IOS231

Customizing Maps

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Microsoft

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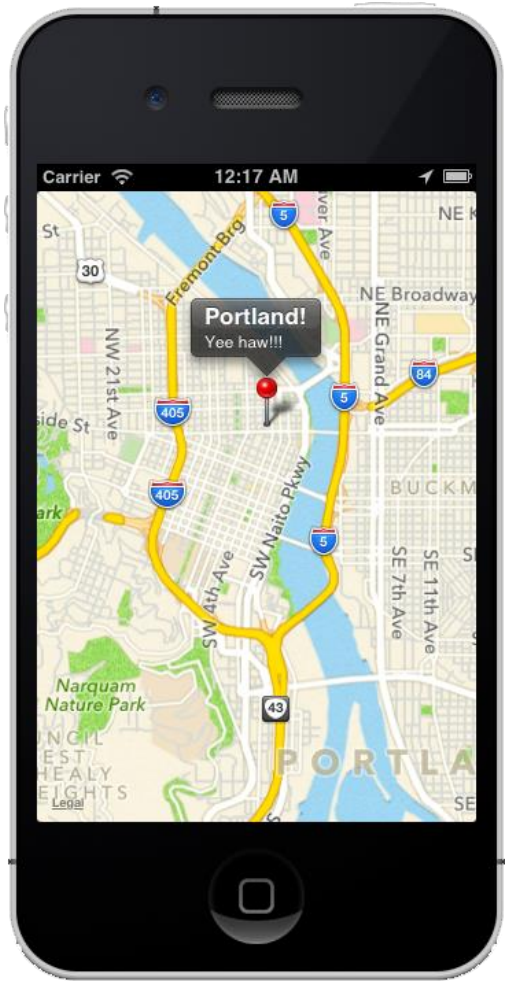
Objectives

1. Create custom annotations
2. Group annotations with clusters
3. Interact with annotations
4. Search for points of interest
5. Add overlays and directions



Create custom annotations

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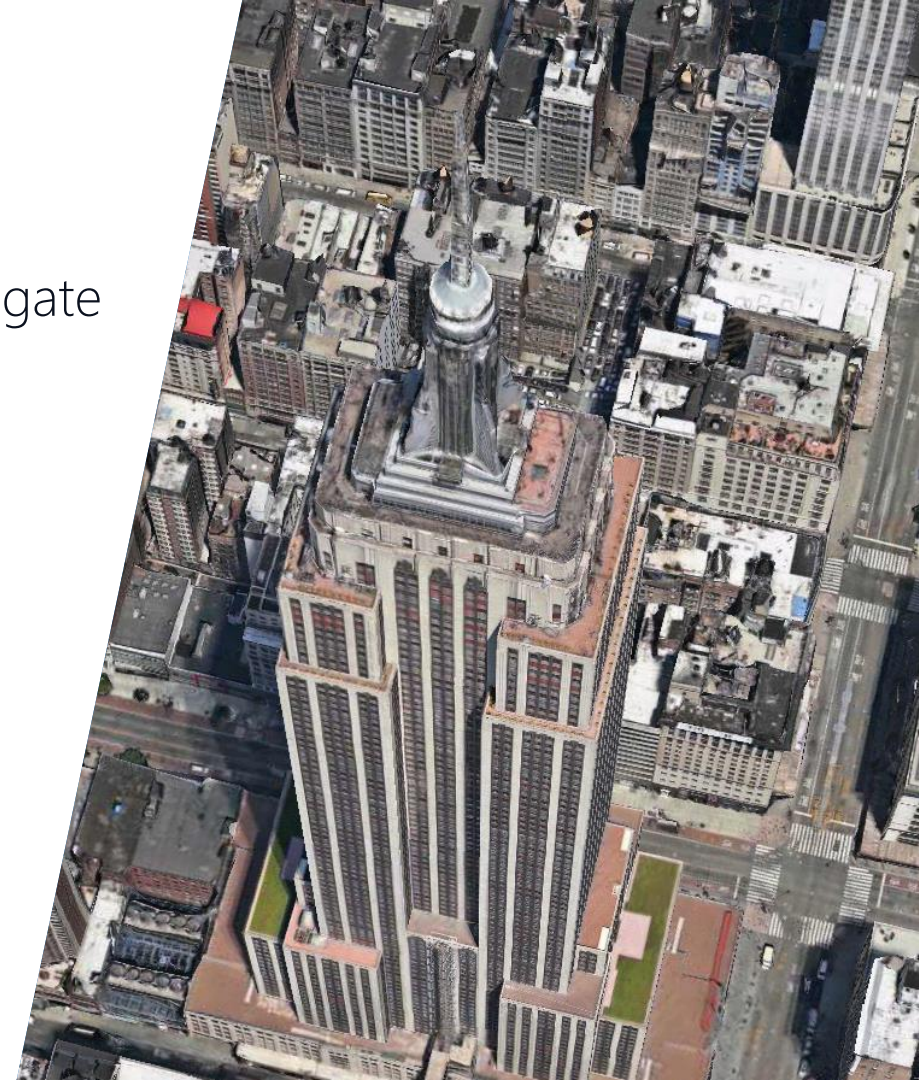
Tasks

1. Identify and create a Map View Delegate
2. Customize the default annotation
3. Create custom annotations
4. Use custom images on annotations
5. Virtualize and reuse annotations



Review: annotations

- An annotation is a visualization of a single location on the map and has several related objects

MKAnnotation

The base class for all annotations

MKAnnotationView

Used to visualize the annotation

MKPointAnnotation

A model containing the title and position of a point of interest on the map

MKMarkerAnnotationView

The default visualization of the location on the map

Event Properties

- **MKMapView** provides public event properties to allow you to respond to map notifications including position changes, user location, change, and annotation rendering

```
MKMapView myMapView = new MKMapView();

myMapView.
```

```
DidAddOverlayRenderers
DidAddOverlayViews
DidChangeUserTrackingMode
DidDeselectAnnotationView
DidFailToLocateUser
DidFinishRenderingMap
DidSelectAnnotationView
```

What is the MKMapViewDelegate?

