MapKit revisited

History:

- Apple introduced MapKit with iOS, maps were based on Google.
- With iOS 6.0, Apple provided its own mapping service, which lacked some quality, especially level-of-detail.
- With iOS 7 Apple opened up its MKMapView to potential other map provider.

Techniques:

- Maps are loaded based on strict locative informations.
- Dedicated SDKs from third party content provider.
- Maps are loaded based on encoded informations, namely from map-tile-services

Loading maps based on defined locations

A complete map can loaded based on locative informations:

- One location with latitude and longitude and a bounding box
- Two locations forming a rectangular section.
- A textual address is used.

The map is loaded as described. Modifying such a map means always recalculating the rectangular section.

This style used for static maps. It is not suitable for dynamic maps with paning and zooming.

SDKs

- Google Maps
- Bing (Microsoft)
- MapQuest
- MapBox
- … and more

Typically there is a subclass, or a similar class to MKMapView, which should be used instead. Usually the delegate-pattern with the same methods as from MKMapView is used.

Third party SDK may show different concepts of the UI. Integration may be difficult.

MapKit revisited

Loading maps
from map tile services

Requirements:

- Consistent projection scheme.

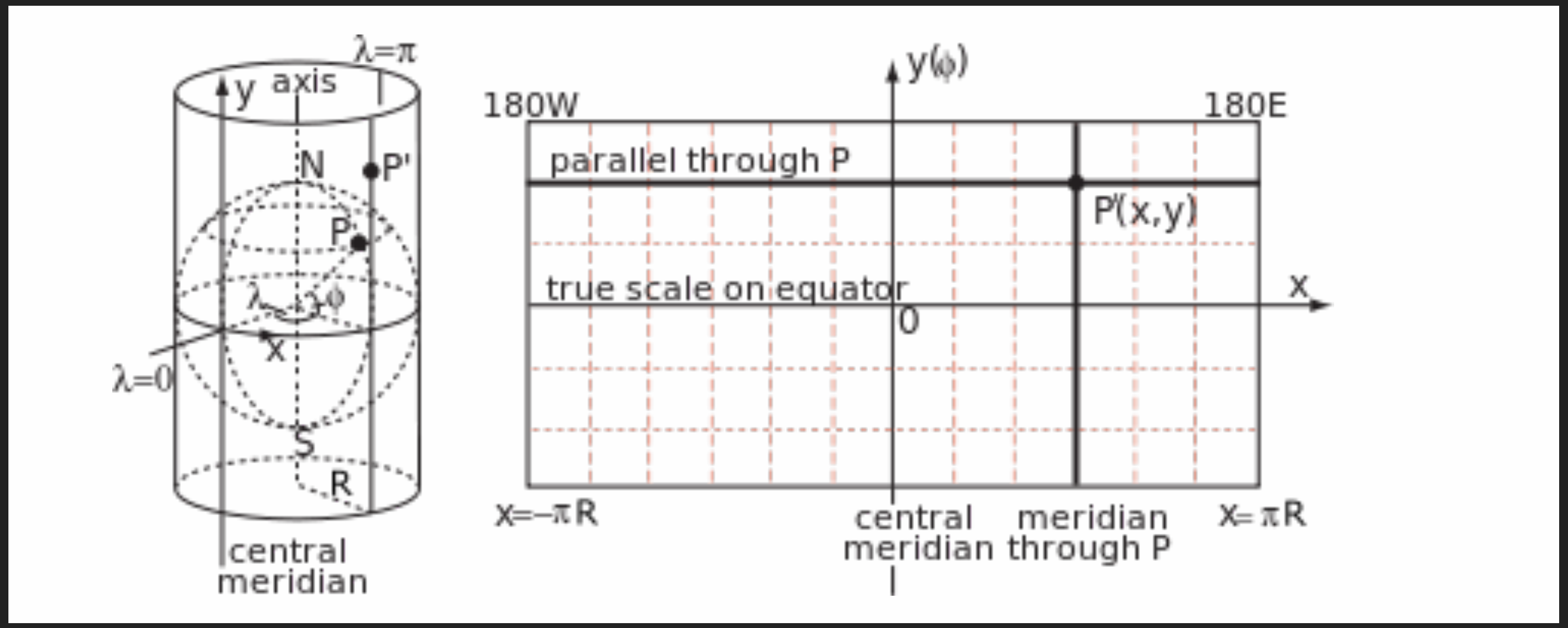
- Tiles are encoded by a tile scheme

✦The scheme is used for loading tiles …

