

# Online GIS

Meet the Cloud Publication Platforms  
that Will Revolutionize our Industry

Christopher Brown



## **Online GIS**

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# Table of Contents

about the Author	6
foreword	8
the short version	10
 ArcGIS Online	 12
Overview - Standout features - Limitation	
Data Import - Cartography - Administration Tools	
Map Tools - APIs - Pricing - Suitability	
 CartoDB	 18
Overview - Standout features - Limitation	
Data Import - Cartography - Administration Tools	
Map Tools - APIs - Pricing - Suitability	
 GeoCommons	 23
Overview - Standout features - Limitation	
Data Import - Cartography - Administration Tools	
Map Tools - APIs - Pricing - Suitability	
 GIS Cloud	 28
Overview - Standout features - Limitation	
Data Import - Cartography - Administration Tools	
Map Tools - APIs - Pricing - Suitability	
 MangoMap	 33
Overview - Standout features - Limitation	
Data Import - Cartography - Administration Tools	
Map Tools - APIs - Pricing - Suitability	

## MapBox + TileMill

39

Overview - Standout features - Limitation

Data Import - Cartography - Administration Tools

Map Tools - APIs - Pricing - Suitability

## summary

46



# about the Author



Christopher Brown

Chris is an internet startup entrepreneur with a background in software development and web mapping. He's the CEO of MangoMap a cloud based web map publication platform that allows users with no programming skills to create of attractive, fully featured web maps in minutes.

He and his team are based Southeast Asia where their web mapping skills were honed developing open source web mapping systems in challenging environments for international development organisations such as UNICEF and the World Food Program.

In his spare time Chris is an extremely active member of Southeast Asia's emerging tech and startup scene. He's an omnipresent organiser and participant in the regions grass roots tech events having played a key role in Barcamp, Startup Weekend, TEDx and pitching events across the region.

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# foreword

**W**eb mapping has become very exciting in the last year or two. Many new products have come onto the market that make the creation and publication of web maps easier by an order of magnitude. These system are poised to revolutionise our industry by allowing anyone with with GIS data to quickly publish compelling maps that tell the unique story of their data and share those maps with the world.

The demand for quick and easy web maps isn't a new one, so why is it only now that we're seeing products that address this need enter the market? The answer is twofold: first, cloud computing has hugely reduced the cost of running resource hungry map servers; and, second, the open source building blocks that most of the products featured in this book utilise have reached the level of maturity required to build reliable, scalable products on top of them. Most of the products in this book are indeed "standing on the shoulders of giants" and wouldn't exist if it wasn't for the tremendous work done by the open source GIS community over the last decade.

The other thing you no doubt are wondering is why the CEO of a web map software company would want to write a book that not only looks at his product but also those of his "rivals". The short answer is that I get asked all the time what the difference is between these products and also see the same question asked many times in online forums and social media channels, so it's obviously something that needs answering. I also don't view most of these products as our rivals, although all of the products featured in this book are capable of similar end results; the steps required to achieve those results differ hugely, with each aiming to make that process as smooth as possible for a certain type of user, be it programmer, casual GIS user or GIS analyst. After reading this book you should know which product is best suited

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to your needs and particular skill set.

I'm a software developer by trade and I think it's fair to say that I'm prone to "geeking out" when explaining technical products, but I want this book to be accessible to as wide an audience as possible, so am going to try my hardest not to lay it on too thick with the underlying technical details and instead focus on the workflow and output of each of the products.

Hopefully once you've finished reading this short ebook you'll have a good idea of the differences between each of these products and have a clearer idea of which of the products is best suited to your unique needs and requirements. This book isn't going to show you how to use these products, but it will show you what is possible with each of them and what it takes in order to achieve the best results.



# the short version

One of the first people to read an early version of this book pointed out that we live in an age of ADD and instant gratification where some of you might not be prepared to read 10,000+ words in order to find the answers which you seek. For you guys, here's a tweet length summary of each of the products!

**ArcGIS Online:** Comprehensive feature list. Jack of all trades, master of none. Confusing pricing. Card carrying ESRI users will love it.

**CartoDB:** A GIS programmers wet dream. The power of PostGIS and Mapnik but none of the setup headache, all wrapped in attractive packaging.

**CloudGIS:** Online alternative to traditional client/server GIS setup. Many features but hampered by a frustrating user interface.

**GeoCommons:** The place to share your data and use the data of others. No coding required. Slick UI, great visualisation tools.

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**MangoMap:** The quickest way for GIS users to publish web maps. No coding required. Lots of map features, slick UI that's geared towards simplicity.

**MapBox:** Making maps sexy again. Programmer focused. Great for maps that need to fit a brand and be able to scale for high traffic.

If you're looking for a more comprehensive overview of each of the products then I suggest that read on...

the short version 11

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# ArcGIS Online

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[www.arcgis.com](http://www.arcgis.com)

**Summary:** “Comprehensive feature list. Jack of all trades, master of none. Confusing pricing. Card carrying ESRI users will love it.”

## OVERVIEW

With anything map related, ESRI is always going to be the 500-pound gorilla in the room and it's no different for web mapping. Their system is focused on web map publication but also offers limited GIS features that allow for the editing of data by multiple individuals within an organisation. It will appeal to users that are already invested in ESRI products and workflows as it will easily integrate with their existing systems and practices.

The system is interface driven so is accessible to non-programmers, but also offers a suite of APIs that will allow web developers to build completely custom systems that can then be hosted on their own server, while the data is hosted on ESRI's cloud servers.

ArcGIS Online is a generalist rather than a specialist, as it has nearly as many features as the other products combined. That said, it's not going to give more cartographic control than MapBox, or be as easy to use as MangoMap, or give you the same data crunching power as CartoDB. But if you need a tool that covers all the bases, then ArcGIS Online is certainly worth exploring.

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## STANDOUT FEATURES

- HTML/JavaScript/CSS Configurable Application Template
- API for building custom application
- Configuration of popups via the user interface
- Editing of feature geometry and attributes

## LIMITATIONS

- No support for labels
- Layers are limited to 1000 features (for free accounts)
- Zipped shapefiles 10MB file size limit
- ArcGIS produced Map Packages (.mpk) can't be added to maps
- Confusing pricing structure & payment options

## DATA IMPORT

Provided that you have an organisational (paid) account you can quickly upload your data in Shapefile, GPX or CSV format. GPX & CSV formats have a 1000 feature limit or a 250 feature limit if geocoding is required.

