

# ArcGIS Online: Developing Web Applications with Geocoding and Routing Services

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# Metadata

- Slides available at <http://esriurl.com/ds15gr>
- Slides and video recording will also be available at <http://proceedings.esri.com>
- Documentation at <http://developers.arcgis.com>
  - First read the REST API doc and then read the doc for your SDK
- Code samples at <http://nadev.arcgis.com/arcgis/samples>

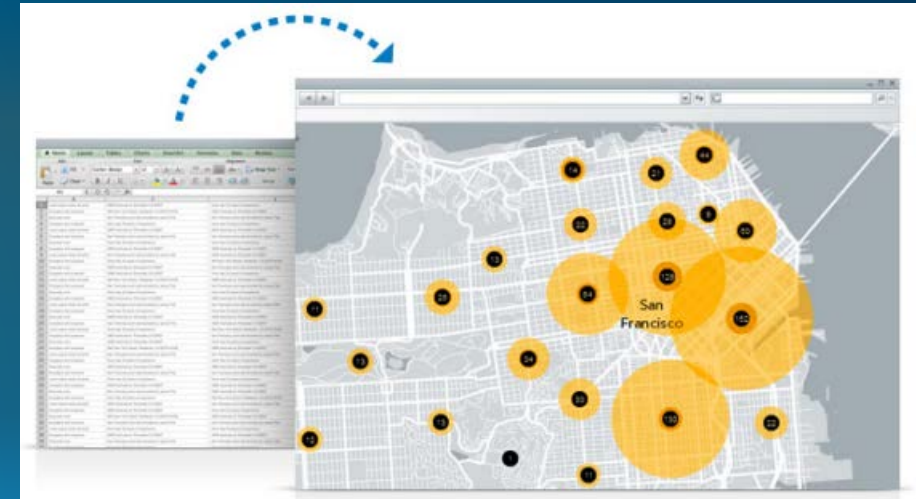
# Topics

- What geocoding and routing services are available with ArcGIS Online?
- What can I do with the services?
- How to access the services?
  - ArcGIS REST API
  - ArcGIS API for JavaScript
- How much will the services cost me?
  - To develop my application (**Free** fine print)
  - To deploy my application



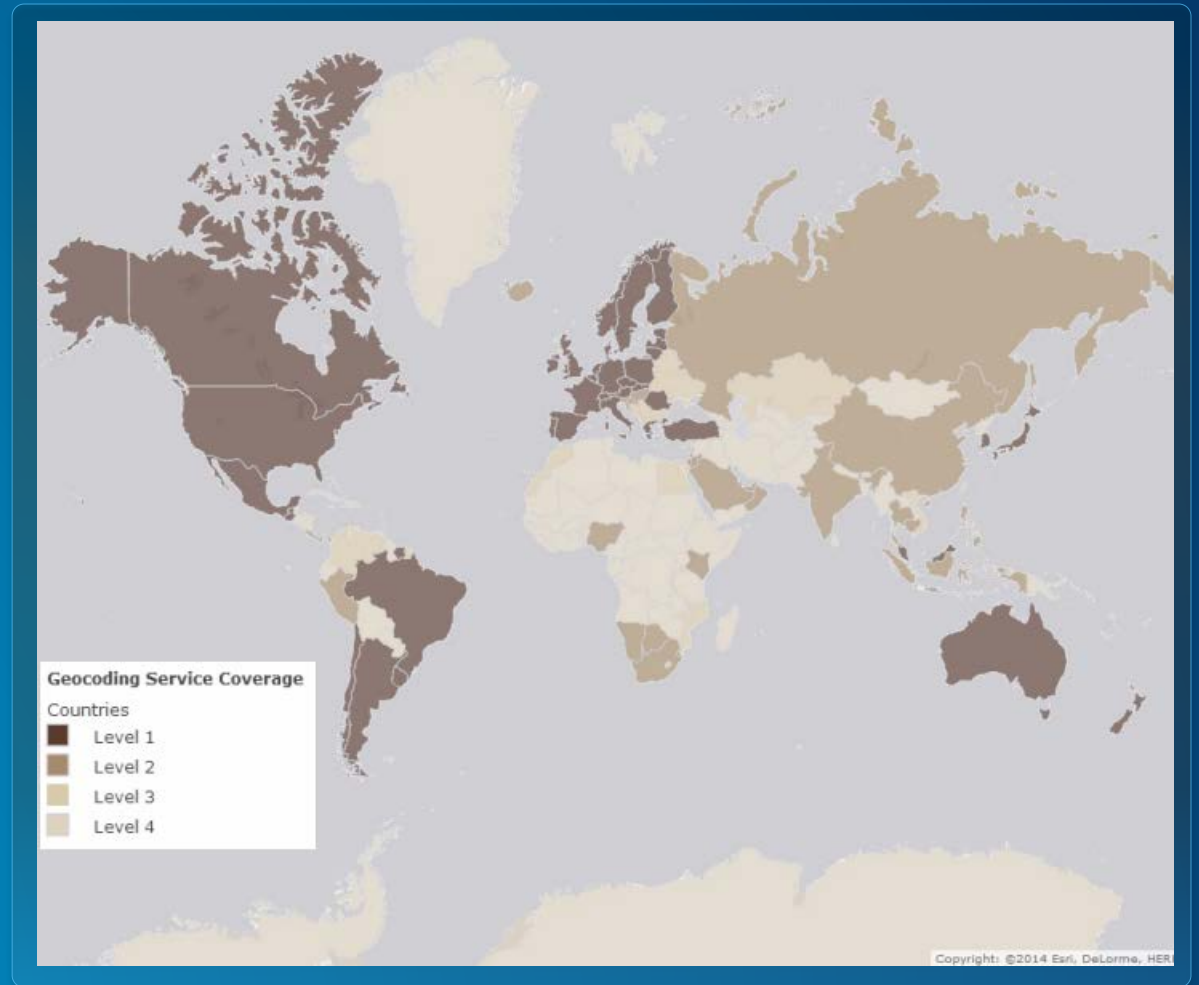
# Geocoding Service

- Turn addresses into coordinates
- Search for point-of-interest, business names using categories
- Auto-complete inputs using suggestions
- Convert coordinates into addresses
- Convert a table of addresses into points



# Geocoding Service Coverage

- Supports global coverage
- Hosted and managed by Esri
- Powered by authoritative content that is updated on a regular basis

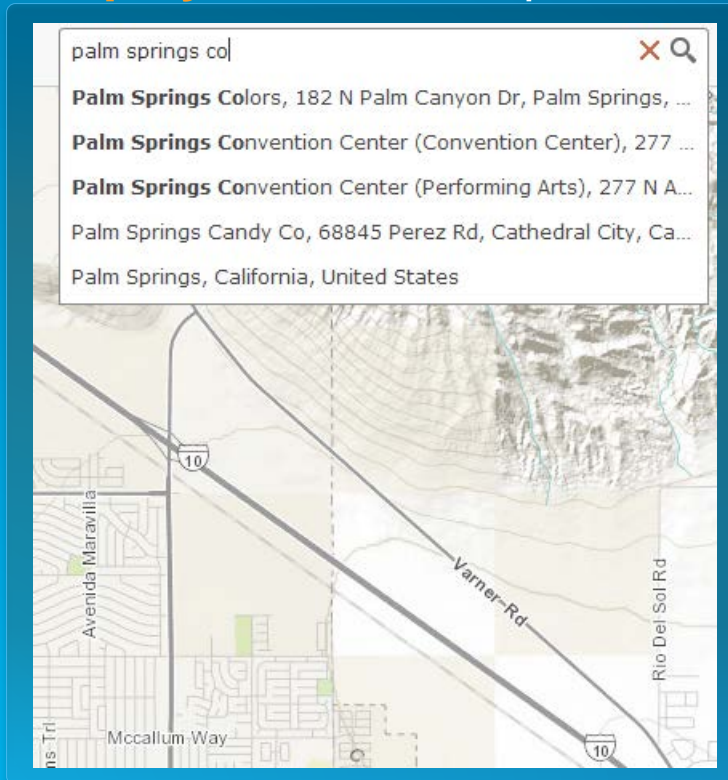


[View larger map](#)

# Geocoding Service Use Cases

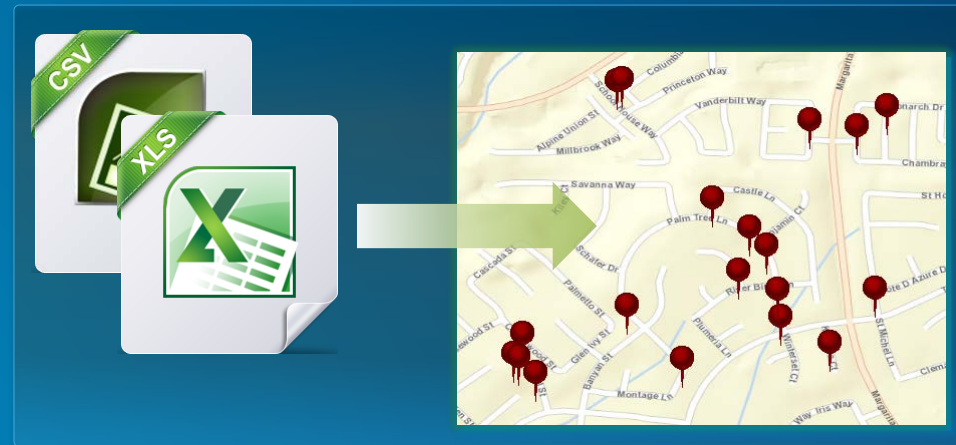
## Geosearch with Suggestions

You can locate an address, or find a place, feature, or point-of-interest. The search **result is displayed** on the map



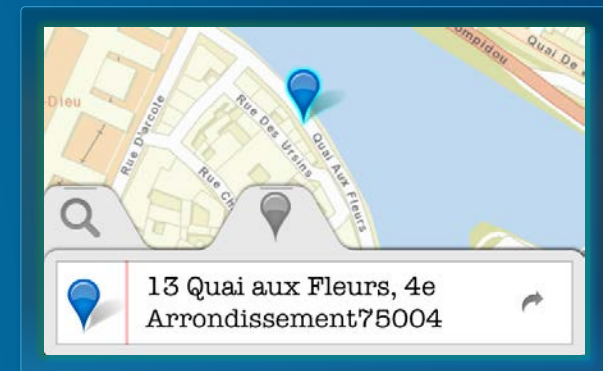
## Batch Geocoding

you can convert one or more address to x, y coordinates and **store the results** in a database.



