CHAPTER 1

Web GIS introduction

This chapter introduces the concept of Web GIS with the ArcGIS Web GIS platform. The chapter begins with an overview of Web GIS and its advantages, introduces the ArcGIS Web GIS platform, lists the technical evolutions in Web GIS, explains the basic content types and user levels in ArcGIS Online and ArcGIS Enterprise, and demonstrates the workflow to build Web GIS apps using the Esri® Story Map Tour™ template. This chapter familiarizes you with ArcGIS Online and ArcGIS Enterprise basic operations and workflows, and introduces flexible ways to build Web GIS apps that you will explore in other chapters.

Learning objectives

• Grasp the concept and advantages of Web GIS.
• Understand ArcGIS Web GIS platform deploy models.
• Learn the components of the new-generation Web GIS platform.
• Understand the technical evolutions and trends in Web GIS.
• Learn the workflow for creating web apps.
• Work with GIS data in comma-separated value (CSV) files.
• Create and share web maps and web apps.
• Familiarize yourself with the Esri Story Map Tour template.
What is Web GIS?

Web GIS is the combination of the web and GIS. The web removed the constraint of distance in cyberspace, and thus allows people the freedom to interact with GIS apps globally and access information almost instantly. Web GIS uses web technologies, including, but not limited to, Hypertext Transfer Protocol (HTTP), Hypertext Markup Language (HTML), Uniform Resource Locator (URL), JavaScript, Web Graphics Library (WebGL), WebSocket, and more.

The first operational GIS was developed in the 1960s by Roger Tomlinson. Since then, GIS has continuously evolved from a local file-based single computer system to a central database-based client/server system, often with multiple servers and many more client computers. The invention of the internet in the late 1950s and the World Wide Web in the early 1990s laid the foundation for an evolutionary leap toward Web GIS. In 1993, the Xerox Corporation’s Palo Alto Research Center (PARC) developed a mapping web page, which marked the origin of Web GIS. In the 2000s, Web GIS evolved into a new generation—a system of distributed web services you can access in the cloud, as represented by the Esri ArcGIS platform.

Inheriting the power of the internet and the web, Web GIS offers many advantages:

- **Global reach:** you can share your geographic information easily within your organization and with people all over the world.
- **Large number of users:** you can share your app with dozens, or even millions, of users supported by the scalable cloud technology.
- **Low cost per user:** the cost of building one Web GIS app is often cheaper than building a stand-alone desktop solution and installing it for every user.
- **Better cross-platform capabilities:** web apps, especially those built with JavaScript, can run on desktop and mobile browsers running a wide range of operating systems, from Windows, Mac OS, and Linux to iOS, Android, and Windows Phone.
- **Easy to use:** Web GIS apps typically incorporate simplicity, intuition, and convenience into their design. Therefore, public users can use these apps without having prior knowledge.
- **Easy to maintain:** web clients can benefit from the latest program and data updates each time they access a web app. The web administrator does not have to update all the clients separately.
GIS is the science about locations, or The Science of Where™. The term has two meanings. One meaning is that GIS is itself a science, as the scientific basis for GIS technology. The other meaning is that GIS has been used for science as an effective tool for making scientific discoveries. The Science of Where is now recognized as a force for solving problems and understanding our world. Web GIS takes the science to a whole new scale, transforming how we share and collaborate, and revealing deeper insight into data. Web GIS unlocks and delivers the science to offices and homes and puts GIS technology in the hands of billions of people. Web GIS demonstrated immense value to government, business, science, and daily life. Recently, the concept and importance of spatial location has become more mainstream, and Web GIS awareness is growing more prominent in many organizations.

- **For government**: Web GIS offers an ideal channel for sharing public information services and delivering open data, an engaging medium for encouraging public participation, and a powerful framework for supporting decision making.
- **For business**: Web GIS helps create novel business models and reshape existing ones. It enhances the power of location-based advertising, business analysis, and volunteered geographic information, generating tremendous revenue, both directly and indirectly.
- **For science**: Web GIS creates new research areas and renews existing avenues of research.
- **In daily life**: Web GIS helps people decide where to eat, stay, and shop, and how to get from here to there.
ArcGIS is a Web GIS platform

Web GIS is central to Esri’s strategic direction for implementing GIS as a platform. ArcGIS represents a cutting-edge and complete Web GIS platform that enables users to easily discover, use, make, and share maps from any device, anywhere, anytime.

ArcGIS is a new generation Web GIS platform that provides mapping, analysis, data management, and collaboration.

At the center of this Web GIS pattern is a portal, namely ArcGIS Online or Portal for ArcGIS, which represents a gateway for accessing all spatial products in an organization. The portal helps organize, secure, and facilitate access to geographic information products.

- Client applications on desktops, web apps, tablets, and smartphones interact with the portal to search, discover, and access maps and other spatial content.
- In the back-office infrastructure, the portal is powered by two components: GIS servers and ready-to-use content.

Web GIS deployment models

The ArcGIS Web GIS platform offers three deployment models.

- The **online model** uses only ArcGIS Online, the cloud-based Web GIS offering, in which all components are hosted in the public cloud. There is no hardware infrastructure for an organization to maintain because Esri manages and maintains ArcGIS Online.
- The **on-premises model** uses only ArcGIS Enterprise. Organizations manage the hardware and software infrastructure by themselves to implement the Web GIS platform. ArcGIS Enterprise includes four software components: Portal for ArcGIS, ArcGIS® Server, ArcGIS® Data Store, and ArcGIS® Web Adaptor. ArcGIS Enterprise has additional server roles such
as ArcGIS® GeoEvent™ Server, ArcGIS® GeoAnalytics™ Server, ArcGIS® Image Server, and ArcGIS® Business Analyst™ Server. Later chapters will have more details on these software components and server roles.