The geocoding feature will look for addresses in the columns of your data and will match them with a geospatial location. I found the geocoding to be a little hit and miss, especially for locations outside of the U.S. It's far from a comprehensive study, but generally I get better results using the free **Nominatim** geocoder from Open Street Map and MapQuest, so it might be worth doing your geocoding with this tool before importing to ArcGIS Online.

For individual (non-organisational) users there is a 1000-feature limit on uploaded Shapefiles that you should be aware of. 1000 features isn't a lot, so many Shapefiles can't be uploaded due to this restriction. If you upgrade to an organisational account then this limit is removed.

As it turns out the 1000 feature limit is actually sensible when you consider that ArcGIS Online displays features using "Feature Services" (ESRI-speak for vectors) in your browser rather than map image tiles (think of the square tiles you see being loaded in Google Maps). Feature Services, or vectors as they are also known, require large amounts of data to be transferred over the internet to your browser in order to be drawn on screen. This works fine for small datasets, but



for anything larger the system can become sluggish and even unresponsive.

For organizational users, ArcGIS Online does have an option to use map tiles instead of vectors for medium or large sized data sets. Map tiles are much faster than vectors and are the data serving method of choice for all of the big map providers such as Google Maps, Bing Maps and Open Street Map.

## **CARTOGRAPHY**

Once you've got your data into the system and created a layer, you can begin altering the symbology, creating class breaks or giving features unique symbology based on their attribute data and is as straightforward as you might expect. The predefined styles are attractive, and very quickly you can put together a good looking map.

The only glaring omission in terms of cartography is the current lack of support for labeling of features. This is core functionality of any GIS system, be it online or offline and frankly, I can't understand why this feature is missing.

## **ADMINISTRATION TOOLS**

A big surprise for me was that although you can upload Map Packages (.mpk) from ArcGIS to ArcGIS Online, once there, the only thing that you can do with them is allow other members in the organisation to download them. Maybe I was expecting too much but I was hoping to be able to import those map packages straight into my ArcGIS Online maps with all of my cartography preserved - alas it wasn't to be.

One of the best features of ArcGIS Online is "Web Applications". You can export your maps into a Web Applications template, each of which is customised for different scenarios. For example, there is a storytelling web application that can display three maps side by side and another that allows points from a time-aware GPX layer to be animated on the screen.

These web applications can either be deployed on ArcGIS Online or the code can be downloaded allowing the HTML/JavaScript/CSS to be edited by a web developer before deploying the web page to your own server (the map data is still hosted on ArcGIS Online).

Another nice feature is the popup window customisations. By default, when you click on a feature a popup is displayed showing the attribute data in the same format as it's stored in the .dbf. This feature allows you to customise the appearance of the popup, you can omit columns or change column names and even include charts that are built from the attribute data.

ArcGIS Online also has some basic editing functionality allowing you to alter the geometry and attributes of features in the feature service (not tiles). This feature could be cool for colleagues who are not co-located and want to work together on a single dataset.

## MAP TOOLS

ArcGIS Online has the basic tools that you would expect from a web map. The print tool produces a decent quality pdf, but unfortunately doesn't include a legend. There is also an address search and a book-marking feature. As mentioned above some of the Web Applications have some additional tools and features that aren't in the standard map. It would also be possible to create your own tools using the APIs.

## APIS

ArcGIS Online offers an impressive assortment of APIs in JavaScript, Flex, Silverlight and REST flavours that open up a lot of possibilities if you're willing to invest time and resources in developing a custom application.

The easiest way to get started with the APIs is to export your map as a Web Application (discussed above), from where you can download the files of the web application and begin playing with the code to make modifications. Once you're done there is no way to re-import the files back to ArcGIS Online. Instead, you will need to host the web application on your own server.

As an experienced software developer I know that you can't make a judgement in regards to the power and usability of an API until you've built a real world application with real world requirements. I will reserve judgement until I have, but what I can say is that my experience so far has been positive, and the API appears comprehensive and

well documented.

## PRICING

I think it's fair to say that ArcGIS Online pricing is complicated.. The pricing is based on something called "Service Credits", you can think of service credits as ESRI's own internal currency. The minimum subscription cost is \$2,500 per year, that includes five users and 2,500 service credits. Additional credits can be purchased in blocks of 1,000 for \$100.

ESRI have produced a service credit calculator which allows you to plug in some estimates about your future mapping applications, such as storage space requirements and the number of users, it then tells you how many service credits per year this theoretical system will require. You can find the calculator here: <http://www.esri.com/software/arcgis/arcgisonline/credits/estimator>

The calculator is great as long as you know how to answer questions like "How many tile services and updates will be hosted?" and "Estimate the data transfer per user per month". For the rest of us the pricing is still a mystery! Joking aside, with some digging around in the documentation you can find decent explanations of the terminology in those questions, I would outline them here but it would likely double the length of this book.

Unsurprisingly ArcGIS Online is the most expensive of the options featured in this book. The absolute **minimum** cost of \$2,500 per year is already more than the cost of the premium plans from all of the other providers with the exception of MapBox. Of course each provider is offering different things so can't be compared directly and I'll leave it to you to make your own value analysis based on your own unique requirements.

## SUITABILITY

ArcGIS Online is probably best suited to medium sized or enterprise level organisations that have an existing investment in ESRI products and workflows. ArcGIS Online will be a low friction path to the publication of their datasets to the cloud. The APIs for ArcGIS Online and ArcGIS Server are the same so users have an easy upgrade route

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should they wish to move from hosting their data on ESRI's cloud servers to their own servers running ArcGIS Server.



# CartoDB

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[www.cartodb.com](http://www.cartodb.com)

**Summary:** “A GIS programmers wet dream. The power of PostGIS and Mapnik but none of the setup headache, all wrapped in attractive packaging.”

## OVERVIEW

Where do I start? As a coder by trade and a lover of all things geospatial CartoDB is a dream come true. The most simple way to explain it would be to imagine that PostGIS was available as a web service API that was also capable of serving up the underlying data as tiled web maps that update themselves every time the data in the spatial table changes. If you can imagine that, then you can imagine CartoDB! The possibilities are literally endless.

