A topographic map of Utah showing county boundaries and elevation contours. A thick green line outlines a specific region in the central and southern parts of the state, including areas around Salt Lake City and the Great Salt Lake. Elevation markers are scattered across the map, such as 1508 m, 1483 m, 1816 m, 2494 m, 2662 m, 2514 m, 2819 m, 2484 m, 2741 m, 3214 m, 3370 m, 3451 m, and 2038 m. County names like BOX ELDER, CACHE, RICH, UTAH, MORGAN, SUMMIT, DAVIS, and SALT LAKE are visible. Major cities and locations include Brigham City, North Ogden, Ogden, Roy, Hill Air Force Base, Kaysville, Farmington, Salt Lake City, West Valley City, East Millcreek, West Jordan, Riverton, Heber City, and Grantsville. The Great Salt Lake is shown in the western part of the map. A white text box is overlaid on the left side of the map.

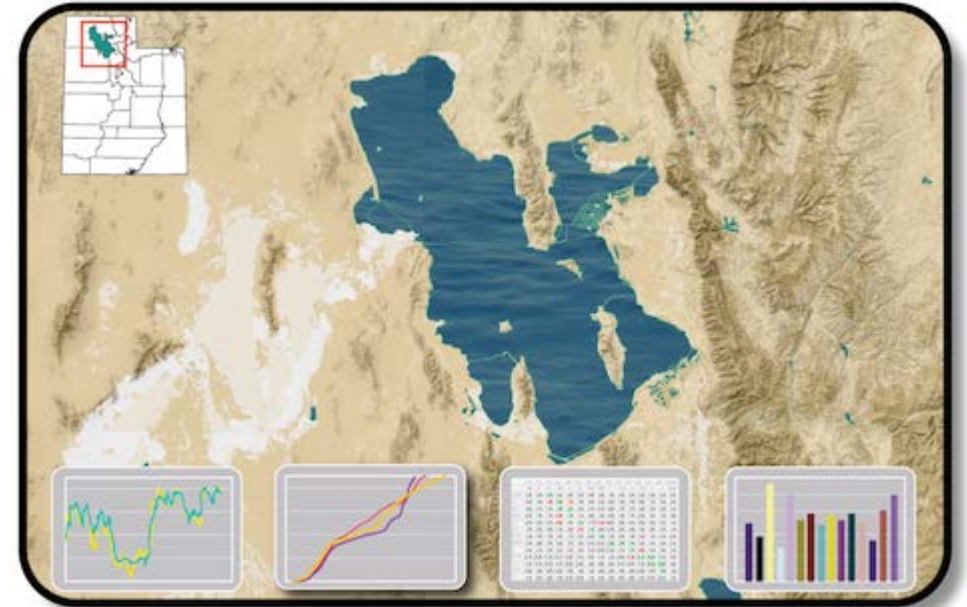
An evaluation of
web mapping functionality
for simple quantitative
hydrologic analysis

Madeline Merck

Motivation → HydroViz

The HydroViz Project:

- *Funding*: NSF TUES grant, multiple Universities
(Transforming Undergraduate Education in STEM)
- *Purpose*: to explore various hydrologic concepts in the context of solving real world problems.
- *Delivery*: case-based, data- and simulation-driven learning experiences in the form of online modules which use data, models and analysis.

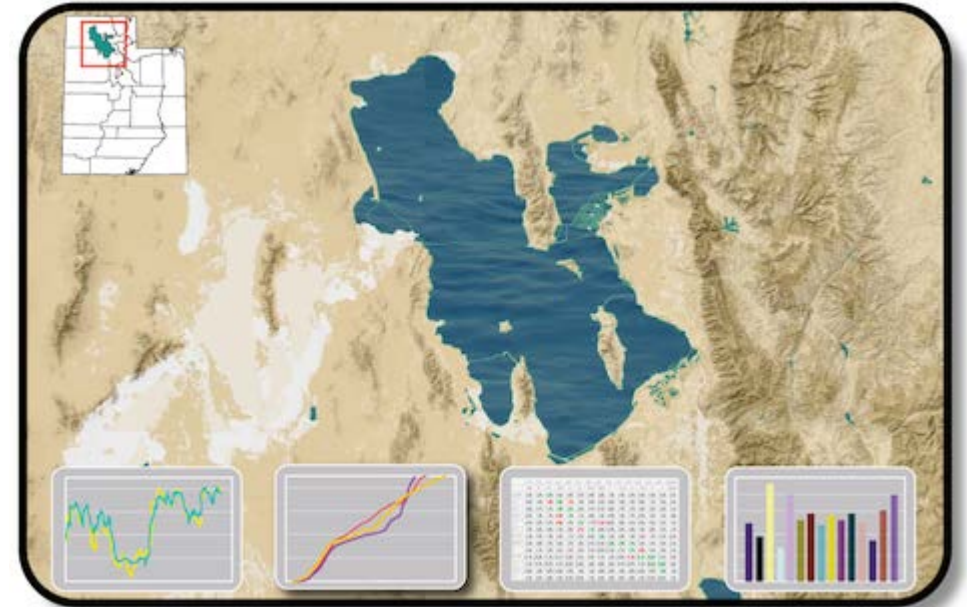


Purpose → Exploration and Evaluation

The Question:

Can the exploration of various hydrologic concepts be facilitated through a **GIS application** that is...

