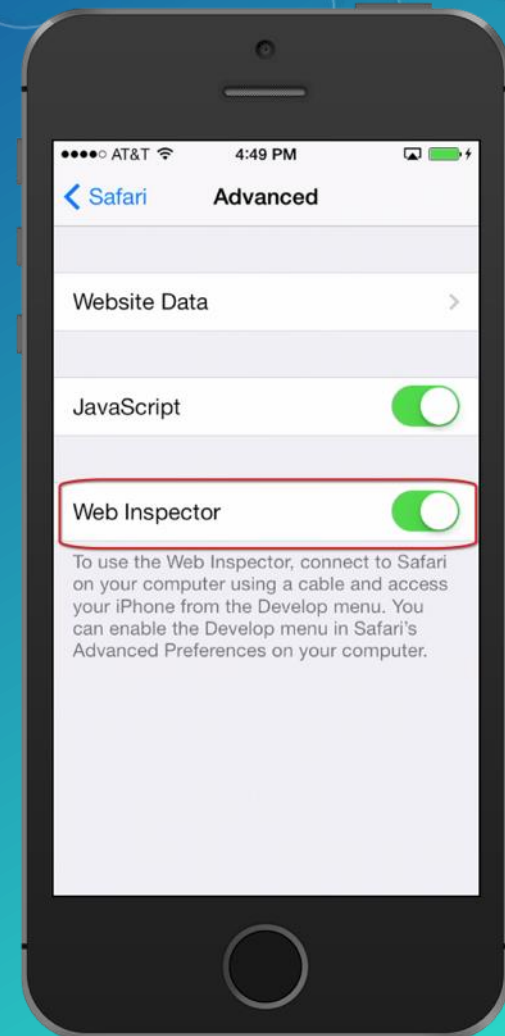
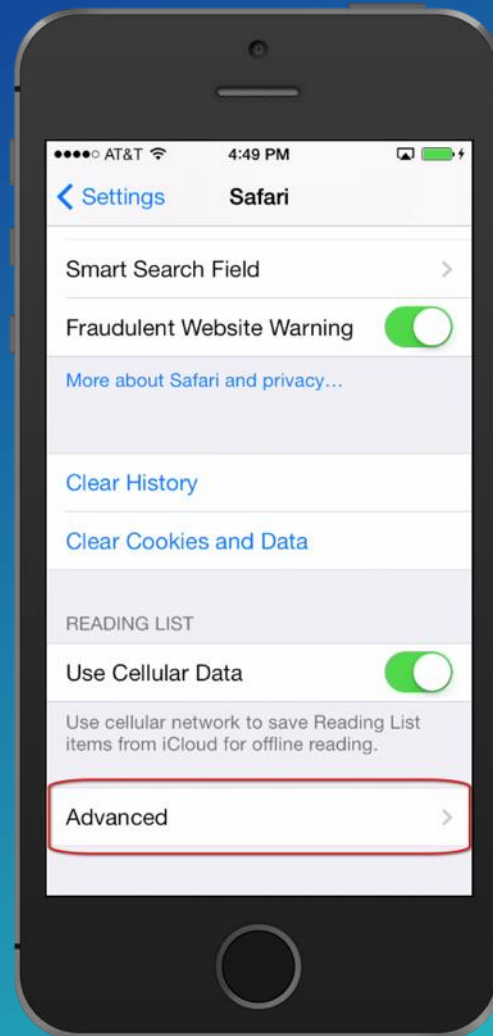