Now I know the above statement won't make perfect sense to all of you, and clearly goes against my promise to not get too nerdy with this book, but it's literally impossible to explain CartoDB without getting at least a little nerdy on you.

Let me try and explain in very simple terms why this excites me. Firstly, the maps that leverage the full power of CartoDB can't do anything that wasn't possible before, CartoDB just speeds up the process by an order of magnitude. CartoDB realised that many web map application projects repeat the following steps over and over again:

1. Setup a web server
2. Install a geodatabase to store the spatial data
3. Install and configure a map image renderer that knows how to take

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- the data from the geodatabase and turn them into pretty map tiles
4. Write code on the server that can be asked questions relevant to the application and retrieve the answers from the geodatabase e.g. Does feature A intersect with feature B
  5. Setup a secure HTTP web server that knows how to ask for map images (usually map tiles) from the image renderer and how to ask the server questions
  6. Code a web page displaying an interactive map which knows how to interpret the actions of the user and update the map and interface accordingly

Leveraging open-source or proprietary technologies getting to step 6 would take an experienced web map developer weeks. For a web developer without web mapping experience it might take months. With CartoDB you can get to step 6 as soon as you've signed up!

As with all the cloud based systems featured in this book you have the added benefit of not having to maintain the server indefinitely. Making sure all of the correct security patches have been installed, backing up the data and locking down the server are all someone else's problem.

As you've no doubt realised already you are going to need a web developer in order to make the most of CartoDB. Unless you're very lucky you likely haven't got a web developer that's also experienced with geodatabases and spatial queries. If that's the case you can pair up a web developer with a GIS analyst and they can figure it out together.

## STANDOUT FEATURES

- Rows in your table can be created, updated and deleted via the JavaScript SQL API
- Changes to geometry and attributes are seen instantly in your maps
- Use the SQL API to perform complex spatial queries on your data
- The API can be used alongside 3rd party libraries like Leaflet to make super custom interfaces

## LIMITATIONS

- Knowledge of HTML, JavaScript & CSS is required to customise the user interface

- Knowledge of SQL & PostGIS are required to unlock the real power of CartoDB

## **DATA IMPORT**

CartoDB doesn't use the term layer like each of the other apps but instead uses the term tables. You can either create a new table or import existing data from Shapefiles, Excel, CSV and GPX. For Excel, CSV and GPX you can then georeference the data within CartoDB. As with ArcGIS Online the geocoder seems to be very U.S-centric, I plugged in three U.K addresses and all of them ended up being geocoded to locations in the U.S so if you're outside the U.S you might want to look into alternative geocoding options.

## **CARTOGRAPHY**

CartoDB joins MapBox in using Carto. Carto uses similar syntax to the CSS markup language that's used to style HTML web pages, so web developers will pick it up very quickly. Just a small gripe; unlike MapBox the Carto editor in interface doesn't have predictive text, this makes it much harder to just guess what the correct syntax might be.

Carto is extremely powerful, it gives a fine grained level of control over the cartography that's a notch above what's possible with applications are user interface driven.

## **ADMIN TOOLS**

CartoDB is primarily about the APIs and creating custom applications, but it also has an administration area that has enough functionality to allow GIS users and decision makers to evaluate the product first.

The interface is split into a map view and a table view. The table contains the geometry in GeoJSON format as well as all of the attributes. The table is fully editable and changes to the table are available immediately in the map. There is also an SQL tab that allows you to play around with the underlying PostGIS functions.

In addition to making small changes to the map, like choosing the basemap or customising the info windows you can also update the table. This can be done either in the table view where the attribute values and geometry (as GeoJSON) can be typed straight in or by the

map view where the geometry can be drawn directly onto the map.

The admin panel is a nice starting point but for any serious customisations you're really going to have to use CartoDB as it was intended and jump into the code.

## MAP TOOLS

Once again the standard map tools are very limited. Out of the box all you get are info window popups, even the address search from the admin area isn't on the embedded map, but as I said earlier I get the impression that the admin area is just there for testing purposes, CartoDB has been built for developers who will code their own tools around the APIs.

## APIS

What CartoDB lacks in standard map tools it more than makes up for in APIs. In my opinion the APIs are much more clean, simple and well thought out than their sprawling ESRI counterparts. There are two APIs; the SQL API and the MAPs API. The APIs are web services that use JSON over HTTP. In non-geek speak, they're using the preferred communication method of most web developers and this API can be easily accessed using your preferred programming language and libraries. To make things even easier CartoDB offers wrapper libraries for the API in nine different languages, including Ruby, Node.js and Python.

As you would expect the SQL API allows you to create, read, update and delete anything within your CartoDB geodatabase. On top of the standard SQL commands you can also use PostGIS functions to give things a spatial twist. The SQL API doesn't need to be learned, it simply passes SQL to CartoDB as an argument in the HTTP query string, so if you understand HTTP and you understand SQL, then by default you already understand this API.

The MAPs API is used to request map tiles – the small squares you see the map is made up from in web maps. It's very straightforward and can easily be integrated into client-side web mapping libraries like Leaflet, OpenLayers or even GoogleMaps. What's really cool is that you can also pass SQL as an argument on the tile request to dynamically change the tile on the fly.

## PRICING

The pricing is very easy to understand and ranges from a free plan through to \$149 per month. The plans are split based on the number of tables that you can create and functionality. The top tier plan gets you unlimited tables, 500MB of storage, online support and white label (CartoDB branding removed).

It has to be said that CartoDB is great value for money at that price. For a niche product like this that will likely appeal most to medium to large sized organisations that are really prepared to put some work into a web map deployment I personally would have expected to pay a lot more.

## SUITABILITY

CartoDB say it best themselves: “CartoDB was built by developers for developers”. I don’t think I need to add anything to that; I’m a developer and I agree with the statement.

Although CartoDB could be used to throw quick maps together on a Friday afternoon, to do so would be a disservice to its potential. CartoDB is really best suited to projects where the application is really going to dig down deep into the data and offer tools and visualisations that allow the user to perform their own analysis from the comfort of their browser.

For potential users who aren’t already familiar with HTML/CSS/JavaScript and SQL there’s going to be a steep learning curve but that said, if you are interested in learning these technologies anyway then this would probably be as good place to start as any.