- **The hybrid model** combines parts of the online-based model with parts of the on-premises model. Hybrid deployment is by far the most common Web GIS deployment pattern. Details of such a model depend on an organization’s business workflows and security requirements.

ArcGIS Web GIS platform can be deployed in three models. The dotted dash line represents the boundary between Esri-owned infrastructure and customer-owned infrastructure.

Compared to ArcGIS Enterprise, ArcGIS Online provides more ready-to-use contents, such as ArcGIS® Living Atlas of the World, and more ready-to-use-analysis services that are supported by these contents. ArcGIS Enterprise with its various license roles allows users to create more types of services than ArcGIS Online can create. But in general, ArcGIS Online and ArcGIS Enterprise share similar capabilities and similar workflows for creating services, web maps, and web apps. The tutorials in the book apply to both ArcGIS Online and ArcGIS Enterprise unless specifically stated.

**Technology evolution and trends in Web GIS**

Since its inception, Web GIS has been coevolving with geographic science and information technology. These evolutions and trends will be discussed in greater detail in later chapters.
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ArcGIS Web GIS platform coevolves with geographic information science and information technology.

Web GIS has exemplified the following evolution of stages and trends in technologies:

**From closed websites to open geospatial web services**

Early Web GIS applications were developed as independent websites. These websites were isolated from each other. It was difficult to share information and functions between them, and difficult to remix the websites to create new applications. In the later 1990s, web services technology was conceived. Web services can be thought of as building blocks that can be shared and remixed in versatile ways for building web applications. The GIS industry adopted the concept of web services in manufacturing Web GIS products. For example, ArcGIS Web GIS products fully support the web services architecture: server side provides ready-to-use services and allows users to create their own services; client side can consume and combine these services to create applications.

**From one-way to two-way information flow**

Early Web GIS products and applications mainly supported one-way information flow, which was from server side to client side. Users were merely the receivers of information. As time entered the new century, user-generated content (UGC) became a significant phenomenon and created a reversed information flow, from client side to server side. Volunteered geographic information (VGI) is the UGC of a geospatial nature and this was supported by Web GIS products. For example, ArcGIS facilitates VGI through editable feature services and hosted feature layers, mobile GIS apps, and browser-based apps. Users can view maps and perform queries, as well as conduct field surveys, collect data, and report events they saw. VGI provides unique values and perspectives to global observation, information sharing, and public engagement.
Portal technology is becoming essential
The word “portal” means gate or entrance. It was adopted in the mid-1990s to form new terms such as “web portals,” referring to websites that serve as the gateway to other websites. Geoportals are gateways to geospatial information. They serve as the gateway or bridge between Web GIS servers and clients. Portals have become a core component of Web GIS technology. For example, ArcGIS Online and Portal for ArcGIS have geoportal capabilities. They facilitate the management, search, discovery, configuration, security, and remix of GIS data layers and services. Today, portals of different organizations can collaborate as hosts and guests, creating a “portal of portals” by using a distributed Web GIS pattern.

Cloud GIS accepted as the primary way to deliver GIS functions and ready-to-use contents
Cloud GIS, utilizing public and private cloud computing to provide GIS software and contents, has become the primary way to deliver GIS, not just functions, but also contents. Because of the vast contents and functions available from cloud GIS, the flexible pay-as-you-go or subscription-pricing model, and the reduced complexity and increased availability of services, cloud GIS, such as ArcGIS Online, has penetrated organizations that have not used GIS before or been able to afford GIS on their own.

Mobile is becoming the pervasive Web GIS client platform
As we entered the post-PC era, mobile devices have surpassed desktops and notebooks as the primary platform for accessing online information. Mobile devices are a part of people’s life and work. “Mobile First” was one of the strategies of many industries, including the Web GIS industry. Vendors have given extra attention to mobile GIS. For example, Esri provides numerous mobile native apps and mobile-friendly browser apps to support people’s and organization’s need for mobile GIS. Mobile GIS is also associated with many frontiers in Web GIS, such as augmented reality (AR). AR can superimpose GIS data on top of a user’s camera views and thus can augment a user’s sense of reality. With the rapid advances in mobile GIS, the vision of using GIS for anything, anytime, anywhere, and by anyone is being realized faster than we can imagine.

Map visualization goes from 2D to 3D and virtual reality (VR)
With the increased client-side graphics processing power and the broader support of WebGL, Web GIS products such as ArcGIS Online and ArcGIS Enterprise can create and display thematic and photo-realistic 3D web scenes smoothly. Representing a big step from 2D online maps, 3D web scenes provide web users a more intuitive means to understand their data. 3D scenes are also important for indoor mapping, an ongoing trend in GIS. Even more intuitive than 3D, VR, such as ArcGIS 360 VR, allows users with certain visual wearables to immerse themselves into 3D city models by teleporting to static viewpoints and comparing different urban design scenarios. The immersive experience brings GIS data and geospatial understanding even closer to users.
Data source goes from static to real time and spatial temporal big data
Many elements in Web GIS are of a real-time nature, such as the incidents immediately reported by field crews or citizens using mobile devices, the concurrent measurements from sensor networks and smart cities. This massive amount of data presents challenges in real-time intake, processing, analysis, visualization, and storage. ArcGIS GeoEvent Server and the ArcGIS Trinity project utilize cluster computing and can ingest thousands and millions of sensor readings per second, process them, and store them in real time. Such products and research allow Web GIS to meet the requirements of the Sensor Web interface and the Internet of Things (IoT).