<http://blog.adtile.me/2014/01/08/adtile-device-lab/>

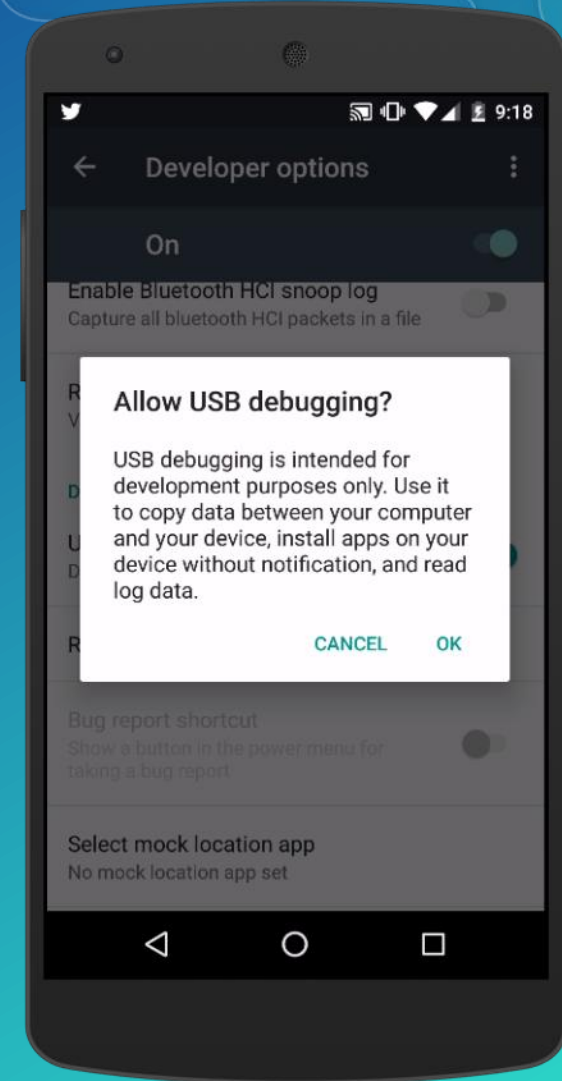