- online
- easily accessible
- free-to-users



Objective → Working GIS Interface

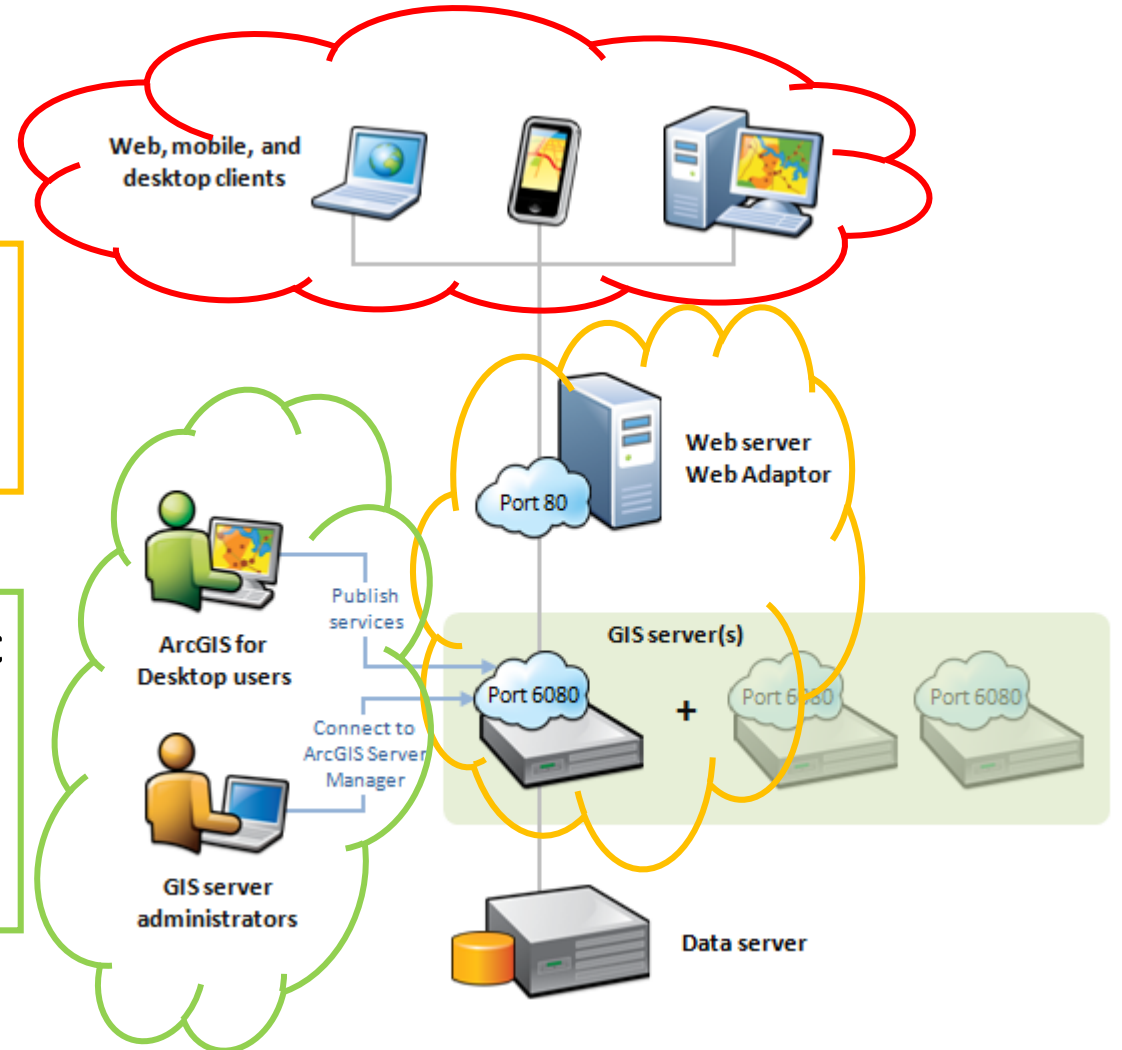
The Overall Goal:

1st → Build the infrastructure

- *Server*: a location to store files and data
- *Web Interface*: an interface to access and manipulate the files and data

2nd → Generate the data and analysis tools

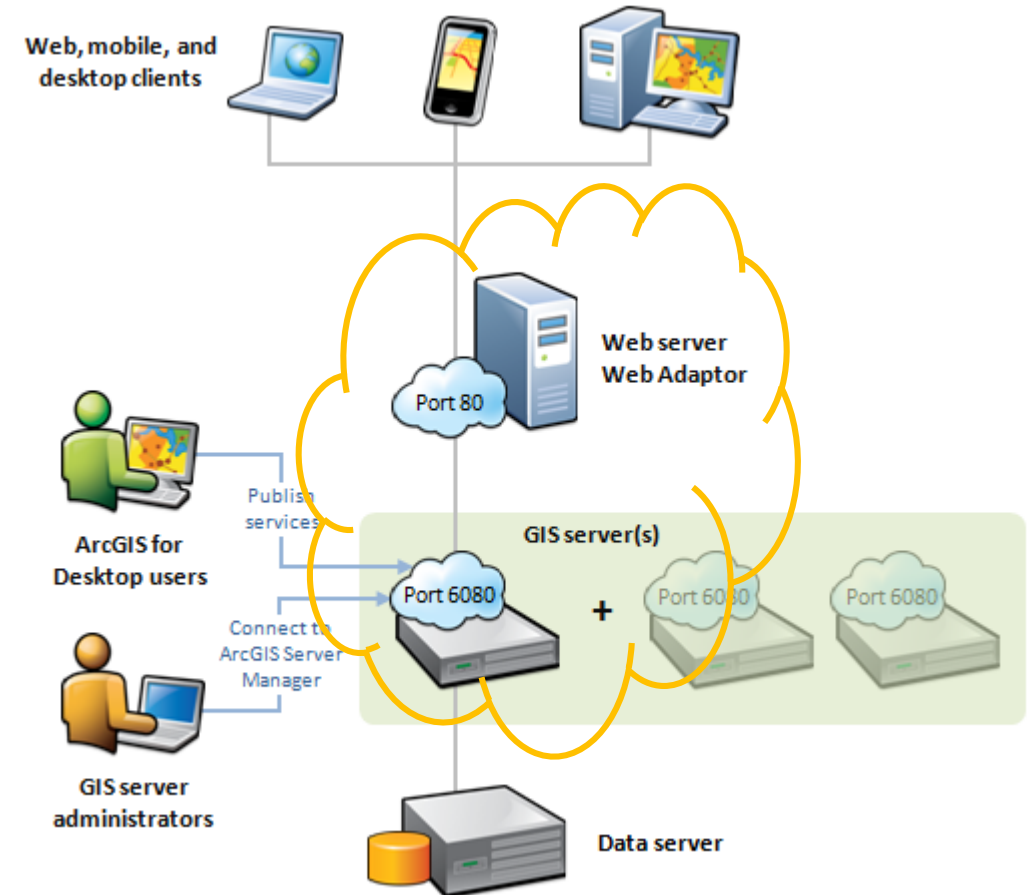
- *Files and Data*: material that is project specific (i.e., supporting data, maps, etc.)
- *Tools*: tools that provide a means to analyze the files and data



