ArcGIS Online: Developing Web Applications with Geocoding and Routing Services

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Metadata

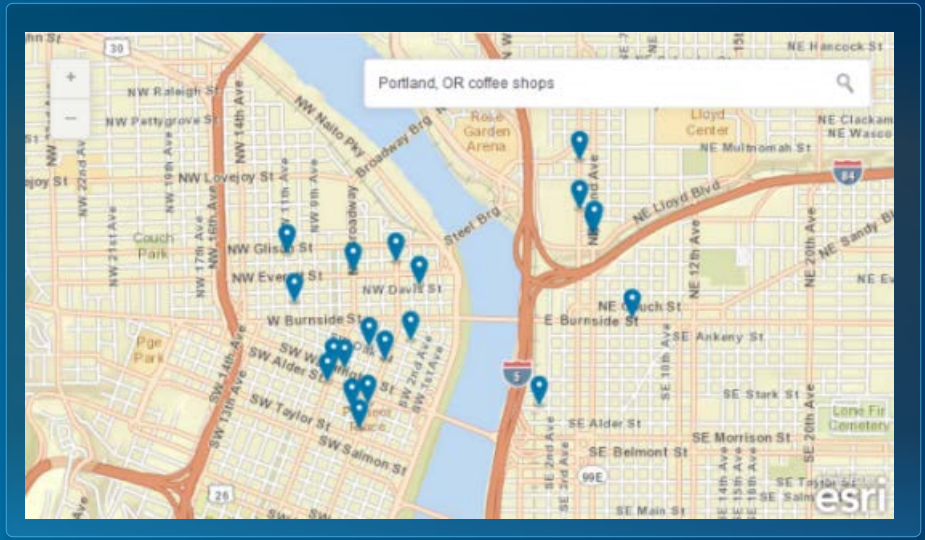
- Slides available at http://esriurl.com/ds15gr
- Slides and video recording will also be available at http://proceedings.esri.com
- Documentation at http://developers.arcgis.com
  - First read the REST API doc and then read the doc for your SDK
- Code samples at http://nadev.arcgis.com/arcgis/samples

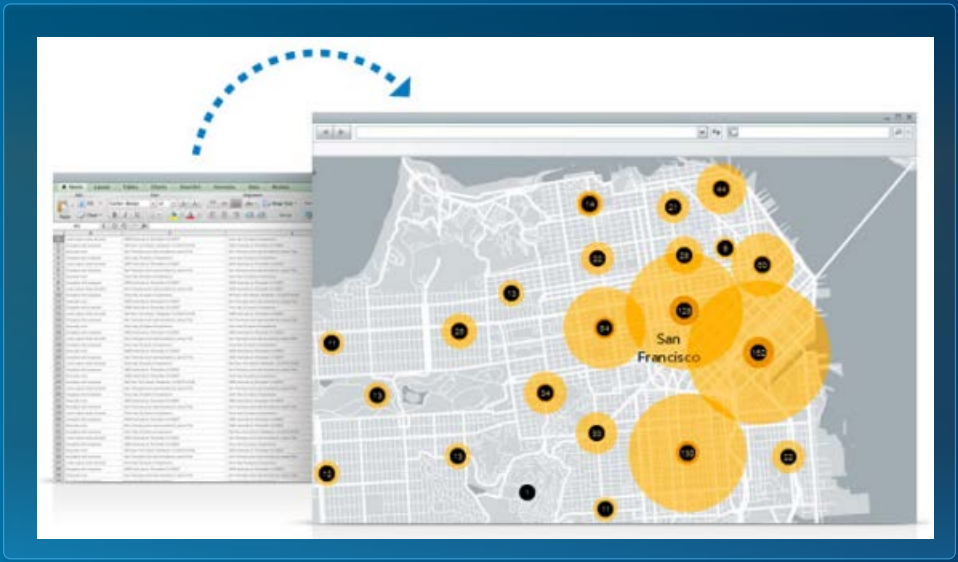
Topics

- 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

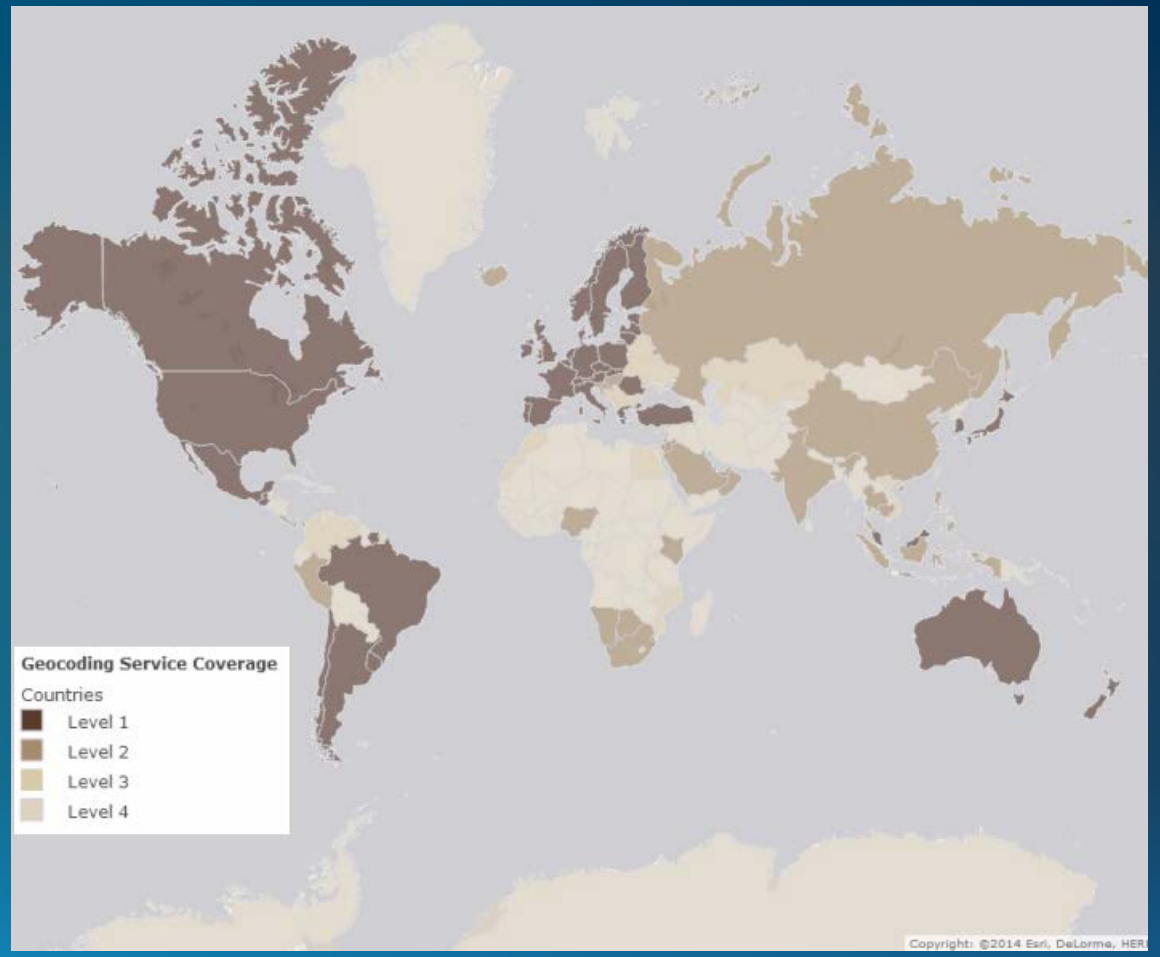
- Turn addresses into coordinates
- Search for point-of-interest, business names using categories
- Auto-complete inputs using suggestions
- Convert coordinates into addresses
- Convert a table of addresses into points