Web GIS becomes smarter and more intelligent
Map visualization is the first step toward data analysis. Online mapping becomes smart today. ArcGIS Smart Mapping can analyze the data automatically and suggest the best mapping style and the best defaults. This can help users, experts or novice, create beautiful and informative maps quickly. Web GIS goes far beyond mapping. ArcGIS GeoAnalytics Server can perform big data analysis using distributed computing, aggregate data in the context of both space and time, extrapolate new ideas from raw data, and bring superior intelligence to business decisions. More recently, Web GIS has started to use machine learning and artificial intelligence. For example, machine learning significantly improved the accuracy of online imagery classification. Artificial intelligence has been able to quickly identify the damaged locations from millions of facilities’ photos, and ensure the damaged facilities are repaired early.

Paths to building Web GIS applications
The tutorials in this book teach readers how to build Web GIS apps. The ArcGIS suite of Web GIS products offers many paths to this goal.
ArcGIS offers many ways to build web applications. The green lines in the figure highlight the technology presented in this chapter.

The previous figure presents the three basic tiers in Web GIS architecture and the generic workflow to build Web GIS apps:

- The data tier (on the left side of the figure) contains formats that range from simple CSVs managed with Microsoft Excel to sophisticated geodatabases managed with enterprise databases. This allows you to create map documents, toolboxes, and 3D scenes in ArcGIS Desktop software, especially ArcGIS Pro.
- In the middle tier of the figure, you can publish desktop resources to ArcGIS Online or ArcGIS Enterprise as several types of web layers and services. You can then add these layers and services to 2D web maps and 3D web scenes.
- Options for the presentation (or client) tier on the right side of the figure are essential apps. Apps range from ready-to-use ones that can be configured without programming to custom ones that use various web application programming interfaces (APIs) or software development kits (SDKs) to meet special requirements.
Start with ArcGIS Online

Cloud computing is based on the idea that many of the computing tasks that individual computers handle locally could operate more efficiently using huge computer centers connected through web technologies and provided as web-based services. Cloud GIS uses cloud computing technology to deliver GIS capabilities. This has helped users lower costs, reduce complexity, and quicken scalability.

ArcGIS Online (www.arcgis.com) is a cloud GIS. With ArcGIS Online, you can use and create web maps and scenes; access ready-to-use maps, layers, and analytics; publish data as web layers; collaborate and share maps; access maps from any device; and create apps from your maps. ArcGIS Online is a cloud GIS that provides the following services:

- **Infrastructure as a Service (IaaS):** you can upload your data and publish web layers to ArcGIS Online and host them on the ArcGIS Online infrastructure, which sits on top of Amazon EC2 (Elastic Compute Cloud) and Microsoft Azure. In this perspective, you would use the ArcGIS Online infrastructure, such as storage, CPU, and bandwidth.

- **Platform as a Service (PaaS):** you can build Web GIS apps without programming by using configurable apps or with programming by using ArcGIS® web APIs and ArcGIS® Runtime SDKs. In this perspective, you would use ArcGIS Online as a development platform for creating apps.

- **Software as a Service (SaaS):** you can use the rich collection of basemaps, thematic layers, analytical capabilities, and the countless and ever-increasing number of apps that are hosted in ArcGIS Online and published by Esri and its user communities. These capabilities are provided as a service from the cloud.

**Adoption of ArcGIS Online and its quality of service**

Before organizations add cloud GIS to their enterprise architecture, they first must assess the quality of services (QoS) of the cloud GIS. The following main factors represent QoS:

- **Performance:** How efficiently the system responds to user requests, usually measured in response time.
- **Scalability:** The ability to support a growing number of users without dramatically reducing performance.
- **Availability:** A measure of how often a system is accessible to end users, often measured in the percentage of time—for example, 99.99 percent.
- **Security:** The ability to provide confidentiality and secure access by authenticating the parties involved, encrypting messages, and providing access control.

ArcGIS Online provides reliable and trustworthy services in the four aspects listed. Based on many servers in the cloud and the use of high-performance computing technologies, ArcGIS Online hosts tens of millions of content items, millions of registered users, and responds to thousands of requests per second with fast performance, high scalability and availability. You can monitor ArcGIS Online availability in its health dashboard (http://doc.arcgis.com/en/trust/system-status). ArcGIS Online follows a robust and effective framework to enforce security and
protect user privacy. ArcGIS Online is certified as compliant with many federal and international security and privacy standards (see more information at http://doc.arcgis.com/en/trust/compliance/compliance-tab-intro.htm). Because of the benefits of cloud computing and because of its high QoS level, ArcGIS Online has been quickly adopted by numerous government and commercial organizations around the world, from local to national governments as well as oil and gas, education, healthcare, law enforcement, banks, retailers, and more.

**Web GIS information model**

The ArcGIS Online information sharing model has elements that include users, groups, content, and tags.

- Users can create and join groups.
- Users sign in to create and share content items, which can be a large variety of data, layers, and web maps and apps.
- Content items have tags. Tags are indexed so users can search and discover items more efficiently.
- Users can keep information to themselves, share with certain groups (not with individual users), share with their organizations, or share with everyone—the public. This allows other users to see and access the items. ArcGIS supports a variety of sharing levels.

**Types of user accounts**

ArcGIS Online and ArcGIS Enterprise support anonymous users, public users, and organizational users. Anonymous users can access the content shared with the public, if an organization has enabled anonymous access. Public users have limited abilities when creating and sharing content. Organizational accounts have levels, roles, and privileges.
There are two levels of organizational user accounts. Level 1 accounts are viewers only. Level 2 accounts can view, create, and share content. A role defines the set of privileges assigned to a member. ArcGIS defines a set of privileges for four default roles. Organizations may refine the default roles into a more fine-grained set of privileges by creating custom roles.