## Reverse Geocoding

You can also reverse geocode an x, y coordinate to get an address





## Service Operations – Geosearch

- If your input is single text field – use **findAddressCandidates** operation with **SingleLine** parameter. Use **maxLocations** parameter to limit the number of candidates returned.

- Example: Find Palm Springs, CA

```
https://geocode.arcgis.com/arcgis/rest/services/World/GeocodeServer/findAddressCandidates?SingleLine=Palm Springs, CA&maxLocations=1&f=pjson
```

- Pass in **location** and **distance** to perform local search

- Example: Find 5 local Starbucks within 5 miles. Get the street address for each Starbucks

```
https://geocode.arcgis.com/arcgis/rest/services/World/GeocodeServer/findAddressCandidates?SingleLine=Starbucks&maxLocations=5&location=-116.5453,33.8303&distance=8000&outFields=Place_addr&f=pjson
```

## Service Operations – Geosearch

- If your input is in multiple text fields, pass address components as different parameters to **findAddressesCandidates** operation

- Example: Find Address = 277 N Avenida Caballeros, City = Palm Springs, State = CA, Zip = 92262

```
https://geocode.arcgis.com/arcgis/rest/services/World/GeocodeServer  
/findAddressCandidates?Address=277 N Avenida Caballeros&City=Palm  
Springs&Region=CA&Postal=92262&maxLocations=1&f=pjson
```

- Pass in **location** and **distance** to perform local search



# Service Operations – Geosearch with Suggestions

- Use **suggest** operation to get a list of candidates for input text

- Example: Get local suggestions for palm springs co

```
https://geocode.arcgis.com/arcgis/rest/services/World/GeocodeServer/suggest?text=palm springs co&location=-116.5453,33.8303&distance=50000&f=pjson
```

- Use **text** and **magicKey** obtained from **suggest** operation with **findAddressCandidates** operation. Pass the same location and distance value if used while getting the suggestion

- Example: Use suggestion to perform geosearch

```
https://geocode.arcgis.com/arcgis/rest/services/World/GeocodeServer/findAddressCandidates?SingleLine=<text-of-the-selected-suggestion>&magicKey=<magicKey-of-the-selected-suggestion>&location=-116.5453,33.8303&distance=50000&f=pjson
```

## Service Operations – Geosearch with Categories

- Use **category** parameter to narrow down your search to specific candidates and avoid false positive matches.

- **Example: Find 5 restaurants serving Italian food near the convention center**

```
http://geocode.arcgis.com/arcgis/rest/services/World/GeocodeServer/  
findAddressCandidates?category=Italian%20Food&location=-  
116.5453,33.8303&distance=50000&maxLocations=5&outFields=Place_Addr  
,Phone,Distance&f=pjson
```

- Query the supported category values from the service description

# Service Operations – Reverse Geocoding

- To convert coordinates into an address – use **reverseGeocode** operation
  - Example: Find street address for Palm Spring Convention Center

```
https://geocode.arcgis.com/arcgis/rest/services/World/GeocodeServer/reverseGeocode?location=-116.537,33.8254&f=pjson
```

Can also return the nearest street intersection using **returnIntersection** parameter

- Example: Find nearest street intersection for Palm Spring Convention Center

```
https://geocode.arcgis.com/arcgis/rest/services/World/GeocodeServer/reverseGeocode?location=-116.537,33.8254&distance=500&returnIntersection=true&f=pjson
```

# Batch Geocoding

- Convert a table of addresses into points
- Synchronous operation that supports **SuggestedBatchSize** (currently set to 150) records per request
  - Requires chunking of inputs on client side
- Workflows to perform batch geocoding
  - Geocode Addresses geoprocessing tool
  - Use addItem, analyze, generate and publish operations from ArcGIS Online
  - **geocodeAddresses** operation from the geocoding service



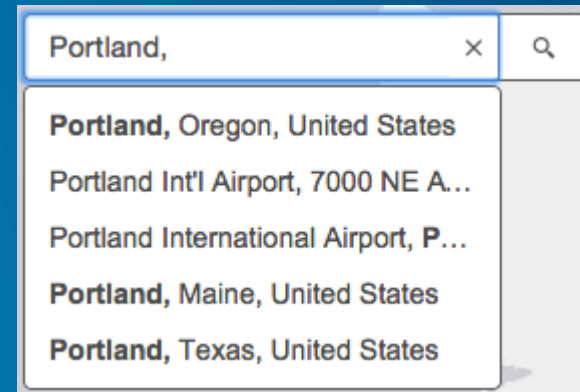
# Batch Geocoding using `geocodeAddresses` operation

- Need to provide the client side logic to
  - Chunk input table into batches of size `SuggestedBatchSize` (currently set to 150)
  - Handle timeouts and failure from any intermediate requests
  - Persist the results from each successful intermediate requests

# Geocode Service in ArcGIS API for JavaScript

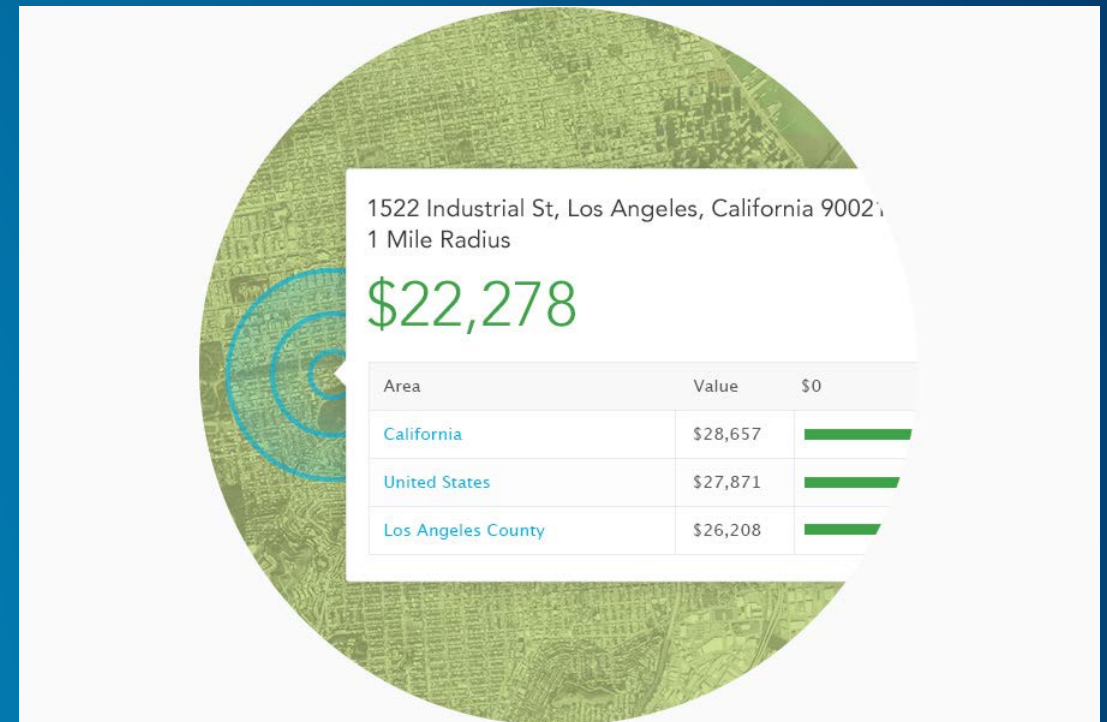
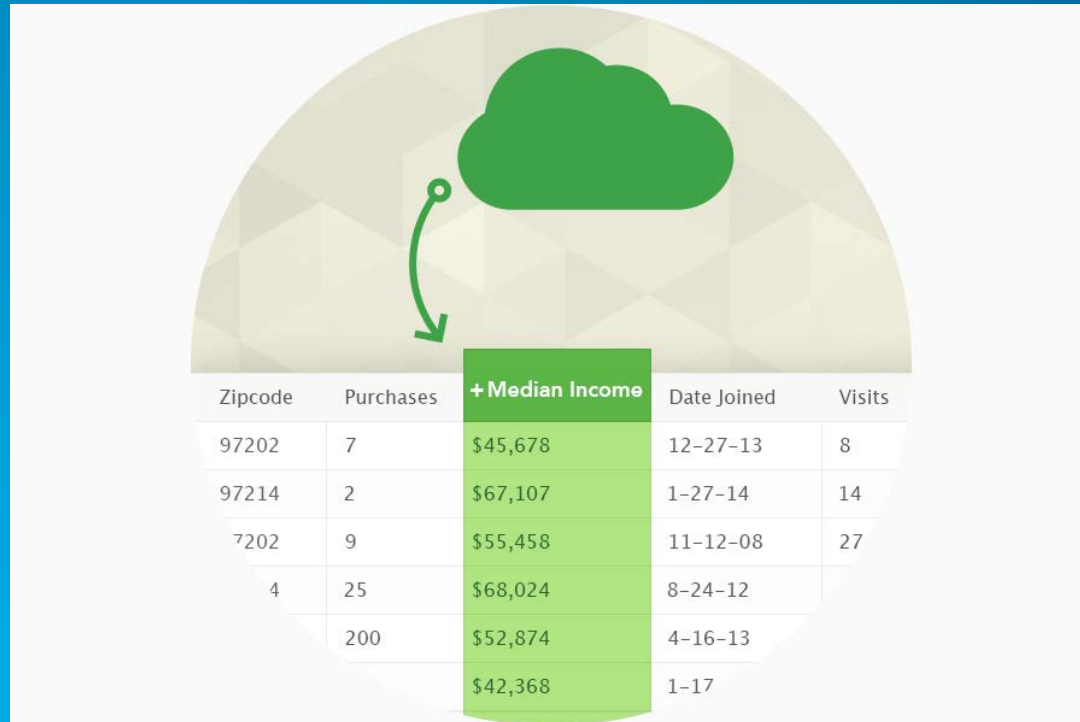
- Easily add local geo-search functionality with suggestions to your application using geocoder and search widget.
- Geocode service operations can be accessed using the Locator class

```
// Geocoder with all common options set. Only map is required.  
Geocoder = new esri.dijit.Geocoder({  
    autoComplete: true,  
    arcgisGeocoder:{  
        placeholder: "Find a place"  
    },  
    map: map  
}, dojo.byId('search'));  
  
// start widget  
Geocoder.startup();
```