Geocoding Service Coverage

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

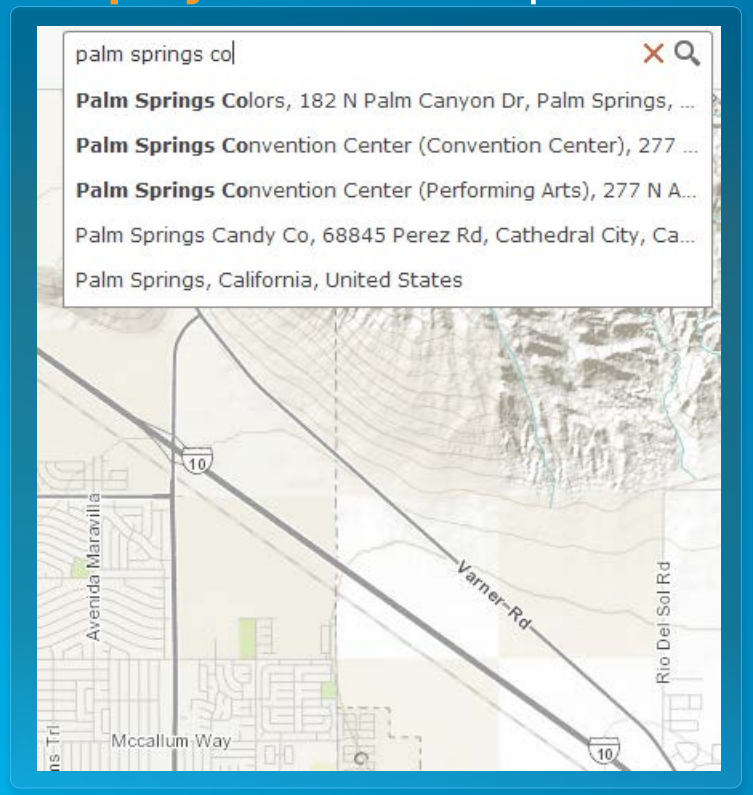


View larger map

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 `findAddreesCandidates` 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

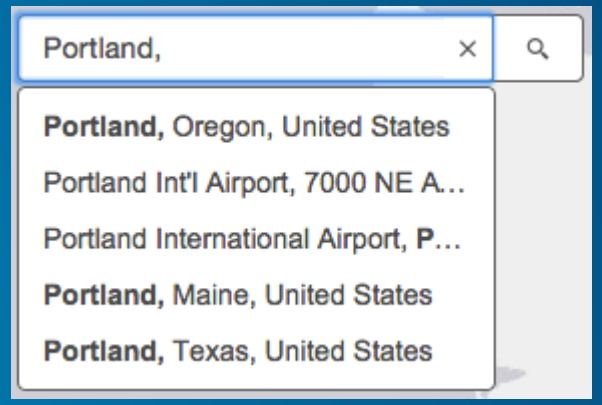
Geocode Service in ArcGIS API for JavaScript

- **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**

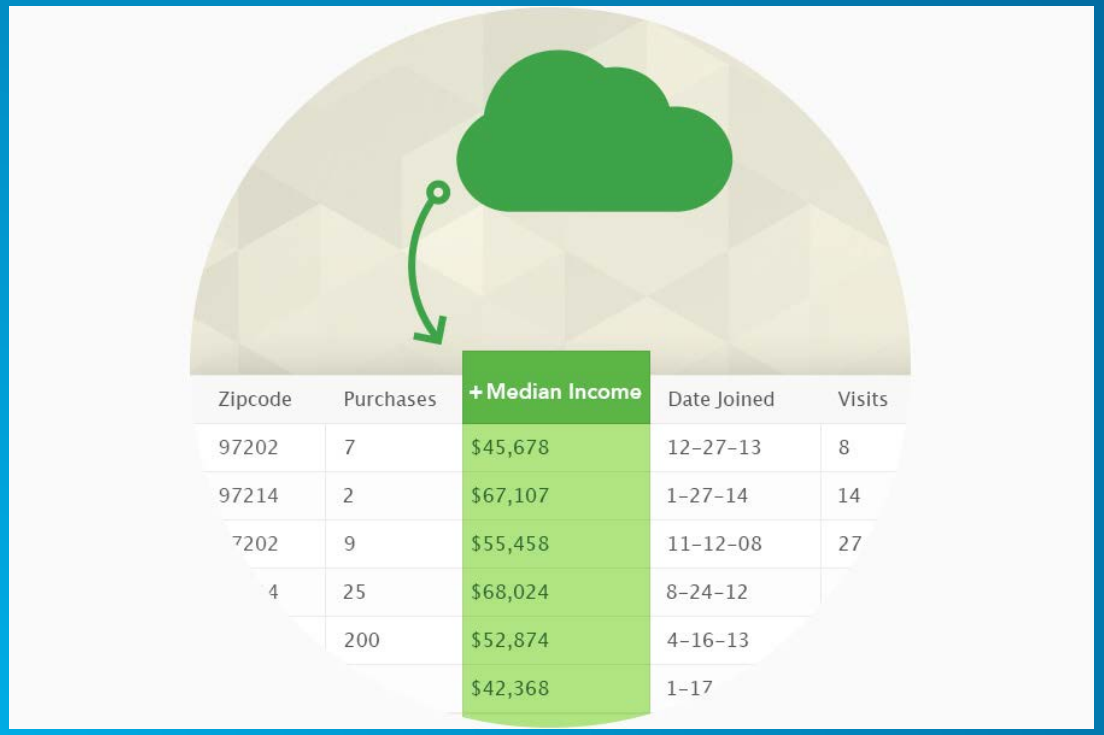
```
// Geocoder with all common options set. Only map is required.
Geocoder = new esri.dijit.Geocoder({
    autoComplete: true,
    arcgisGeocoder:{
        placeholder: "Find a place"
    },
    map: map
}, dojo.byId('search'));

// start widget
Geocoder.startup();
```



