

Real-Time GIS: Leveraging Stream Services



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- **If you have downloaded these slides and are viewing them on your own computer, please view the slides in “Slide Show” mode. There are animations in the slides that replicate demo-like workflows**
- **If you do not view in slide show mode many slides will appear cluttered and unintuitive when all of the slide’s graphics appear at once.**

In this presentation:

Leveraging Stream Services

- **What are stream services?**
 - How are stream services different from traditional feature services?
 - What are some advantages to using stream services?
- **What are stream layers?**
 - How are stream layers added to a web map?
 - How can stream layers be used to support real-time spatial analytics?
 - How can real-time web maps be incorporated into a web application?

This is a beginner level technical workshop

Leveraging Stream Services

- **We expect that you know and have probably used:**
 - **Web maps and feature layers in web maps**
- **This presentation will demonstrate and discuss:**
 - **How stream services are published using the GeoEvent Manager**
 - **How stream services are discovered in the ArcGIS REST Services Directory**
 - **Advantages stream services provide vs. traditional feature services**
 - **Support for stream services available in the 10.3 and 10.3.1 product releases**



What are Stream Services



Demo – Stream Services

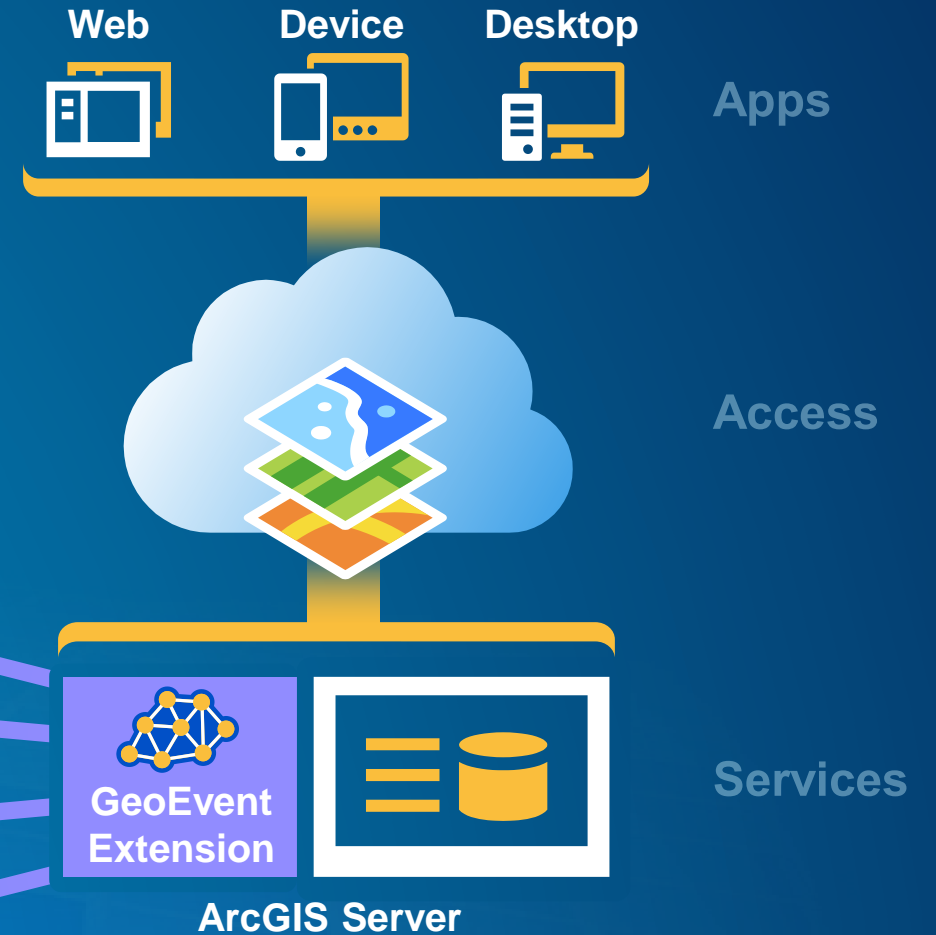
Publishing a real-time data feed

Real-Time GIS

Integration and exploitation of streaming data

- Integrates real-time streaming data into ArcGIS
- Performs continuous processing and real-time analytics
- Sends updates and alerts to those who need it where they need it