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<th>Privileges of anonymous users and default roles</th>
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<tr>
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<td>Use maps and apps shared with them.</td>
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<tr>
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<tr>
<td>Join groups with update capability; use subscriber content, spatial analysis, and GeoEnrichment; create content and groups; share maps, apps, and scenes; edit features.</td>
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<tr>
<td>Publish hosted web layers; perform analysis.</td>
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<tr>
<td>Manage user accounts; manage organizational settings; create custom roles; set up enterprise log-ins; disable multifactor authentication on member accounts; manage credit budgets; view subscription status; create and own groups that allow members to update all items in the group.</td>
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Main types of content items in ArcGIS Online

Five main types of content in ArcGIS Online relate closely to this book’s main goal—learning how to build Web GIS apps.

Typically, a web app comprises one or more web maps, which in turn include or reference one or more layers.

- **Data**: ArcGIS Online supports data in a variety of formats, including CSV, TXT, Shapefile, GPX (GPS Exchange Format), and geodatabase.
- **Layers**: ArcGIS Online can host layers including the aforementioned data and can reference layers that include feature layers, tiled layers, vector tiles, map image layers, image layers, stream service layers, KML, GeoRSS, WMS, WFS, WMTS, and so on.
- **Web maps and scenes**: These maps interactively display geographic information that you can use to answer questions. A web map or scene (the 3D counterpart to a web map) comprises or references one or multiple layers.
- **Tools**: These tools perform analytical functions, such as geocoding, routing, generating PDFs, summarizing data, finding hot spots, and analyzing proximity.
- **Web apps**: Apps are the face of Web GIS and they are what brings Web GIS to life. Developers can program with ArcGIS web APIs to build web apps. However, you do not have to be a developer to create a web app. ArcGIS provides many templates that you can use to create impressive web apps without any programming.
Steps to creating Web GIS apps

Here is the typical workflow used to create web apps using ArcGIS Online or ArcGIS Enterprise:

1. Define the objectives of your information product.
2. Search for data layers in ArcGIS Online, ArcGIS Open Data (http://opendata.arcgis.com), your organization’s ArcGIS Enterprise, and/or publish your data, maps, and toolboxes as web services or web layers.
3. Create and share your web map using the map viewer.
   - Add the layers you found and/or created to your web map.
   - Symbolize the layers (for some types of layers only) and configure pop-ups.
   - Save and share your web map.
4. Create and share your web app.
   - Browse the configurable apps to find a template that best suits your needs, and then use it to transform your web map into a web app. If no templates meet your requirements, use ArcGIS web APIs or Runtime SDKs to create your own app. After it is created, your app is private. You need to share it for others to search, discover, and use. There are different sharing levels.

ArcGIS Online and ArcGIS Enterprise allow users to easily create web maps by assembling various formats of layers and to create web apps from web maps by applying app templates.

Esri Story Map Tour

Story Map Tour is one of the most popular templates in ArcGIS Online. See two screen captures of the template in the figure and live samples at http://arcg.is/2wOWLo2 (short for http://storymaps.arcgis.com/en/gallery/#s=0&md=storymaps-apps:map-tour).
The Story Map Tour template produces attractive, easy-to-use web apps that help you present geographic information with compelling photographic and video story elements. The template layout automatically rearranges itself to adapt to various screen sizes and can display a set of places on a map in a numbered sequence made for browsing. The template is designed for use in web browsers on the desktop, smartphones, and tablets.

Many scenarios benefit from this template:

- Show the world the work your government department, organization, or agency is doing or has done.
- Showcase key attractions of a city or region.
- Introduce a park and its features.
- Provide a tour of a campus, an outdoor art collection, or a historical district.
- Educate people about areas of scientific or geographic interest.
- Direct public attention to places you want to improve or protect.
- Create online photo or video journals of a trip or event.
This tutorial

In this tutorial, you will create a Web GIS app that introduces the main points of interest (POIs) in the City of Redlands, California.

Data: A CSV file contains data for the main POIs in Redlands, including longitude, latitude, names, descriptions, photo or video URLs, and thumbnail URLs.

The sample data for this entire book are available at esri.com/gtkwebgis3. Windows users can extract the files to C:\EsriPress. Mac users can create an EsriPress folder under your home directory and extract the files there. If you are in class, follow your instructor’s instructions to download the data.

Requirements:

• Your web app should display a basemap (a street map or satellite imagery) of the city and POI locations, along with their descriptions and photos or videos.
• The web app is engaging and easy to use.
• The web app should work on desktops, tablets, and smartphones.

System requirements:

• Microsoft Excel or a text editor to create and edit your CSV data.
  • CSV easily represents points, though not complex geometric forms such as lines and polygons.
  • Excel automatically maintains correct CSV format (for example, adding correct quotes).
• A web browser.
• ArcGIS Online or Portal for ArcGIS.
  • A publisher or administrator level account: If your organization offers ArcGIS Online for Organizations or Portal for ArcGIS, ask your administrator or instructor to create an account for you. Otherwise, create a free trial account. Creating a trial organizational account will make you the administrator of the organization, which will allow you to create hosted feature layers.
• Note to instructors: Optionally, you can create a group for your students in which they can share their work with other members.
1.1 Create an ArcGIS Online trial account

You will skip this section if you already have an account for ArcGIS Online or Portal for ArcGIS. If your organization has ArcGIS Online for Organizations or Portal for ArcGIS, please ask your administrator or instructor to create an account for you.


2. Fill out the Sign Up for the ArcGIS Trial form:
   - Input your name, email, and other requested information.
   - Click Start Trial to submit the form. You will know the form has submitted correctly when a new page comes up that reads, “Confirmation email sent!”

Esri will send you a confirmation email for you to activate your account.

3. Check your email and click the activation URL link in the Activate Your Free ArcGIS Trial email.

4. On the activation page, fill in the fields, accept the terms and conditions, and click Create My Account.

Having created an ArcGIS Online for Organizations trial account, you have been made the administrator for your organization. You will be directed to the Set up Your Organization page.