Detour -- Geoenrichment Service

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

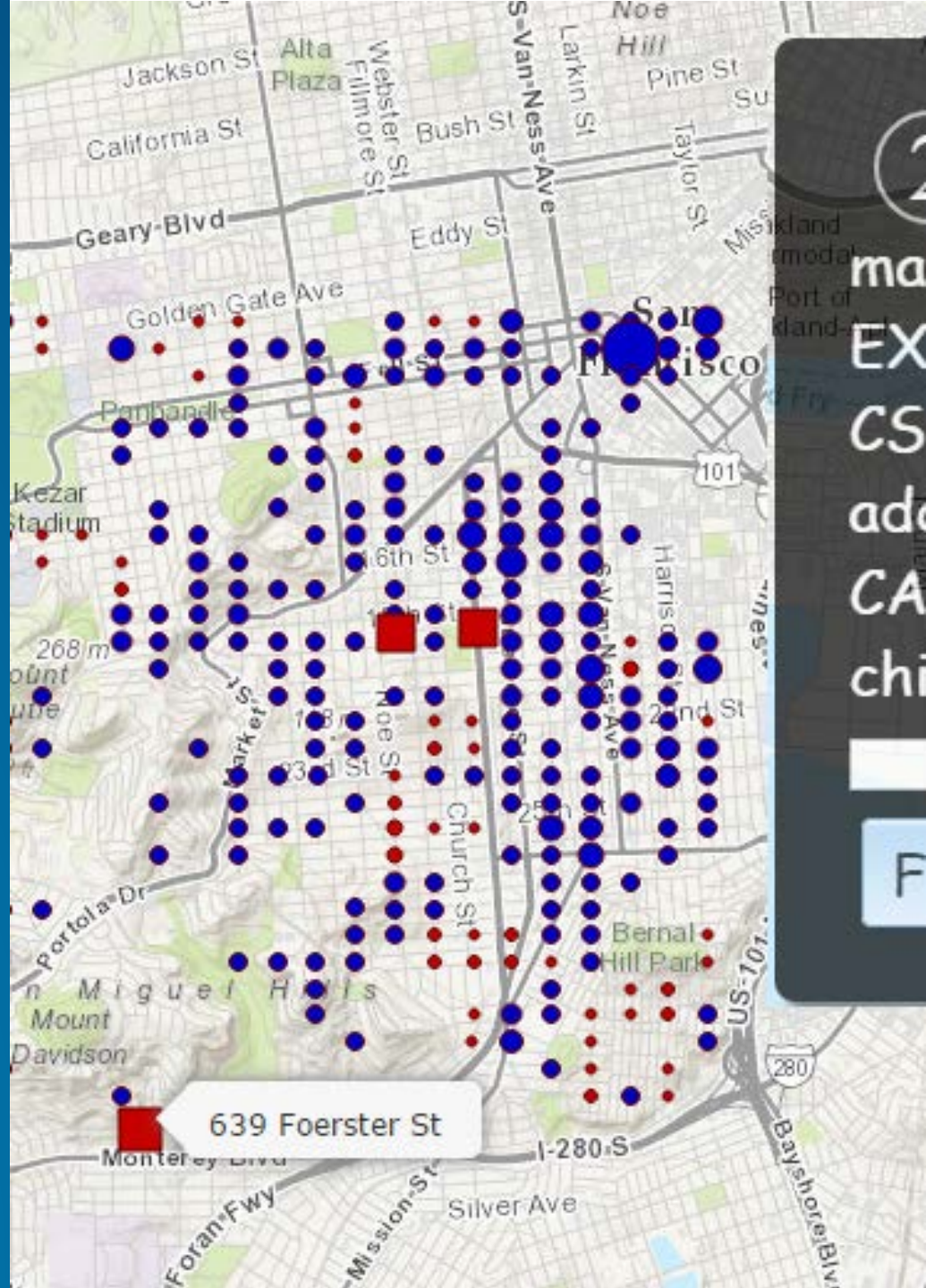


Zipcode	Purchases	+ Median Income	Date Joined	Visits
97202	7	$45,678	12-27-13	8
97214	2	$67,107	1-27-14	14
7202	9	$55,458	11-12-08	27
4	25	$68,024	8-24-12	
	200	$52,874	4-16-13	
		$42,368	1-17	

Demo

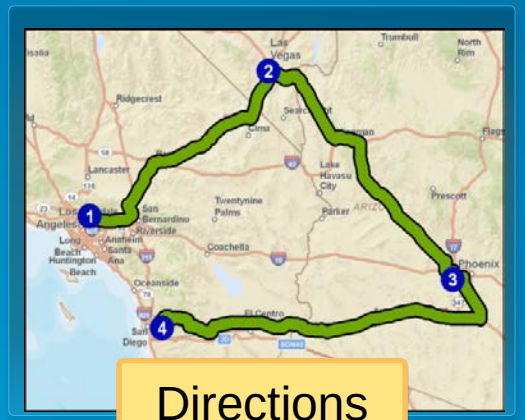
Batch geocode a CSV file containing candidate child care facility addresses

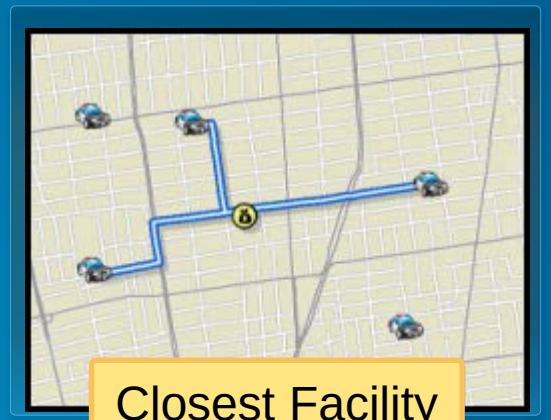
- `geocodeAddresses` operation
- View live sample
  Works best with Google Chrome browser

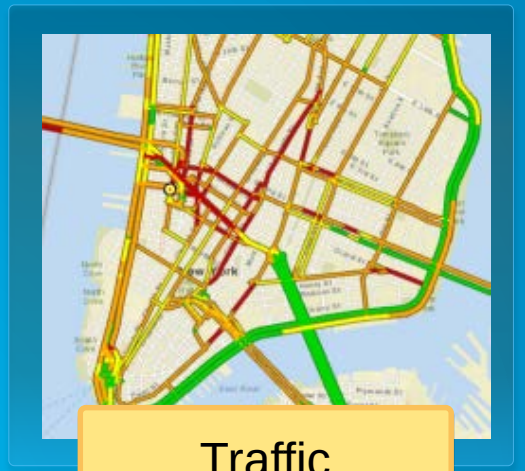


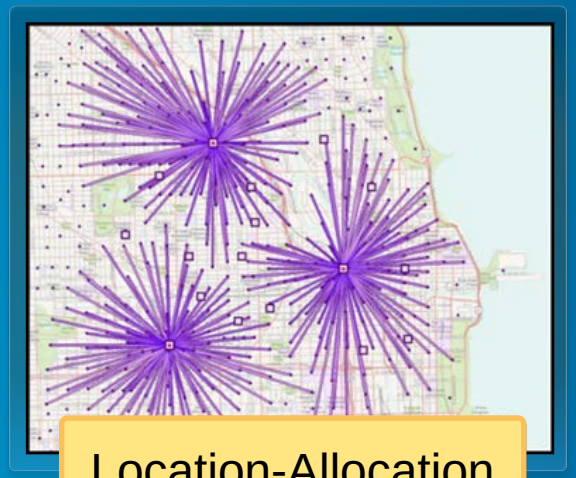
Direction and Routing Services

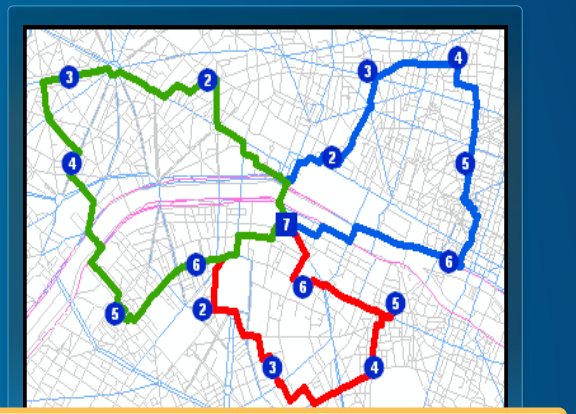
- Services that allow you to perform analyses on street networks