10.2

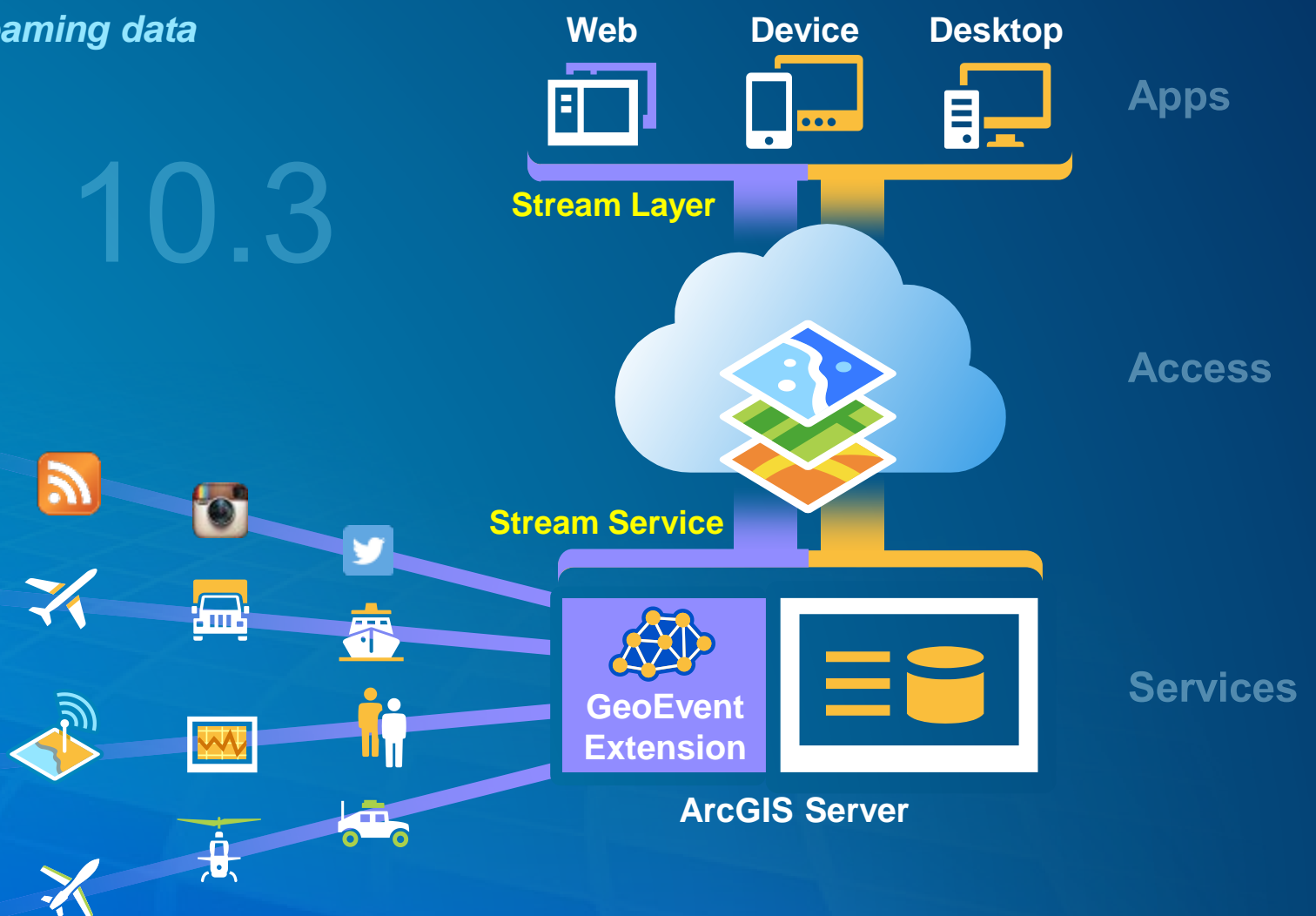


Real-Time GIS

Integration and exploitation of streaming data

- Integrates real-time streaming data into ArcGIS
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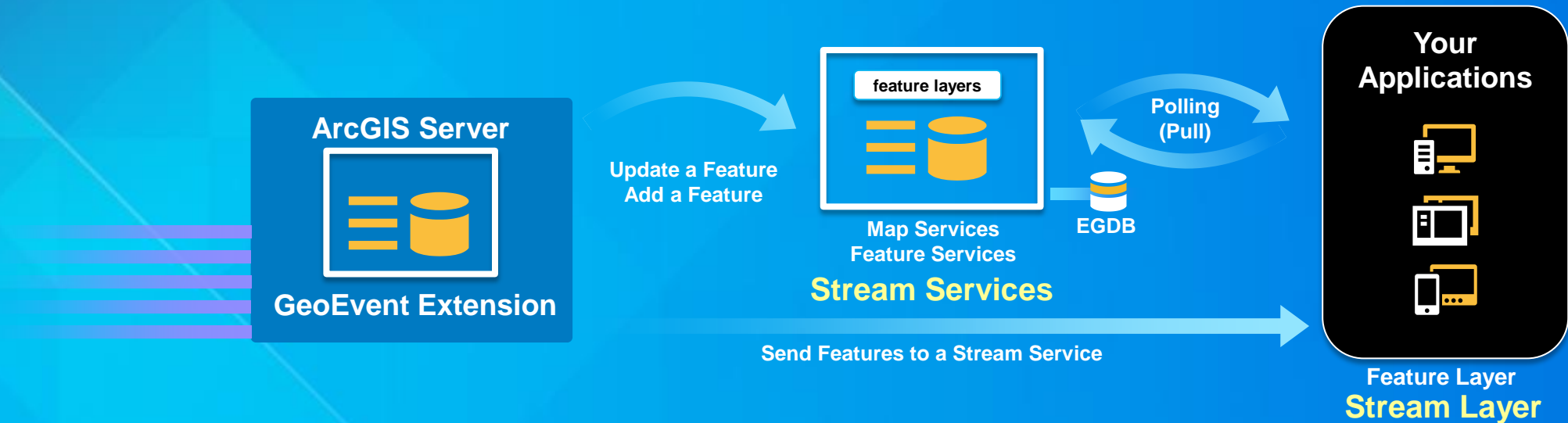
10.3



Stream services vs. traditional feature services

Two patterns of Real-time GIS

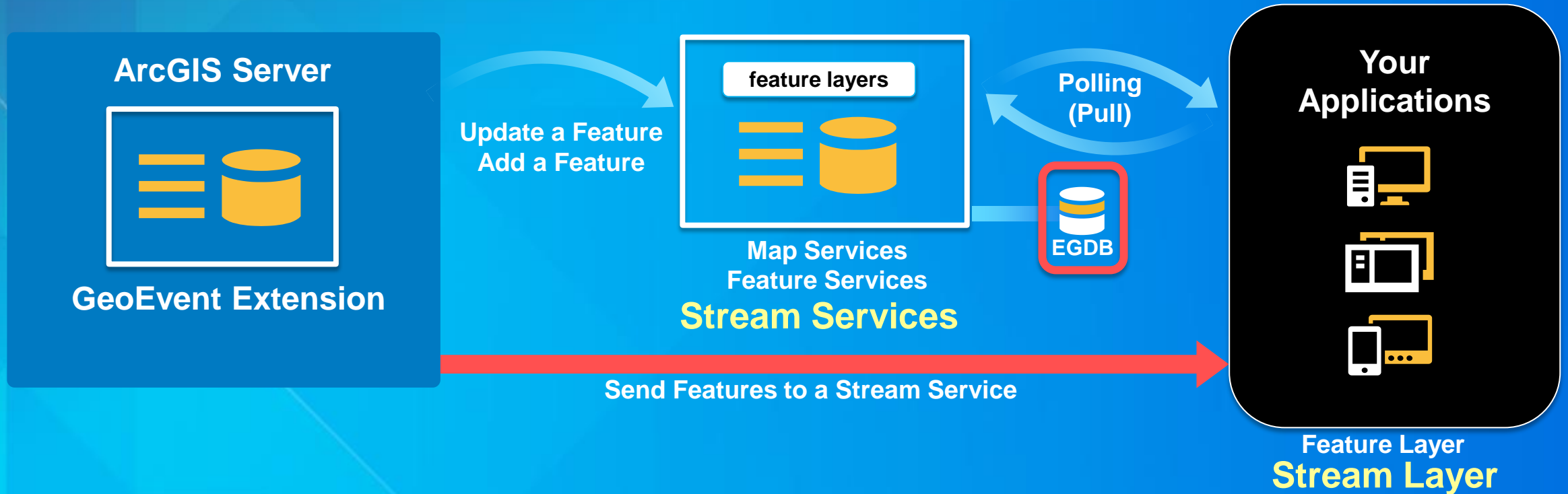
- Feature layers **pull** from feature services
 - Web apps poll to get periodic updates
- Stream layers **subscribe** to stream services
 - Web apps subscribe to immediately receive data
 - Low latency and high throughput



Stream services vs. traditional feature services

Two patterns, two important differences

- Feature services **persist** their data in a Geodatabase
- Stream services **broadcast** their data without first persisting the data



Stream services are published using the GeoEvent Manager

Publish your stream service as part of configuring your GeoEvent output

Send Features to a Stream Service



Sends GeoEvents to a Stream Service.