## Detour -- Geoenrichment Service

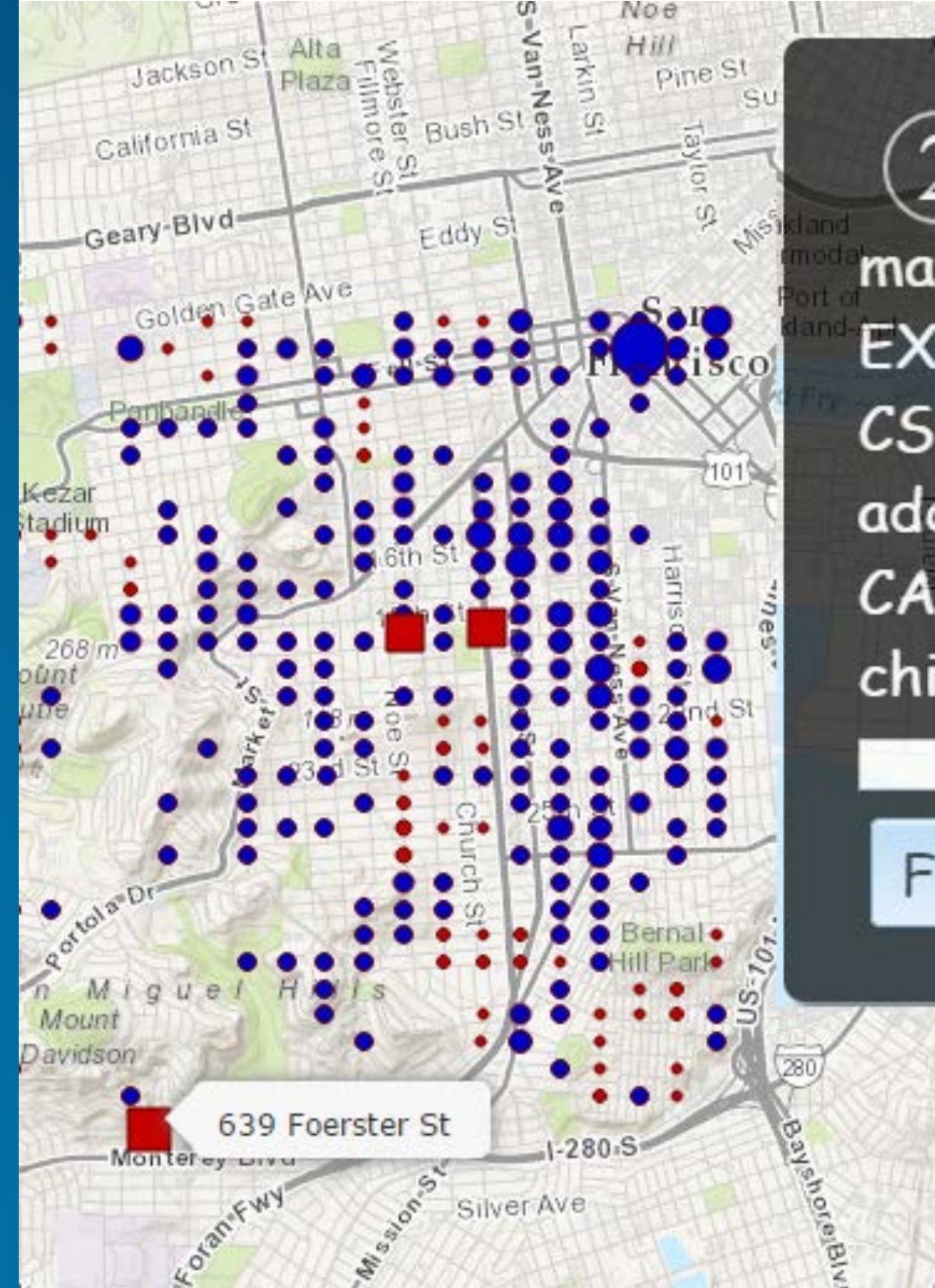
- Add demographic, business, and landscape data to your maps and applications.



Demo

# Batch geocode a CSV file containing candidate child care facility addresses

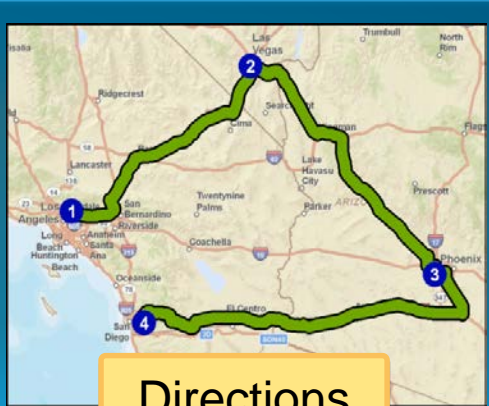
- **geocodeAddresses** operation
- [View live sample](#)  
Works best with Google Chrome browser



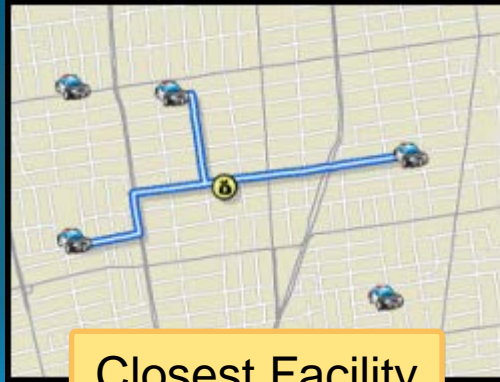


# Direction and Routing Services

- Services that allow you to perform analyses on street networks



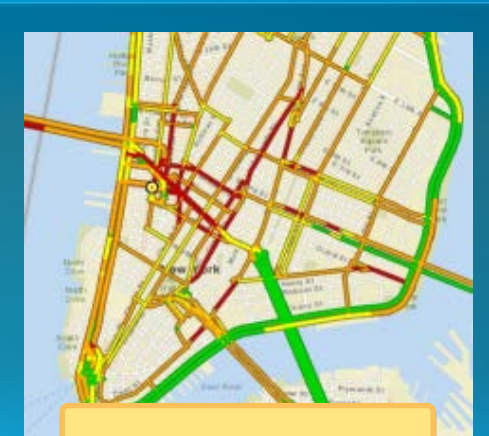
Directions



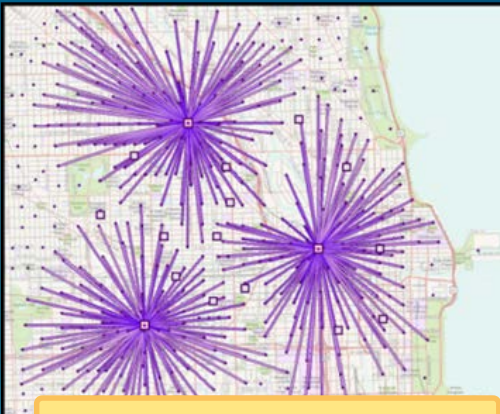
Closest Facility



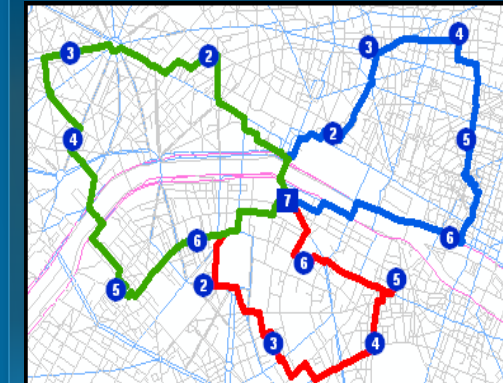
Service Areas



Traffic



Location-Allocation



Vehicle Routing Problem

# Common to all Services

- Work globally
  - Currently 147 countries.
  - New countries are added periodically
- Use high quality underlying street data
  - Real time traffic where available
  - Support driving, walking and trucking travel modes
  - Support for vehicle weight, width and height restrictions
  - Can use preferred truck routes or avoid toll roads



[View larger map](#)