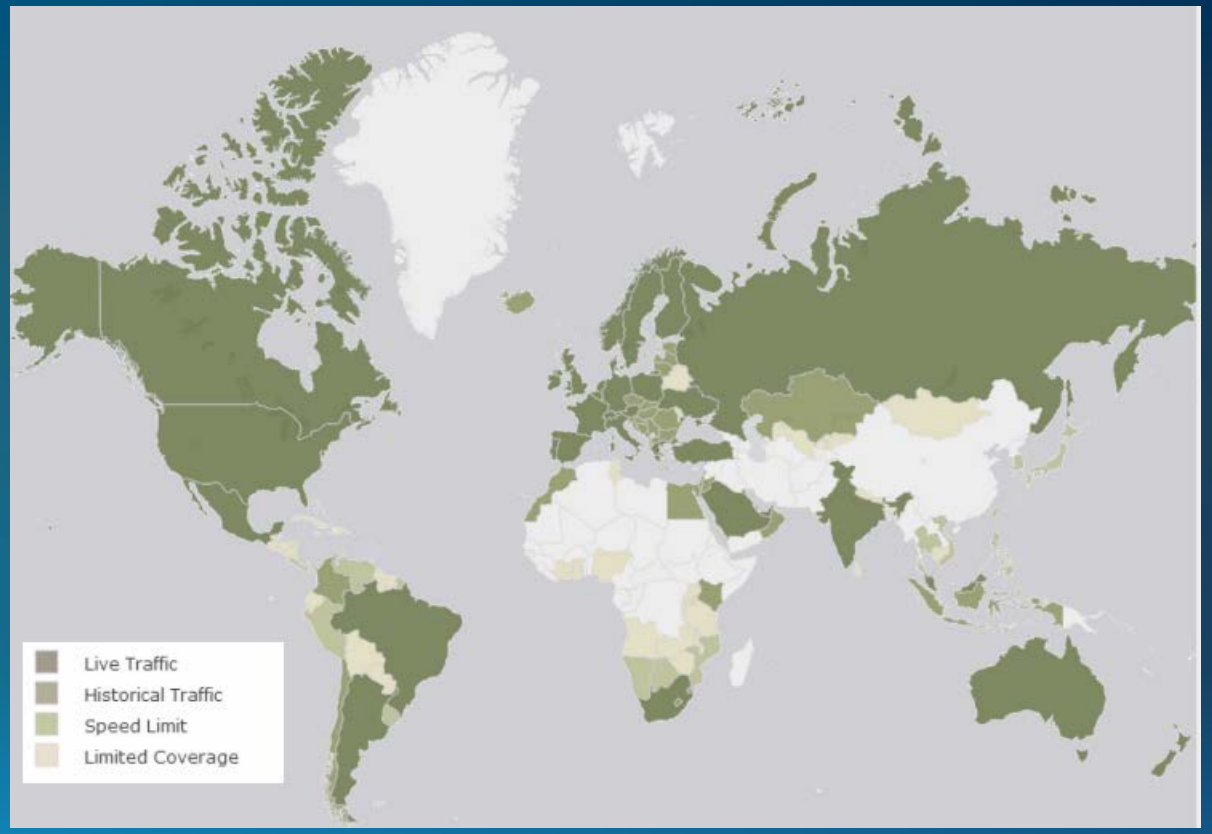






Common to all Services

- 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



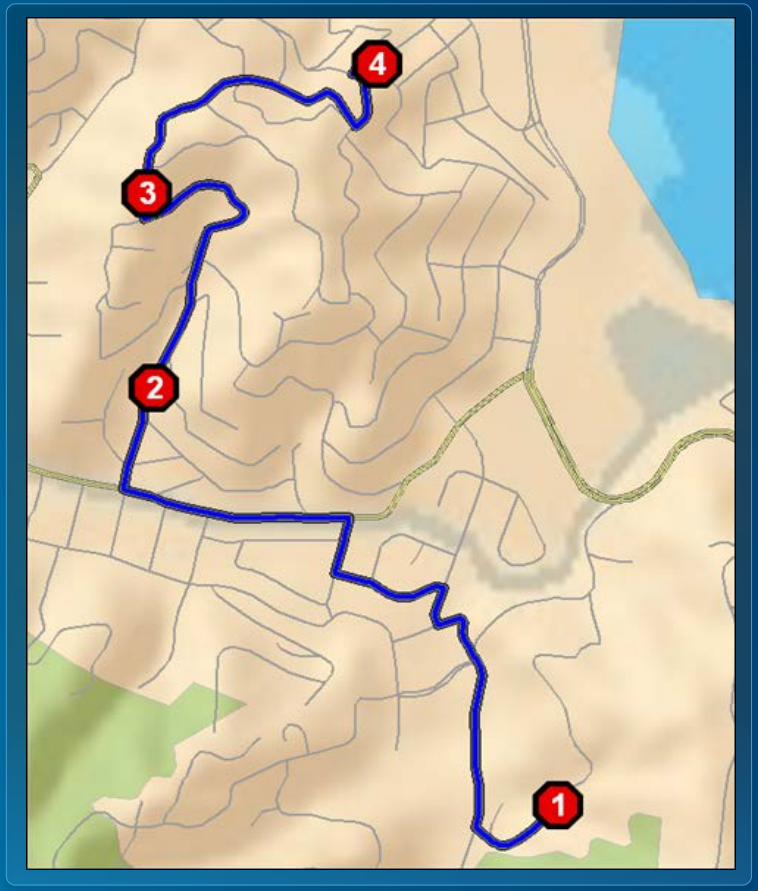
View larger map

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)

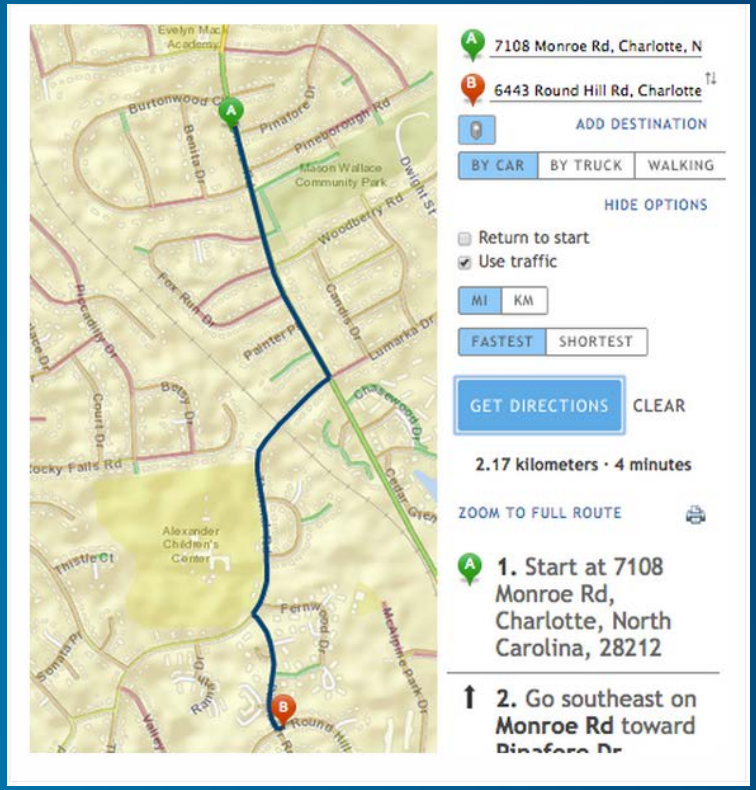
```
https://route.arcgis.com/arcgis/rest/services/World/Route/NAServer/Route_World/solve?token=<yourToken>&stops=-122.4079,37.78356;-122.404,37.782&f=pjson
```

Directions Service in ArcGIS API for JavaScript

- Easily add point to point routing with driving directions to your applications using the directions widget.