Methods → Infrastructure

The Server: a location to store files and data...

- ArcGIS Online (arcgis.com)?
 - No gridded data
 - Few tools
 - Analysis requires special account
- ArcGIS for Server?
 - Completely customizable
 - But a lot more involved...

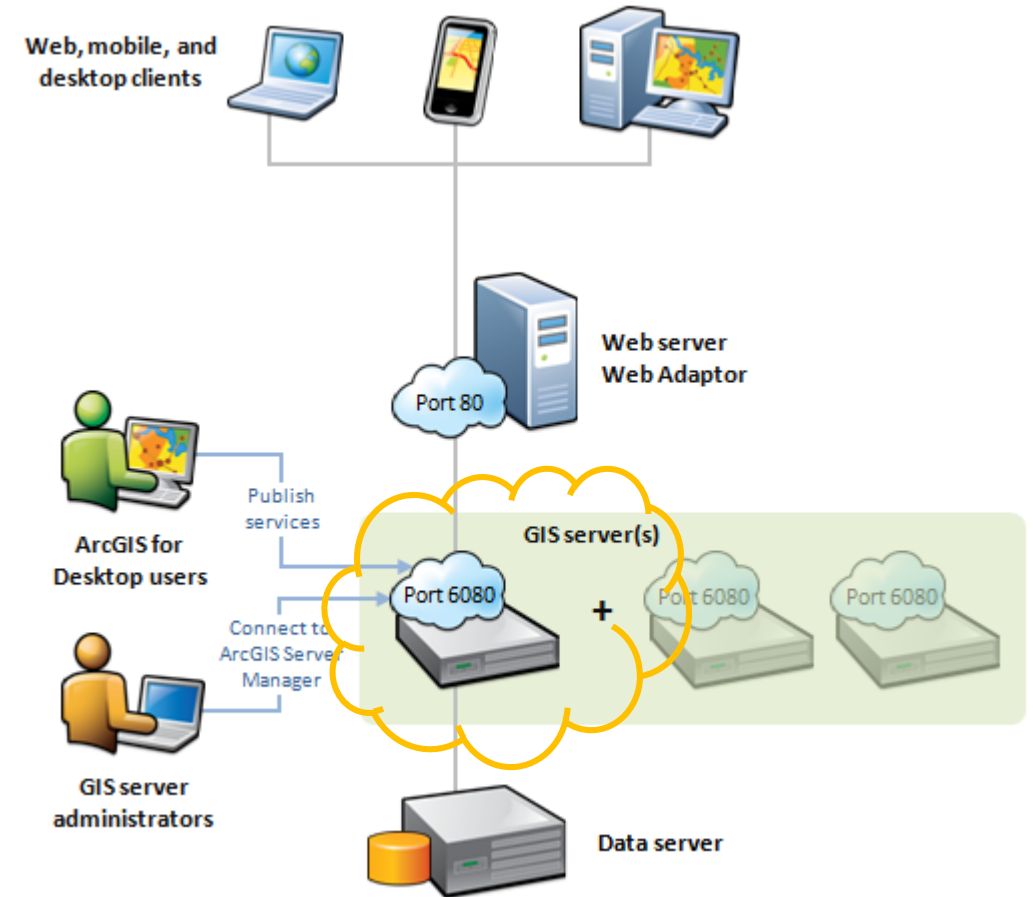


Methods → Infrastructure

The Server: a location to store files and data...

But what, where, and how?

- *What:* ArcGIS Enterprise for Server 10.2.2
 - Requires Windows Server 2008 R2
- *Where:* Virtual Machine at USU
- *How:* ???



Methods → Infrastructure

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ArcGIS Online

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ArcGIS Help 10.2, 10.2.1, and 10.2.2

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www.resources.arcgis.com

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Desktop

Geodata

Services

Introduction

Approaches for publishing services with ArcGIS

ArcGIS for Server (Windows)

Welcome to the ArcGIS 10.2.2 for Server (Windows) Help

Introducing ArcGIS for Server

What is ArcGIS for Server?