5. On the Set up Your Organization page, fill in the fields. Then click Save and Continue. (Do not select Allow access to the organization through HTTPS only.)

Refer to the “Questions and answers” section for details on the HTTPS only option.

6. If prompted with the pop-up window asking if you want to download ArcGIS Pro and other software, click Continue with ArcGIS Online.

You will need ArcGIS Pro later in this book, but not now.

7. Click the Organization tab, click Editing Settings, click Security, and select Allow anonymous access to your organization’s website.
This setting will allow your instructor to see your homework anonymously. Otherwise, your instructor will need to have an account in your trial organization to see your layers, maps, and apps.

8. Click Save.

You have successfully created your trial organization account.

1.2 Create a hosted feature layer

Certain configurable apps require certain kinds of data content. The Story Map Tour template, for example, requires a layer of points. The layer should have the locations, captions, descriptions, photos or videos, and thumbnails associated with the tour points. You can organize your data in a CSV or point shapefile, feature service, map service, or other formats. This section will create a hosted feature layer for using in the web map and web app.

1. If you have not already done so, navigate to esri.com/gtkwebgis3, or follow your instructor’s directions to download the sample data for this book. Extract the files to C:\EsriPress on a PC or to EsriPress under your home directory on a Mac.
This tutorial works for both PCs and Macs, though the lab data directories differ on them. To simplify the tutorial instructions, the following tutorial mentions the data directory on the PC only.

2. In Microsoft Excel, navigate to C:\EsriPress\GTKWebGIS\Chapter1\Locations.csv, and study its data format.

<table>
<thead>
<tr>
<th>Name</th>
<th>Caption</th>
<th>Icon_color</th>
<th>Lat</th>
<th>URL</th>
<th>Thumb_URL</th>
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</thead>
</table>
| Welcome to the City of Redlands | Located about 90 miles east of Los Angeles, replete with cultural, artistic and historical sites. Redlands, emerging as a regional leader, boasts small-town charm, and features a world center of geospatial information technologies. | R          | -117.382421 | https://geopedrive.com/hsd/06Bläänen7VjHf4eA5 | https://geopedrive.com/hsd/06Bläänen7VjHf4eA5#
| Eurl                           | Eurl is a world leader in GIS software. Founded by Jack and Laura Dangermond in 1989, Esri now has 10 regional offices in the U.S. and a network of 80 international distributors, with about a million users in 200 countries. | R          | -117.395588  | https://geopedrive.com/hsd/06Bläänen7VjHf4eA5 | https://geopedrive.com/hsd/06Bläänen7VjHf4eA5#

This file has the main POIs in the City of Redlands. You will examine the sample data to familiarize yourself with the required fields. The first row of your spreadsheet provides the header. Below that, each row contains one tour point. For each point, the Story Map Tour template expects the following fields:

- **Name:** A short name identifying the point.
- **Caption:** A description of the point. Keep it short (less than 350 characters is recommended). The caption can include HTML tags to format the text or provide hyperlinks.
- **Icon_color (optional):** The color of each point. The valid values—R, G, B, and P—indicate red, green, blue, and purple, respectively.
- **Geographic Location:** You can describe geographic location by specifying longitude and latitude as Long and Lat (in decimal degrees), a single Address field containing a complete street address, or multiple fields (such as Address, City, State, and ZIP). This tutorial uses Long and Lat.
- **URL:** The full web address for the full-size image or video, starting with http://, https://, or //. The recommended image size is 1000 × 750 pixels, but other sizes will also work.
- **For videos:** The template does not include a generic video player. Instead, you will use the URL that a video hosting service, such as YouTube, provides for embedding videos via a link. You will append #isVideo to the end of the URL (for example, http://www.youtube.com/embed/RM0eMdKPhE8#isVideo). For YouTube videos, you will right-click the video being played, click Copy Embed Code, paste the code into Notepad, find the URL in the code, and append #isVideo to the end of the URL.
  - To use photos or videos on your computer, you must first upload them to some form of online storage, such as Flickr, YouTube, or your own web server.
  - If you have not yet collected your own images and videos, you can search for media through search engines and then copy their URLs. For images: Right-click an image. Select Copy Image Location in Firefox or Copy Image URL in Chrome. For Internet Explorer, select Properties and then copy the image address URL.
• **Thumb_URL**: The full web address of the thumbnail image (starting with http://, https://, or //). Images can fit to scale, but the recommended image size is 200 × 133 pixels.

3. Open a web browser, navigate to ArcGIS Online ([www.arcgis.com](http://www.arcgis.com)) or your Portal for ArcGIS, and sign in.

![ArcGIS Online Navigation](image)

You can familiarize yourself with the links at the top of the page:
- Home returns to the homepage.
- Gallery leads to featured maps and apps.
- Map goes to ArcGIS Map Viewer.
- Scene goes to ArcGIS Scene Viewer.
- Groups takes users to the My Groups page where you can create and join groups.
- Content links to the Content page, where you can see your own content, your groups’ content, and your organization’s content that are shared with you. Users with corresponding privileges can add and delete content items.
- Organization leads you to a page about your organization. If you are an administrator of your organization, the page includes tools you can use to manage your organization.
- In the upper-right corner of the page, the Search box and button allow you to search for content in the ArcGIS Online catalog.