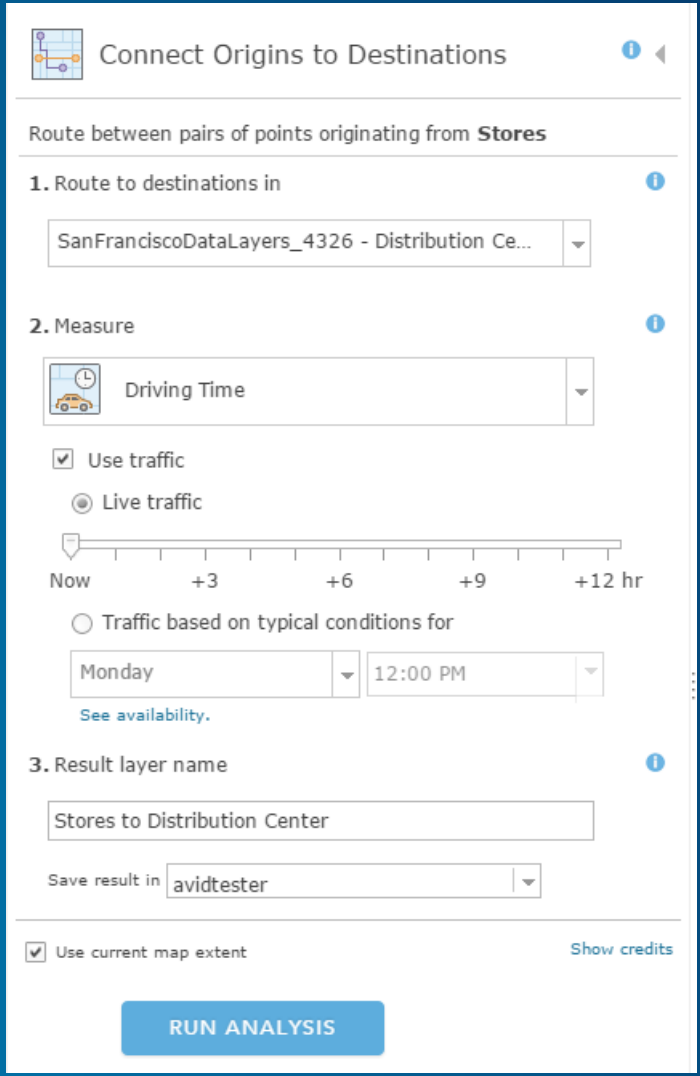
- Access Directions service in synchronous execution mode using the RouteTask class.

```
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**



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)

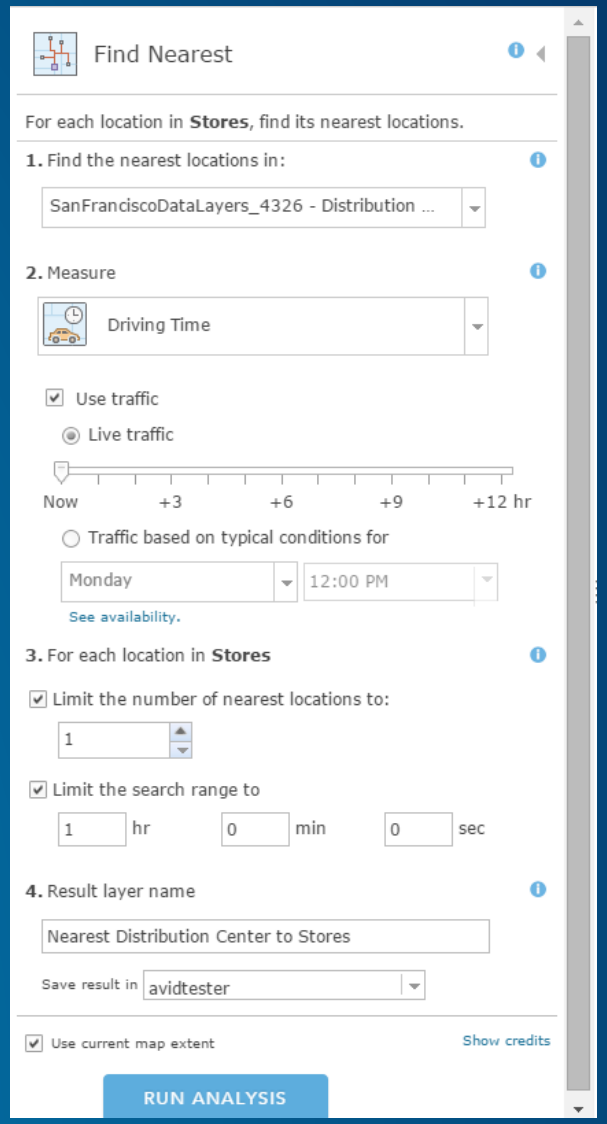
```
https://route.arcgis.com/arcgis/rest/services/World/ClosestFacility/NAServer/ClosestFacility_World/solveClosestFacility?<parameters>
```

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

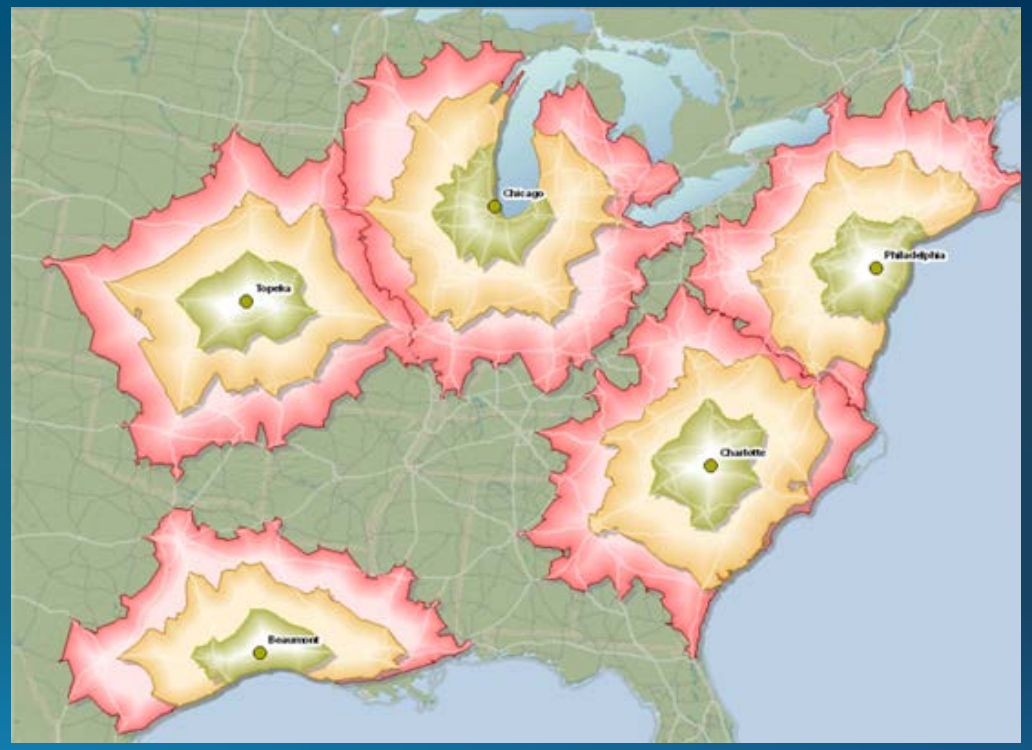


Service Areas

- 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)

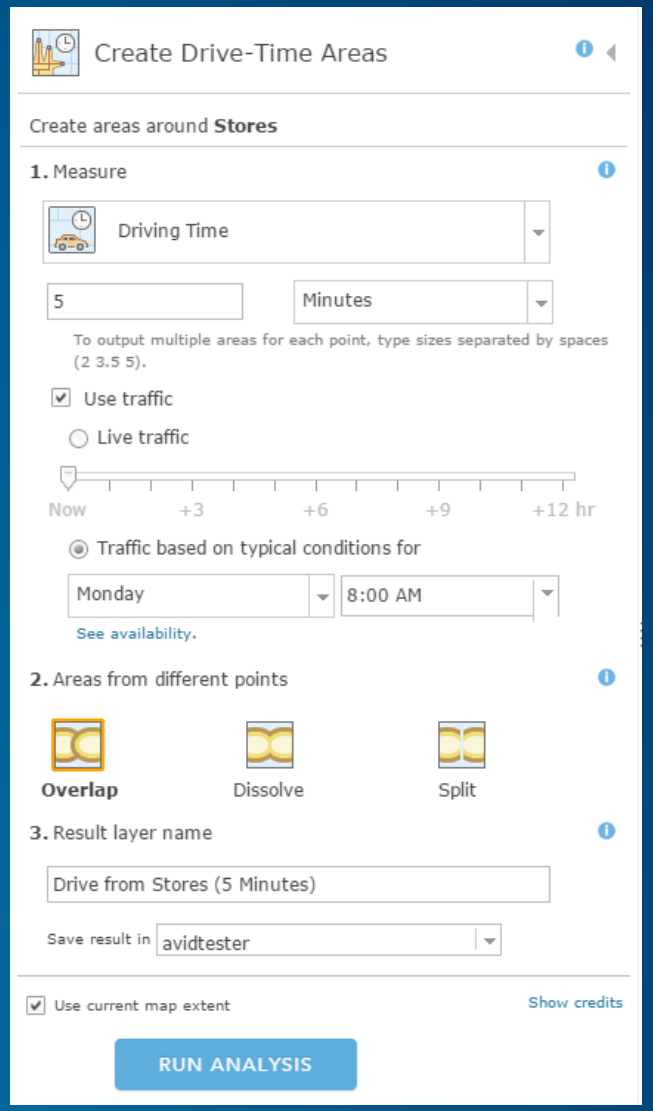
```
https://route.arcgis.com/arcgis/rest/services/World/ServiceAreas/NAServer/ServiceArea_World/solveServiceArea?<parameters>
```

Example Request (Synchronous Execution)