- **Check to make sure you have specified the correct GeoEvent Definition ...**

Creating Output - Send Features to a Stream Service

Save Cancel

Name*:

GeoEvent Definition Name:

ArcGIS Server Connection*:

Folder:

Stream Service Name*:

Advanced

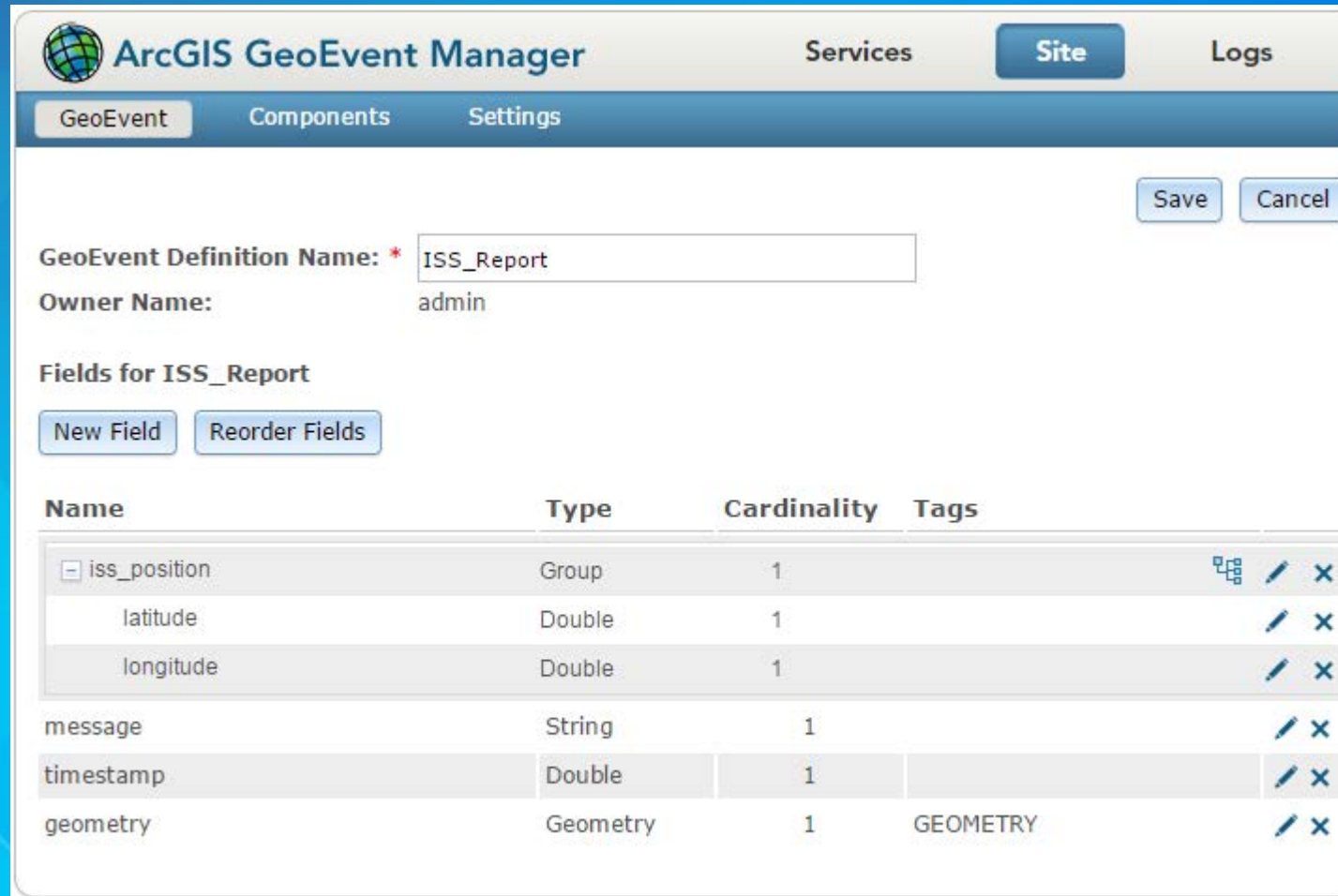
Update Interval (seconds)*:

Formatted JSON*: Yes No

Enforce Unique TrackID*: Yes No

Stream services are published using the GeoEvent Manager

Publish your stream service as part of configuring your GeoEvent output



The screenshot displays the ArcGIS GeoEvent Manager interface. The top navigation bar includes 'Services', 'Site', and 'Logs'. Below this, a secondary navigation bar shows 'GeoEvent', 'Components', and 'Settings'. The main content area is titled 'GeoEvent Definition Name: * ISS_Report' and 'Owner Name: admin'. There are 'Save' and 'Cancel' buttons in the top right. Under the heading 'Fields for ISS_Report', there are 'New Field' and 'Reorder Fields' buttons. A table lists the fields for the stream service:

Name	Type	Cardinality	Tags
iss_position	Group	1	
latitude	Double	1	
longitude	Double	1	
message	String	1	
timestamp	Double	1	
geometry	Geometry	1	GEOMETRY

Stream services are published using the GeoEvent Manager

Publish your stream service as part of configuring your GeoEvent output

Send Features to a Stream Service



Sends GeoEvents to a Stream Service.

- Click 'Publish Stream Service'
- Your event definition will be part of the stream service you publish

Creating Output - Send Features to a Stream Service Save Cancel

Name*:

GeoEvent Definition Name:

ArcGIS Server Connection*: Register ArcGIS Server

Folder:

Stream Service Name*: Publish Stream Service

▼ Advanced

Update Interval (seconds)*:

Formatted JSON*: Yes No

Enforce Unique TrackID*: Yes No

Stream services are published using the GeoEvent Manager

Publish your stream service as part of configuring your GeoEvent output

Publish Stream Service

Publish a new stream service.

Name:

Replace existing stream service:

Cluster Name:

Store Latest:

Geometry Type:

▼ Advanced


Related Features:

- **Optional store latest (uses feature service)**
- **Click 'Publish'**

Stream services are published using the GeoEvent Manager

Publish your stream service as part of configuring your GeoEvent output

Send Features to a Stream Service



Sends GeoEvents to a Stream Service.

**Don't Forget to Save
your GeoEvent output**

Creating Output - Send Features to a Stream Service

Save **Cancel**

Name*:

GeoEvent Definition Name:

ArcGIS Server Connection*: **Register ArcGIS Server**

Folder:

Stream Service Name*: **Publish Stream Service**

▼ Advanced

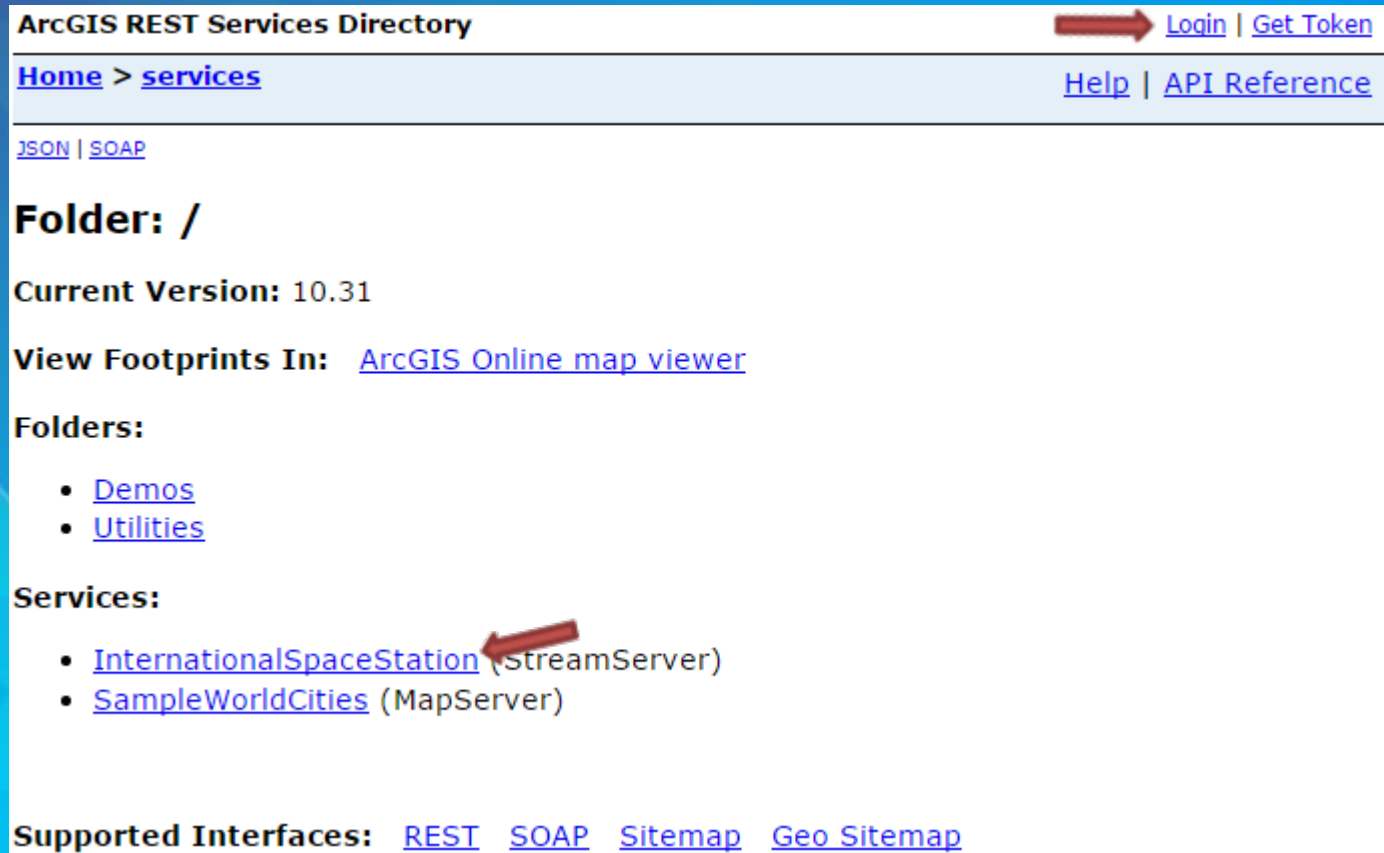
Update Interval (seconds)*:

Formatted JSON*: Yes No

Enforce Unique TrackID*: Yes No

Stream services are discoverable in the ArcGIS REST Services Directory

Logging in as an administrator will expose additional capabilities such as publishing content to the stream



ArcGIS REST Services Directory [Login](#) | [Get Token](#)

[Home](#) > [services](#) [Help](#) | [API Reference](#)

[JSON](#) | [SOAP](#)

Folder: /

Current Version: 10.31

View Footprints In: [ArcGIS Online map viewer](#)

Folders:

- [Demos](#)
- [Utilities](#)

Services:

- [InternationalSpaceStation](#) (StreamServer)
- [SampleWorldCities](#) (MapServer)

Supported Interfaces: [REST](#) [SOAP](#) [Sitemap](#) [Geo Sitemap](#)

- Click the service to open its REST specification page...

Stream services are discoverable in the ArcGIS REST Services Directory

- Click the JSON link to view a more complete specification of the service...
- Click the Subscribe link to jump to an HTML page and see the JSON being broadcast by the service...

```
{
  "description": null,
  "objectIdField": null,
  "timeInfo": {
    "trackInfo": null,
    "startInfo": null,
    "endInfo": null
  },
  "geometryType": "esriGeometryPoint",
  "geometryField": "geometry",
  "spatialReference": {
    "wkid": 4326,
    "latestWkid": 4326
  },
  "fields": [
    {
      "name": "iss_position",
      "type": "esriFieldTypeString",
      "alias": "iss_position",
      "nullable": true
    },
    {
      "name": "message",
      "type": "esriFieldTypeString",
      "alias": "message",
      "nullable": true
    },
    {
      "name": "timestamp",
      "type": "esriFieldTypeDouble",
      "alias": "timestamp",
      "nullable": true
    }
  ],
  "relatedFeatures": [
    {
      "url": "http://MAJERE.ESRI.COM:6180/arcgis/ws/services/InternationalSpaceStation/StreamServer"
    }
  ],
  "currentVersion": "10.3",
  "transport": "ws",
  "url": "http://MAJERE.ESRI.COM:6143/arcgis/ws/services/InternationalSpaceStation/StreamServer",
  "capabilities": "broadcast,subscribe"
}
```

[Home](#) > [services](#) > [InternationalSpaceStation \(StreamServer\)](#)

[JSON](#) ←

InternationalSpaceStation (StreamServer)

View In: [ArcGIS JavaScript](#)

Description: null

Object ID: null

Geometry Type: esriGeometryPoint

Geometry Field: geometry

Spatial Reference: 4326 (4326)

Fields:

- iss_position (type: esriFieldTypeString , alias: iss_position , nullable: true)
- message (type: esriFieldTypeString , alias: message , nullable: true)
- timestamp (type: esriFieldTypeDouble , alias: timestamp , nullable: true)

Web Socket URLs:

- ws://MAJERE.ESRI.COM:6180/arcgis/ws/services/InternationalSpaceStation/StreamServer
- wss://MAJERE.ESRI.COM:6143/arcgis/ws/services/InternationalSpaceStation/StreamServer

Capabilities: [Subscribe](#) ←

Subscribe to view JSON broadcast by the stream service

Stream services broadcast Esri Feature JSON

ArcGIS REST Services Directory [Login](#) | [Get Token](#)

[Home](#) > [services](#) > [InternationalSpaceStation \(StreamServer\)](#) > [subscribe](#) [Help](#) | [API Reference](#)

[JSON](#)

InternationalSpaceStation (StreamServer)

```
{
  "geometry": {
    "x": -54.34148022533627,
    "y": -21.431571209727373,
    "spatialReference": {
      "wkid": 4326
    }
  },
  "attributes": {
    "iss_position": ""
  },
  "\latitude\": -21.431571209727373,
  "\longitude\": -54.34148022533627,
  "message": "success",
  "timestamp": 143579
},
{
  "geometry": {
    "x": -54.12191354918246,
    "y": -21.682162312638678,
    "spatialReference": {
      "wkid": 4326
    }
  },
  "attributes": {
    "iss_position": ""
  },
  "\latitude\": -21.682162312638678,
  "\longitude\": -54.12191354918246,
  "message": "success",
  "timestamp": 143579
},
{
  "geometry": {
    "x": -53.902763514568015,
    "y": -21.930974151271194,
    "spatialReference": {
      "wkid": 4326
    }
  },
  "attributes": {
    "iss_position": ""
  },
  "\latitude\": -21.930974151271194,
  "\longitude\": -53.902763514568015,
  "message": "success",
  "timestamp": 14357
},
{
  "geometry": {
    "x": -53.68264359309143,
    "y": -22.179579376681318,
    "spatialReference": {
      "wkid": 4326
    }
  },
  "attributes": {
    "iss_position": ""
  },
  "\latitude\": -22.179579376681318,
  "\longitude\": -53.68264359309143,
  "message": "success",
  "timestamp": 143579
}
```