4. Click Content.

5. Click Add Item +, and then click From my computer.
6. In the Item from my computer window, perform the following tasks:
   • For File, browse to C:\EsriPress\GTKWebGIS\Chapter1\Locations.csv, and click it. If you have published a file of the same name to your content before, rename your Locations.csv file to a unique name, and then select it.
   • For Title, use the default, or specify a new one.
   • For Tags, specify keywords, such as Redlands Tour, GTKWebGIS, and your organization name, as illustrated. Separate the keywords with commas.
   • Make sure the check box next to Publish this file as a hosted layer remains selected.
   • Leave the Use Latitude/Longitude option selected.
   • Review the field types and location fields.
   • Click Add Item.
Among the tags, GTKWebGIS stands for the title of the book. This tag indicates this item is based on the tutorial from this book.

The item details page appears as your CSV file is being published as a hosted feature layer. Each item in ArcGIS Online and Portal for ArcGIS includes an item page with a variety of information, actions, options, and settings organized by tab: Overview, Data, Visualization, Usage, and Settings. The tabs you see, as well as the options and information available on the tabs, depend on the item type, your privileges, and whether you are the item owner or administrator.

7. Click each tab to familiarize yourself with the tabs on the item details page.

- The **Overview** tab includes overview information about an item, such as a description, tags, data source information, creation date, size, and sharing status. The tab also includes options to open, add to favorites, share the item, edit metadata, and add ratings and comments.
- The **Data** tab allows you to view, sort, and edit—if you are the item owner or the administrator—the attribute data of feature layers.
- The **Visualization** tab allows you to change default properties such as style, filter, pop-ups, and labels, of a feature layer without having to open the layer in map viewer.
- The **Usage** tab allows owners and administrators to see the usage statistics of the layer over time.
- The **Settings** tab allows editors and administrators to enable editing and configure other related settings for a feature layer.

8. Click the Overview tab, click Share, share your layer with Everyone (public), and click OK.
This way, your web users can use your feature layer without having to log in.

In this section, you have created a feature layer, which will be used in the web map and web app you will be creating in the following sections.

### 1.3 Create a web map

You will make sure you are signed in before continuing with the remaining steps. Otherwise, you will not be able to save your web map and may lose your work. If you are not continuing from the last section, sign in to ArcGIS Online or your Portal for ArcGIS, go to your content, find and click the feature layer you created in the previous section.

1. Continuing from the last section, on the item details page of your feature layer, click Open in the Map Viewer drop-down list, and choose Add to new map.

   ![Open in Map Viewer](image)

   This button has two options. You can Add to new map or Add to new map with full editing control. The latter allows owners and administrators to edit the layer data and schema. You don’t need to edit the layer here. Either option will direct you to the map viewer. The locations of your data are displayed on the map automatically.

2. Familiarize yourself with the map viewer menu bar.

   ![Map Viewer Menu Bar](image)

   The ArcGIS Online map viewer helps users create, customize, and view web maps. On the menu bar, you will see the following buttons:
   - The **Details** button **Details** toggles the panel on the left side of the web map canvas. This panel can display a web map’s metadata, table of contents (TOC), or legend.
   - The **Add** button **Add** is used to add a variety of layers into the web map.
• The **Basemap** button displays a gallery of underlying imagery that users can choose from.
• The **Analysis** button leads to a rich set of analysis functions.
• The **Save** button allows you to save your web map.
• The **Share** button lets you select the people who will have access to your web map and choose how you will share it, either by embedding the web map in a webpage or by creating a web app from a template.
• The **Print** button creates a hard copy of the current map view.
• The **Directions** button can calculate the best route from a starting location to the destinations you specify.
• The **Measure** button helps determine areas, distances, and a location’s longitude and latitude.
• The **Bookmarks** button allows you to save a list of map areas so you can quickly select one and zoom to that map area.
• In the **Find address or place** text box, you can specify an address or place and find its location on the map viewer.

3. If you are prompted with the Change Style pane, click Cancel.

The Map Tour template will use the style defined in the app template. There is no need to configure your layer style.

4. In the Contents pane, point to the Locations Layer, click the More Options button, click Set Visibility Range, set the range to always visible (in other words, from World scale to Room scale).

5. Zoom and pan the map to an extent that you will use as the initial extent of your web app.
6. On the menu bar, click the Save button \(\text{Save} \) and choose Save.

7. In the Save Map window, enter the title, tags, and summary of your web map. Then click Save Map. Leave the web map open.

💡 **Tip:** For your homework, include your name in the title or tags, and include your university or organization name in the tags so that you and your instructor can easily identify your web map.

Congratulations! You have created a simple web map.
Typically, users need to configure pop-up windows and sometimes change styles on map layers. You will learn these skills in the next chapter. For this tutorial, the Map Tour template automatically handles the style of your layer, so you do not need to configure pop-ups or change layer style here.

1.4 **Create a web app using a template**

This step will transform your web map into a web app using the Story Map Tour template.

1. Continue from the previous section or sign in to ArcGIS Online or Portal for ArcGIS, and open the web map you just created. In the map viewer, click the Share button \(\text{Share} \) on the menu bar, which opens the Share window.
2. In the Share window, select the check box next to Everyone (public) or next to the check box(es) next to the organization and group(s) with which you would like to share your web map.

![Share window](image)

**Note:** Unless you share your web map and all the layers in the web map with everyone, a prompt will ask users to sign in whenever they open your web map and any web apps that use this map.

3. Click Create a Web App.

The Create a New Web App window opens presenting a gallery of the templates. If your organization has configured custom galleries, you may not see these same configurable apps as the figure.
The templates are grouped and the groups are listed in alphabetical order. You can use the scroll bar to review the full gallery, or you can click a group name on the left to see the templates in this group.

4. Click Build a Story Map group on the left, find and click the Story Map Tour template, and then click Create Web App.

5. Leave the title, tags, and summary information as they are or make appropriate updates, and then click Done.

⚠️ **Note:** The check box, “Share this app in the same way as the map (Everyone),” is selected by default. With this check box selected, your web app will be shared with the public, along with your web map.