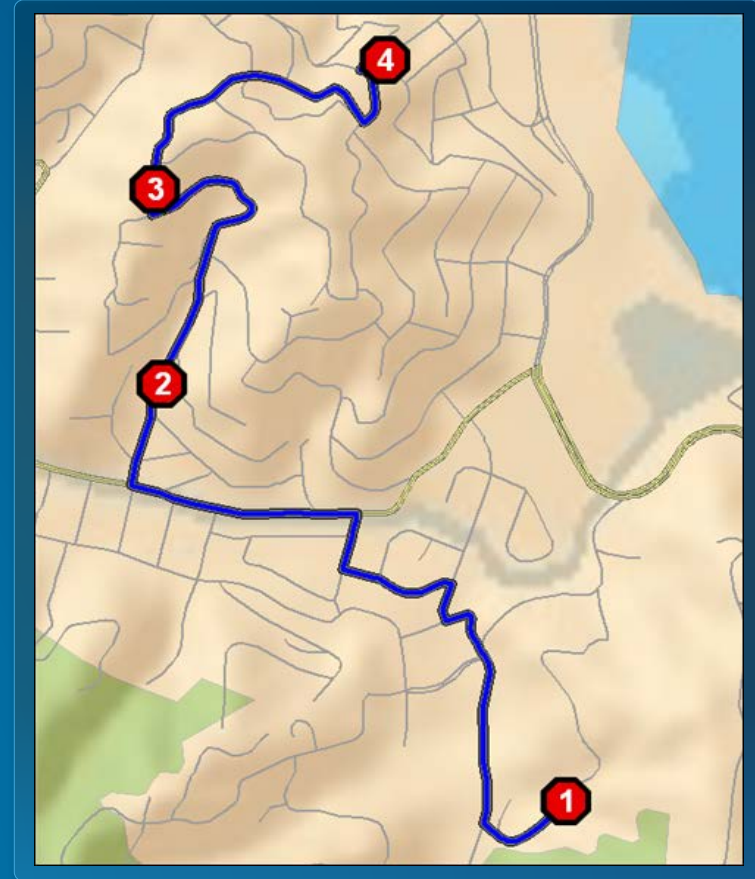
# Execution modes

- Many services support **synchronous** as well as **asynchronous** execution modes.
- Use synchronous mode for requests that execute quickly.
- Use asynchronous mode for long running requests (batch processing).
  - Submit a job and get a job id
  - Check job status
  - Get outputs



# Directions

- Point-to-point routing – Simple Route
- Find the best route for visiting a series of stops that minimizes travel time or travel distance – Optimized route
- Use live traffic conditions
- Driving directions in many languages
- Synchronous and Asynchronous execution





# Directions

## Request URL (Synchronous Execution)

`https://route.arcgis.com/arcgis/rest/services/World/Route/NAServer/Route_World/solve?<parameters>`

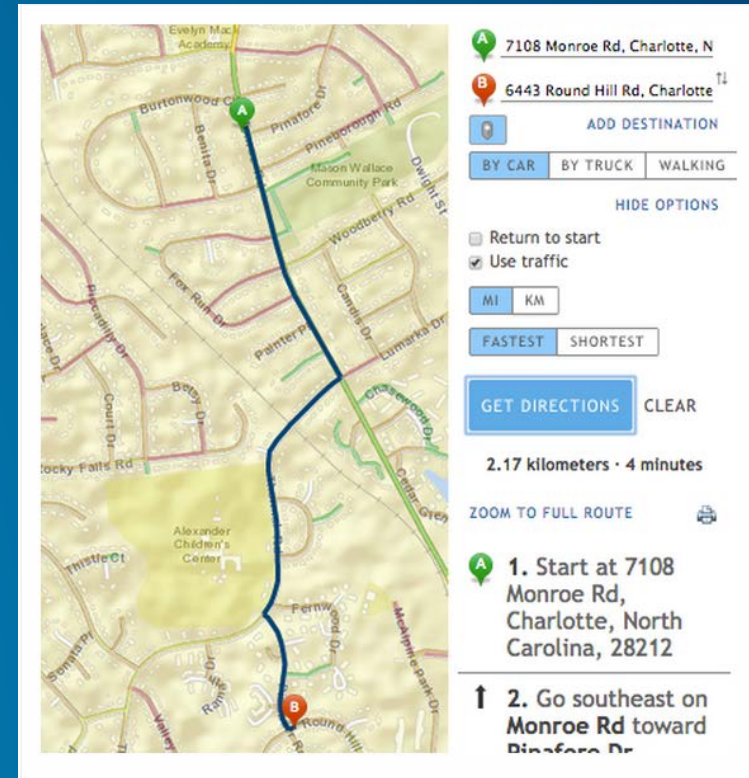
## Example Request (Synchronous Execution)

`https://route.arcgis.com/arcgis/rest/services/World/Route/NAServer/Route_World/solve?token=<yourToken>&stops=-122.4079,37.78356;-122.404,37.782&f=pjson`

# Directions Service in ArcGIS API for JavaScript

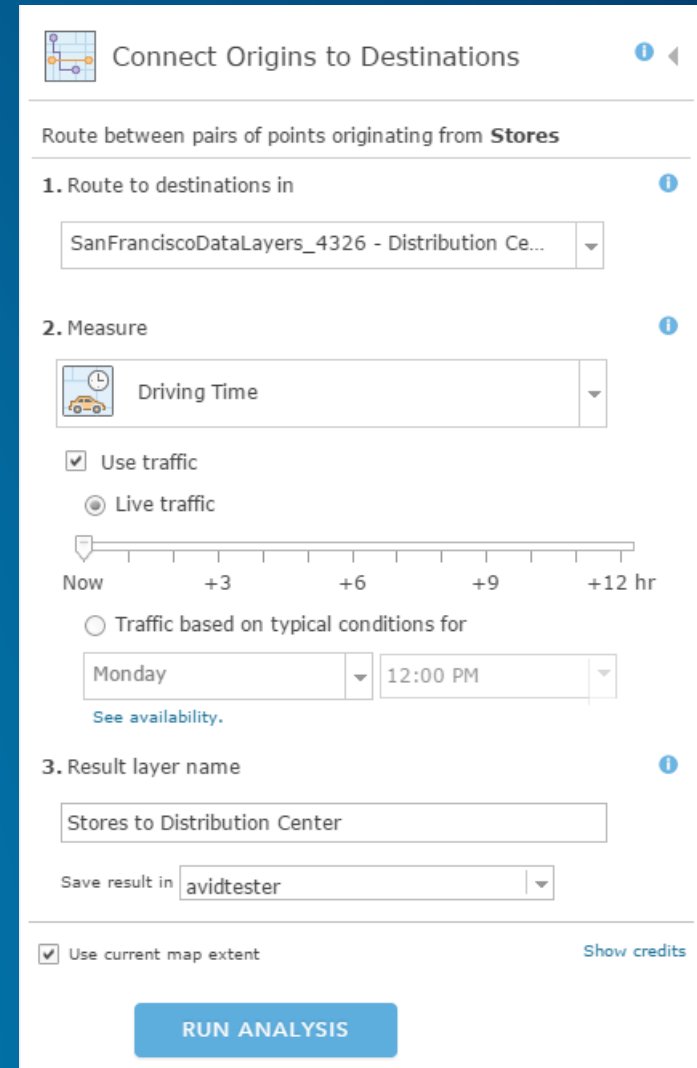
- Easily add point to point routing with driving directions to your applications using the directions widget.
- Access Directions service in synchronous execution mode using the RouteTask class.

```
var directions = new Directions({  
  map: map,  
  showClearButton: true  
}, "dir");  
directions.startup();
```



# Directions Service in ArcGIS API for JavaScript

- Access Directions service in asynchronous execution mode
  - Using the Connect Origins to Destinations analysis widget
  - Geoprocessor class



The screenshot shows the 'Connect Origins to Destinations' analysis widget. It is titled 'Connect Origins to Destinations' and has a subtitle 'Route between pairs of points originating from **Stores**'. The widget is divided into three main sections:

- 1. Route to destinations in**: A dropdown menu shows 'SanFranciscoDataLayers\_4326 - Distribution Ce...'. There is an information icon (i) to the right.
- 2. Measure**: A dropdown menu shows 'Driving Time' with a car icon. Below it, there is a checkbox 'Use traffic' which is checked. Under 'Use traffic', there is a radio button 'Live traffic' which is selected. Below the radio buttons is a slider for time delay, ranging from 'Now' to '+12 hr', with markers at '+3', '+6', and '+9'. Below the slider, there is a radio button 'Traffic based on typical conditions for' which is unselected. Below this, there are two dropdown menus: 'Monday' and '12:00 PM'. Below these is a link 'See availability.'. There is an information icon (i) to the right.
- 3. Result layer name**: A text input field contains 'Stores to Distribution Center'. Below it, there is a dropdown menu 'Save result in' with 'avidtester' selected. There is an information icon (i) to the right.

At the bottom of the widget, there is a checkbox 'Use current map extent' which is checked, and a link 'Show credits'. A large blue button labeled 'RUN ANALYSIS' is at the bottom center.