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# GeoCommons

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[www.geocommons.com](http://www.geocommons.com)

**Summary:** “The place to share your data and use the data of others. No coding required. Slick UI, great visualisation tools.”

## OVERVIEW

The name GeoCommons is a hat tip to **Creative Commons**, the non-profit organisation that released and promotes a series of copyright licenses that allow content creators to communicate which rights they reserve, and which rights they waive for the benefit of recipients or other creators. GeoCommons was built by GeolQ, the Washington based GIS software company recently – surprisingly to some – acquired by their previous sparring partner ESRI. GeoCommons provides full data upload, sharing, and search features that allow users to easily share data with the world.

Over the last year or so the functionality and tone of the GeoCommons website have changed, users can now make a limited number of private maps in GeoCommons and the homepage – which in its early days didn’t have a single mention of GeolQ – now feels like a feeder page for GeolQ enterprise products and services. This kind of change is always a risk when something that is open is contained within something which is closed.

For some the acquisition put a question mark over the future GeoCommons as many of its features overlap with those of ArcGIS Online. There were even rumours circulating that GeoCommons would be shut down completely.

Personally I don’t buy into the rumours, GeoCommons is a great plat-



form with a large user base and many fans, shutting it down would be a PR disaster for ESRI. No doubt ESRI observed the brand damage such efforts yielded for other incumbent software giants like Microsoft and Oracle, I doubt ESRI will be queuing up to repeat their mistakes.

The much larger risk is that GeoCommons will be starved of investment and left to die a slow death or rebranded as ArcGIS Online Lite and slowly butchered. A quick look at GeoCommons social media stats suggest this process may have already begun with their Twitter and blog activity down significantly since the acquisition.

Speculation aside, GeoCommons is still a very cool product and one of the fastest ways to share your data with the world.

## **STANDOUT FEATURES**

- Community sharing of geospatial data
- Temporal Visualization (time based animation)
- Address GeoCoding of CSV files
- Use filters to create derived datasets

## **LIMITATIONS**

- Private data is limited to 20MB or 10 private maps
- No support for labeling features
- No support for class breaks for text fields
- No support for categorical layers
- No API for custom applications (Parent company GeoIQ offers APIs)
- Very few options for customising the look and feel of the application

## **DATA IMPORT**

This is an area where GeoCommons are great, as the system is effectively one huge data repository. You can either choose to include data that another user has uploaded to GeoCommons or you can add your own data either by uploading or supplying a URL. For uploads GeoCommons supports Shapefile, KML, CSV. For URLs you can provide links to a web map service, a web tile service, KML, CSV, GeoRSS or RSS.

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For CSVs GeoCommons has a geocoding wizard which is by far the most usable of all the web mapping products in this book, allowing users to select which columns contain address data and what kind of address data it is. You can also stipulate if a column contains a coordinate.

## CARTOGRAPHY

Although GeoCommons doesn't have many options in terms of cartography, the tools they do have are really interesting and well thought out. The interface is self-explanatory and even users who have never used a GIS will be able to get up and running quickly.

The drawback is the lack of features. As with ArcGIS Online there are no options for labeling features but even more surprisingly there is no support for categorised layers which in my opinion is an absolute must have feature in any map authoring tool. What is available are graduated colours for numeric attribute columns and graduated markers which changes the size of the marker based on the underlying attribute data.

These limitations have to be viewed in the context of GeoCommons original goals. GeoCommons is, before all else, a platform for publicly sharing geospatial data and the authoring tools were likely intended to do just enough to showcase the data so viewers can make a decision on whether or not to download the data. It's testament to the great job that GeoCommons did with their authoring tools, that many users started using it as a map publication platform and requesting features like private maps and extra cartographic features that weren't aligned with the original vision.

## ADMIN TOOLS

There are some very cool admin tools here and I already talked about the geocoder in the data upload section which for me is the best in its class. The other standout feature for me is the filter. Instead of a series of drop down menus for building queries we're given some sliders that we can just drag to update the filter, is extremely intuitive and a lot of fun to play with. Once you're happy with the filter, you can share the map with the filter already applied. Users of the map can even manipulate the filter control themselves.

In addition to the filters, GeoCommons also offers a timeline for temporal data sets. If you upload a point layer that has a column containing timestamps you will be given the option to use the timeline tool. The tool displays an interactive control that allows you to render the points on the map as a time based animation.

Another nice feature is the Analytics Brewer which gives some basic GIS functionality that allows you to modify your spatial data or attribute table based on preloaded formulas. On the spatial analysis side, we have the usual suspects such as simplify, clip, buffer and merge. For attribute modification we also have familiar functions such as addition and subtraction. What's really cool is that you can build your own custom mathematical formulas to manipulate the attribute data and then share those formulas with all users of the dataset.

## MAP TOOLS

GeoCommons has a solid set of map tools. On top of all of the basic stuff we would expect such as legend and an identify tool we also have some tools that take it a step further such as a data view that displays a layers attribute data in a table view and a chart view that displays the attribute data for a single column in a chart with a variety of charts available.

We touched on the timeline tool in the admin tools section, but we'll mention it again here. It allows users to run a time based animation of the data based on a timestamp in the attribute table, the animation can either be sequential or cumulative. We also touched on filters in the admin section, for map users the filter control offers some sliders so users can move the sliders and see the features being added or removed from view depending on whether they match the current filter variables.

Unfortunately the map client view doesn't offer address search or attribute search making it tricky to navigate maps that contain a large number of features.

## APIS

GeoCommons doesn't offer an API. GeoIQ, the company behind GeoCommons does offer an API for their products which are not directly connected to GeoCommons, in fact the functionality of GeoCommons

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was built using those APIs so is a showcase of their capabilities. GeolQ is primarily catering for enterprise clients and their pricing is in the “call us for a demo and a quote” category, which is shorthand in the software industry for “not cheap”.

## SUITABILITY

If you have some raw geospatial data that you would like to share with the world under an open license and make some example visualisations to showcase the data for potential users then look no further, this is exactly what GeoCommons was originally built for, none of the other web mapping products come close in this department.