- **`MKMapViewDelegate`** is a protocol defined by iOS to extend and influence the **`MKMapView`** class

- This is an optional protocol – if you don't define and assign it, you get the default behavior and visualization

When using a **`MKMapViewDelegate`**, it's not possible to subscribe to the Event Properties on the same **`MKMapView`** instance

Create an MKMapViewDelegate

- To use the map delegate, create a new class that derives from **`MKMapViewDelegate`**

```
public class MyMapDelegate : MKMapViewDelegate
{
    ...
}
```

Override the delegate methods

- **`MKMapViewDelegate`** provides methods we can override to customize the appearance and behavior of the **`MKMapView`**

```
public override |
    CalloutAccessoryControlTapped(MKMapView mapView, MKAnnotationView view, UICon…
    ChangedDragState(MKMapView mapView, MKAnnotationView annotationView, MKAnnota…
    DidAddAnnotationViews(MKMapView mapView, MKAnnotationView[] views)
    DidAddOverlayRenderers(MKMapView mapView, MKOverlayRenderer[] renderers)
    DidAddOverlayViews(MKMapView mapView, MKOverlayView overlayViews)
    DidChangeUserTrackingMode(MKMapView mapView, MKUserTrackingMode mode, bool an…
    DidDeselectAnnotationView(MKMapView mapView, MKAnnotationView view)
```

Assign the MKMapViewDelegate

- Must then assign a delegate instance to the map through the **`MKMapView.Delegate`** property

```
var map = new MKMapView(...);

map.Delegate = new MyMapDelegate();
```

GetViewForAnnotation

- Override the **`GetViewForAnnotation`** method in the map delegate to customize the appearance of annotations

```
public class MyMapDelegate : MKMapViewDelegate
{
   ...
   public override MKAnnotationView GetViewForAnnotation(
           MKMapView mapView, IMKAnnotation annotation)
   {
      MKAnnotationView view = new MKMarkerAnnotationView(annotation, "pin");
      ...
      return view;
   }
}
```

Pass the annotation model we are visualizing

Must return the annotation view to render

MKMarkerAnnotationView

- `MKMarkerAnnotationView` provides the default marker visualization of a map annotation

- Renders a red marker image by default

Change the marker's color

- You can select any color for your markers by setting the **`MarkerTintColor`** property

```
var view = new MKMarkerAnnotationView (annotation, "pin");

view.MarkerTintColor = UIColor.Yellow;
```

```
view.MarkerTintColor = UIColor.FromRGB (0xFF,0x98,0x03);
```

Customize the marker's content

- There are multiple properties on **MKMarkerAnnotationView** that allow you to change the content of the marker

Change the text of the marker

```
var view = new MKMarkerAnnotationView (annotation, "pin");

view.GlyphText = " A+ ";

View.GlyphImage = UIImage.FromBundle (...);

view.SelectedGlyphImage = UIImage.FromBundle (...);
```

Use an image

Use a different image when selected

Going beyond colors

- Annotations are composed of two related objects, both of which may be customized to provide custom annotations

`MKPointAnnotation`
The data

`MKAnnotationView`
The visual

Custom MKPointAnnotation

- To associate additional information with a map annotation, create a class that inherits from **`MKPointAnnotation`**

```
public class HouseAnnotation : MKPointAnnotation
{
   public double Price { get; set; }
   public double Stories { get; set; }
   public int YearBuilt { get; set; }

   public  HouseAnnotation  (double price, double stories, int year)
   {
      ...
   }
}
```

Adding a custom annotation to the map

- Custom annotations can be added using the the **MKMapView**'s add annotation method

```
var houseAnnotation = new HouseAnnotation (200000, 2, 1990);

myMap.AddAnnotation (houseAnnotation);
```

No cast necessary since we conform to the proper protocol (**IMKAnnotation**) by deriving from **MKPointAnnotation**

Accessing custom annotation data

- The map delegate stores the annotation as an **IMKAnnotation**, cast to your custom class to access it's unique properties and/or methods

```
public override MKAnnotationView GetViewForAnnotation(
   MKMapView mapView, IMKAnnotation annotation) {
   ...
   var house = annotation as HouseAnnotation;

   if (house != null && house.Price < 50000)
         annotationView.MarkerTintColor = UIColor.Blue;

   ...
}
```

Individual Exercise

Change the marker color

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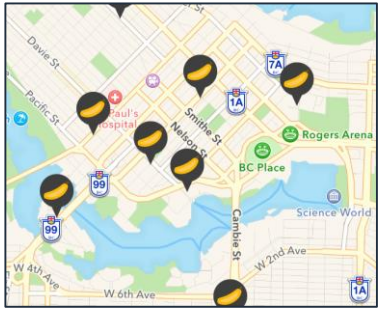
What if I want a banana pin?

- We can create custom annotations when we want to display something other than the standard pin

Custom annotation visualizations

- We can tweak the **`MKAnnotationView`** in two ways:



Customize instances of `MKAnnotationView`

Place a custom image on an annotation view

Subclass `MKAnnotationView`

Allows for more control of the visualization

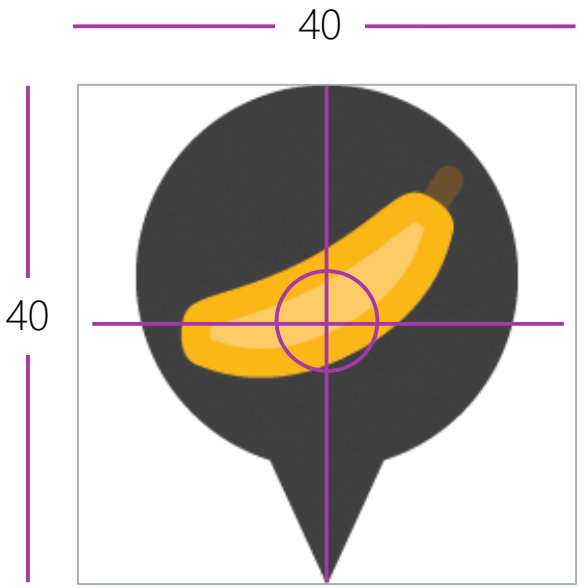
Replace the default annotation image

- In **`GetViewForAnnotation`** – create instances of **`MKAnnotationView`** and set the image property to your custom image

```
public override MKAnnotationView GetViewForAnnotation(
     MKMapView mapView, IMKAnnotation annotation)
{

   var view = new MKAnnotationView (annotation, "pin");
   view.Image = UIImage.FromBundle ("banana_pin.png");

   ...

   return view;
}
```

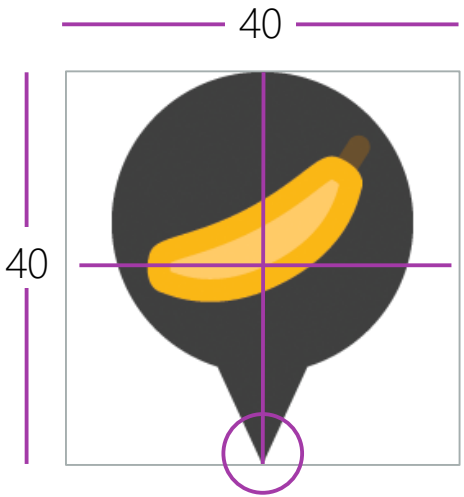
Align pin visualization to their locations