# Closest Facility

- Find the closest facilities from each incident
- Generate routes and driving directions
- You can also...
  - Use live traffic conditions
  - Limit the search distance
  - Limit the number of facilities to find
  - Travel from the facility to the incident
- Synchronous and Asynchronous execution





# Closest Facility

## Request URL (Synchronous Execution)

```
https://route.arcgis.com/arcgis/rest/services/World/ClosestFacility/NAServer/ClosestFacility_World/solveClosestFacility?<parameters>
```

## Example Request (Synchronous Execution)

```
https://route.arcgis.com/arcgis/rest/services/World/ClosestFacility/NAServer/ClosestFacility_World/solveClosestFacility?token=<yourToken>&incidents=-122.4496,37.7467&facilities=-122.4267,37.7486;-122.4561,37.7513&f=pjson
```

# Closest Facility Service in ArcGIS API for JavaScript

- Access Closest Facility service in synchronous execution mode using the ClosestFacilityTask class.
- Access Closest Facility service in asynchronous execution mode
  - Using the Find Nearest analysis widget
  - Geoprocessor class

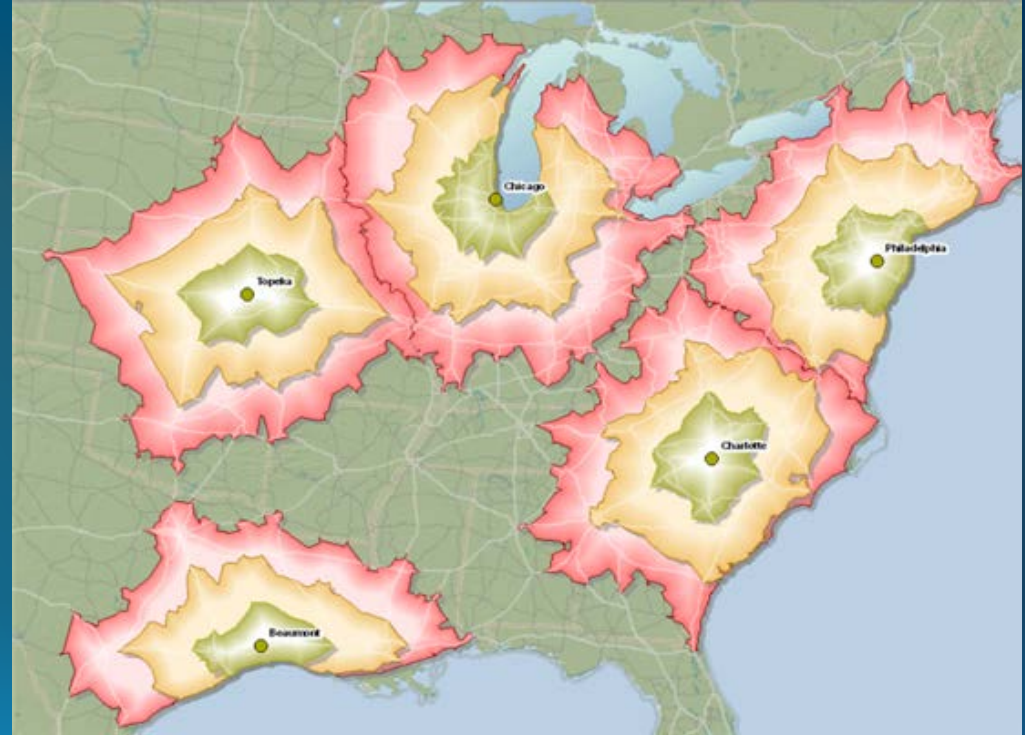
The screenshot shows the 'Find Nearest' analysis widget. It is titled 'Find Nearest' and has a sub-header 'For each location in **Stores**, find its nearest locations.' The widget is divided into four numbered sections:

- 1. Find the nearest locations in:** A dropdown menu shows 'SanFranciscoDataLayers\_4326 - Distribution ...'.
- 2. Measure:** A dropdown menu shows 'Driving Time'. Below it, there are checkboxes for 'Use traffic' (checked) and 'Live traffic' (selected). A slider shows a range from 'Now' to '+12 hr' with markers at '+3', '+6', and '+9'. Below the slider, there are radio buttons for 'Traffic based on typical conditions for' (selected), a dropdown for 'Monday', and a dropdown for '12:00 PM'. A link 'See availability.' is present.
- 3. For each location in **Stores**:** There are two checkboxes: 'Limit the number of nearest locations to:' with a dropdown set to '1', and 'Limit the search range to' with input fields for '1' hr, '0' min, and '0' sec.
- 4. Result layer name:** A text input field contains 'Nearest Distribution Center to Stores'. Below it, a dropdown for 'Save result in' is set to 'avidtester'.

At the bottom, there is a checkbox 'Use current map extent' (checked) and a 'Show credits' link. A large blue button labeled 'RUN ANALYSIS' is at the bottom right.

# Service Areas

- Find the area you can reach from a location in a given time period
- You can also...
  - Solve for many locations
  - Use multiple drive time values
  - Analyze for different times of the day
  - Specify the direction of travel
- Synchronous and Asynchronous execution



# Service Areas

## Request URL (Synchronous Execution)

```
https://route.arcgis.com/arcgis/rest/services/World/ServiceAreas/NA Server/ServiceArea_World/solveServiceArea?<parameters>
```

## Example Request (Synchronous Execution)

```
https://route.arcgis.com/arcgis/rest/services/World/ServiceAreas/NA Server/ServiceArea_World/solveServiceArea?token=<yourToken>&facilities=-122.4496,37.7467&f=pjson
```



# Service Areas Service in ArcGIS API for JavaScript

- Access Service Areas service in synchronous execution mode using the ServiceAreaTask class.
- Access Service Areas service in asynchronous execution mode
  - Using the Create Drive-Time Areas analysis widget
  - Geoprocessor class

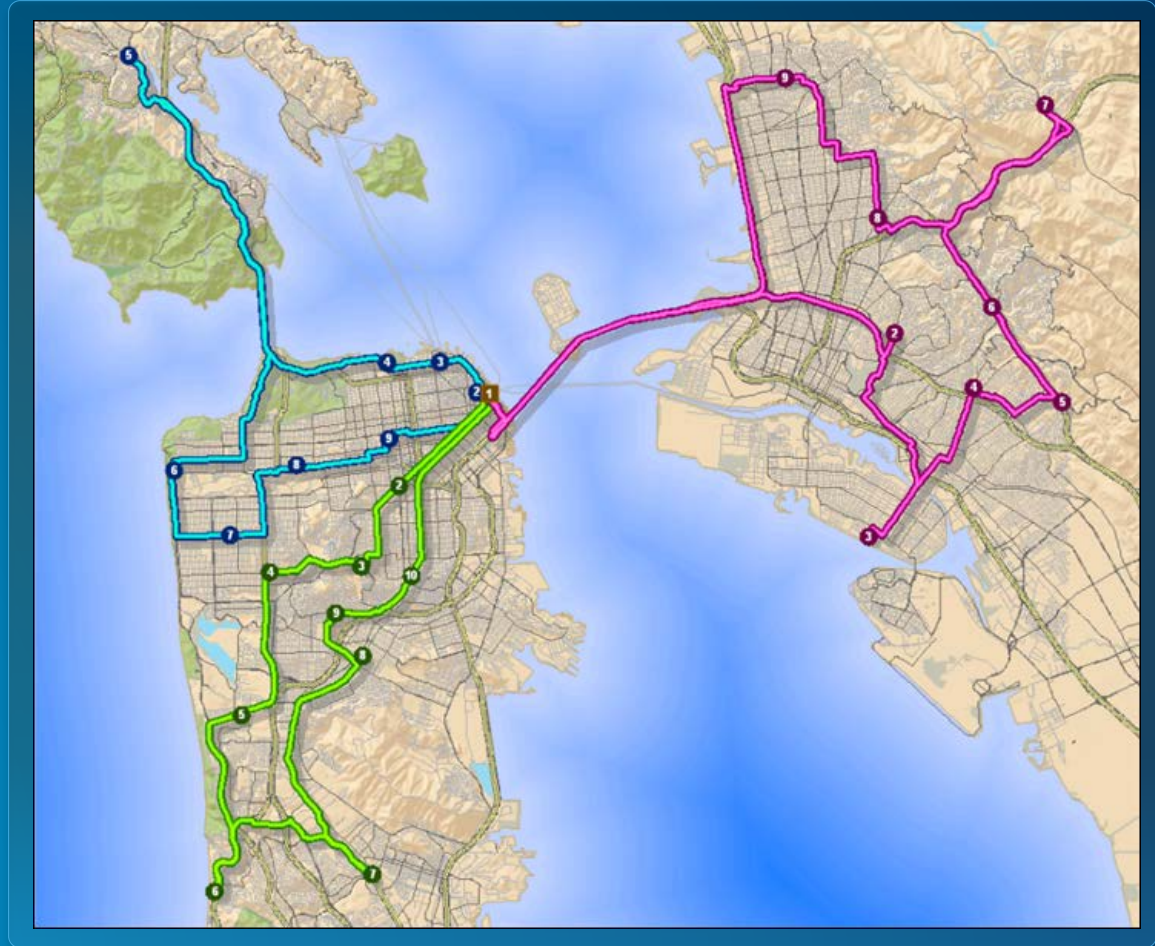
The screenshot shows the 'Create Drive-Time Areas' widget interface. It is titled 'Create Drive-Time Areas' and has a subtitle 'Create areas around Stores'. The interface is divided into three main sections:

- 1. Measure**: This section allows users to specify the measurement type and duration. It includes a dropdown menu for 'Driving Time', a text input for '5', and a dropdown for 'Minutes'. Below this, there is a note: 'To output multiple areas for each point, type sizes separated by spaces (2 3.5 5)'. There are two radio buttons: 'Use traffic' (selected) and 'Live traffic'. A timeline slider shows time intervals from 'Now' to '+12 hr'. Below the slider, there is a radio button for 'Traffic based on typical conditions for', followed by a dropdown for 'Monday' and a time input for '8:00 AM'. A link 'See availability.' is present.
- 2. Areas from different points**: This section offers three options for how areas from different points are handled: 'Overlap' (selected), 'Dissolve', and 'Split'. Each option is represented by an icon and a label.
- 3. Result layer name**: This section includes a text input for the result layer name, currently set to 'Drive from Stores (5 Minutes)', and a dropdown for 'Save result in' with the value 'avidtester'.