As it turns out GeolQ did such a great job with the data visualisations tools that many people who aren't interested in the sharing of their raw data have been using GeoCommons as a map publication platform. GeoCommons have recognised this and rather than trying to stamp it out have embraced it and added features to facilitate it. One such feature is map and data permissions that allow you to create up to ten private maps and data sets that are only available to member of a group that you have defined. Currently, users are allowed up to 10 private maps with 20MB of private storage.

So if you are unable to share your underlying data sets publicly and can work within the private map limitations and don't mind GeoCommons branding on your published maps then GeoCommons is also a great platform for non-coders to quickly and easily publish web maps to share with the public or a closed group.

# GIS Cloud

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[www.giscloud.com](http://www.giscloud.com)

**Summary:** “Online alternative to traditional client/server GIS setup. Many features but hampered by a frustrating user interface.”

## OVERVIEW

GISCloud based out of Zagreb Croatia is an interesting product, though initially I wasn't sure whether or not to include it in this book, the reason being that my original intent was focus on cloud based web map publication platforms rather than online GIS systems.

What I mean by that is that it was my intent to focus on platforms that are used to publish a data set has been created using a desktop GIS rather than products that are designed to replace a desktop GIS, but after digging further into each of the product I realised that all of the products in this book have some overlap with desktop GIS systems to varying degrees. In the case of CartoDB and ArcGIS Online they could in theory be used to create a data set from the ground up and manage its entire lifecycle without any need for a traditional GIS. That said, they are still primarily web map publication platforms and although using it as an alternative to a traditional GIS is possible, it's not the intended use case.

GISCloud on the other hand feels like it is an online GIS tool first and a web map publication tool second which makes it difficult to compare directly with the other products in the book because it has different goals. The other tools all have the same end point; an interactive web map hosted in the cloud that presents the underlying data in interesting ways, what differentiates them is the process used to create that map and the functionality that it's possible to deliver to the end users

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via the map interface.

GISCloud is different. Although it does offer basic web map publication features, GISCloud's primary goal is to offer an alternative to traditional server/client based GIS systems, so is heavily focussed on data manipulation and analysis. They offer a series of niche products that focus on use cases such as asset, roadworks and fleet management that are usually serviced by traditional server/client enterprise GIS systems.

For the purpose of this book I will be looking at the Map Editor product rather than the niche asset management products as they are too specialised for the scope of this book. So when I refer to GISCloud for the remainder of this book I am specifically referring to the Map Editor product.

GISCloud offers a wide array of functionality especially on the data manipulation and analysis side of things, unfortunately many of the features are difficult to find, difficult to use or too often, both. If you are willing to invest some time you can get some interesting results but for me it wasn't a smooth journey. The usability is by no means worst I've seen in a web app, but when compared to the superb usability of CartoDB, GeoCommons, MangoMap and MapBox it's left wanting.

## **STANDOUT FEATURES**

- Create heat maps and buffers on the fly
- PostGIS SQL filters to create derived datasets
- Inline editing of geometry and attribute data
- Address GeoCoding of CSV files

## **LIMITATIONS**

- Frustrating user interface
- Limited map publication options
- No options for customising the look and feel of the application

## **DATA IMPORT**

GIS Cloud supports just about every type of data that you can think of:

Vector: .shp, .mif, .mid, .tab, .kml, .gpx  
Spatial Raster files: .tif, .tiff, .jpg, .gif  
Image files: .jpg, .gif, .swf, .png  
Excel 2003 and CSV: .csv, .xls

That's an impressive list, but as I found to be a running theme with GIS-Cloud, the product tends to take a quantitative rather than qualitative approach to features. On the data upload page nowhere does it say what formats are supported so you either have to go and trawl through the documentation or just start using a trial and error approach. This is in stark contrast to the other products in the book where usability of the software is generally great and the documentation or support is seldom needed.

## **CARTOGRAPHY**

GISCloud has all of the cartographic tools you would expect from an online GIS but getting them to work is a challenge. For example, I uploaded a polygon shapefile and wanted to give features a distinct colours based on a field in the attribute table, the option is available in the styling wizard, but when I press it I'm greeted with a message informing me "We don't support getting distinct values directly from files at the moment. To perform this operation the layer must be added from the PostGIS database". Initially I took this to mean that I must connect a PostGIS database that I maintain to the product.

If I was evaluating this product and didn't have a PostGIS database I would probably have walked away at this point, but as I'm writing a book I took the time to dig deeper and upon further investigation and some Googling I discovered that you can convert files uploaded to GISCloud into PostGIS tables that they host. If the message had of explained this and provided me with a link to the very well hidden place in the application that this can be achieved I would have had a much more pleasant experience.

## **MAP ADMIN FEATURES**

There are a lot of features on the admin side and many of them are unique to GISCloud such as the ability to create heat maps and buffer layers on the fly. You can also do area calcluations on features and compare layers. The tools are often not self explanatory so a trip over to the documentation will be required in most cases which is one more feature that is shared with most desktop GIS systems.

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GISCloud allows users with permissions to create new features as well as edit and delete existing ones. With GISCloud you could quite easily create a new data set from the ground up.

As well as importing data GISCloud also allows you to export your data in Shapefile, MapInfo, KML, DXF and CSV which makes a lot of sense when you look at GISCloud from data collection rather than publication perspective.

GISCloud gives you a lot of sharing options, you can share your maps with other individual GISCloud users, publish a web map or access your map from other platforms that support WMS.

## MAP CLIENT FEATURES

The client for GISCloud is quite limited and feels a lot like the web map interfaces of the past with a legend and a few simple controls like identify, basic print and a ruler. I don't think it's fair to compare the client of GISCloud with the other platforms as publication is not the main purpose when working with GISCloud. A far more common scenario will be a distributed team working together on a data set and then sharing that data set for use in other client, either by exporting the file or consuming the map as a WMS service.

## API'S

GISCloud exposes API's in two forms, a REST and a JavaScript API. I couldn't really make sense of the REST API and the only thing I could see in the documentation were instructions for retrieving lists of all of the public maps created in GISCloud. Maybe there's more to it, but if there is I couldn't find any information or documentation to help.

The JavaScript API is more promising as it allows you to create and configure a map viewer and also edit the maps data, I didn't have time to build a comprehensive application, but from what I could see all of the building blocks are there to build a more comprehensive viewer leveraging the API.