Components of ArcGIS for Server

What's included with ArcGIS for Server

Compatibility of ArcGIS 10.2.2 for Server with earlier versions

ArcGIS Server editions

What's new in ArcGIS Server

Migrating ArcGIS Server 10.0 to later versions

Tutorials

Publishing services

Creating web applications

Administering ArcGIS for Server

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Common problems and solutions

ArcGIS for Server (Linux)

ArcGIS Server on Amazon Web Services

What is ArcGIS for Server?

Services » ArcGIS for Server (Windows)

ArcGIS for Server is software that makes your geographic information available to others in your organization and optionally anyone with an Internet connection. This is accomplished through web services, which allow a powerful server computer to receive and process requests for information sent by other devices. ArcGIS for Server opens your GIS to tablets, smartphones, laptops, desktop workstations, and any other devices that can connect to web services.

To get started with ArcGIS for Server, you'll need to prepare your hardware, software, and data, then you can set up GIS web services. Finally, you can use various types of applications to consume your services.

Preparing hardware, software, and data

The hardware you use for your server is typically more powerful than your other desktop computers. ArcGIS for Server requires a machine capable of running a 64-bit operating system. The ArcGIS for Server architecture is scalable, meaning you can add multiple machines if extra processing power is needed.

Depending on organizational requirements, you may need the help of your IT staff to allow your server to be accessed over the Internet. When planning your hardware and environment, remember that ArcGIS for Server can also be deployed on virtual machines or commercial cloud platforms such as Amazon EC2.

Once you install ArcGIS for Server, you can start using it right away or you can integrate it with your organization's existing web server by installing the ArcGIS Web Adaptor. You also need to have ArcGIS for Desktop on at least one computer in your organization in order to publish GIS web services. This computer does not have to be the server.

Publishing GIS web services

If you've worked with ArcGIS for Desktop, then you know how to use applications like ArcMap and ArcGlobe to view and analyze GIS data. You use these same applications when publishing web services to ArcGIS for Server. You can author maps, geoprocessing models, mosaic datasets, and other GIS resources in ArcGIS for Desktop and use a simple wizard to share them as web services.

As part of the sharing process, ArcGIS alerts you to potential performance issues in the resource you are publishing. It also checks its list of registered data locations to understand whether it needs to fix any paths after your resource is moved to the server.

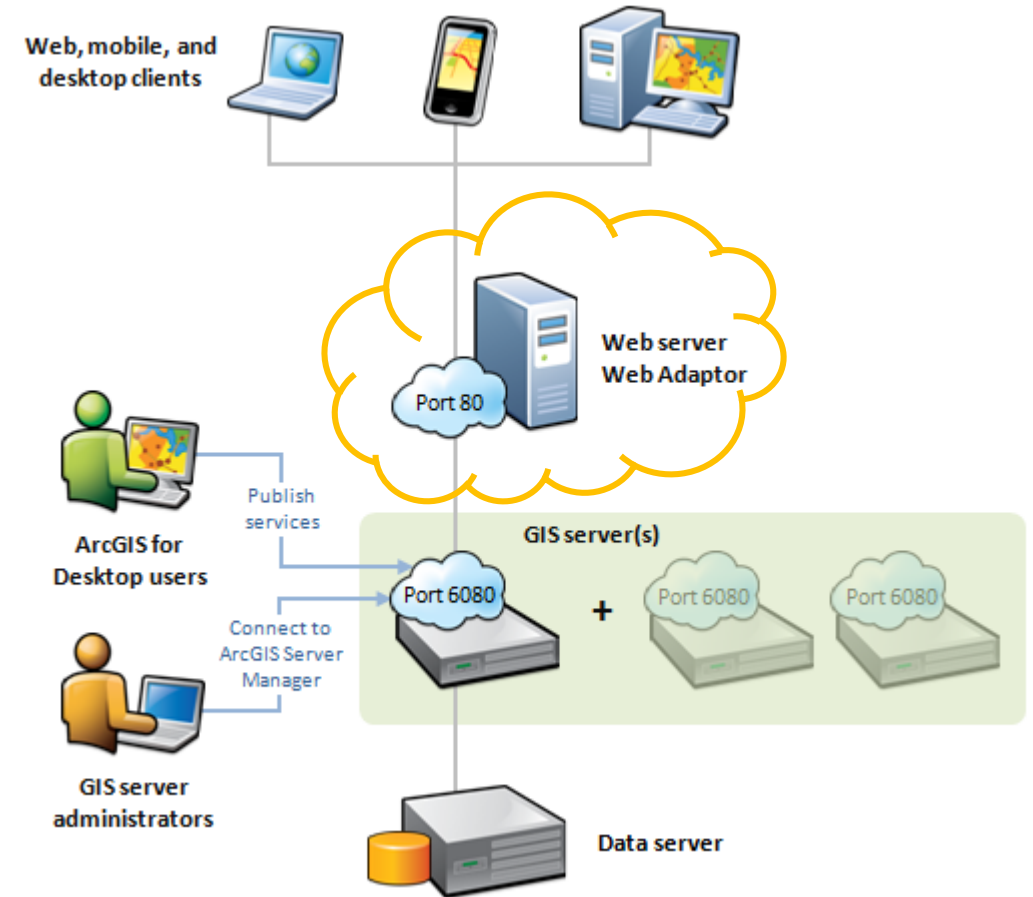
Below are the types of resources you can publish to ArcGIS for Server.

Methods → Infrastructure

The Web Interface: accessing and manipulating the files and data...