You have subscribed



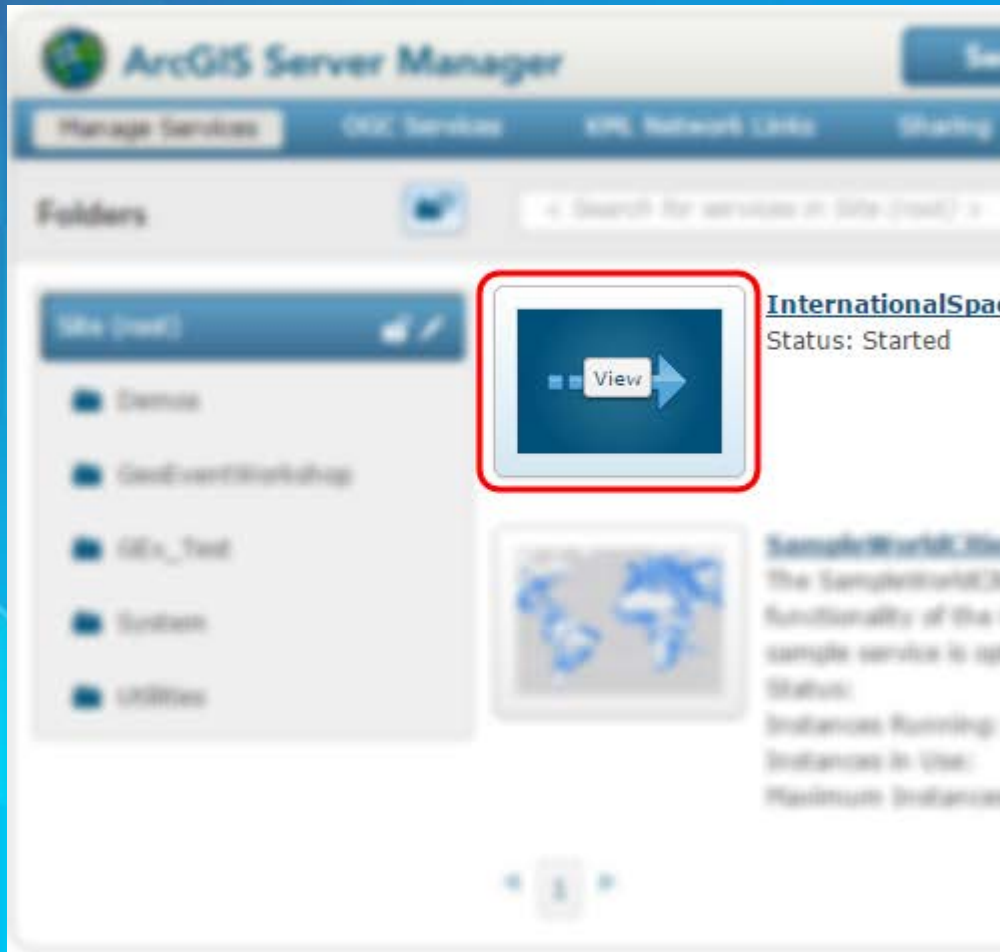
Stream service administration

Stream services are started, stopped, and configured using ArcGIS Server Manager

The screenshot displays the ArcGIS Server Manager web interface. At the top, there are navigation tabs for 'Services', 'Site', 'Security', and 'Logs'. Below these, a sub-navigation bar includes 'Manage Services', 'OGC Services', 'URL Network Links', and 'Sharing'. The main content area is titled 'Folders' and contains a search bar and a 'Publish Service' button. On the left, a sidebar lists folders: 'Site (root)', 'Demos', 'GeoEventWorkshop', 'GIS_Test', 'System', and 'Utilities'. The main area shows two service cards. The first card, 'InternationalSpaceStation', is a Stream Service with a status of 'Started'. It features a blue arrow icon and a red double-up arrow icon. The second card, 'SampleWorldCities', is a Map Service with a status of 'Started'. It features a world map icon and a red double-up arrow icon. Below the 'SampleWorldCities' card, there is a table with the following data:

Status:	Started
Instances Running:	1
Instances in Use:	0
Maximum Instances:	1

Click to view stream service content in a java script web map



ArcGIS Server Manager

Manage Services | OGC Services | WFS Network Links | Streaming

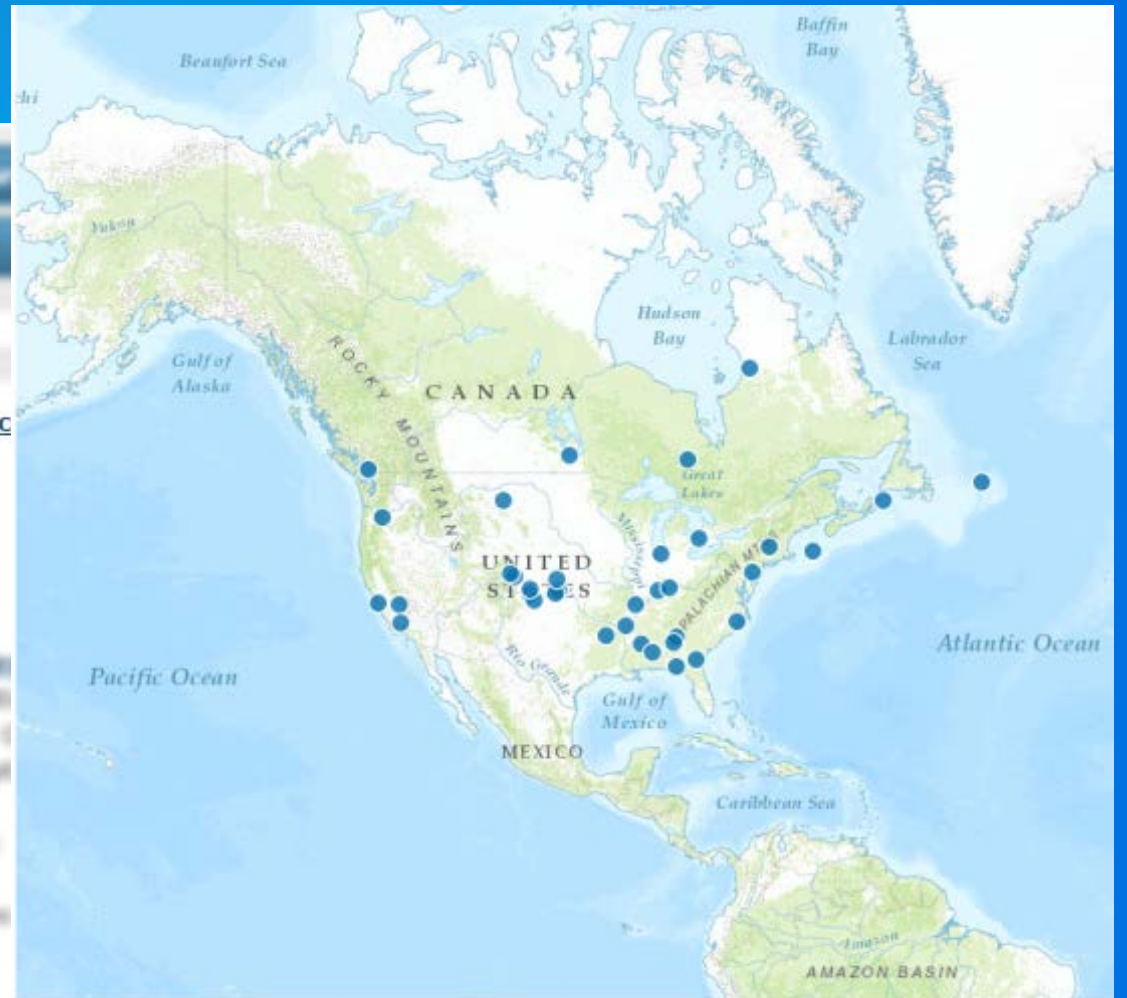
Folders

- Site (root)
- Demos
- GeoEventWorkshop
- GIS_Test
- System
- Utilities

View →

InternationalSpace
Status: Started

SampleWorldWide
The SampleWorldWide functionality of the sample service is off
Status:
Instances Running:
Instances in Use:
Maximum Instances:



Stream service url: <http://mbramer2:6080/arcgis/rest/services/FAA/StreamServer> Start Stream Stop Stream

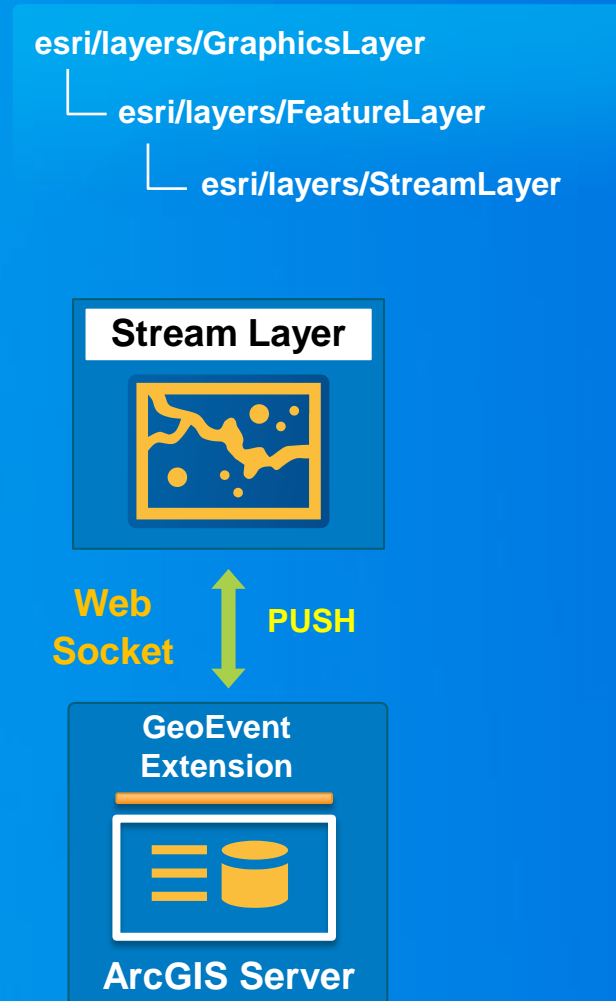
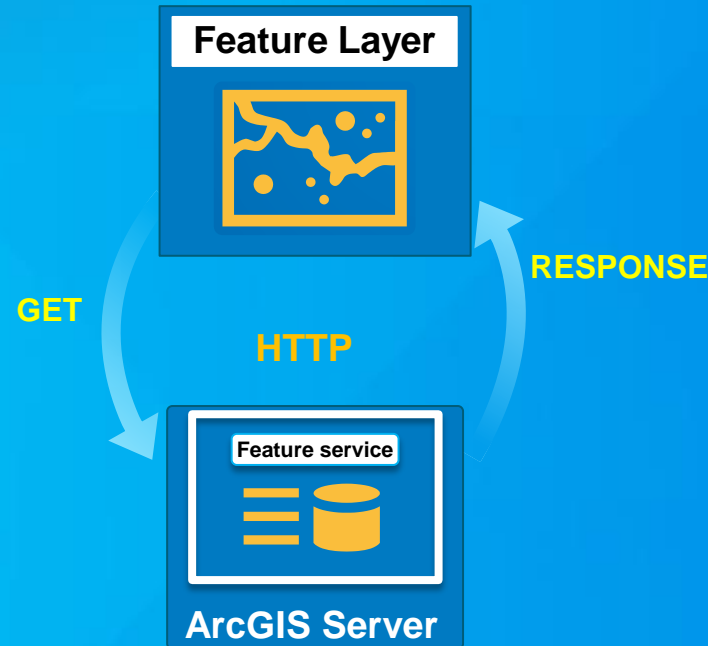
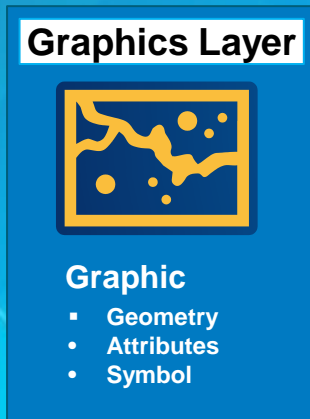


What are Stream Layers

Stream Layer

What is it?

- A layer in the Javascript API
 - Available since version 3.6
- Draws data on map using client-side graphics



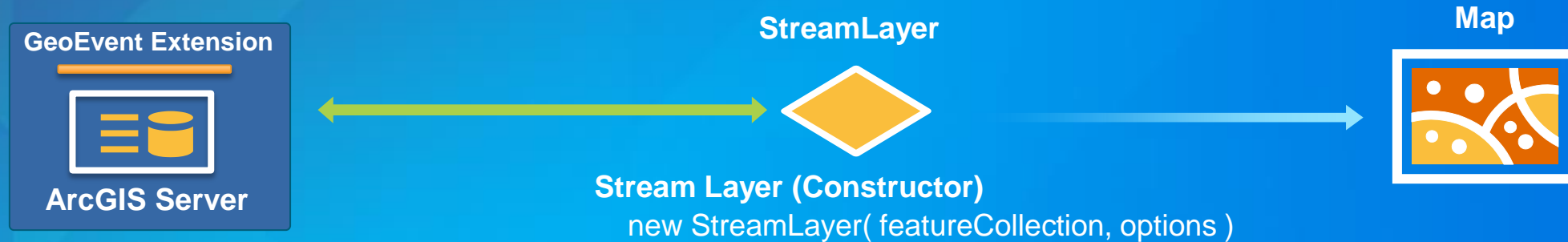


Demo – Stream Layers

Locating the International Space Station

Stream layer

The lifecycle of a stream layer



FeatureCollection:

```
{ layerDefinition:  
  { geometryType: esriGeometryPoint,  
    timeInfo: {  
      startTimeField: "StartTime",  
      trackIdField: "Name" },  
    fields: [ ... ] },  
  featureSet: null }
```