## PRICING

GISCloud costs \$55 per user per month. A user is someone who can login and create maps, not someone who is merely viewing a map published with GISCloud. They also offer a free plan for personal, academic and non-commercial use which is fantastic.

## SUITABILITY

GISCloud is designed to replace or supplement a traditional client/server GIS system and it has enough functionality to do so. If you don't need the more advanced features of a desktop GIS system, then GISCloud is certainly a viable and lower cost alternative.

Yes, the user interface can be frustrating at times, but no more frustrating than the interfaces of its desktop counterparts and like its desktop counterparts you're going to have to invest some time to really get the most out of the system and its features.

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# MangoMap

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[www.mangomap.com](http://www.mangomap.com)

**Summary:** The quickest way for GIS users to publish web maps. No coding required. Lots of map features, slick UI that's geared towards simplicity.

## OVERVIEW

As you already know from the foreword I'm the CEO of MangoMap. I'm not going to even attempt to try and look at my own baby impartially from the outside-in as I have with the other products we've looked at in this book. It's impossible for me to speak about MangoMap without passion or a sense of pride and purpose so I'm not even going to try. I will just tell you about MangoMap as I see it and I'll leave it to you try MangoMap for yourself and form your own opinions. Hopefully what's lost in perspective and potential for impartiality will be made up with insight and boyish enthusiasm!

Some history; MangoMap didn't start life as a product, it evolved into one. I founded and ran a Web Development company in 2001 that did work across Southeast Asia, mainly in the development aid sector. Frequently my clients would tell me that they would like to publish their data sets to interactive web maps but the costs and technical barriers to entry when using enterprise GIS software were simply too high to justify.

To meet this demand I began building turnkey web mapping systems for my clients using an open source stack of technologies hosted my own server. Over time my processes improved and we wrote custom scripts that greatly simplified labour intensive tasks until we reached a point where we could deploy custom web map applications in days



rather than weeks and the cost had dropped to a point that it was no longer a major factor in our client's decision process. As the price and turnaround times for web map deployments dropped, I noticed a change in the behaviour of our clients; instead of huge online GIS portals for all of their data sets, they were requesting small, highly targeted, highly relevant web maps that used a handful of data sets tailored to a specific use case.

This change in behaviour was amazing to me! I began to wonder, if reducing the cost of custom web maps to the low thousands and having deployment times measured in days had caused such a big change in the behaviour of our clients, imagine what might be possible if the process was fully automated, cost less than my shirt and deployment times were measured in hours or even minutes? The MangoMap that you see today is our attempt to answer that question.

Our tool isn't aimed at programmers who want to code with APIs to build branded web maps for consumer facing internet companies or online news portals. MangoMap is for GIS users and has one simple objective; to allow people to quickly and easily publish stunning web maps that are compelling, insightful and easy to use.

## **STANDOUT FEATURES**

- Fully UI based interface (no coding required)
- Comprehensive suite of symbolization tools
- Search: attribute search / address search / query builder
- High Quality (300dpi) print export
- Pushpins with clustering
- Map Templates
- Password protected maps
- Labels!
- Embeddable into web sites

## **LIMITATIONS**

- No API for custom applications
- Interface can't be customised with HTML/JavaScript/CSS
- Only Shapefiles are supported

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## DATA IMPORT

At the time of writing MangoMap only supports Shapefiles but there are plans to support GeoTIFF for raster imagery in the near future.

## CARTOGRAPHY

Once you've got your data into the system and created a layer you can begin altering the symbology or giving features unique symbology based on their attribute data is straightforward and easy to use. We've also tried to make default styling as attractive as possible so in some cases you won't even need to make any alterations.

You can also add labels to points, lines and polygons and are able to change the font type, size, color and even the shadow/halo of the text.

## ADMIN TOOLS

The admin tools have been designed to be intuitive and allow you to add some very cool pieces of functionality to your map in as few steps as possible. The controls are sensibly grouped into four categories; map settings, layer settings, map feature settings and support. We've deliberately made the tools shallow so almost everything in the application is only two clicks away. For example the map feature settings allow you to password protect your map, add attribute search and create a clustered pushpin layer all from a single form in a single popup window. Using the admin tools, you can control your map's appearance and functionality.

The pushpin feature is very cool as it allows you turn any of your uploaded layers into a pushpin layer, with pushpins opening an info window containing the features attribute data when clicked. It even works for polygon and line layers with the pushpin is placed on the centroid of the feature. A clustering algorithm is used to group colliding pushpins into clusters and when the cluster is clicked it explodes and the map zooms to the extent of the pushpins in that cluster. Clustering means that even layers with 50,000 features won't appear crowded on the map. Alternatively, you can select a layer to behave as a highlight layer. When the user moves their mouse across the screen the feature that the mouse is above will be highlighted in real time. When the user clicks on the highlighted feature then an info window will be opened to display the features attribute data.

MangoMap also allows you to choose a template for your maps. The templates have been designed to suit different types of data and different use cases. They range from the GIS Template which will feel familiar to desktop GIS users and allows layers to be added to groups which can be turned on and off by a checkbox through to a Slide to Compare template that allows two layers to be shown side by side and a slider dragged to reveal the differences between the two. This is great for highlighting the differences in a data set at two points in time. More templates are being added all the time so stay tuned. We also love to implement templates that have been suggested by our users, so if you have an idea for a new template just let us know.

The attribute data that's used in the information window for features and the search results can also be customised by giving column aliases, choosing a column to be used as the title of a features and also removing columns that you don't wish to display giving you an extra level of control over the presentation of your data.

## MAP TOOLS

This is the area where MangoMap is really trying to push the boundaries of what's possible in a web map that's been created using a user interface rather than hand coded by a web developer. We want to give end users of your map a rich and fulfilling experience that goes way beyond a simple pan and zoom controls. We already have an impressive list of map tools and this list will continue to grow as we roll out all of the new tools we have planned. As well as working in a desktop browser the maps also support all modern touch screen browsers, meaning iPhone, iPad and Android users will also be able to interact with your maps.

The standout feature for me is our search capabilities. Search is made up of three core parts, the first is an address search powered by Open Street Map and MapQuest data that allows users to search for addresses anywhere in the world. The second is a full text attribute search which allows users to search across the attribute data of all of the maps layers simultaneously. The results are displayed in a table with the most relevant results first. The third is our advanced search feature that allows you to build a custom query and have the features that match that query highlighted on the map. For example if you were looking at a presidential election results layer you could create a query

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that shows you all states where this winner was Barack Obama and the margin of victory was less than 5%. These search features allow the map user to do more than just look at the map; they can view and interact with the underlying attribute data.