Three options for developing the site:

- ESRI's interface (arcgis.com)
- ESRI's templates
- Completely custom



Methods → Infrastructure

ArcGIS for Developers ▾

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ArcGIS API for JavaScript

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[Customize navigation animation](#)

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[Locate Button](#)

Basemap Toggle

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www.developers.arcgis.com



Description

Toggle between basemaps using the BasemapToggle widget. When creating the widget define a basemap that users will be able to switch to from the current basemap. Note: At version 3.7 the widget does not work with maps created from web maps using createMap.

Code

```
<!DOCTYPE HTML>
<html>
<head>
  <meta charset="utf-8">
  <meta name="viewport" content="initial-scale=1, maximum-scale=1,user-scalable=no">
  <title>Basemap Toggle</title>
  <link rel="stylesheet" type="text/css" href="http://js.arcgis.com/3.11/esri/css/esri.css">
  <style>
    html, body, #map {
      padding:0;
      margin:0;
```

Methods → Infrastructure

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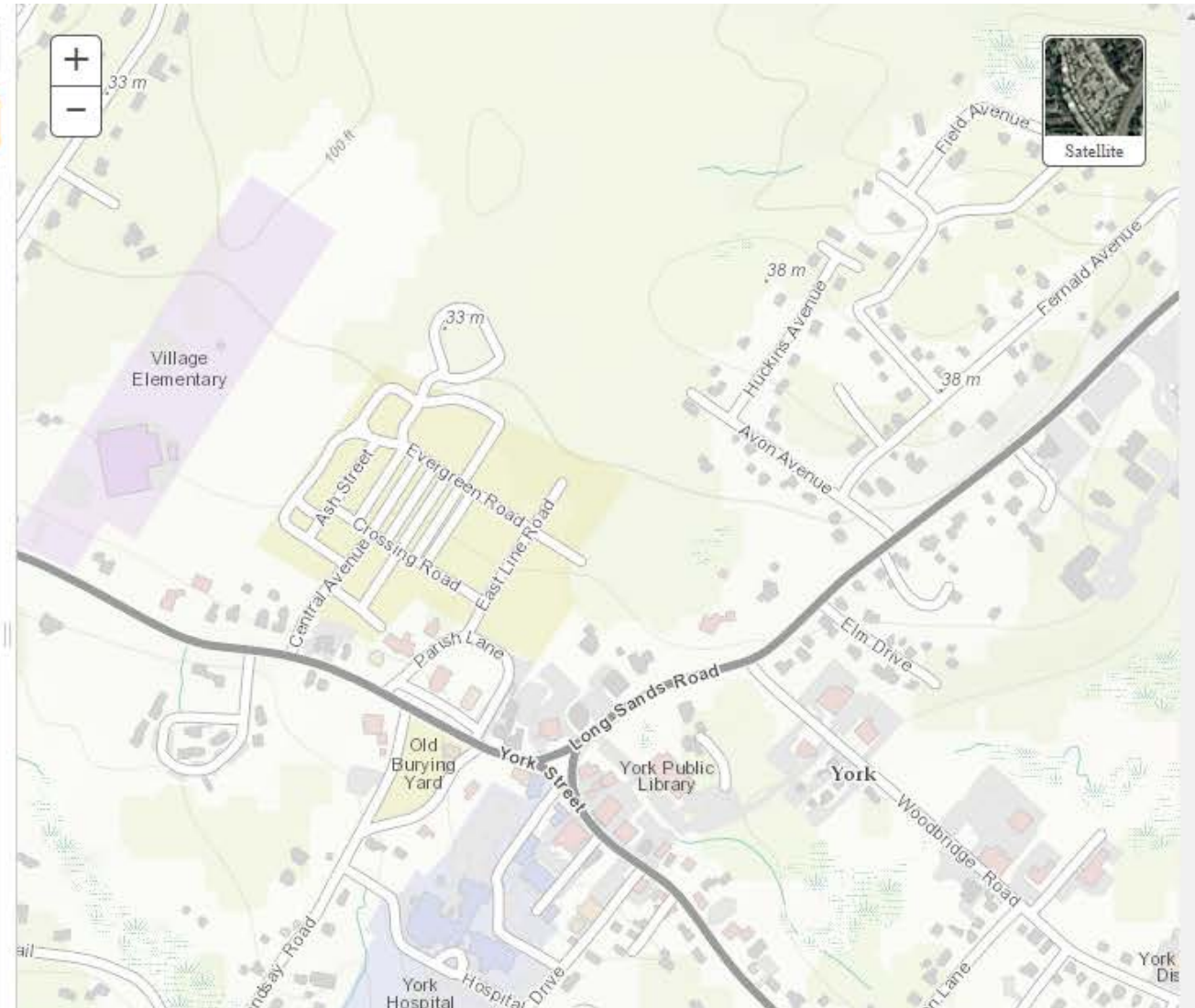
ArcGIS API for JavaScript Sandbox

TOGGLE

DOWNLOAD

RUN

```
1 <!DOCTYPE HTML>
2 <html>
3 <head>
4   <meta charset="utf-8">
5   <meta name="viewport" content="initial-scale=1, maximum-scale=1,user-scalable=no">
6   <title>Basemap Toggle</title>
7   <link rel="stylesheet" type="text/css" href="http://js.arcgis.com/3.11/esri/css/esri.css">
8   <style>
9     html, body, #map {
10      padding:0;
11      margin:0;
12      height:100%;
13    }
14    #BasemapToggle {
15      position: absolute;
16      top: 20px;
17      right: 20px;
18      z-index: 50;
19    }
20  </style>
21  <script src="//js.arcgis.com/3.11/"></script>
22  <script>
23    var map;
24    require([
25      "esri/map",
26      "esri/dijit/BasemapToggle",
27      "dojo/domReady!"
28    ], function(
29      Map, BasemapToggle
30    ) {
31
32      map = new Map("map", {
33        center: [-70.6508, 43.1452],
34        zoom: 16,
35        basemap: "topo"
36      });
37
```