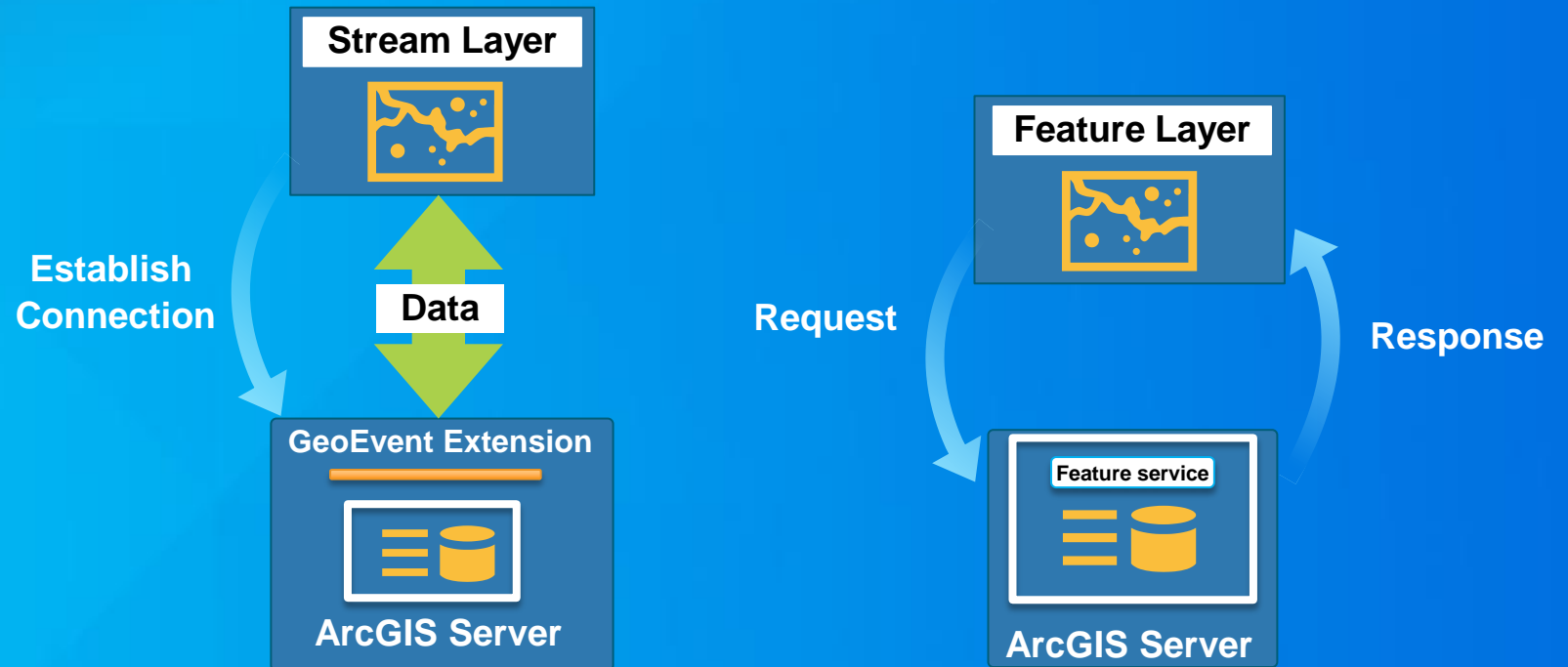
Options

- **websocketUrl:**
ws://gep:6180/urlpath
- **purgeOptions:**
{ displayCount: 500 }

Advantages to using stream layers

Stream layers are more responsive and more efficient than feature layers

- Stream layers display immediately and refresh automatically
- Data is only sent to the client once
- Messages are sent without extra headers



Stream layer requirements

Browser support for web sockets / JavaScript application support

- **ArcGIS GeoEvent Extension for Server**
 - Stream services are published as GeoEvent output connectors
- **Web Browser that supports Web Sockets**
 - <http://caniuse.com/websockets>
- **Network support for the Web Socket protocol**
 - `ws://` `wss://`
- **No custom plug-in required: Standard JavaScript implementation**



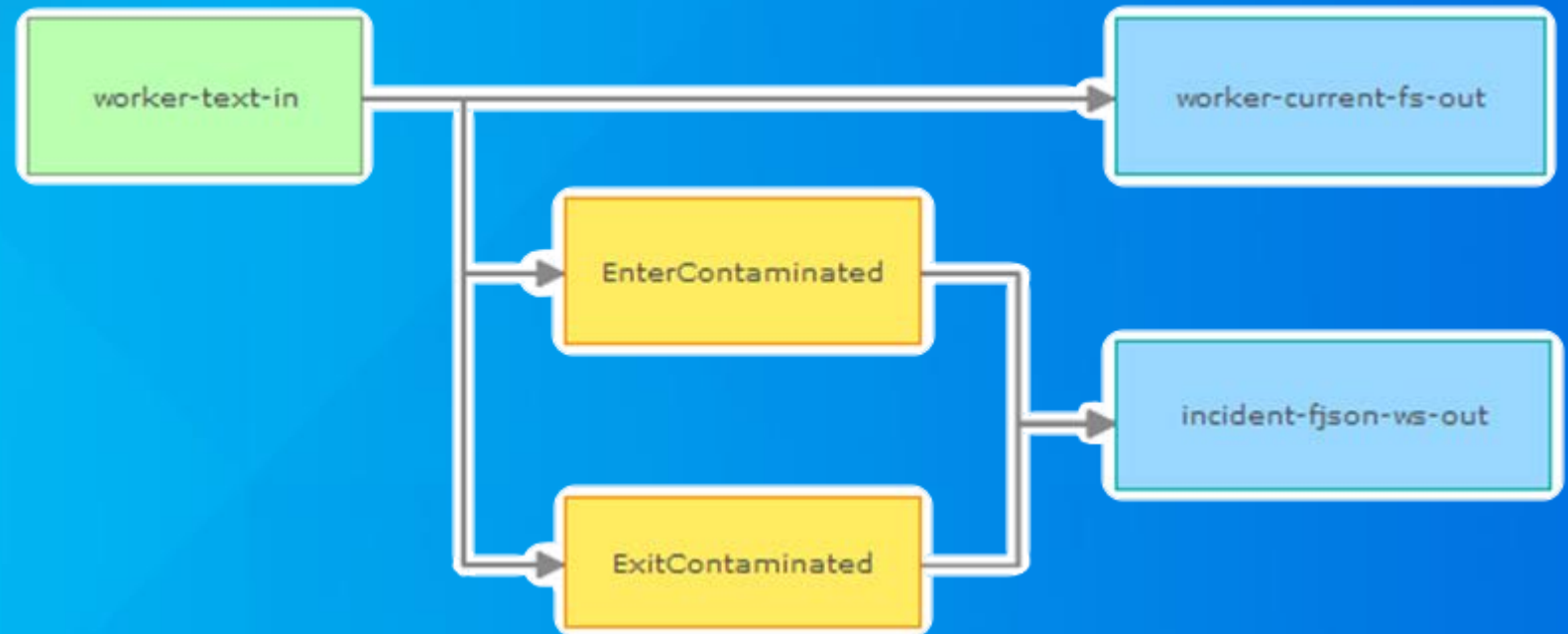
Dynamic GeoFences



Applying real-time analytics

Stream services enable dynamic GeoFences

- A **GeoEvent Service** configures the flow of GeoEvents
- **Processors** and **Filters** rely on **GeoFences** for spatial analytics
- GeoFence synchronization can receive data broadcast from a stream service





Demo – Stream Services

Dynamic GeoFences

Web Maps and Apps



Support for stream services in the 10.3 and 10.3.1 product releases

What can I use to consume stream services?