At the bottom of the widget, there is a checkbox for 'Use current map extent' and a 'Show credits' link. A large blue button labeled 'RUN ANALYSIS' is positioned at the bottom center.

# Vehicle Routing Problem

- Route a fleet of vehicles to service a set of orders
- You can also specify...
  - Vehicle capacities
  - Driver specialties
  - Work breaks
  - Time windows on orders
- Synchronous and Asynchronous execution



# Vehicle Routing Problem

## Request URLs (Asynchronous Execution)

### Submit Job

`https://logistics.arcgis.com/arcgis/rest/services/World/VehicleRoutingProblem/GPServer/SolveVehicleRoutingProblem/submitJob?<parameters>`

### Get Job Status

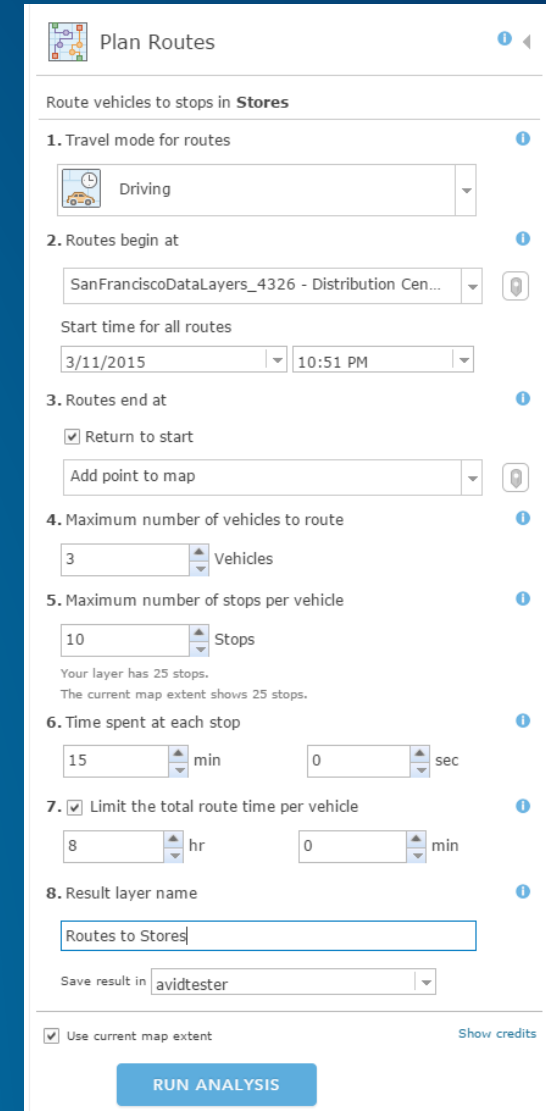
`https://logistics.arcgis.com/arcgis/rest/services/World/VehicleRoutingProblem/GPServer/SolveVehicleRoutingProblem/jobs/<yourJobID>?token=<yourToken>&f=json`

### Get Outputs

`https://logistics.arcgis.com/arcgis/rest/services/World/VehicleRoutingProblem/GPServer/SolveVehicleRoutingProblem/jobs/<yourJobID>/results/<output_parameter_name>?token=<yourToken>&f=json`

# Vehicle Routing Problem Service in ArcGIS API for JavaScript

- Access Vehicle Routing Problem service in synchronous execution mode using the Geoprocessor class.
- Access Vehicle Routing Problem service in asynchronous execution mode
  - Using the Plan Routes analysis widget
  - Geoprocessor class



The screenshot shows the 'Plan Routes' analysis widget. It is titled 'Plan Routes' and has a subtitle 'Route vehicles to stops in Stores'. The widget contains eight numbered steps for configuring a vehicle routing problem:

- 1. Travel mode for routes:** A dropdown menu set to 'Driving'.
- 2. Routes begin at:** A dropdown menu set to 'SanFranciscoDataLayers\_4326 - Distribution Cen...'. Below it, a 'Start time for all routes' section with date '3/11/2015' and time '10:51 PM' dropdowns.
- 3. Routes end at:** A checkbox 'Return to start' is checked. Below it, a dropdown menu set to 'Add point to map'.
- 4. Maximum number of vehicles to route:** A spinner box set to '3' with the unit 'Vehicles'.
- 5. Maximum number of stops per vehicle:** A spinner box set to '10' with the unit 'Stops'. Below it, text indicates 'Your layer has 25 stops. The current map extent shows 25 stops.'
- 6. Time spent at each stop:** Two spinner boxes for '15 min' and '0 sec'.
- 7. Limit the total route time per vehicle:** A checked checkbox. Below it, two spinner boxes for '8 hr' and '0 min'.
- 8. Result layer name:** A text box containing 'Routes to Stores'. Below it, a 'Save result in' dropdown menu set to 'avidtester'.

At the bottom, there is a checked checkbox 'Use current map extent' and a 'Show credits' link. A large blue button labeled 'RUN ANALYSIS' is at the bottom center.



# Location-Allocation

- Choose best facilities based on their potential interaction with demand points
- You can also...
  - Choose from many different analysis types
  - Limit the capacity of facilities
  - Analyze for different times of the day
- Asynchronous execution only



# Location-Allocation

## Request URLs (Asynchronous Execution)

### Submit Job

`https://logistics.arcgis.com/arcgis/rest/services/World/LocationAllocation/GPServer/SolveLocationAllocation/submitJob?<parameters>`

### Get Job Status

`https://logistics.arcgis.com/arcgis/rest/services/World/LocationAllocation/GPServer/SolveLocationAllocation/jobs/<yourJobID>?token=<yourToken>&f=json`

### Get Outputs

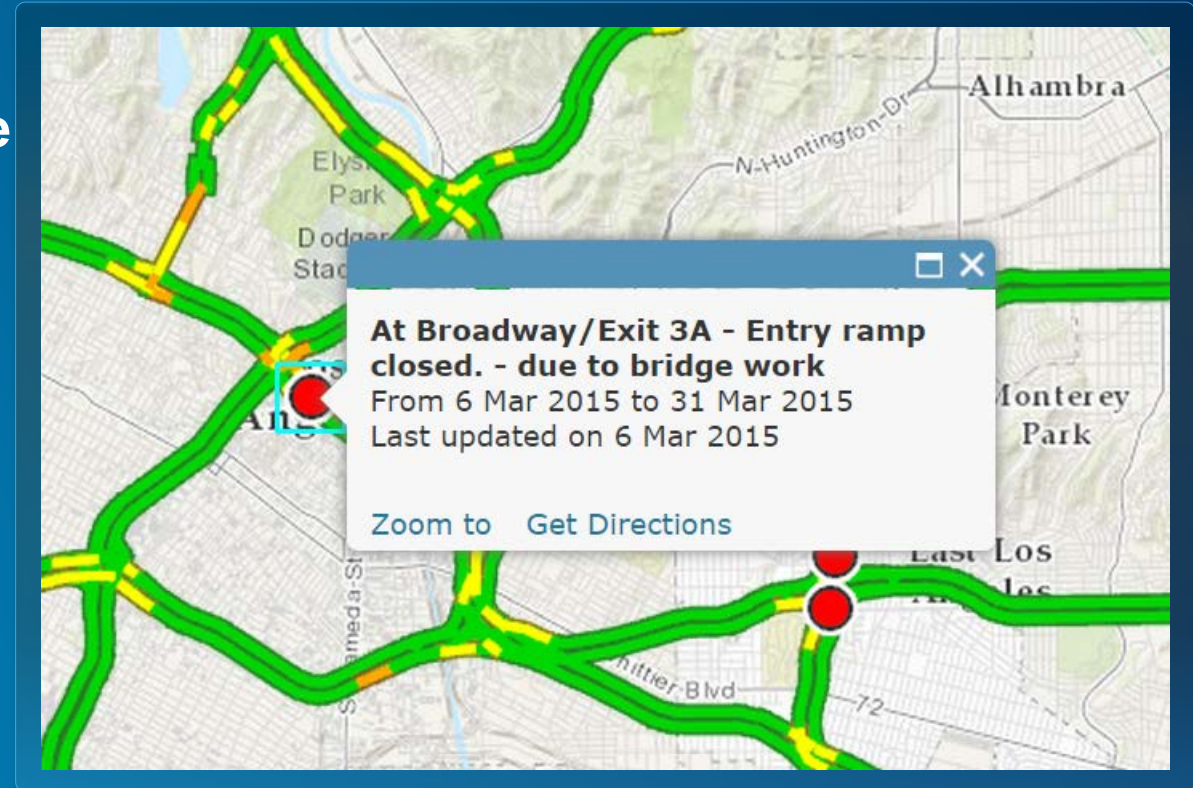
`https://logistics.arcgis.com/arcgis/rest/services/World/LocationAllocation/GPServer/SolveLocationAllocation/jobs/<yourJobID>/results/<output_parameter_name>?token=<yourToken>&f=json`

# Location Allocation Service in ArcGIS API for JavaScript

- Access Location Allocation service in asynchronous execution mode using the Geoprocessor class.