Methods → Infrastructure

ArcGIS API for JavaScript Sandbox

TOGGLE

DOWNLOAD

RUN

```
102     }, "legendDiv");
103     legendDijit.startup();
104   }
105   });
106
107   map.addLayers([huc1, huc2, huc3]);
108   });
109 </script>
110
111 </head>
112
113 <body class="claro">
114 <div id="content"
115   data-dojo-type="dijit/layout/BorderContainer"
116   data-dojo-props="design:'headline', gutters:true"
117   style="width: 100%; height: 100%; margin: 0;">
118
119 <div id="rightPane"
120   data-dojo-type="dijit/layout/ContentPane"
121   data-dojo-props="region:'left'">
122
123 <div data-dojo-type="dijit/layout/AccordionContainer">
124 <div data-dojo-type="dijit/layout/ContentPane" id="legendPane"
125   data-dojo-props="title:'Layers', selected:true">
126   <div id="legendDiv"></div>
127 </div>
128 <div data-dojo-type="dijit/layout/ContentPane"
129   data-dojo-props="title:'Tools'">
130   This pane will contain analysis tools
131 </div>
132 </div>
133 </div>
134 <div id="map"
135   data-dojo-type="dijit/layout/ContentPane"
136   data-dojo-props="region:'center'"
137   style="overflow:hidden;">
138 </div>
```

Layers

HUC6_160202_Jorda



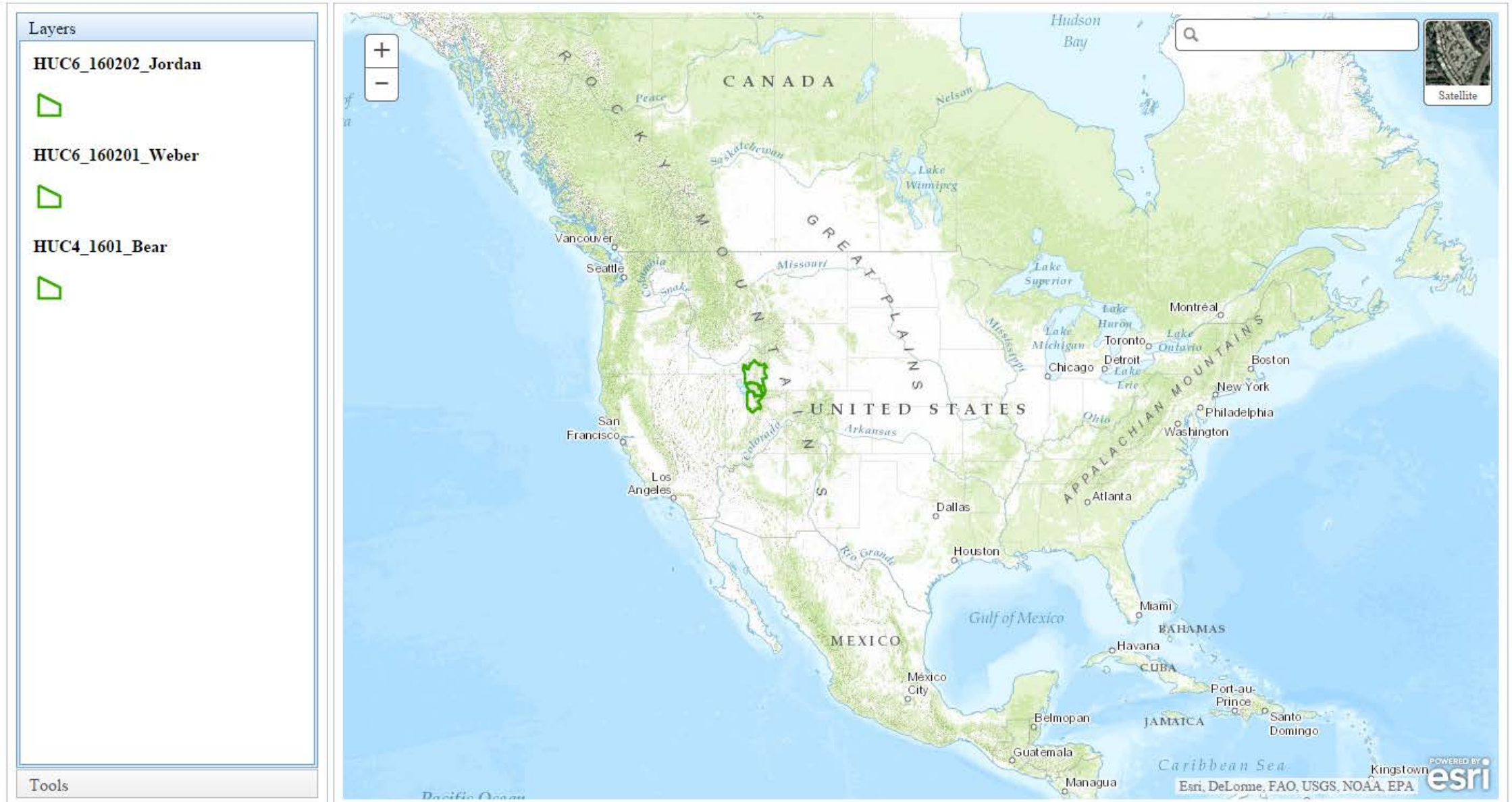
HUC6_160201_Webe



HUC4_1601_Bear



Methods → Infrastructure



Methods → Infrastructure

The image displays a GIS web application interface. On the left, a sidebar contains a 'Layers' section and a 'Tools' section. The 'Tools' section lists the following options:

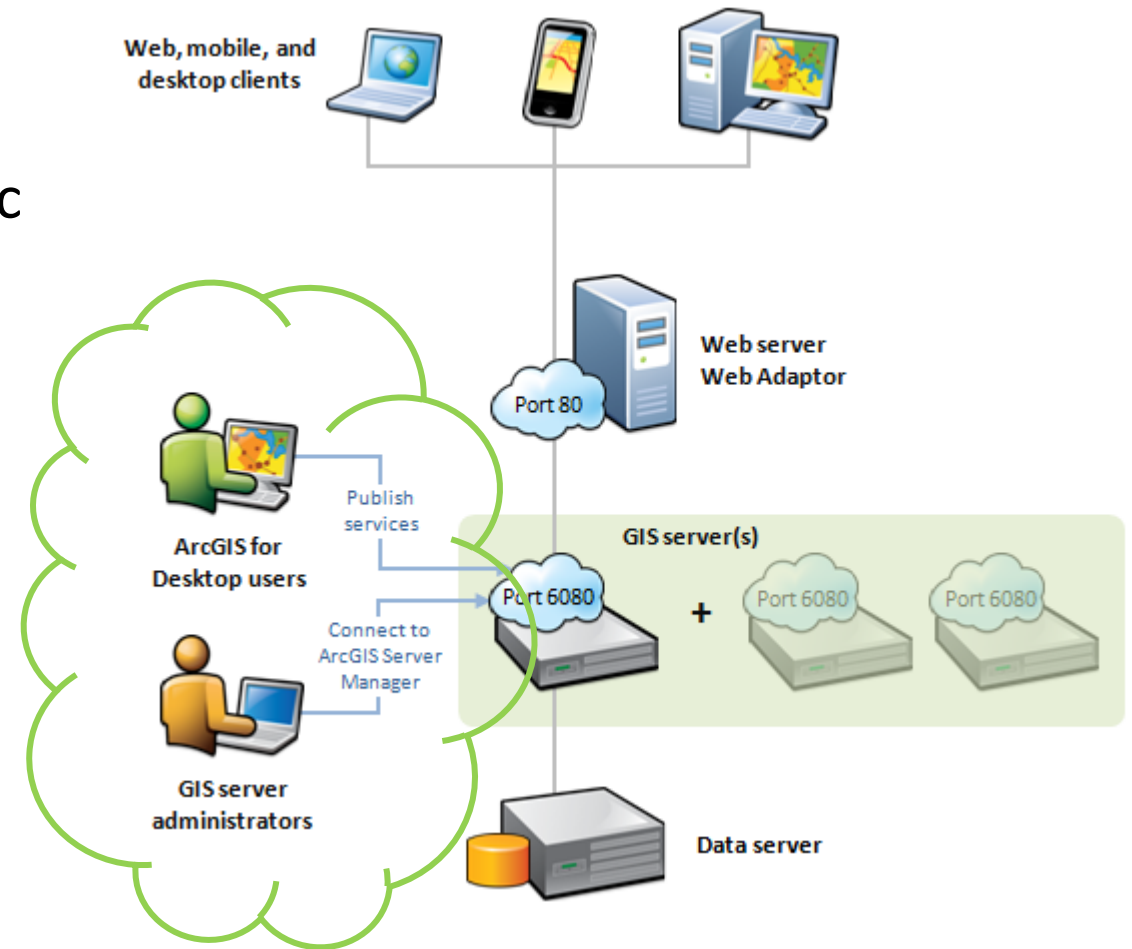
- Delineate Watershed
- Trace Downstream
- Fetch Gage Data
- Thiessen Polygons
- Elevation-SWE
- Runoff Ratio

The main map area shows a satellite view of the Great Salt Lake region. A bright green line delineates the watershed boundary. The lake itself is shown in dark blue. The surrounding terrain is a mix of brown, tan, and green, indicating varying elevations and vegetation. In the top right corner, there is a search bar with the text 'great salt lake' and a search icon. Below the search bar is a small inset map showing the location of the main map area. In the bottom right corner, there is a logo for 'Earthstar Geographics' and 'esri' with the text 'POWERED BY'.

Methods → Data and Analysis Tools

The Data and Tools...

- *Files and Data*: material that is project specific (i.e., supporting data, maps, etc.)???
 - Dynamic access to data
- *Tools*: generic GIS tools???
 - project specific and directed



Methods → Data and Analysis Tools

The screenshot displays the ArcMap interface with the following components:

- Table of Contents:** Lists layers including snotel (blue dot), streamflow (green dot), precip (yellow dot), Basemap, and World_Topo_Map.
- Catalog:** Shows the file system structure with the current location set to `C:\Users\Public\Documents\GSL_server\GageStations`. The `GageStations` folder is expanded, showing subfolders like `Delineate`, `ElevPrecip`, `layers`, `scripts`, `Tools`, `RunoffRatio`, `ThiessenPolygons`, and `TraceDownStream`.
- GageStations Dialog:** Configured for the `Bear` watershed. The `Data Type` is set to `Snow Water Equivalent`. The `Output Table Location` is `C:\Users\Public\Documents\GSL_server\Tools\GageStations\layers\snotel.shp`.
- Map:** A topographic map of the Bear River watershed in Utah, showing towns such as Malad City, Preston, Newton, Smithfield, Hyde Park, Tremonton, Brigham City, North Ogden, Ogden, Roy, Hill Air Force Base, Syracuse, Evanston, and Malad. Elevation contours and the Bear River are visible.