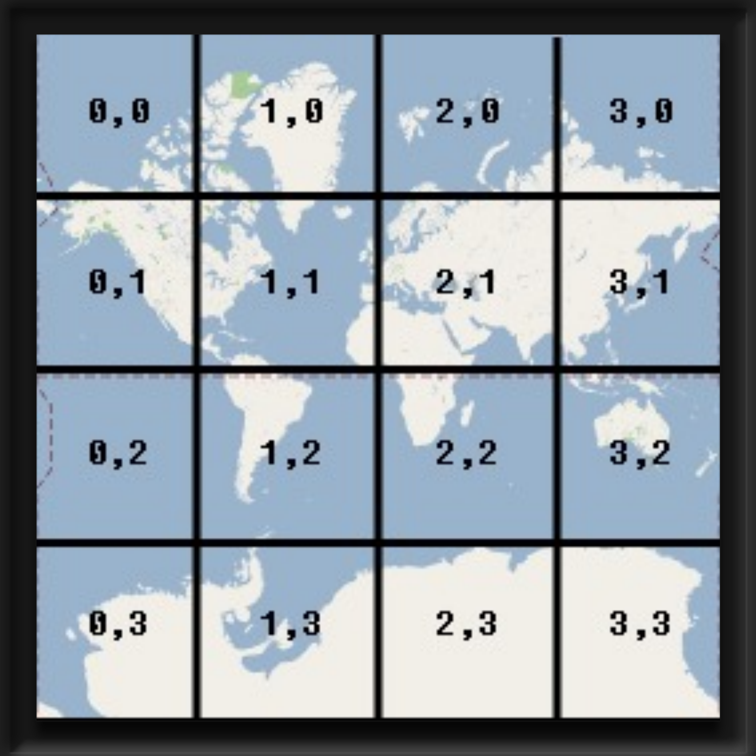
✦… and displaying the tiles

MapKit revisited Mercator projection

- True scale only on the equator
- Angles true on small scales
- Easy to use for rectangular tile schemes



Source: Wikipedia



Source: Google

MapKit *revisited*

Slippy map tilenames

[Openstreetmap convention]

- Tiles are 256 × 256 pixel PNG files
- Each zoom level is a directory, each column is a subdirectory, and each tile in that column is a file
- Filename(url) format is /zoom/x/y.png
- Zoom levels between 0 and 18, maybe more or less
- Zoom level n: $2^n \times 2^n$ tiles for the complete globe

Good News

- All major map-services are following the scheme:
  - Tiles 256 x 256 pixels
  - Mercator projection
  - Zoom levels
  - Same tile scheme; only Bing uses quad keys.

It’s really simple

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Code:

```
static NSString * const template = @"http://tile.openstreetmap.org/{z}/{x}/{y}.png";

MKTileOverlay *overlay = [[MKTileOverlay alloc] initWithURLTemplate:template];
overlay.canReplaceMapContent = YES;

[self.mapView addOverlay:overlay
                   level:MKOverlayLevelAboveLabels];



#pragma mark - MKMapViewDelegate

- (MKOverlayRenderer *)mapView:(MKMapView *)mapView
            rendererForOverlay:(id <MKOverlay>)overlay
{
    if ([overlay isKindOfClass:[MKTileOverlay class]]) {
        return [[MKTileOverlayRenderer alloc] initWithTileOverlay:overlay];
    }

    return nil;
}
```