# Traffic

- Visualize traffic speeds
  - Support for live, historical and predictive traffic conditions
- Traffic Incidents
- Background layer to display results from routing services
- Data updated every five minutes
- Synchronous execution only





# Traffic

## Request URL

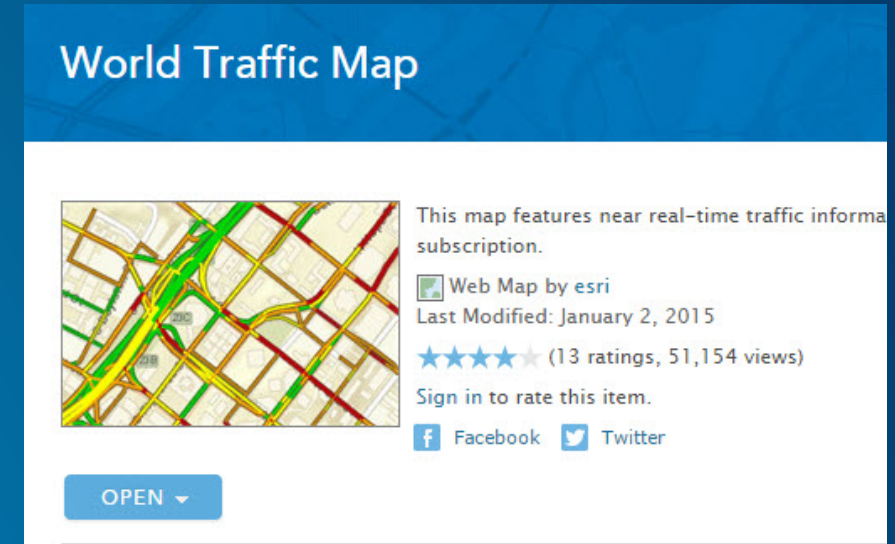
```
https://traffic.arcgis.com/arcgis/rest/services/World/Traffic/MapServer/export?<parameters>
```

## Example Request

```
http://traffic.arcgis.com/arcgis/rest/services/World/Traffic/MapServer/export?token=<yourToken>&bbox=-13168112.16706758,4029125.2769380505,-13152117.71889893,4037275.375078947&f=image
```

# Traffic Service in ArcGIS API for JavaScript

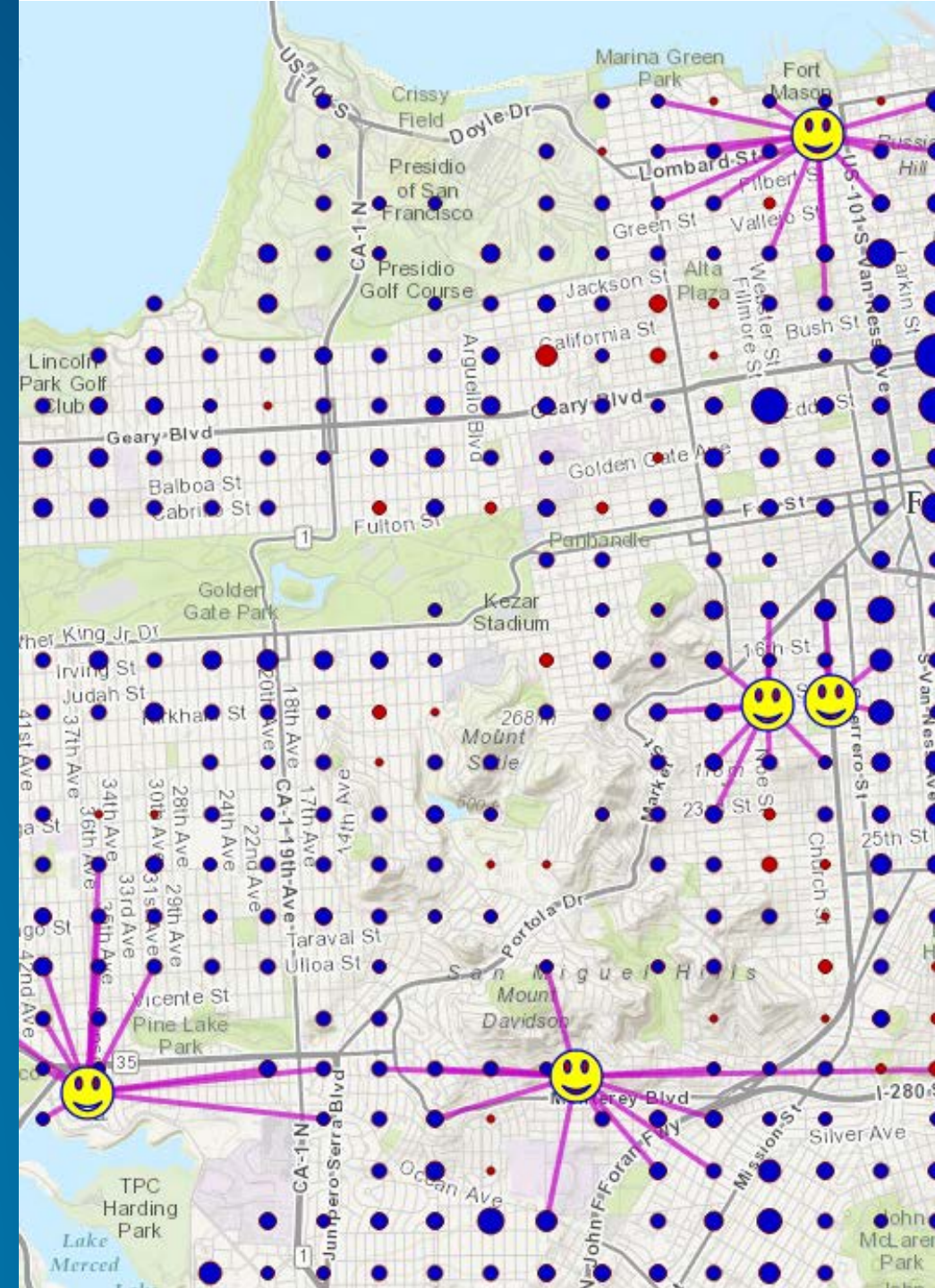
- Access Traffic service
  - Using the [Traffic Web Map](#)
  - Using the [ArcGISDynamicMapServiceLayer](#) class



Demo

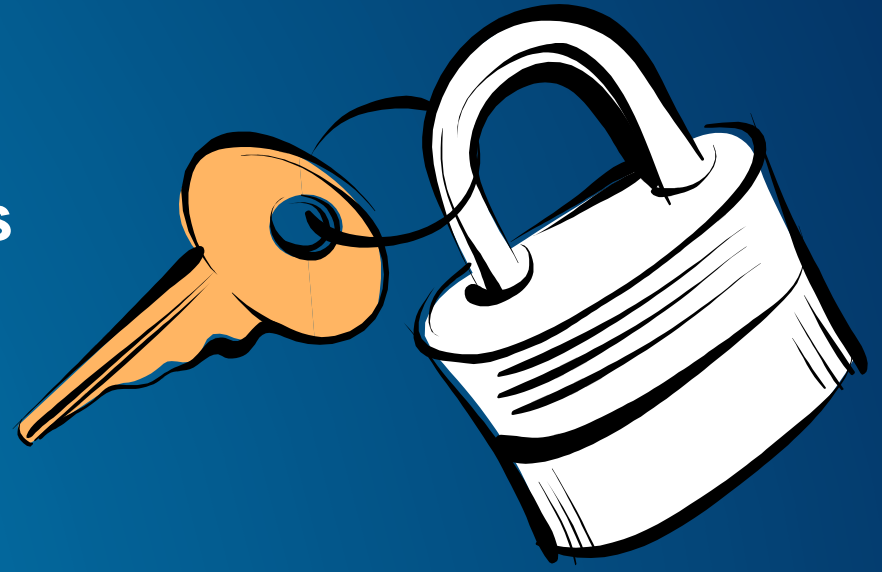
# Find best locations to open child care facilities

- Use the location-allocation service
- [View live sample](#)  
Works best with Google Chrome browser



# Accessing Geocoding and Routing Services














- Every request to a secured service requires a valid token
- Geosearch operations can be made anonymously if you are not storing the results
  - If storing results, you need to pass a token and `forStorage=true`
- Batch geocoding is a secured operation
- All routing services are secured