In addition to search, we provide several ways that the user can interact with the features they see on the map. The most basic of which is the identify feature that allows for the attribute data of any feature to display in an info window after that feature has been clicked. This is pretty standard functionality for a GIS map. However, because many end users are far more familiar with the controls of web maps such as those provided by Google than they are with desktop GIS systems, we also cater for this group by allowing any layer to be turned into a pushpin or mouse over layer.

The pushpin layer clusters overlapping pushpins to even maps that have tens of thousands of pushpins never feel cluttered. The mouse over highlights a features as the user moves their mouse over it. Clicking on either the pushpin or the highlighted layer will display an info window with the underlying attribute data. These two controls are far more discoverable and intuitive for users that are more familiar with Google Maps than a desktop GIS identify tool.

MangoMap also offers an impressive print function and pressing the print button will export the current view to a 300 dpi pdf. Most exported web maps are pixelated and feel of low quality once printed, but our 300 dpi export is far more impressive on the printed page, with smooth lines between these features and labeling displaying at an appropriate size. The print view also contains the title of the map and a full legend so won't need any modification in order to be usable in reports and such.

MangoMap is a product still under very active development, these features are just the tip of the iceberg with many more cool visualisation tools planned for release in the coming months.

## APIS

MangoMap doesn't offer any API access as our product is for user of GIS data rather than software developers.

Although we do have plans to allow users to access their maps via

OGC standards such as WMS and WTMS so maps created in MangoMap can be viewed in other GIS platforms, we have no plans to implement any APIs or tools for software developers.

## **PRICING**

At the time of writing MangoMap is still free. We decided to keep the product free during early development in order to have the maximum number of users possible engaged in the conversation regarding how MangoMap should be improved and which direction it should go. All maps created during this period are free and will always be free!

We have already confirmed the pricing and expect the paid plans to be release in early 2013. The pricing is affordable and very easy to understand, plans start from \$5 per month for a single map through to \$150 per month for unlimited maps.

All maps offer unlimited storage and unlimited visitors. There is a fair usage policy, but unless you are an extremely high traffic site such as an international news network, you won't need to worry about those.

## **SUITABILITY**

MangoMap has been built from the ground to allow users of GIS data quickly and easily publish their data to attractive interactive web maps. So whether you are a GIS professional or a casual user of GIS data, MangoMap will provide a fun, affordable and low friction path to web map publication.

We're not here for news networks or consumer web portals with teams of web developers ready to code with APIs. We're here for anyone with GIS data that wants to publish a web map that offers an absolutely first rate experience to its users without having to break the bank or invest hundreds of hours of time.

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# MapBox + TileMill

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MapBox

[www.mapbox.com](http://www.mapbox.com)

**Summary:** “Making maps sexy again. Programmer focussed. Great for maps that need to fit a brand and be able to scale for high traffic.”

## OVERVIEW

The stereotypical map maker falls into two categories; one sits working on a Windows PC in a cubicle adorned with ESRI certificates at the HQ of some large unknown government department. The other sits in a dark basement at 2am looking at green text on a black screen trying to figure out why GEOS won't compile on Slackware Linux 10. So as you can imagine, when I first saw someone doing something that looked like GIS on a Mac in a trendy cafe, I felt a great disturbance in the force. MapBox are making mapping cool again (Yes I did Google it, mapping was once cool!).

Branding and mapping were two things that before Web 2.0 would never be used in the same sentence, but now in 2012 I've lost count of how many companies for whom web mapping is a critical component of their consumer facing business. MapBox already have household names like Foursquare and Evernote on their client list and have developed a platform that allows companies to decouple themselves from Google and regain control of their maps.





A common misunderstanding for new users is the difference between MapBox and TileMill. Basically, MapBox is a company that offers web map hosting services and TileMill is an open-source cross-platform tool released by MapBox. TileMill is used for authoring maps that can then primarily be exported as tile-sets in the MBTiles format. MapBox offers paid hosting for MB-Tilesets and this is their primary source of revenue, but as MB-Tiles format is an open and documented you can also choose to host the tiles yourself without paying anything to MapBox if you so wish. MapBox even helps with that route by offering an open-source product called TileStream that makes it easy to host the tiles yourself.

Customisation and scalability are the two areas where MapBox really shines. If you need fine grained control over the presentation of your web map and to be confident that those maps will be displayed quickly and consistently to the users of your high traffic web site then MapBox was made for you.

## **STANDOUT FEATURES**

- Base maps color customisation
- Ease of use for web developers
- Scalability
- Well thought out API's
- Carto gives very fine grained control over cartography
- SDK for building native iOS apps

## **LIMITATIONS**

- Can take a long time to upload MB-Tilesets for detailed maps or large areas
- Knowledge of HTML, JavaScript & CSS is required for the best results
- Mobile SDK doesn't support Android

## **DATA IMPORT**

TileMill is the desktop authoring platform used to create maps for MapBox and supports Shapefiles, KML, GeoJSON, GeoTIFF, Post-GIS, CSV, and SQLite. TileMill doesn't perform geocoding so CSV and SQLite datasets will need to have the columns that contain the geometry named wkt, x/y or longitude/latitude.

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## CARTOGRAPHY

Cartography is where MapBox really shines. To start with, MapBox provides it's own base map called MapBox Streets, with 13 preset colour themes to choose from. You can also control what's shown on the base map with options to customise the colors or disable completely the streets, water and land. There is also an option to enable terrain. All customisations to Mapbox Streets are performed via the interface at MapBox.com rather than in TileMill and are only available to users of TileMill who choose to host their MB-Tilesets with MapBox.

When it comes to making maps with your own data, everything is done on the desktop using TileMill. TileMill doesn't use a graphical user interface for styling maps, instead it uses Carto. Carto is a markup language similar in appearance to the CSS markup language that's used to style HTML web pages, this makes it very accessible for web developers as they will already be familiar with the syntax and structure. The learning process is made easier still by predictive text feature in the TileMill Carto editor, which makes it easy to guess what a style name might be, rather than consulting the documentation.