You have created your own informative and easy-to-use web app!

6. Click the Settings button, select the Three-panels layout, and click Apply.

7. Spend a few minutes exploring your new web app.
For example, you can navigate through the app’s tour points by clicking the thumbnails, the arrows next to the photos, and the numeric icons on the map. If you click the thumbnail for the University of Redlands, for example, a video introducing the university appears.

Your web app is already created and saved. You will further configure it in the next section.

1.5 Configure your web app

Once you have determined that your app’s tour points and their order, captions, and descriptions are correct, your app is complete. Optionally, you can enhance your application’s features by using the template’s builder mode. In this mode, you can add or import new tour points; update and delete existing images; set or update locations and descriptions; update the app title, subtitle, and logo; and change the app layout.

1. If you are continuing from the previous section, go to step 3; otherwise, sign in to ArcGIS Online or your Portal for ArcGIS.
2. Click the Content tab, in your content list, find and click the web app you just created to go to its details page, and then click Configure App.

3. Familiarize yourself with the builder mode.
   - The pencil icon means that you can update nearby text, such as titles, subtitles, image captions, and descriptions.
   - The Change media and Change thumbnail buttons can be used to change the URLs of media and thumbnail locations.
   - The Add, Organize, and Import buttons allow you to interactively add more locations, change the order of points, and import media from Flickr, Picasa, Facebook, YouTube, or a CSV file.

Now, you will change the Esri photo into a video.

4. Click the Esri thumbnail image. Click Change media, then click Video. Remove the current URL, enter https://www.youtube.com/embed/RM0eMdrPhEA, and click Apply.

The video loads into the picture frame. Refer to the “Questions and answers” section to learn how to get video URLs for use with the Map Tour template.

Next, you will change the thumbnail for Esri to a new one that indicates a video.

6. Click Save to save your changes.

In the following steps, you should save your work regularly to prevent losing your changes.

7. Above the thumbnail carousel, click Organize.

The Organize the tour window allows you to delete tour points and drag pictures to change their order.

8. At the bottom of the Organize the tour window, select the check box for Use the first point as introduction (does not appear in carousel). Click Apply to close the Organize the tour window.

Selecting the check box sets the first record in your CSV as the introductory image to your app. This selection allows you to start your tour by showing a compelling image and an introductory
caption to set the scene. The location of this record will not be shown on the map as a numbered point in your tour.

Optionally, you can click the Import button next to the Organize button to import tour points and media from Flickr, Picasa, YouTube, or an additional CSV file. You can also add additional tour points manually by clicking the Add button and filling in the media, name, and location information.

9. In the page header, click Settings.

Clicking Settings opens the Story settings window with the following tabs:
- **Layout**: Choose between the Side-panel Layout, Three-panel Layout, and Integrated Layout.
- **Colors**: Choose from predefined color themes or define your own theme.
- **Header**: Set the header logo and share links.
- **Data**: No configuration is needed here. The sample CSV you use has all the fields named properly for the map tour template to use.
- **Extent**: Define the initial map extent that users will see when the app first opens.
- **Zoom Level**: Specify a scale to which the map will automatically zoom whenever the app user goes from one tour point to another (but if users manually zoom in or out, the map tour app respects their choice and no longer applies your auto zoom level).

10. Click the Zoom Level tab and set the Scale/level to 1:5K (level 17) as illustrated.
This scale allows users to see the selected POI and its adjacent area.

11. Click the Header tab, change the logo and text if needed, and then click Apply.

For example, you can add your name to the header so that your instructor can easily tell who created your application. Optionally, you can also exchange the logo for your organization’s logo.

Examine the application to see if there is anything else you would like to configure. If so, you can make and apply further changes.

12. In the page header, click Save to save your work.
1.6 Share your web app

In step 5 of section 1.4, you created and shared this web app with the same people with whom you shared your web map. Now you will share the URL of this web app with your audience so that they can see your web app.

1. Click Share in the page header. If you see a message saying your tour is not shared, share your tour publicly.

2. In the Share your Tour window, click Open to preview your web app.

3. Share the tour URL with your audience (for example, by copying and sending the URL through email, or by displaying the URL link on your organization’s home page).

4. Test your web app on smart mobile devices.

Open your app in your smart device’s browser. To do this easily, send the URL to yourself, check your email on your smart device, find the message, and then click the URL.

Configurable apps use responsive web design technologies and can change their layouts to best fit various devices with different screen sizes. You will find they work well on iOS, Android, and Windows Phone tablets and phones.

In this tutorial, you have created a user-friendly, informative, and cross-platform web app. The app meets all the requirements listed earlier in this chapter—it displays a basemap and POI locations, their descriptions, and any photos or videos; is engaging and easy to use; and works on desktops, tablets, and smartphones.

You can create a map tour app using other workflows. In addition to pictures and videos, you can also display webpages and 3D web scenes. See the Resources section for more information.
QUESTIONS AND ANSWERS

1. How can I get the latitude and longitude coordinates of a location or address?

**Answer:** You can use ArcGIS Online or Portal for ArcGIS map viewer to do so. If you know where the location is, navigate there directly on the map. If not, you can type the address in the map viewer Search text box, and click the Search button. After the address is found and the map is centered to the location, click the zoom in button until you can no longer zoom in. Next, click the Measure button, click the Location button, and then click the location on the map. The location’s longitude and latitude display under Measurement Result.

![Image of Measurement Result](image)

2. Locating longitudes and latitudes manually (one by one) can be slow work. Is there a more efficient way to define the locations of my points?

**Answer:** Use addresses, feature classes, or geotagged media if you have them. In your CSV, specify the addresses of your points in one or multiple address fields such as Address, City, State, and ZIP. When you create your feature layer, ArcGIS Online and Portal for ArcGIS will geocode these addresses and find their locations automatically.