Methods → Data and Analysis Tools

The image shows the ArcMap interface with the following components:

- Table of Contents:** Lists layers including 'Delineate::Start_Point', 'snotel', 'streamflow', 'precip', 'delineate', 'Basemap', and 'World_Topo_Map'.
- Map View:** Displays a topographic map of a region in Utah, showing a delineated watershed area in green and several points (blue and green) on the map.
- Delineate Tool Dialog:** Shows the 'Start Point' as 'Delineate::Start_Point' and the 'Delineated Watershed' output path as 'C:\Users\Public\Documents\GSL_server\Tools\Delineate\layers\delineate.shp'.
- Catalog Panel:** Shows the project structure, including a 'Delineate' folder with sub-folders like 'layers' and 'my_point', and a 'Delineate.tbx' file.

Future → Work To Complete

The Overall Goal:

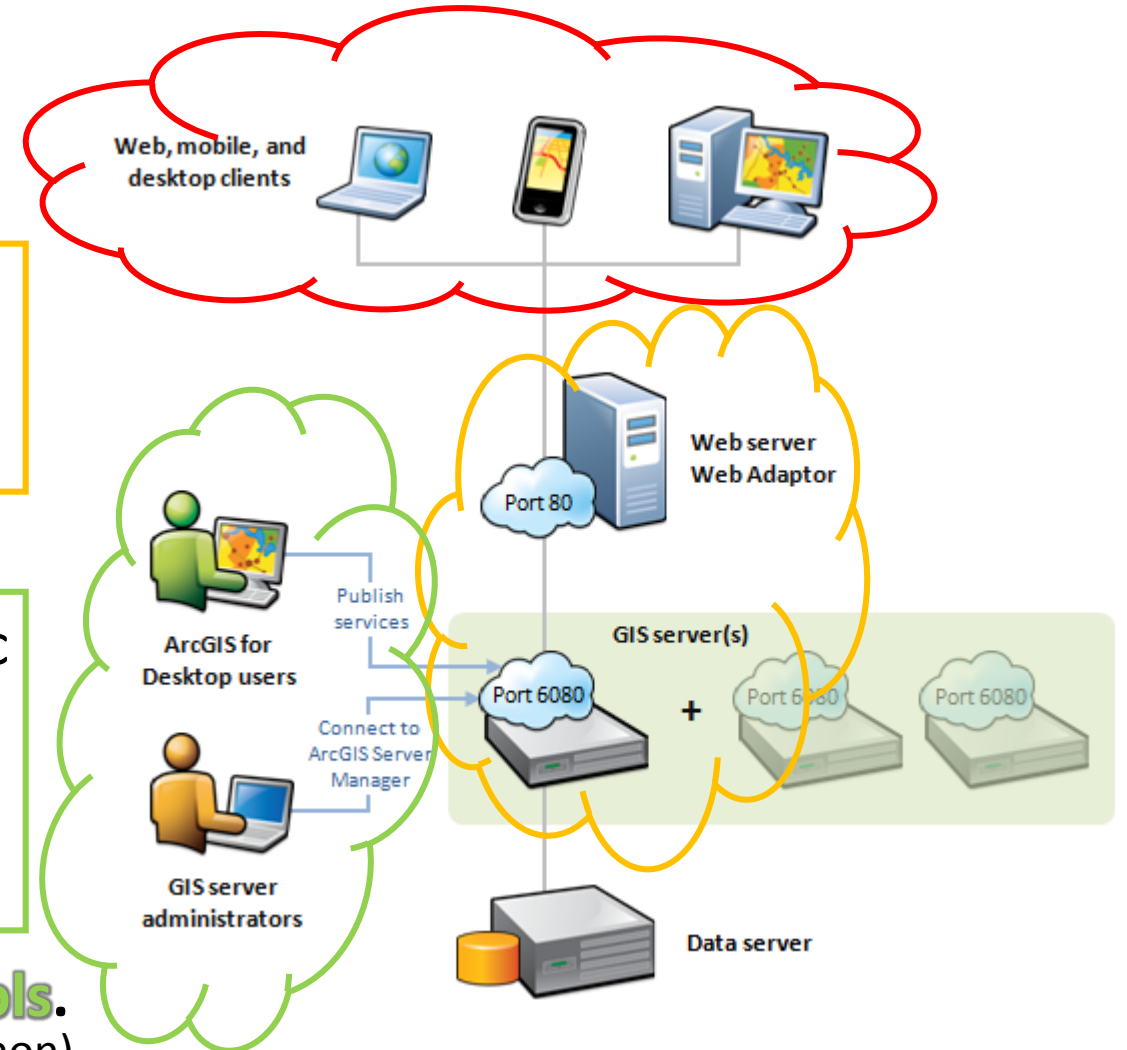
1st → Build the infrastructure

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- *Web Interface*: an interface to access and manipulate the files and data

2nd → Generate the data and analysis tools

- *Files and Data*: material that is project specific (i.e., supporting data, maps, etc.)
- *Tools*: project specific and directed tools that provide a means to analyze the files and data

To Do: Get the **infrastructure** to talk with the **tools**.
(JavaScript) (Python)



Thank You!