- By default Apple aligns your annotation to the center of the image



Align pin visualization to their locations

- Use the **`CenterOffset`** property on an **`MKAnnotationView`** to offset the center position




```
view = new MKAnnotationView (annotation, "pin");
view.Image = UIImage.FromBundle ("banana_pin.png");
view.CenterOffset = new CoreGraphics.CGPoint (0, -20);
...
```

MKAnnotationView

- Subclass **`MKAnnotationView`** for more complex annotation customizations

```
public class HousePin : MKAnnotationView
{
    UILabel lblPrice = new UILabel();
    double price;

    public  HousePin (IMKAnnotation annotation, string reuseID, double price)
    : base (annotation, reuseID)
    {
        this.Image = UIImage.FromBundle ("price_pin.png");
        this.price = price;
        AlignViews();
    }

    public void OnTapped () { ... }
}
```

This approach is often used to improve architecture when visualizing complex data

Recycling annotations

- Much like Table View cells, Map View allows you to reuse annotations to improve memory usage and performance

```
public override MKAnnotationView GetViewForAnnotation(
      MKMapView mapView, IMKAnnotation annotation)
{
   MKAnnotationView view = mapView.DequeueReusableAnnotation ("pin");

   if (view == null)
   {
      view = new MKAnnotationView (annotation, "pin");
      ...
   }
   return view;
}
```

Reuse identifier

Update recycled pin data

- Must update the **`Annotation`** property of the **`MKAnnotationView`** when using "recycled" pins to assign the annotation data

```
MKAnnotationView view = mapView.DequeueReusableAnnotation("pin");

if (view == null) {
   view = new MKAnnotationView (annotation, "pin");
}
else {
   view.Annotation = annotation;
}
```

Individual Exercise

Create a custom annotation

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Summary

1. Identify and create a Map View Delegate
2. Customize the default annotation
3. Create custom annotations
4. Use custom images on annotations
5. Virtualize and reuse annotations

Group annotations with clusters

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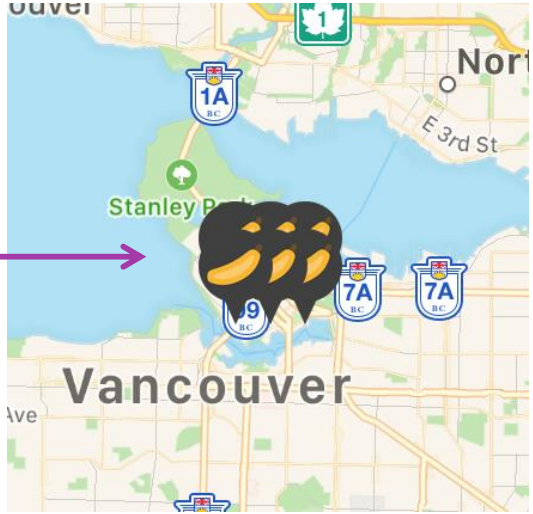
Tasks

1. Enable cluster support
2. Create clusters with MKMarkerAnnotationView

Motivation

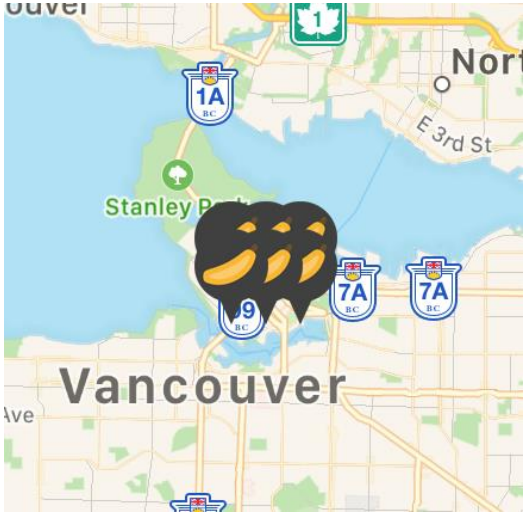
- An **MKMapView** with multiple annotations close together can be difficult to read

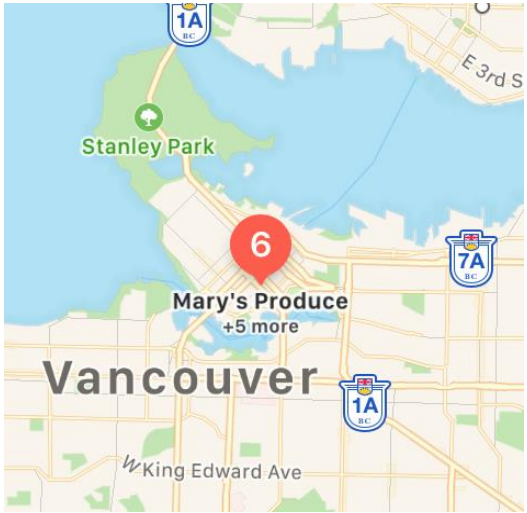
Annotations overlap and obscure the map



What is clustering?

- *Clustering* replaces overlapping annotations with a single annotation

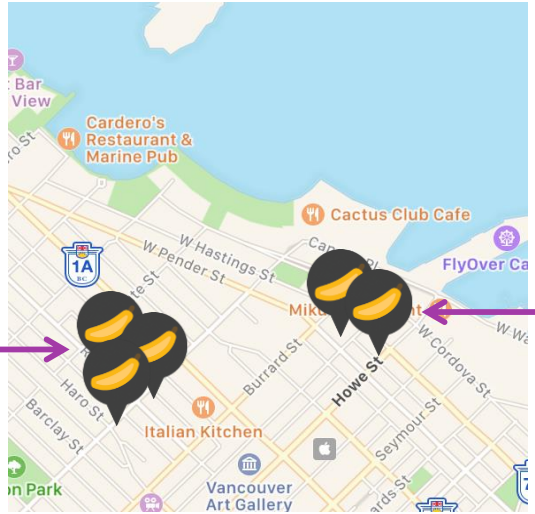




Cluster detection

- **MKMapView** does cluster detection based on hit testing of annotation views; annotations that overlap are eligible to be grouped into a cluster