To sum up, Carto is extremely powerful as it gives a fine grained level of control over the cartography that's a notch above what's possible with a user interface.

## ADMIN TOOLS

We've already touched on the available admin tools in the sections above and the tools are split into two parts; tools that are available on MapBox and tools that are available on TileMill.

The tools on MapBox can be viewed as publication tools they can be used to customise your basemap and choose which tools are available in your map client. Maps hosted on MapBox can either be accessed directly via a URL, embedded in a webpage or accessed via the JavaScript and iOS APIs. The URL and embedding tools are a great starting point, but will only take you so far. As with CartoDB, MapBox is really about building custom applications with the APIs.

TileMill, the map authoring tool, has the feel of an integrated devel-

opment environment (IDE) so will appeal to developers. Apart from the most basic settings everything is expressed in code, be it Carto markup for the cartography or HTML/CSS for the legend and tooltip windows.

One thing that's not currently possible is the ability to display your custom MapBox Streets base map in TileMill so that you can see what the finished product will look like in MapBox before you do the upload. I would love to see this feature added in a future release.

The other big drawback to creating these tile sets on your desktop is their size; they can be huge! It's not uncommon to see a map of a single U.S state that allows for zooming down to a town level to produce tile sets that are hundreds of gigabytes in size, yes you read that correctly 100GB+! You don't need me to tell you that getting that much data uploaded could take time. If you need to get maps online quickly or you expect your data to change frequently, this could pose a serious limitation.

That said, I think MapBox have taken this route for all of the right reasons. TileMill is open-source and MB-Tiles is an open format so this means that rather than locking you into MapBox hosting, Mapbox are giving you choices. The choice to host your maps on their infrastructure or yours. Although it's not happened yet in theory, another company could even start offering hosting for maps produced in TileMill. This means that MapBox have to compete through innovation and service quality rather dependencies, which is great for consumers. It's also great for large companies for whom the map is core to their business. For these guys, dependency on a single company, be it MapBox or Google is a very scary thought as one change in policy or pricing and your whole business could be sunk. By making things open MapBox is giving these guys an exit strategy, this will no doubt increase confidence and therefore sales for MapBox.

## MAP TOOLS

Even though MapBox is primarily intended for users of the API, they offer enough functionality to make the embedding of maps with the default interface a compelling option. The default interface can have a legend, tooltips and address search so you have all of the ingredients for a basic web map. The legend and the tooltips aren't automatically generated and they need to be hand-coded using HTML/CSS in Til-

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eMill beforehand, which is what you would expect from a tool aimed at web developers.

The basic map template has the following tools:

- Zoom controls
- Tooltips
- Legend
- Share links
- Scroll zoom
- Geocoder
- Bandwidth detection

## APIS

MapBox is all about the APIs, so if you want to use the platform to its full potential then you're going to need to write some code. MapBox has been designed to make web mapping accessible to web developers who may not have any previous web mapping experience, by providing a platform that feels familiar to web developers, whilst avoiding GIS jargon.

Before we talk about what the API can do, I think it's important to discuss first what it can't do. The API only has access to data that's stored in MBTiles, MBTiles only stores map image tiles and not the underlying geospatial data that was used to produce those tiles. This means that the MapBox APIs are not going to allow you modify the data or perform the kind of geospatial queries that are possible with the APIs of CartoDB or ArcGIS Online.

The API comes in three flavours, an HTTP API, a JavaScript API and an iOS SDK. The HTTP API gives direct access to the map tiles. This leaves you free to use 3rd party web map client libraries like Leaflet or OpenLayers, which is a running theme in MapBox; giving you other options that don't couple you or your maps to MapBox.

Most developers will be using the JavaScript API, which unlike the CartoDB is very much focussed on presentation and map client functionality rather than data modification and analysis. MapBox offers an impressive array of map tools through the API and includes the kind of features that ArcGIS Online and MangoMap make available to non-



programmers through their “Web Applications” and “Map Templates” respectively. Invoking these features through code obviously gives a far greater level of control, however.

The API is well documented with 29 working examples of all the available functionality at the time of writing. The possibilities are numerous with everything from embedding YouTube Videos to customising the zoom controls. My favourite features were the Swipe control that allows you to drag a line across the screen exposing the difference between two layers and the easing links feature that once you click on a button say “London” zooms out pans to London and zooms back in. With a few of these options combined you could start building some very impressive visualisations.

## PRICING

The pricing is clear and straightforward with the plans being split based on map views, storage and support options with the price ranging from a very limited free plan to a \$499 per month premium plan. If you are building a map for an existing website you will already know how many visitors you’re getting per month and when you are using TileMill it will tell you how big your MBTiles set currently is. With these two numbers in hand you can figure out which pricing plan fits you best.

## SUITABILITY

MMapBox is all about fine grained control of the presentation of your maps and being able to serve those maps to your users at scale. The typical MapBox customers will likely be high traffic web companies whose map is core to their business and web news portals that wish to embed interactive maps into their stories and features. Although it’s possible to throw maps together with MapBox very quickly, the platform is more suited to organisations that are prepared to invest time and effort in a web map that is befitting to their brand as a whole. The fact that MapBox has attracted customers like FourSquare and USA Today is testament to that fact.

Apart from the most basic features, MapBox will require a web developer to code the web map using the APIs. Unlike CartoDB and to a lesser extent ArcGIS Online, web developers with no GIS experience will still be able to get the most out of MapBox. The system has clearly been designed for web developers without GIS experience in mind,

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the word GIS is hardly mentioned in any of the promotional materials or documentation.



# summary

In this usefully short guide to online GIS and web map publication platforms, we've examined a bunch of useful applications that take the pain out of web mapping. I hope you've got something out of the past few dozen pages. If you have, then please forward the eBook onto your friends and colleagues, tweet about it and share it around your network.

If you spot any errors in this book, it would be amazing if you could let me know. If you think I've left something out, or got something wrong, then drop me an e-mail at [chris@mangomap.com](mailto:chris@mangomap.com) or get in touch with me via **Twitter** @chrisincambo.

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## MangoMap

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*It's easy and it's free!*

Why Use MangoMap?



**SIMPLE DEPLOYMENT**



**POWERFUL AUTHORIZING TOOLS**



**RICH WEB MAP INTERFACE**



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