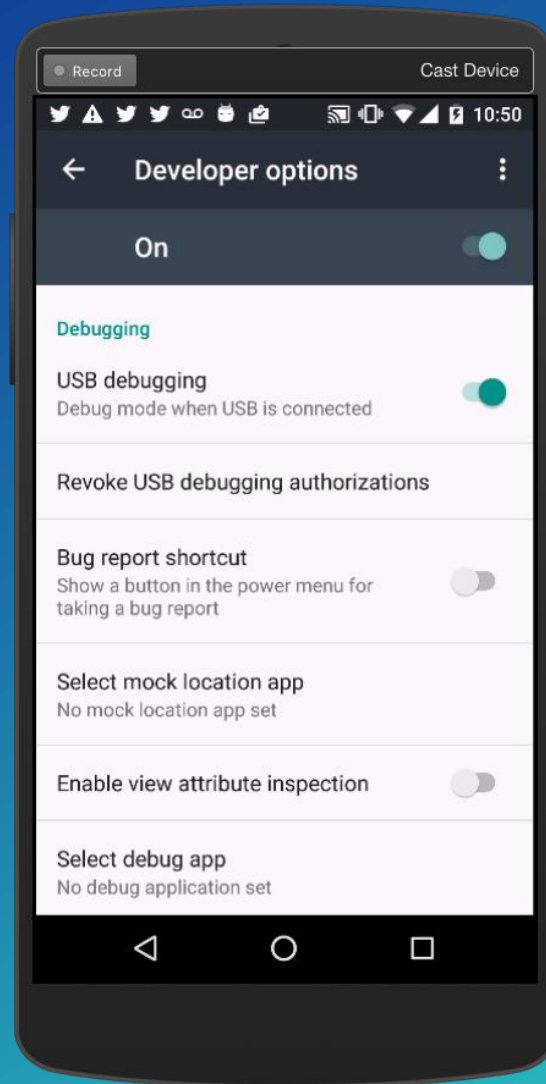
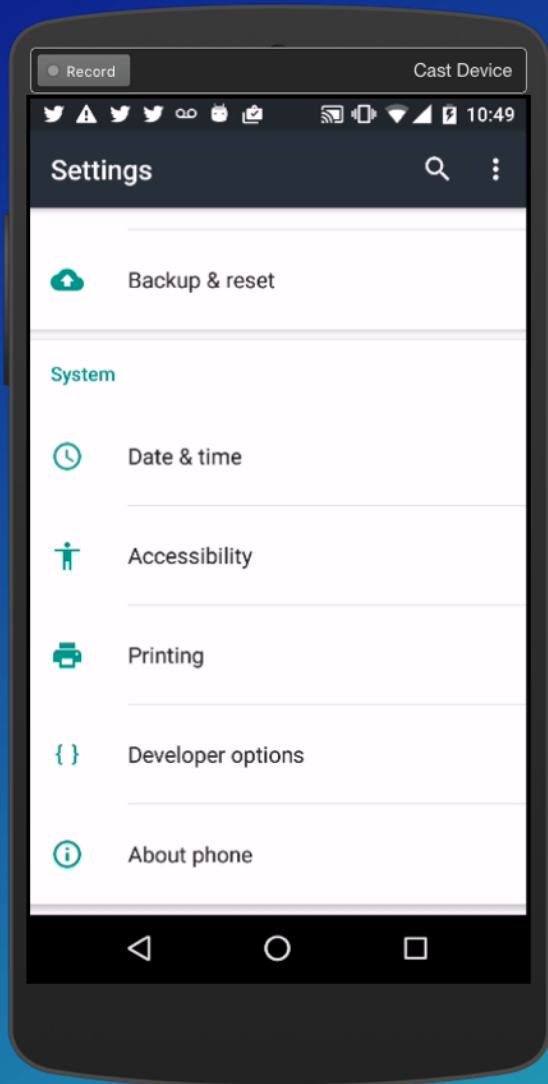
Remote debugging