Will become a cluster of 3

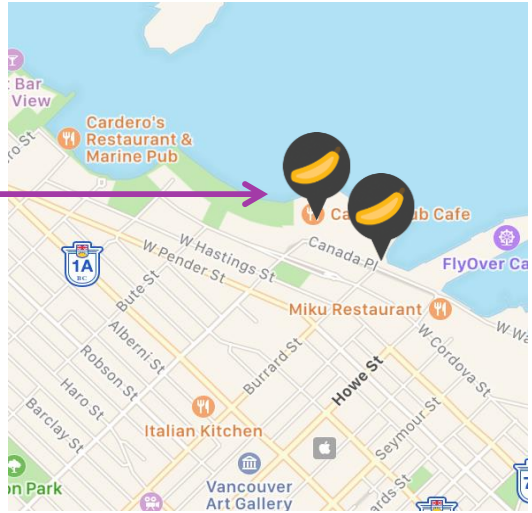


Will become a cluster of 2

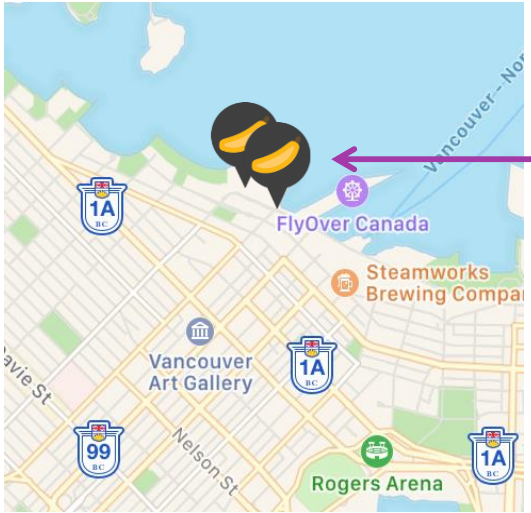
Clustering and zoom level

- Zoom level impacts placement of annotations; changing the zoom level may change which annotations overlap

No overlap



Zoom level: 15x



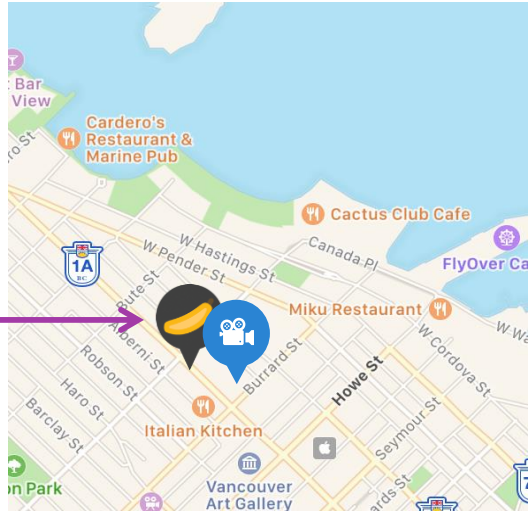
Overlapping

Zoom level: 10x

Related annotations

- Only annotations that are related should be grouped into a cluster

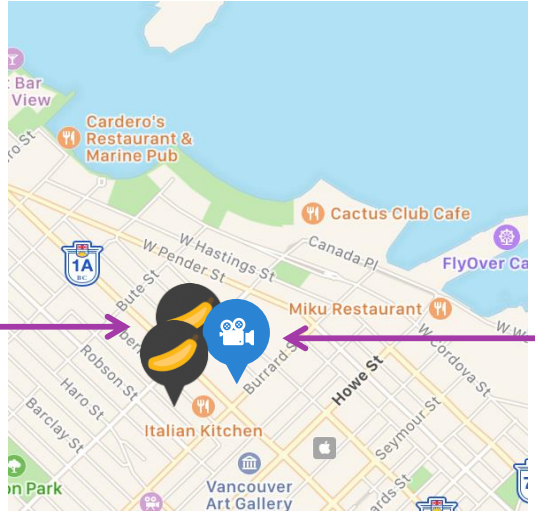
No cluster should be created



What is a cluster identifier?

- A cluster identifier is a string used by **MKMapView** to identify annotations that are eligible to be grouped

Same cluster identifier:
`"groceryStore"`



Different cluster identifier:
`"movieTheater"`

Enable clustering

- To enable clustering you assign the **`ClusteringIdentifier`** property to a string

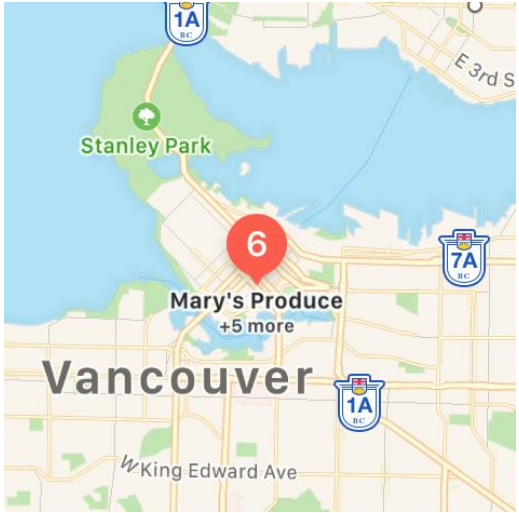
```
public override MKAnnotationView GetViewForAnnotation(
     MKMapView mapView, IMKAnnotation annotation)
{
   var view = new MKAnnotationView (annotation, "pin");
   view.ClusteringIdentifier = "banana";
   ...
   return view;
}
```

This enables clustering and sets the identifier

MKMarkerAnnotationView support

- `MKMarkerAnnotationView` supports clustering and will display the amount of replaced annotations automatically

This happens automatically; no custom code is required



Individual Exercise

Enable cluster support

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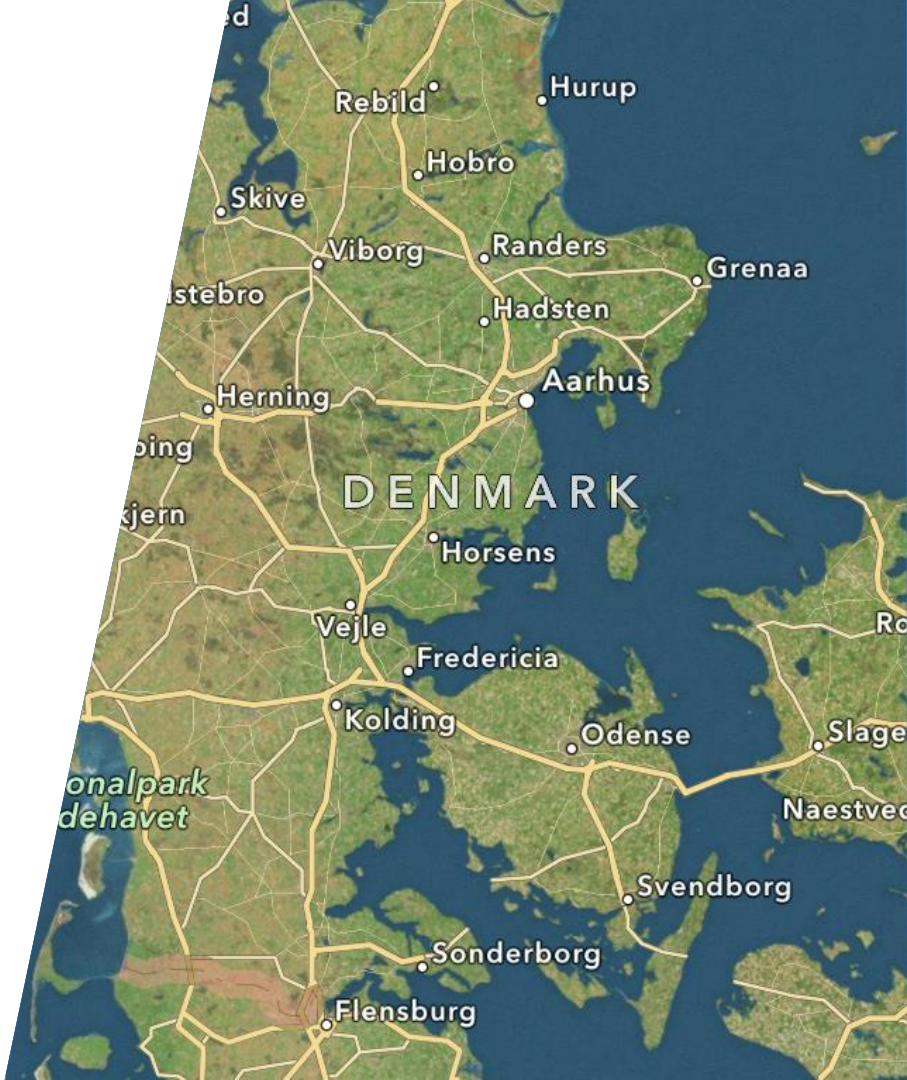
Summary