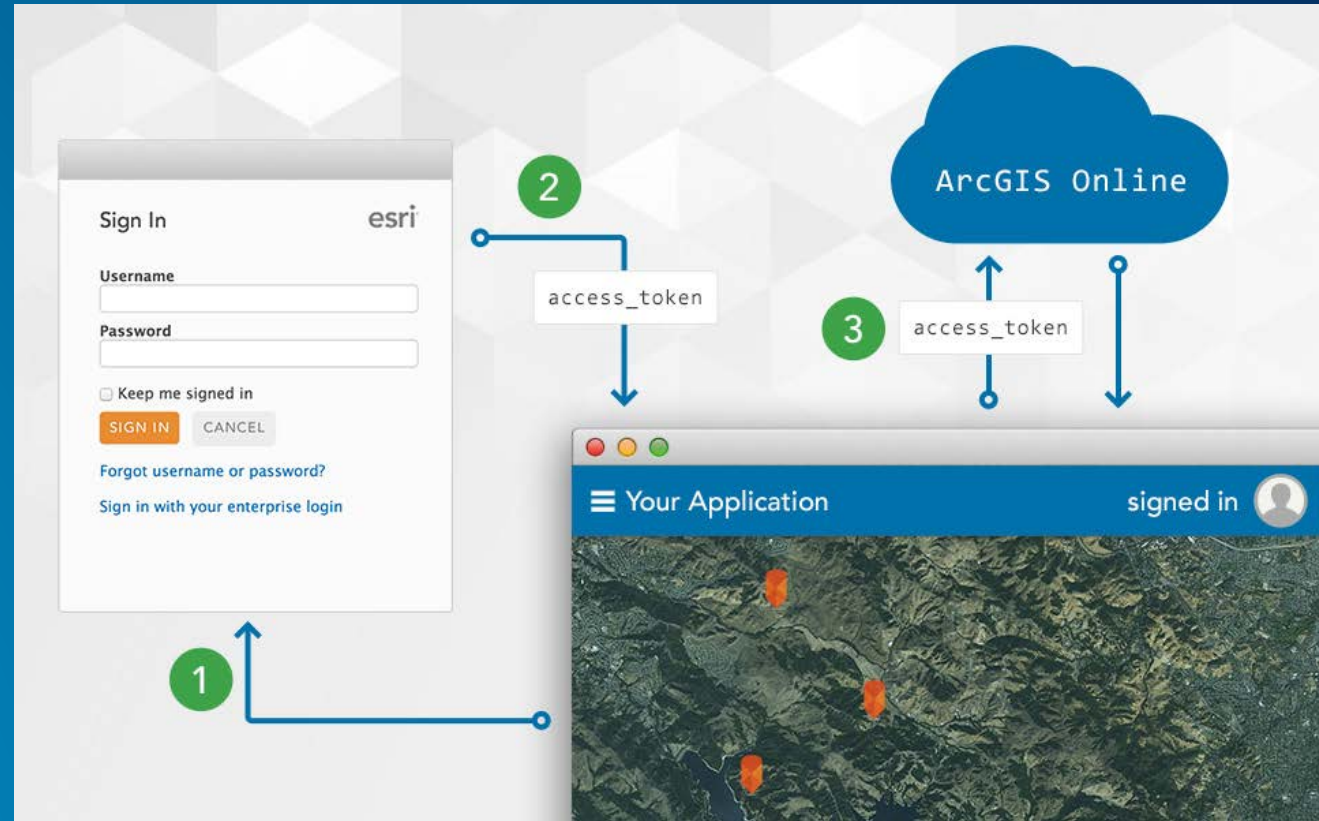
# ArcGIS Online Subscriptions

- Required to access geocoding and routing services
- Sign up for a 60 day free trial with 200 service credits
- Sign up for a free introductory developer account

Plan	Credits	Users	Support
Free For Development	50	1	  
\$\$/ month	200	1	  
\$\$\$ / month	900	1	  
\$\$\$\$ / month	2000	1	  
\$\$\$\$\$ / month	5000	1	  
\$\$\$\$\$ / month	10000	1	  
\$\$\$\$\$\$ / month	20000	1	  
\$\$\$\$\$\$\$ / month	40000	1	  

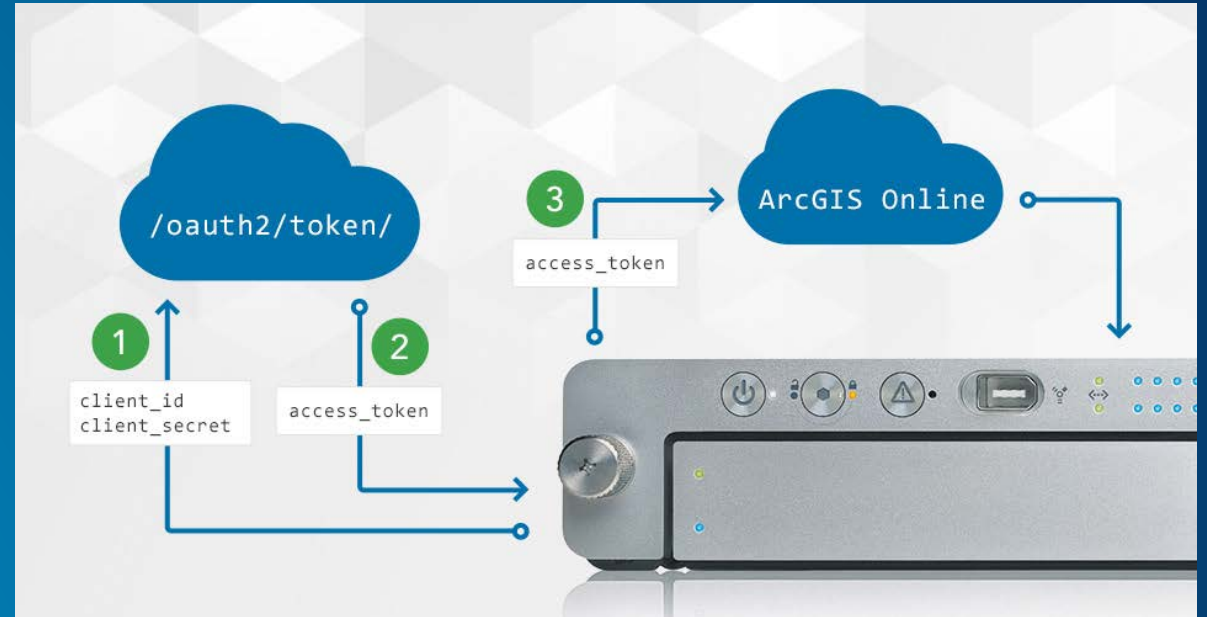
# Authentication using OAuth2 – User Logins

- Your app asks the end users to login.
- Use the identity manager provided by your SDK.
- [Authentication documentation](#)



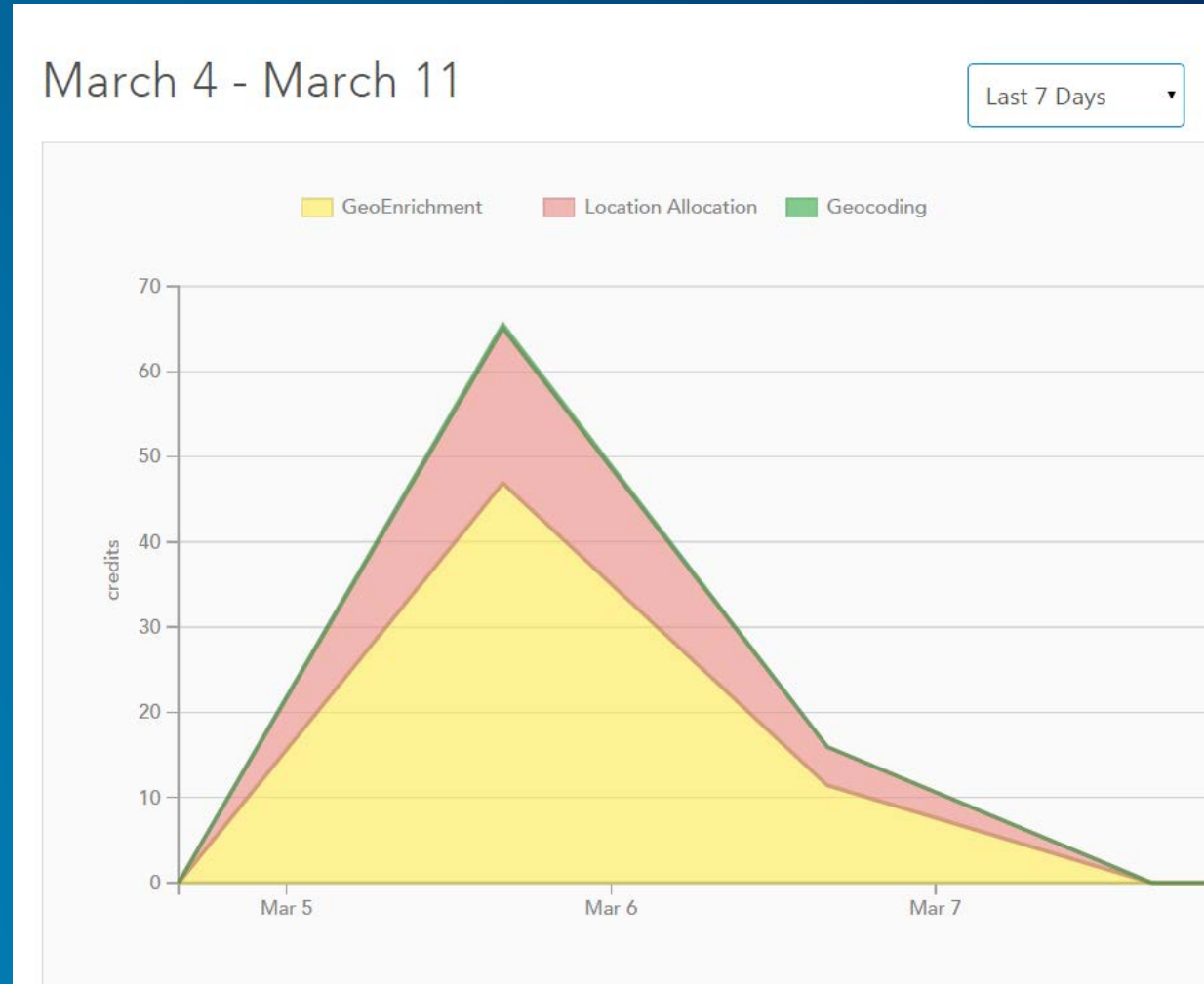
# Authentication using OAuth2 – App Logins

- Your app logs in behind the scenes
- Register your app and get a **client id** and **client secret**
  - Manage your client id and client secret using a server side proxy
  - [Proxy examples](#) in .NET, Java and PHP on Esri's github site
- [Authentication documentation](#)



# Understanding Your Bill – Service Credits

- Every successful request to secured services deducts credits
  - Use of traffic service does not deduct credits
- Track credits used by your app
- Credits Explained
- Credit Estimator





## Data Privacy Concerns

- When performing batch geocoding, do I have to send in my sensitive data along with the addresses to Esri's cloud?

No. You can just send in your addresses and a value from a key field that can be used to join back geocoded points to your data.

- Does Esri store my routes?

No. For synchronous requests the routes are returned instantly to the client and never stored.

For asynchronous requests the routes are stored for 24 hours and automatically deleted. No relationship between input request and output routes is stored.

# Rate This Session

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