- [Safari Web Inspector Remote](#)
- [Google Chrome remote debugging](#)
- <http://livereload.com/>
- [Browser-sync](#)

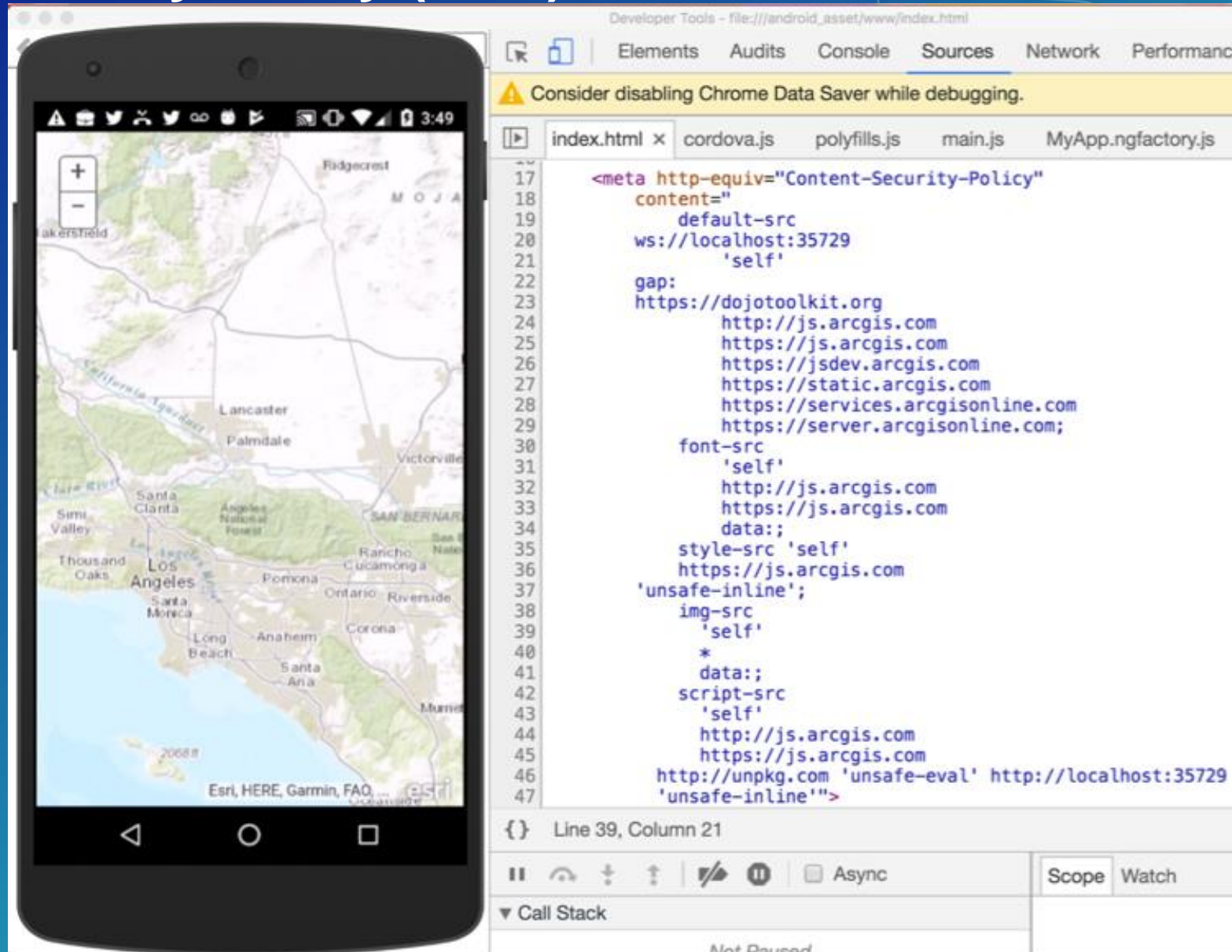
Enable iOS remote web inspection



Enable Android remote web inspection



Content Security Policy (CSP)



The image displays a mobile application interface on the left, showing a map of Southern California with various cities labeled. On the right, the Chrome DevTools source code editor is open, showing the Content Security Policy (CSP) configuration for the application. The CSP configuration is as follows:

```
17 <meta http-equiv="Content-Security-Policy"
18   content="
19     default-src
20     ws://localhost:35729
21     'self'
22   gap:
23     https://dojotoolkit.org
24     http://js.arcgis.com
25     https://js.arcgis.com
26     https://jsdev.arcgis.com
27     https://static.arcgis.com
28     https://services.arcgis.com
29     https://server.arcgis.com;
30   font-src
31     'self'
32     http://js.arcgis.com
33     https://js.arcgis.com
34   data;;
35   style-src 'self'
36     https://js.arcgis.com
37   'unsafe-inline';
38   img-src
39     'self'
40     *
41   data;;
42   script-src
43     'self'
44     http://js.arcgis.com
45     https://js.arcgis.com
46     http://unpkg.com 'unsafe-eval' http://localhost:35729
47   'unsafe-inline'>
```

The CSP configuration includes a warning to consider disabling Chrome Data Saver while debugging. The configuration allows default resources from the local host (ws://localhost:35729) and 'self'. It also allows resources from various ArcGIS domains (https://js.arcgis.com, https://jsdev.arcgis.com, https://static.arcgis.com, https://services.arcgis.com, https://server.arcgis.com) and the Dojo Toolkit (https://dojotoolkit.org). The font-src policy allows resources from 'self' and http://js.arcgis.com. The style-src policy allows resources from 'self' and https://js.arcgis.com. The img-src policy allows resources from 'self' and *. The script-src policy allows resources from 'self', http://js.arcgis.com, https://js.arcgis.com, http://unpkg.com 'unsafe-eval', and http://localhost:35729. The CSP configuration is located in index.html at line 17, column 17.