1. Enable cluster support
2. Create clusters with MKMarkerAnnotationView

Interact with annotations

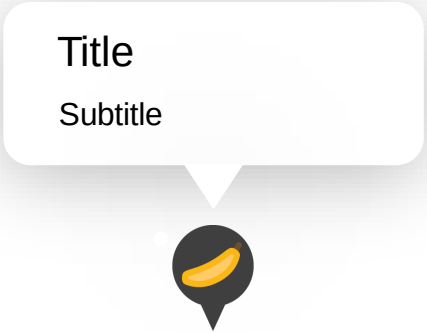
Tasks

1. Customize a callout
2. Detect touch events on the callout



Show the Callout View

- The callout for a specific location can be enabled or disabled by setting the **`CanShowCallout`** property of the **`MKAnnotationView`** class



The callout is displayed when a user taps a marker

```
view = new MKAnnotationView (annotation, "pin");
pinView.CanShowCallout = true;
...
```

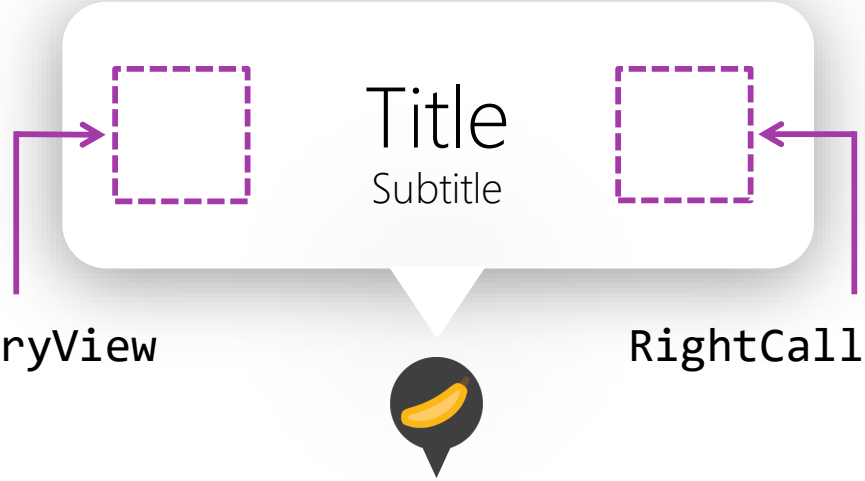
Why customize callouts?

- When we want to display more information in our callout than just a title and subtitle we have to implement some customization

VS

Callout accessory views

- The callout has two accessory views that can be utilized to display additional visual information



`LeftCalloutAccessoryView`

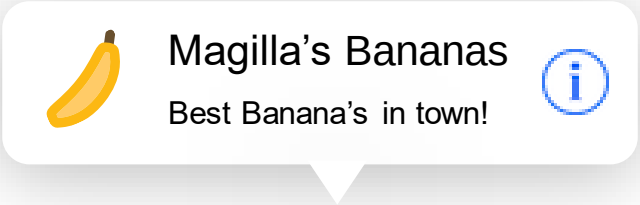
`RightCalloutAccessoryView`

Customize Accessory View

- Customize the accessory views by setting the **`RightCalloutAccessoryView`** or **`LeftCalloutAccessoryView`** properties of a **`MKAnnotationView`**

```
pinView.RightCalloutAccessoryView =
    UIButton.FromType(UIButtonType.DetailDisclosure);

pinView.LeftCalloutAccessoryView =
    new UIImageView(UIImage.FromFile("banana.png"));
```



Interact with the callout

- Override **`CalloutAccessoryControlTapped`** in the map delegate to respond to the taps on the callout

```
public override void CalloutAccessoryControlTapped (MKMapView mapView,
                                MKAnnotationView view, UIControl control)
{
   var annotation = view.Annotation as HouseAnnotation;
   ...

   var msg = String.Format ("Price:{0} Stories {1}",
                            annotation.Price, annotation.Stories);

   new UIAlertView (annotation.Title, msg, null, "OK", null).Show();
}
```

`CalloutAccessoryControlTapped` is only raised if a button has been added as an accessory view

Respond to taps

- Override **`DidSelectAnnotationView`** in the map delegate class to get notified when the user taps on an annotation

```
public class MyMapDelegate : MKMapViewDelegate
{
   public override void DidSelectAnnotationView (MKMapView mapView,
                                                 MKAnnotationView view)
   {
      var tappedAnnotation = view.Annotation;
      ...
   }
}
```