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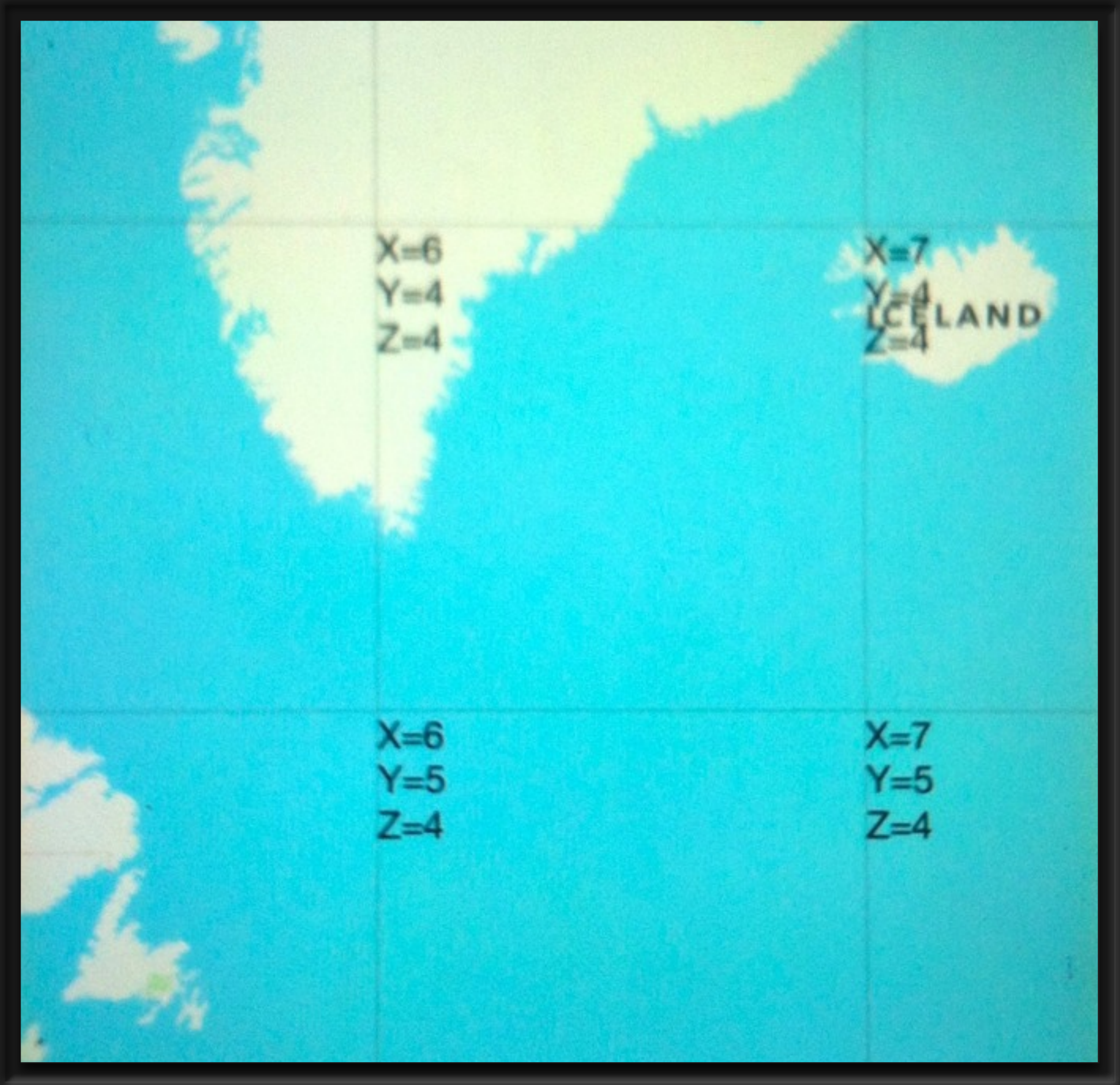
Custom overlays:

- Add informations above the tiles
  - subclass MKTileOverlay
- Watermarking
  - subclass only MKTileOverlayRenderer



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subclass of MKTileOverlay

```
-(void)loadTileAtPath:(MKTileOverlayPath)path result:(void (^)(NSData *, NSError *))result {

    CGSize sz = self.tileSize;
    CGRect rect = CGRectMake(0, 0, sz.width, sz.height);

   UIGraphicsBeginImageContext(sz);
    CGContextRef ctx = UIGraphicsGetCurrentContext();
    [[UIColor grayColor] setStroke];
    CGContextSetLineWidth(ctx, 0.5);
    CGContextStrokeRect(ctx, CGRectMake(0, 0, sz.width, sz.height));
    NSString *text = [NSString stringWithFormat:@"X=%ld\nY=%ld\nZ=%ld",(long)path.x,(long)path.y,
(long)path.z];
    [text drawInRect:rect withAttributes:@{NSFontAttributeName:[UIFont systemFontOfSize:20.0],
                                          NSForegroundColorAttributeName:[UIColor blackColor]}];
    UIImage *tileImage = UIGraphicsGetImageFromCurrentImageContext();
   UIGraphicsEndImageContext();
    NSData *tileData = UIImagePNGRepresentation(tileImage);
    result(tileData,nil);

}
```