Debugging Mobile

Demo

Working with 3D on Mobile

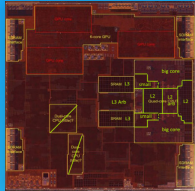
Topics

- GPU Hardware
- GPU Architecture
- 3D on Mobile Devices
- Performance
- JavaScript API
Example
- Progressive Web Apps

GPU Hardware

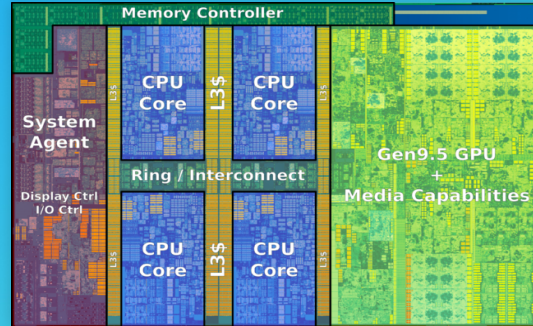
Apple A10

- TBDR Architecture
 - 650 MHz Clock
 - 12 Clusters
- > 500 GFLOPS



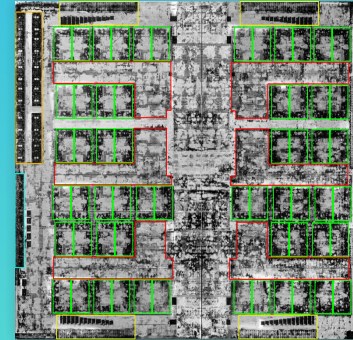
Intel Kaby Lake

- TB/EZ IMR Architecture
 - 1115 MHz Clock
 - 48 Clusters
- > 730 GFLOPS



nVidia Pascal

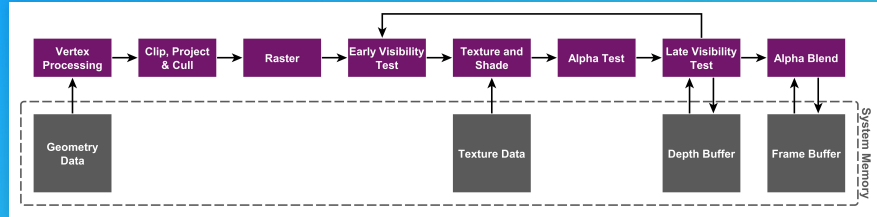
- TB/EZ IMR Architecture
 - 1465 MHz Clock
 - 256 Clusters
- > 750 GFLOPS



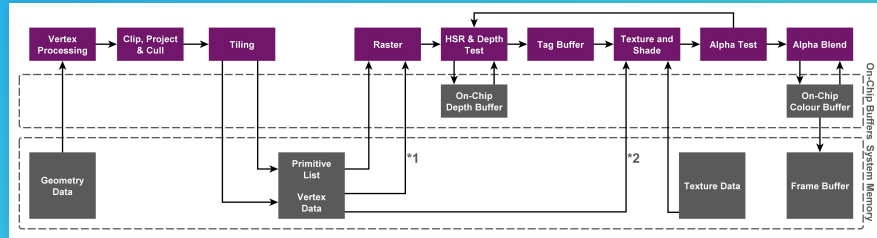
GPU Architecture

IMR vs. TBDR

Immediate Mode Renderer

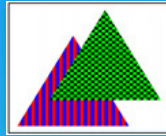


Tile Based Delayed Renderer



GPU Architecture

Simple Rendering



	Immediate Mode Renderer	Tile Based Delayed Renderer
Texture Reads	150 * 4 Bytes	150 * 4 Bytes
Depth Reads	200 * 4 bytes	0 bytes
Depth Writes	150 * 4 bytes	0 bytes
Color Writes	150 * 4 bytes	0 bytes
Total Bandwidth	2600 bytes	600 bytes

Source <https://www.anandtech.com/show/4686/samsung-galaxy-s-2-international-review-the-best-redefined/15>

ArcGIS JavaScript API

3D on Mobile Devices

- Works on mobile
 - Apple iPhone 8
 - Apple iPad Pro 2
 - Samsung Galaxy S8
 - Samsung Galaxy Tab S3
- It's as simple as opening a webpage
 - <http://www.arcgis.com/home/webscene/viewer.html>