Individual Exercise

Add behavior to the annotations

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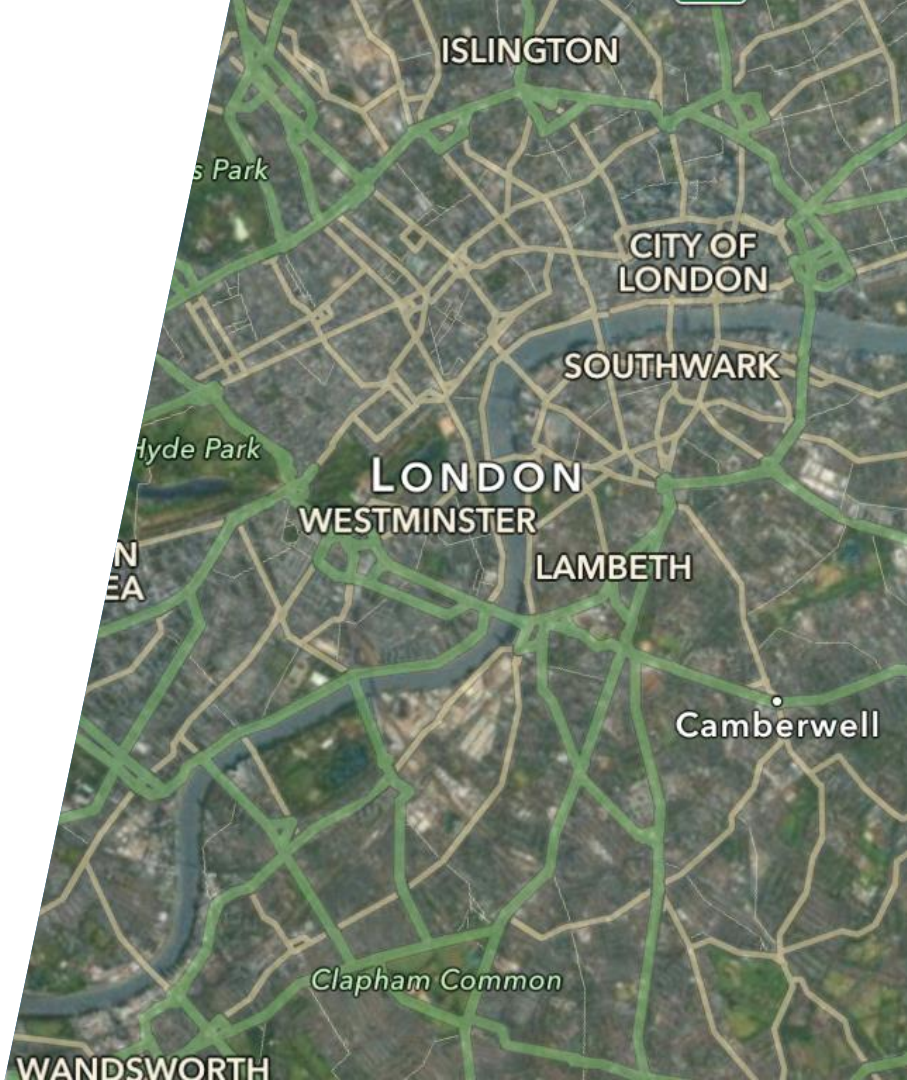
Summary

1. Customize a callout
2. Detect touch events on the callout



Search for points of interest

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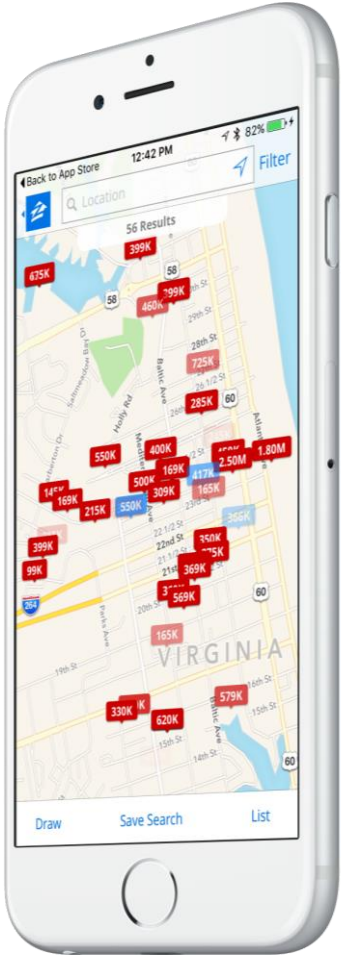
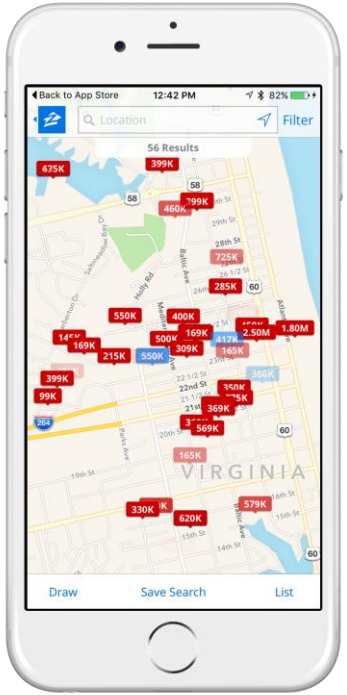
Tasks

1. Perform a search for points of interest
2. Display search results on the map



Searching for addresses and places

- **`MapKit`** has built in support for searching for addresses, names of locations and points of interest
- API is exposed through **`MKLocalSearch`** class



MKLocalSearchRequest

- **`MKLocalSearchRequest`** is used to provide search parameters

Set a natural language search term

```
var request = new MKLocalSearchRequest ();
   request.NaturalLanguageQuery = "Coffee Shops";
   request.Region = map.Region;
```

Optionally restrict searches to a specific region

Performing a search

- To perform a search, instantiate a new **MKLocalSearch** passing in a **MKLocalSearchRequest** and then call the **StartAsync** method

```
var request = new MKLocalSearchRequest ();
request.NaturalLanguageQuery = "Coffee shops";
request.Region = map.Region;

var local = new MKLocalSearch(request);

var response = await local.StartAsync();
```

MKLocalSearchResponse

- A **MKLocalSearchResponse** object is returned when **StartAsync** completes containing the search results

```
var local = new MKLocalSearch(request);

MKLocalSearchResponse response = await local.StartAsync ();
```

Returns a **Task** – can use **async**/**await** to easily consume API

Search Results

- **MKLocalSearchResponse** provides the search results as an array of **MKMapItem**s on its **MapItems** property

```
var local = new MKLocalSearch(request);

MKLocalSearchResponse response = await local.StartAsync ();

if (response != null && response.MapItems.Length > 0)
{
   foreach (var item in response.MapItems)
   {
      string result = item.Name + ": "+ item.Placemark.Title;
   }
}
```

MKMapItem

- **`MKMapItem`** is an object that encapsulates information about a specific location including:

Name

Phone Number

Url

Placemark

MKPlacemark

- A **`MKPlacemark`** object stores placemark data for a particular location including longitude, latitude, address and available geographically related information

CoreLocation.CLPlacemark

- AddressDictionary
- AdministrativeArea
- AreasOfInterest
- ClassHandle
- Country
- InlandWater
- IsoCountryCode
- Locality
- Location
- Name
- Ocean
- PostalCode
- Region
- SubAdministrativeArea
- SubLocality
- SubThoroughfare
- Thoroughfare
- TimeZone