```
https://route.arcgis.com/arcgis/rest/services/World/ServiceAreas/NAServer/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

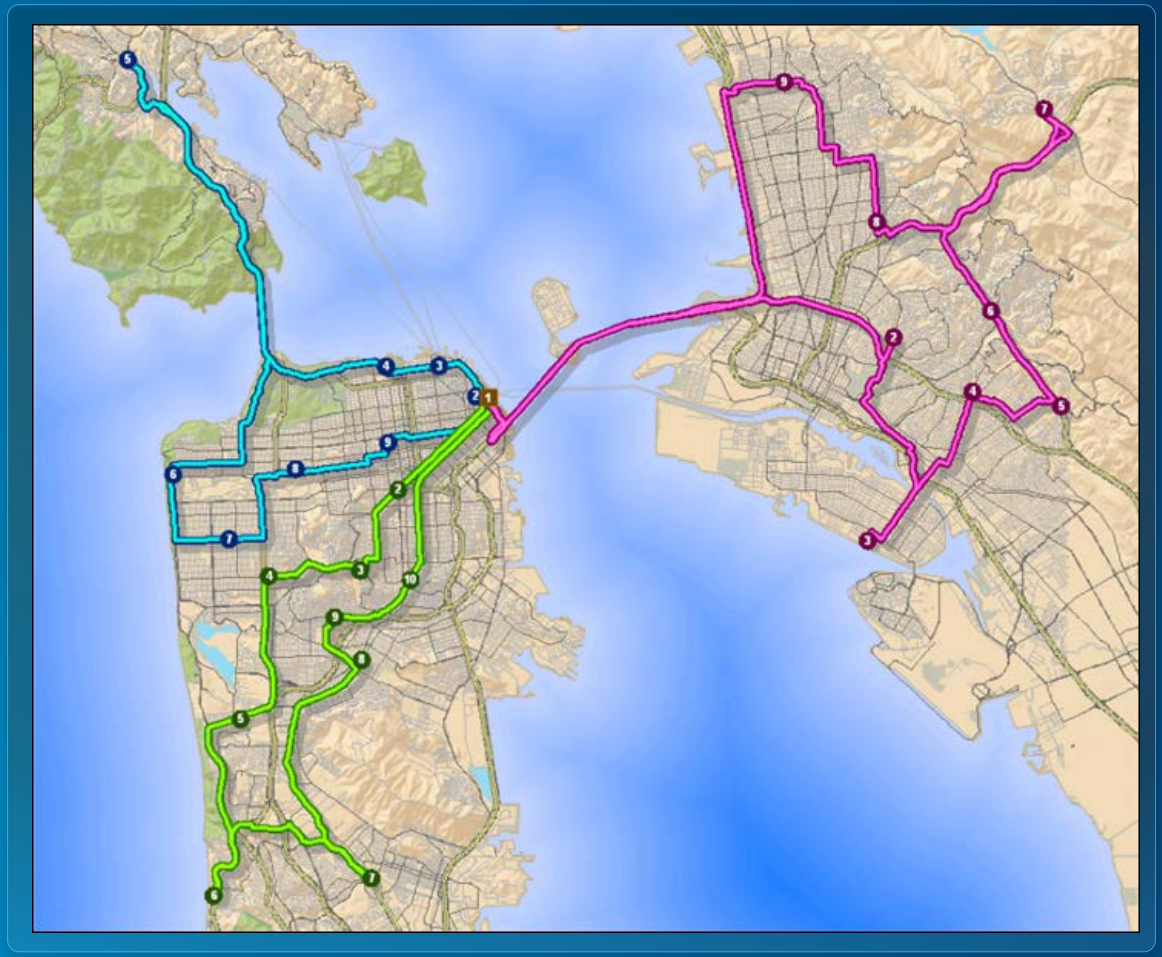


Vehicle Routing Problem

- 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

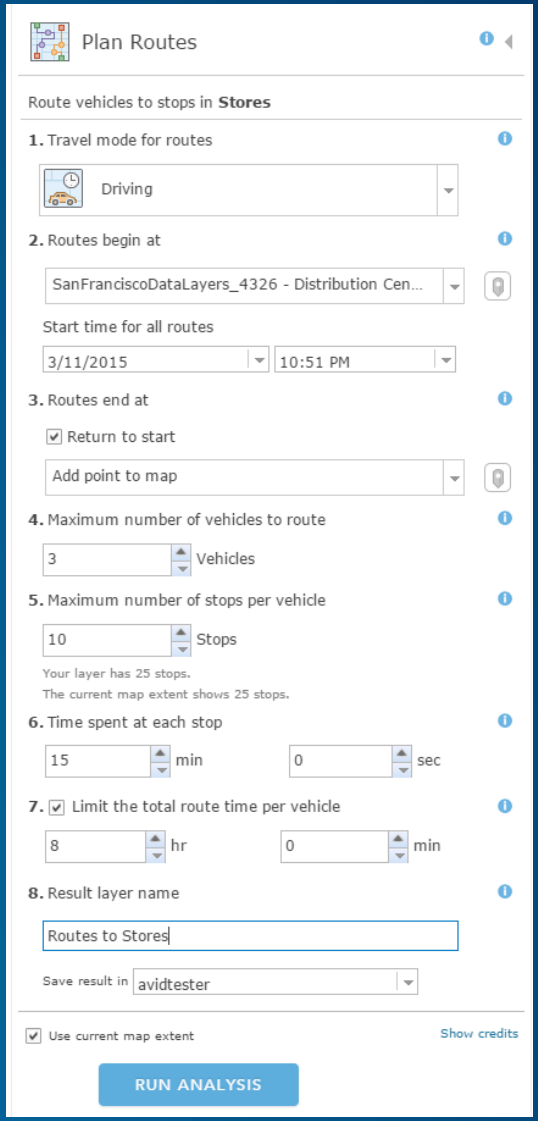
```
https://logistics.arcgis.com/arcgis/rest/services/World/VehicleRoutingProblem/GPServer/SolveVehicleRoutingProblem/jobs/<yourJobID>?token=<yourToken>&f=json
```