ArcGIS JavaScript API

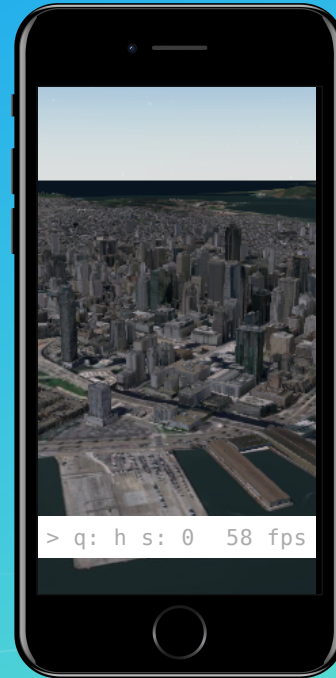
Performance

- Performance can vary across
 - Hardware
 - Operating System
 - Browser Vendor
- Poor performance can be avoided by
 - keeping the number of layers limited (10 - 30)
 - using appropriate symbols for every visualization
 - using advantageous viewpoints
 - throttling resource consumption
 - turning off features

JavaScript Example

Change Quality and Visualizations

```
require([
  "esri/Map",
  "esri/layers/FeatureLayer",
  "esri/layers/SceneLayer",
  "esri/views/SceneView"
], function(
  Map,
  FeatureLayer,
  SceneLayer,
  SceneView
) {
  var view = new SceneView({
    map: new Map({
      basemap: "satellite",
      ground: "world-elevation",
      layers: [
        new FeatureLayer({ url: "//services.arcgis.com/..." }),
        new SceneLayer({ url: "//services.arcgis.com/..." })
      ]
    }),
    container: "viewDiv"
  });
});
```



⚙️ featureLayer.renderer.symbol

☀️ view.environment.lighting.directShadowsEnabled

⚙️ view.qualityProfile
view.environment.atmosphere.quality

Progressive Web Apps

Service Workers #1

```
// index.html
if ('serviceWorker' in navigator) {
  navigator.serviceWorker.register('./service-worker.js', { scope: './' })
  .then(function() {
    if (navigator.serviceWorker.controller) {
      // Service Worker is active
    }
    else {
      // Service Worker is installed but inactive
    }
  })
  .catch(function(error) {
    // An error occurred during Service Worker creation
  });
}
else {
  // The current browser doesn't support service workers
}
```

Progressive Web Apps

Service Workers #2

```
// service-worker.js

// Called during app installation
self.addEventListener("install", function(event) {

  event.waitUntil(
    caches.open("cache_v1")
      .then(cache => {

        return cache.add("./index.html"); // Add index to cache

      })
  );
});

// Called during app start
self.addEventListener("activate", function(event) {});

// Called on every network request when installed and active
self.addEventListener("fetch", function(event) {

  event.respondWith(
    caches.open("cache_v1").then(function(cache) {
      return cache.match(event.request).then(function(response) {

        if (response) {
          return response; // Serving response from cache
        }

        return fetch(event.request.clone()).then(function(response) {
          return response; // Serving response from network
        });
      });
    });
  });
});
```

Progressive Web Apps

Web App Manifest

```
// index.html
<link rel="manifest" href="./manifest.json">

// manifest.json
{
  "short_name": "Hiking trails",
  "name": "Hiking trails Swiss National Park",
  "icons": [{
    "src": "src/img/android-icon-36x36.png",
    "sizes": "36x36",
    "type": "image/png"
  }],
  "start_url": "index.html",
  "display": "standalone",
  "background_color": "#2d2b07",
  "theme_color": "#b5e2c1"
}
```

Lloyd Heberlie – lheberli@esri.com

Andy Gup – agup@esri.com

Thomas Other – TOther@esri.com



esri

**THE
SCIENCE
OF
WHERE**