If you have your tour points in a shapefile or file geodatabase, you do not need to create a CSV file. You can zip your shapefile (do not include a folder) or file geodatabase (include the folder of the file geodatabase), and then create your feature layer using this zip file.

If you have geotagged media, for example, photos taken using your smartphone with location enabled for your camera, you can create an empty web map and import these photos using the app builder mode.
3. After publishing my CSV to ArcGIS Online as a feature layer, I need to update my CSV. Will the changes to my CSV automatically update in my feature layer, web map, and web app?

**Answer:** No, but you can overwrite the feature layer, or edit your data directly in ArcGIS Online or Portal for ArcGIS. Once your CSV data has been published to ArcGIS Online, it is uploaded to the cloud. Your feature layer, web map, and web app will use this cloud copy, rather than your local copy. To use your new CSV data, go to the details page of your feature layer, click the Update Date button, select Overwrite Entire Layer to re-create your feature layer using the new CSV. This will preserve your feature layer id, and thus won’t break the web maps and web apps using your layer.

You can also edit data directly in ArcGIS Online or Portal for ArcGIS. You can go to the details page of your feature layer, click the Data tab, and double-click a value in the table to change it. Or you can click the Overview tab, click Open in Map Viewer, select Add layer to new map with full editing control, click the Edit button in the map viewer, click a tour point on the map, and click Edit in the pop-up. Then you can edit the attribute values and move the point on the map.

4. I submitted my homework URL, but my professors can’t access it. Why? How can I fix this problem?

**Answer:** First, make sure your layer(s), web map, and web app for this assignment are all shared with the public. Next, check if your organizational settings allow anonymous access. Refer to step 7 in section 1.1. If you still have the problem, go to [http://storymaps.arcgis.com/en/my-stories/](http://storymaps.arcgis.com/en/my-stories/), sign in, and click the Check Stories button to find the causes.

5. Should I enable my ArcGIS Online organization to use HTTPS only?

**Answer:** It depends. In general, it is recommended that you enable HTTPS only, which gives you enhanced security. If you enable HTTPS only, this implies that all the services and layers that your web maps and apps will be using must be configured to support HTTPS because web browsers do not allow the mixing
of HTTP and HTTPS content. Some organizations still have map services and geoprocessing services running on the ArcGIS Server that doesn’t have HTTPS configured. These services can be loaded via HTTPS. If you will use such services in your web maps and apps, you should disable the HTTPS only option (refer to step 5 in section 1.1).

6. I need to upload my photos to a web server to get their URLs. Is there a web hosting service that you would recommend?

**Answer:** There are many ways to upload and host your photos. Here are a couple easy ways:
- Upload your photos to [https://imgur.com](https://imgur.com), and then find the direct links to each photo.
- Upload your photos to ArcGIS Online. Refer to [https://blogs.esri.com/esri/arcgis/2018/01/05/photos-images](https://blogs.esri.com/esri/arcgis/2018/01/05/photos-images).
- Upload your photos to Flickr, and then import them to your map tour app.

7. I can drag and drop my CSV to the map viewer directly. How does this layer differ from a hosted feature layer?

**Answer:** The former can be used for quick demos of small amounts of data, but it is not recommended in general. The latter has better reusability, supports larger data sizes, and supports more operations.

<table>
<thead>
<tr>
<th>Embedded layers (layers added to web maps directly)</th>
<th>Hosted feature layer and feature service</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Storage</strong></td>
<td>The data is stored or hardcoded in the web map.</td>
</tr>
<tr>
<td><strong>Data size limitation</strong></td>
<td>Limited. Up to 1,000 features per layer, or 250 features per layer if using geocoding.</td>
</tr>
<tr>
<td><strong>Reusability</strong></td>
<td>Not reusable. To use the data in a different web map, you would have to add the CSV to the web map one more time. This essentially creates another copy.</td>
</tr>
<tr>
<td><strong>Capabilities</strong></td>
<td>Doesn’t support query, search, and charting in most ArcGIS client apps such as Web AppBuilder for ArcGIS.</td>
</tr>
</tbody>
</table>
8. It’s slow to upload my photos to a web server and find the latitudes/longitudes of these photos manually. Are there ways to create Story Map Tour apps without me having to upload photos and locating them myself?

**Answer:** This tutorial teaches the generic workflow from data > layer > web map > web app. This workflow is applicable when you create web apps using other templates or app builders.

You can create map tour apps using many other ways, some of which are easier though they are specific to the map tour template. For example, you can use Story Map Tour Builder, and choose to upload your images. This approach will upload your photos for you. If your photos are geotagged, the location of each photo is automatically extracted. Refer to [http://storymaps.arcgis.com/en/app-list/map-tour/tutorial](http://storymaps.arcgis.com/en/app-list/map-tour/tutorial) for more details.
ASSIGNMENT

Assignment 1: Choose from the following topics, and create an app using Esri Story Map Tour to showcase your chosen topic:

- Your personal story (where you were born, where you moved, where you went to school or worked, and so on)
- Your city’s key attractions
- The landmarks, buildings, and departments on your campus
- Places you have visited in the past or during a recent vacation
- Branches of a bank or supermarket in your city or region
- Projects that your organization has accomplished or is working on
- Locations of key environmental interest (for example, largest/oldest trees) or historic interest (for example, oldest houses)
- Other interests

What to submit:

- Your web app URL
Resources


“ArcGIS Online: Sharing Basics,” http://www.esri.com/videos/watch?v=968gWcN1Mk&channelid=UCgDPs8cte-VLJbgpaK4GPw&title=arcgis-online:-sharing-basics (or http://arcg.is/2mtn6EO).