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



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

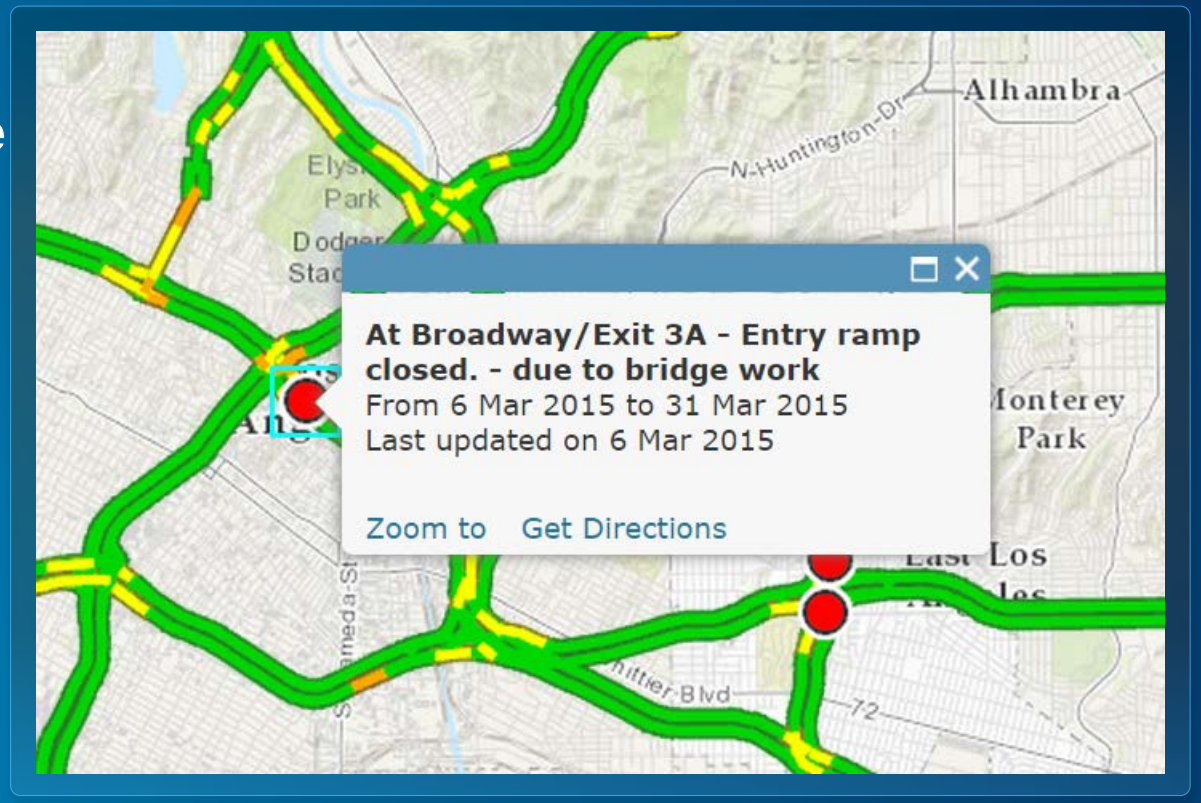
```
https://logistics.arcgis.com/arcgis/rest/services/World/LocationAllocation/GPServer/SolveLocationAllocation/jobs/<yourJobID>/results/<output_parameter_name>?token=<yourToken>&f=json
```