Individual Exercise

Search for points of interest

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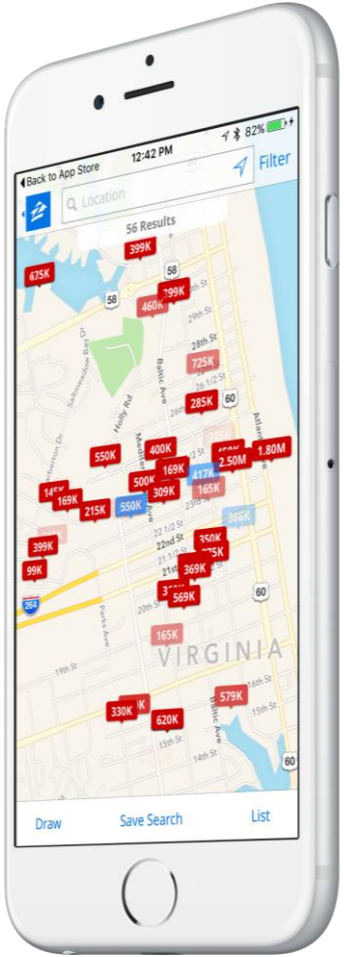
Tasks

1. Perform a search for points of interest
2. Display search results on the map



Add overlays and directions

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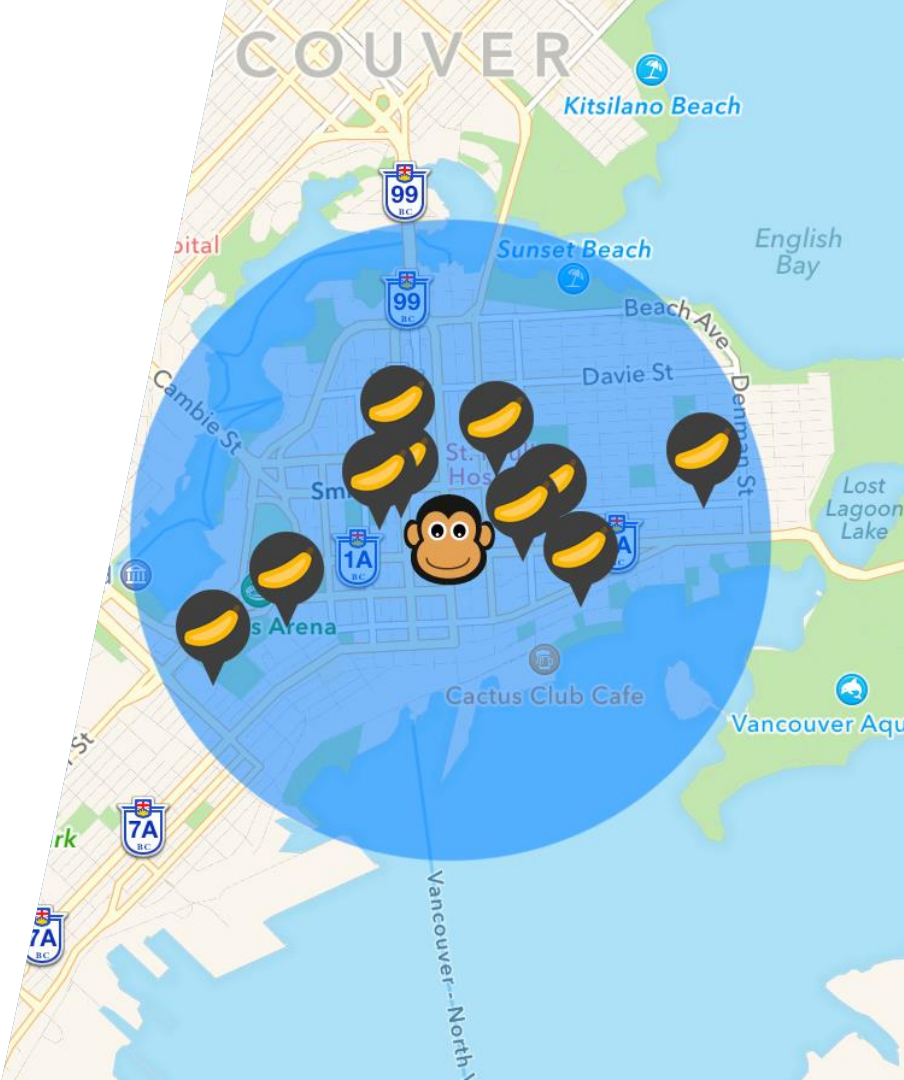
Tasks

1. Create overlays
2. Render overlays on a map
3. Calculate directions



Types of Overlays

- iOS provides support for several geometric types of overlays

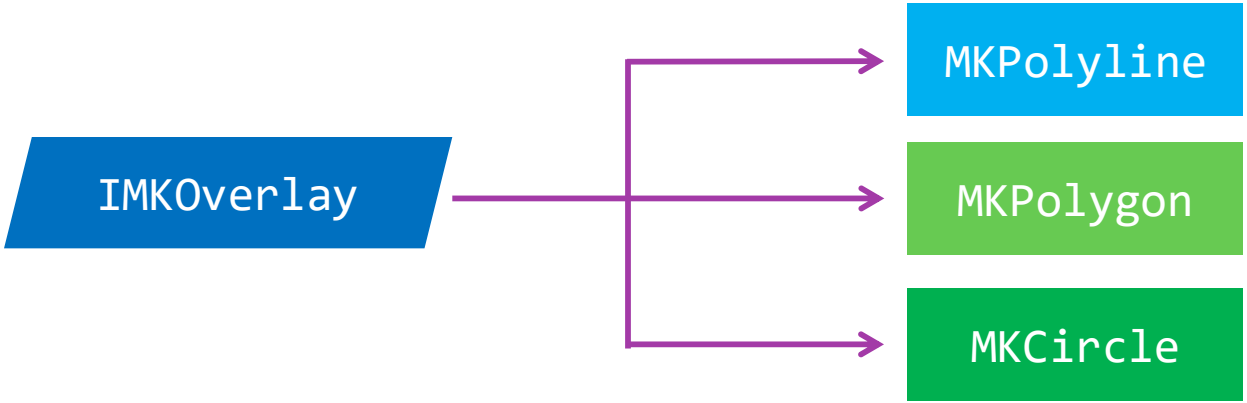
Circles – used to show a range

Polygons – used to highlight an area

Polylines – used to show routes

IMKOverlay

- **`IMKOverlay`** exposes the **`MKOverlay`** protocol, which defines a type of annotation that represents a location and an area on the map



Several implementations provided to describe specific shapes

Creating overlays

- Overlays are created using **static factory methods** that accept size and position details

MKPolygon creates a closed polygon from points or coordinates


```
var mapPoints = new CLCoordinate2D[] { ... };
MKPolygon polygonOverlay = MKPolygon.FromCoordinates(mapPoints);
```

Add Overlays to a map

- To add an overlay to the map, use the **`MKAddOverlay`** method on a **`MKMapView`**

```
var circle = MKCircle.Circle ();
circle.SetCoordinate (new CLLocationCoordinate2D (49, -123));
Circle.SetRadius(1000000);
mapView.AddOverlay(circle);
```