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Watermarking

```
-(void)drawMapRect:(MKMapRect)mapRect zoomScale:(MKZoomScale)zoomScale inContext:(CGContextRef)context {

    [super drawMapRect:mapRect zoomScale:zoomScale inContext:context];

    CGRect rect = [self rectForMapRect:mapRect];
    CGContextSetFillColorWithColor(context,
                                   [UIColor colorWithRed:1.0 green:0.5 blue:0.5 alpha:0.2].CGColor);

    CGContextFillRect(context, rect);


}
```

subclass

MKTileOverlayRenderer

implement drawMapRect:...

Offline

- The tiles from map-services are stored in instances of NSDate
- Instances of MKTileOverlay provide these instances.

What can we do here?

- Cache them locally using NSCache.
- Store them persistently.

There is nothing to do with Apple’s service.

MapKit revisited using NSCache

```
- (void)loadTileAtPath:(MKTileOverlayPath)path result:(void (^)(NSData *data, NSError *error))result
{
    if (!result) {return;}

    NSString *keyPath = [self stringFromTileOverlayPath:path];
    NSPurgeableData *cachedData = [self.cache objectForKey: keyPath];
    if (cachedData) {
                              result([NSData dataWithData: cachedData], nil);
    } else
    {
     NSURLRequest *request = [NSURLRequest requestWithURL:[self URLForTilePath:path]
                             cachePolicy:NSURLRequestReloadIgnoringCacheData timeoutInterval:20];
     [NSURLConnection sendAsynchronousRequest:request queue:self.operationQueue
                  completionHandler:^(NSURLResponse *response, NSData *data, NSError *connectionError)
    {
       NSPurgeableData *cachedData = nil;
            if (data)
            {
                cachedData = [NSPurgeableData dataWithData:data];
                [self.cache setObject:cachedData forKey: keyPath];
                [self saveTile: data toFileSystemWithTilePath:keyPath];
            }
            result(data, connectionError);
        }];
    }
}
```

Persistent storage

Collect tiles while connected
and use them offline.

Take care of the MKTileOverlayPath

Store the tiles using CoreData
Using the file-system

Read the license(s)!

MapKit revisited

Some demo, maybe

Customization

- ✦Tiles from different sources can be combined according to
  - ✦scale, or zoom-level
  - ✦location
  - ✦user dependent data
- ✦ Other overlays can be added:
  - ✦ as map-tiles
  - ✦ as shapes

MapKit revisited MKMapSnapshotter

```
MKMapSnapshotOptions *options = [[MKMapSnapshotOptions alloc] init];
options.region = self.mapView.region;
options.size = self.mapView.frame.size;
options.scale = [[UIScreen mainScreen] scale];

NSURL *fileURL = [NSURL fileURLWithPath:@"path/to/snapshot.png"];

MKMapSnapshotter *snapshotter = [[MKMapSnapshotter alloc] initWithOptions:options];
[snapshotter startWithCompletionHandler:^(MKMapSnapshot *snapshot, NSError *error) {
    if (error) {
        NSLog(@"[Error] %@", error);
        return;
    }

    UIImage *image = snapshot.image;
    NSData *data = UIImagePNGRepresentation(image);
    [data writeToURL:fileURL atomically:YES];
}];
```

Does not draw annotations

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Directions

- Using directions requires always a connection and/or some sort of registration

Mapkit provides MKDirections and MKDirectionsRequest, provider is Apple.

Third party: MTDirectionsKit (usable before iOS 7.0)

Different provider, API-keys and/or registration is needed.

Once retrieved, directions can be shown on all kind of maps as overlays.

MapKit revisited

Ecosystem

A real ecosystem has been established in recent years, MapKit is one part of it.

Some options:

Dedicated own Tile-server, e.g. ArcGis-Server
Using MapBox, TileMill an so on
Using vector-based maps with custom color schemes for renderings

MapKit revisited

Thank you!