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,-13152117.71889893,4037275.3750789 47&f=image
```

Traffic Service in ArcGIS API for JavaScript

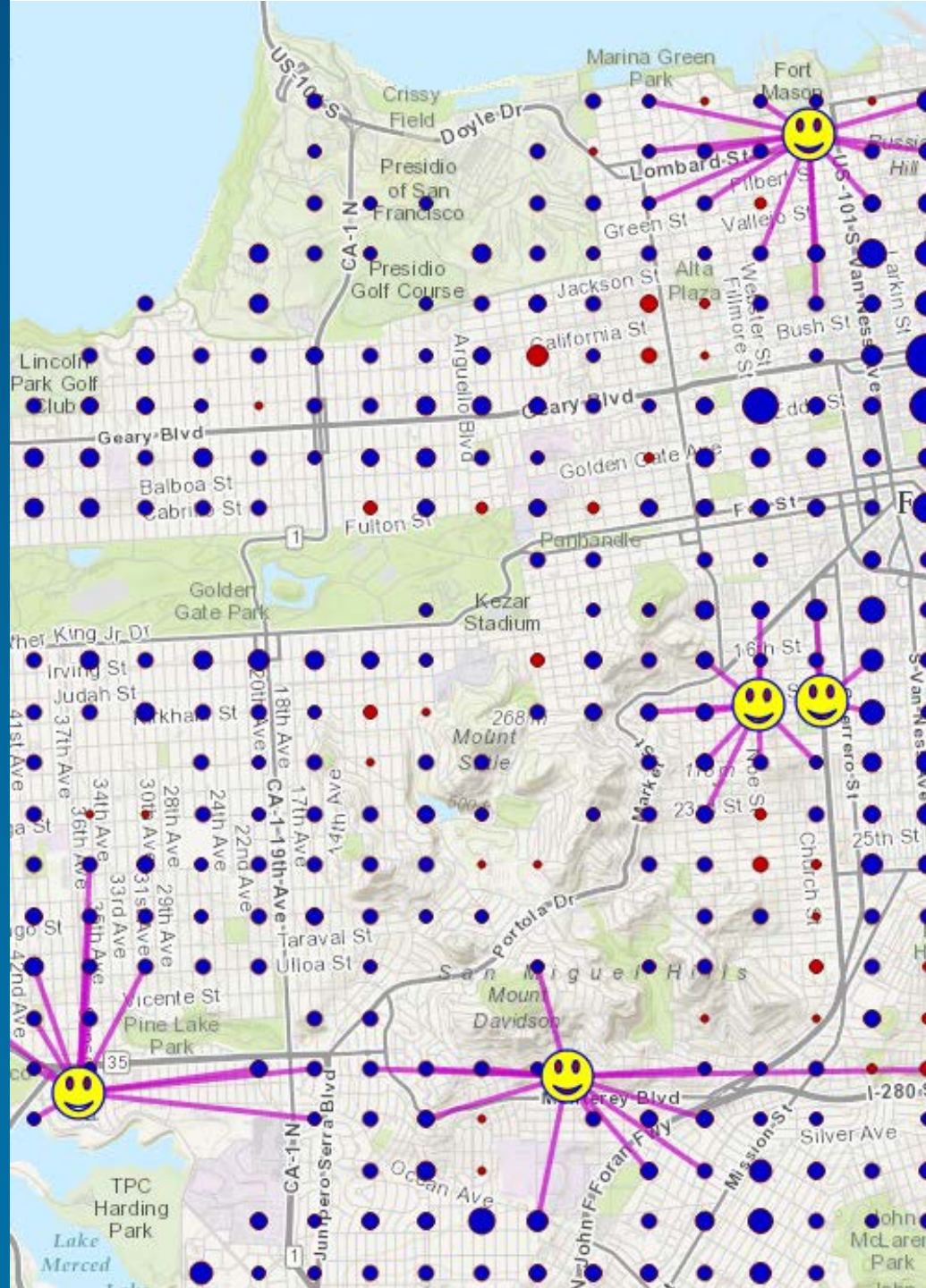
- **Access Traffic service**
  - **Using the Traffic Web Map**
  - **Using the ArcGISDynamicMapServiceLayer class**

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

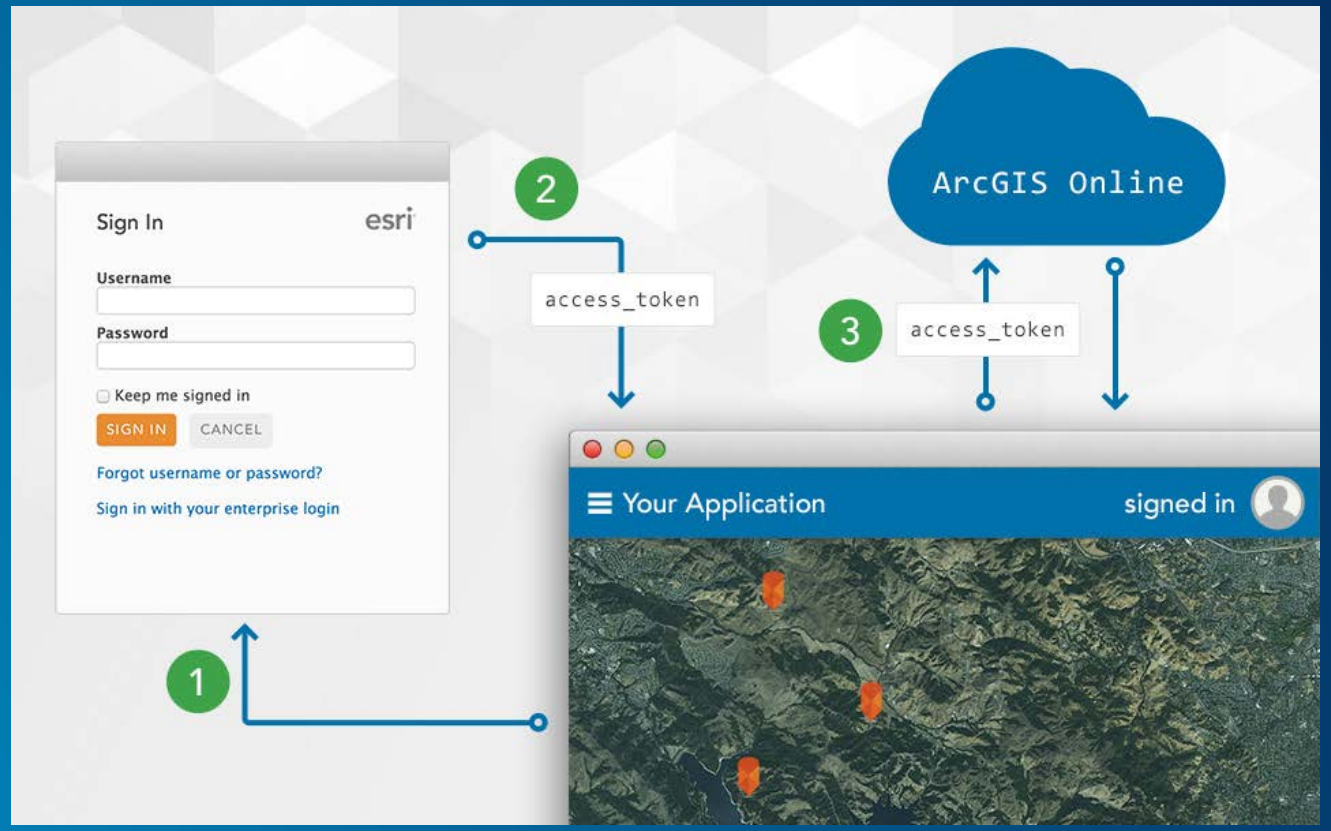
ArcGIS Online Subscriptions

- 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	

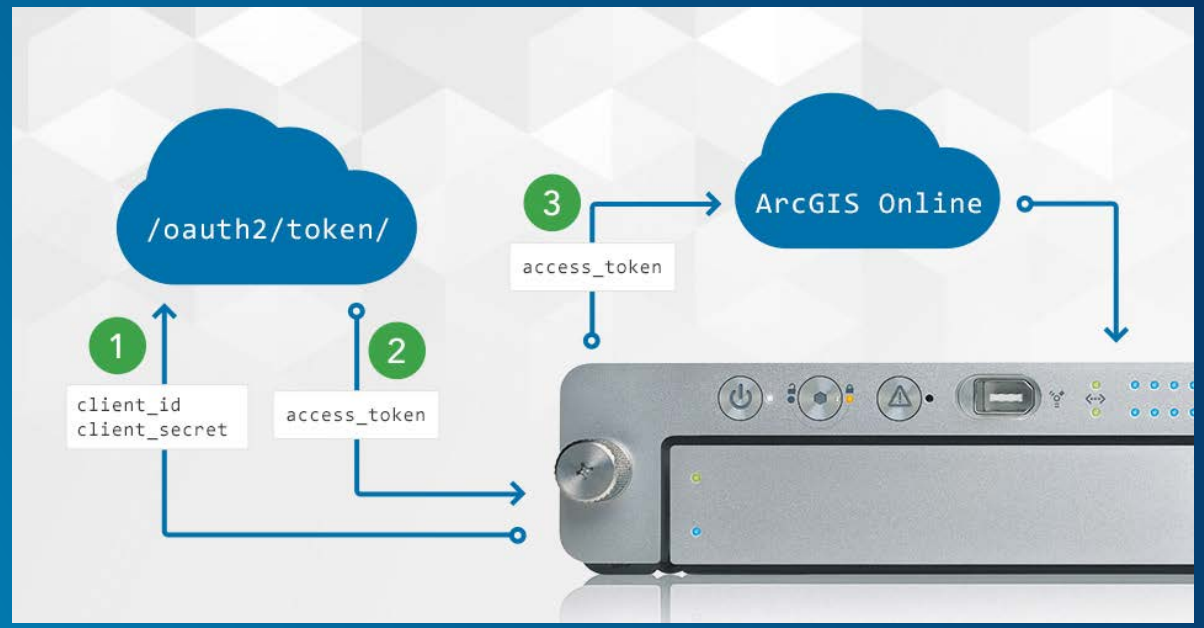
Authentication using OAuth2 – User Logins

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



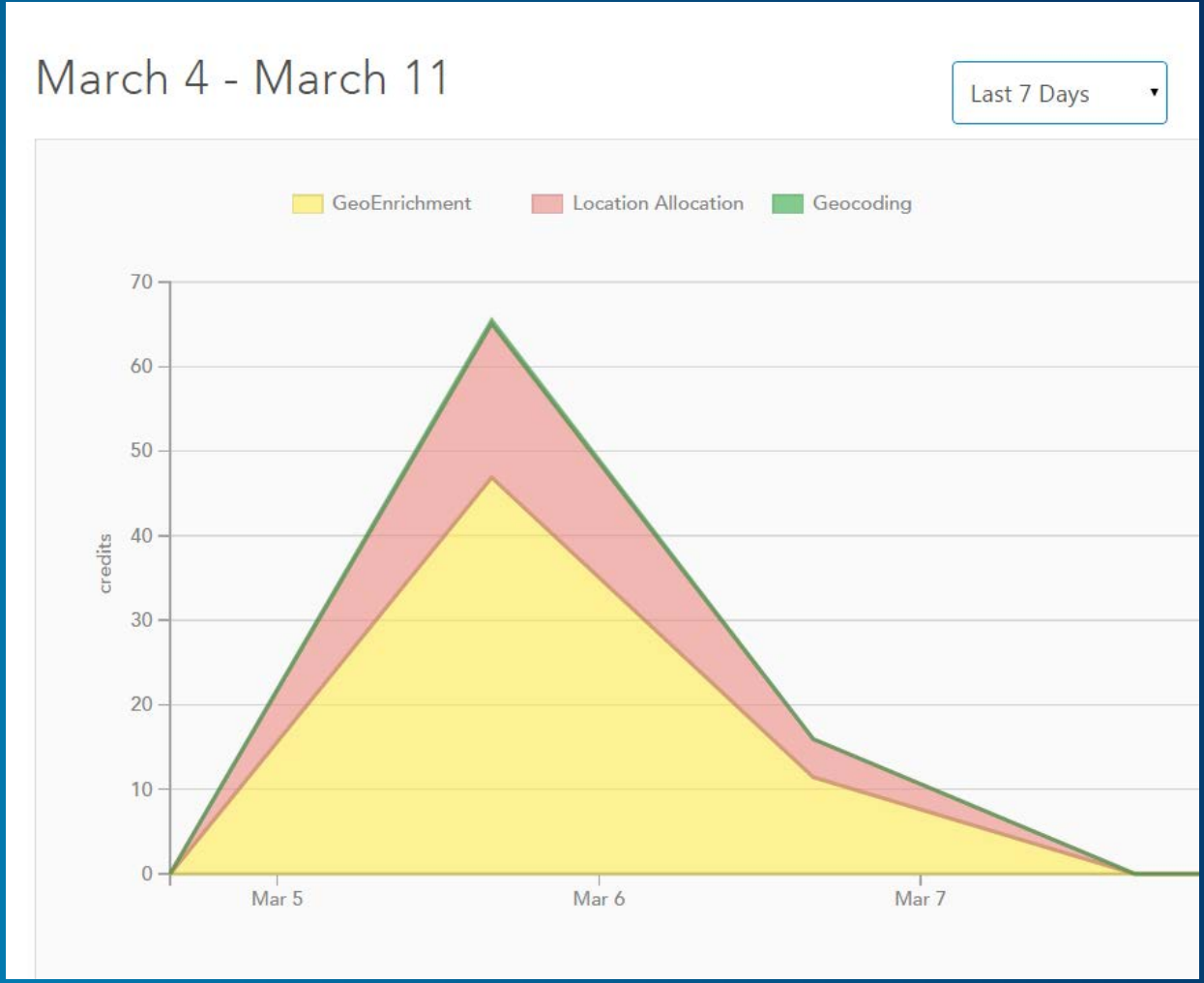
Authentication using OAuth2 – App Logins

- 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.

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