Rendering Overlays

- To control the visualization of an overlay, we use one of the three available renderers – each tied to an overlay type

`MKCircleRenderer`

`MKPolygonRenderer`

`MKPolylineRenderer`

OverlayRenderer

- To provide a customized renderer for an overlay, override the **`OverlayRenderer`** method in the map view delegate class

```
public override MKOverlayRenderer OverlayRenderer(
   MKMapView mapView, IMKOverlay overlay)
{
   ...
}
```

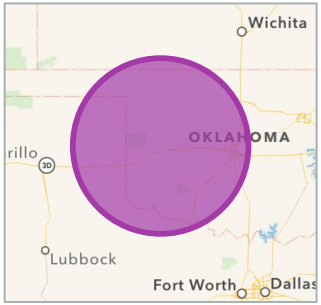
MKOverlayRenderer

- Create a renderer based on the overlay type and set the visualization properties


```
public override MKOverlayRenderer OverlayRenderer(
    MKMapView mapView, IMKOverlay overlay)
{
   if (overlay is MKCircle) {
      var renderer = new MKCircleRenderer ((MKCircle)overlay)
      { FillColor = UIColor.FromRGBA (0.0f, 0.5f, 1.0f, 0.1f) };
      return renderer;
   }
   ...
}
```

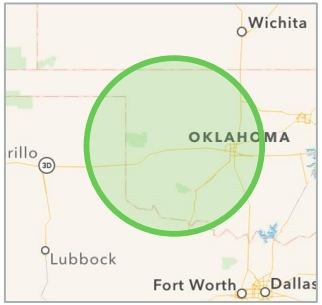
Properties on a renderer

- Customize the overlay apperance using properties inherited from `MKOverlayPathRenderer`



FillColor

StrokeColor



LineWidth

Overlays + Directions

- A common use of overlays is to plot out directions and points of interest
- MapKit has built in support for directions to get from point "A" to point "B"
- Exposed through the `MKDirections` API

MKDirectionsRequest

- **`MKDirectionsRequest`** object holds the source and destination information when requesting routing information from the **`MapKit`** APIs

```
var source = new MKMapItem (...);
var destination = new MKMapItem (...);

var request = new MKDirectionsRequest()
{
   Destination = mapItem,
   Source = source,
   RequestsAlternateRoutes = false
};
```

MKDirections

- Request turn-by-turn directions by calling **`CalculateDirections`** method on an instance of **`MKDirections`**

```
var directions = new MKDirections (request);

directions.CalculateDirections (
  (MKDirectionsResponse response, NSError e) =>
  {
     ...
  });
```

Must pass a delegate callback which will process the asynchronous response

Directions Response

- If succesful, the returned **MKDirectionsResponse** object has a **Routes** property that contains an array of **MKRoute** objects

```
var directions = new MKDirections (request);

directions.CalculateDirections (
  (MKDirectionsResponse response, NSError e) =>
  {
     if (e == null) {
        MKRoute[] routes = response.Routes;
        ...
     }
  });
```

MKRoute

- The **`MKRoute`** class defines a single route between 2 locations

Contains route data including geometry, name, and estimated travel time

Polyline is of type **`MKPolyline`** can be added to a **`MKMapView`** as an overlay

MapKit.MKRoute

- AdvisoryNotices
- ClassHandle
- Distance
- ExpectedTravelTime
- Name
- Polyline
- Steps
- TransportType

Individual Exercise

Add overlays and display directions

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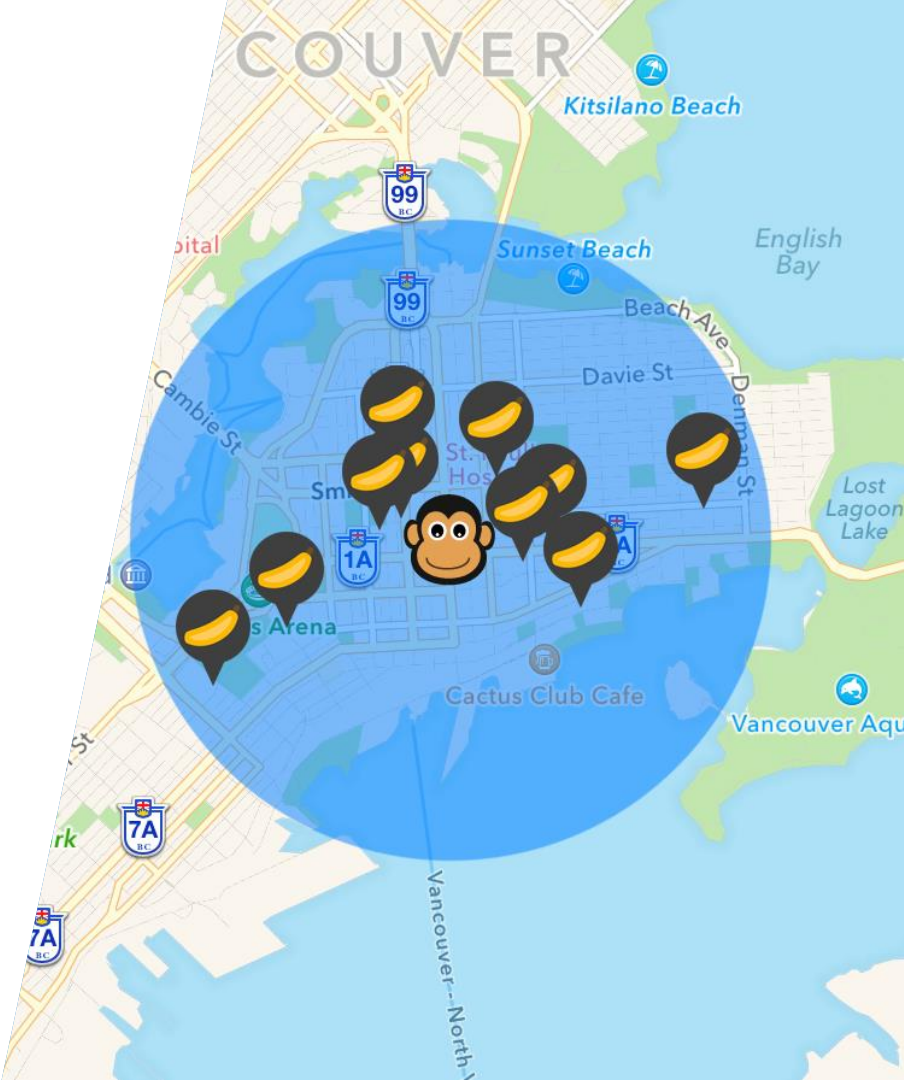
Summary

1. Create overlays
2. Render overlays on a map
3. Calculate directions



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