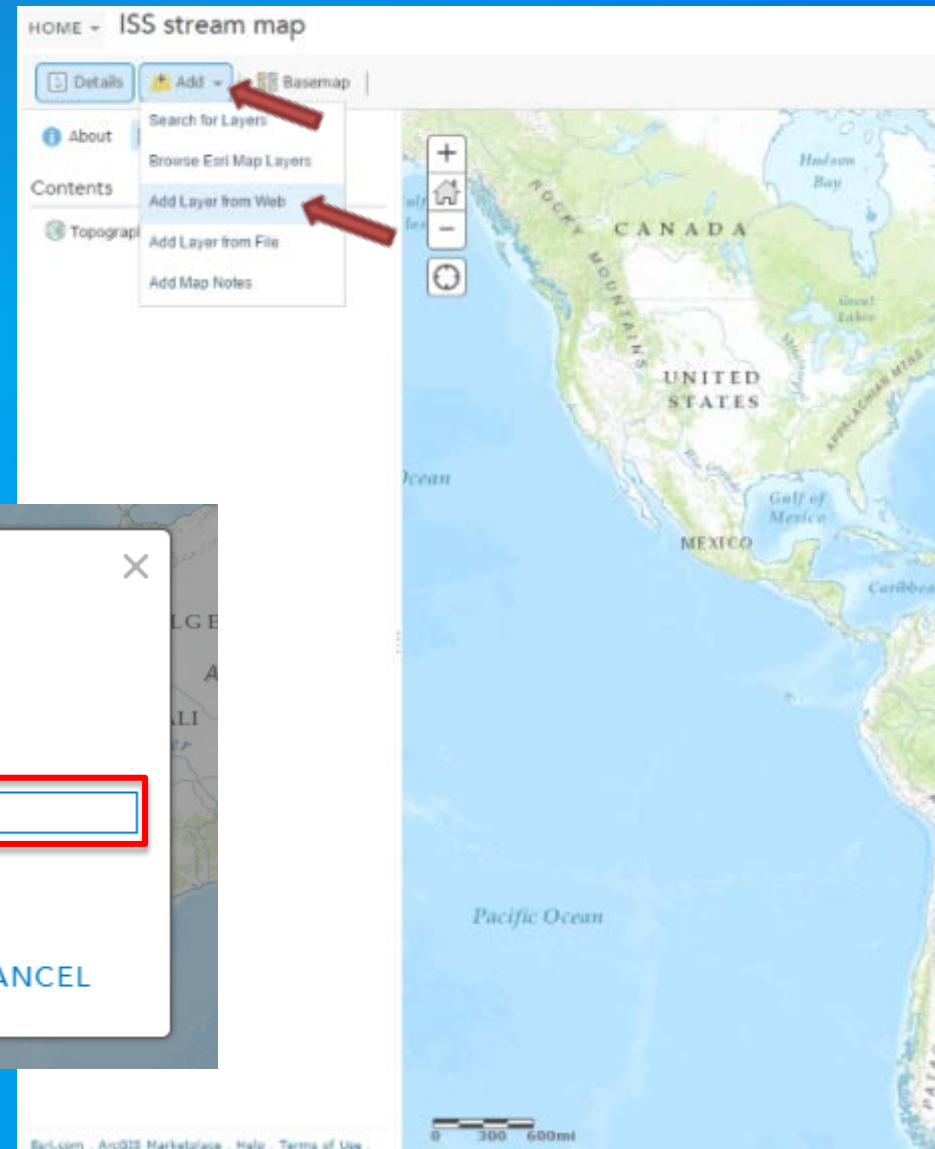
- ArcGIS Online and Portal for ArcGIS Web Maps
- ArcGIS Online and Portal for ArcGIS web application templates
- Web applications built using Web AppBuilder
- Your own web apps that use the ArcGIS API for JavaScript

Web Maps and Apps

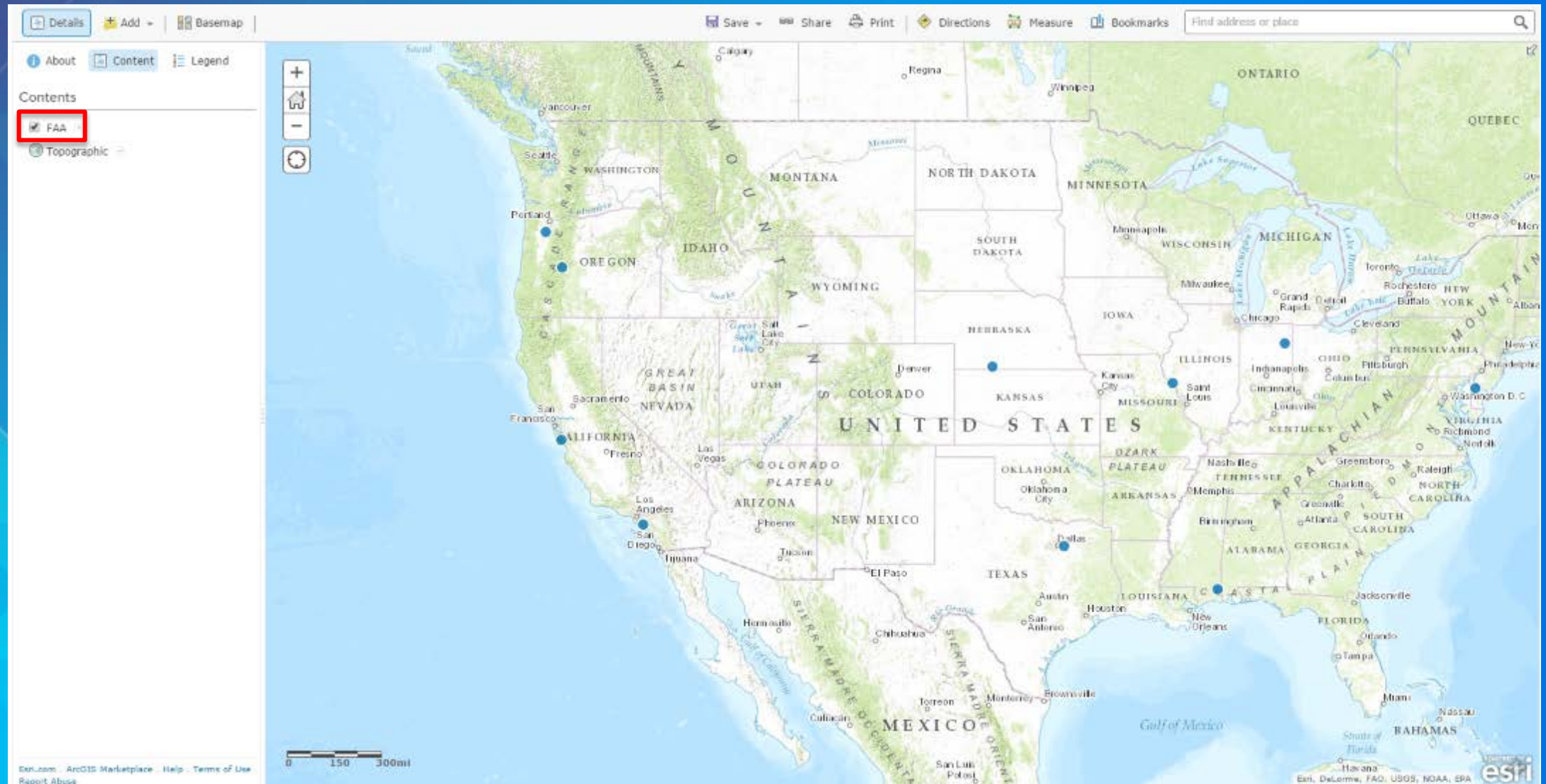
Web Maps

Stream Services in a Web Map

- “Add” menu...
- “Add layer from web”...
- Add stream service endpoint URL



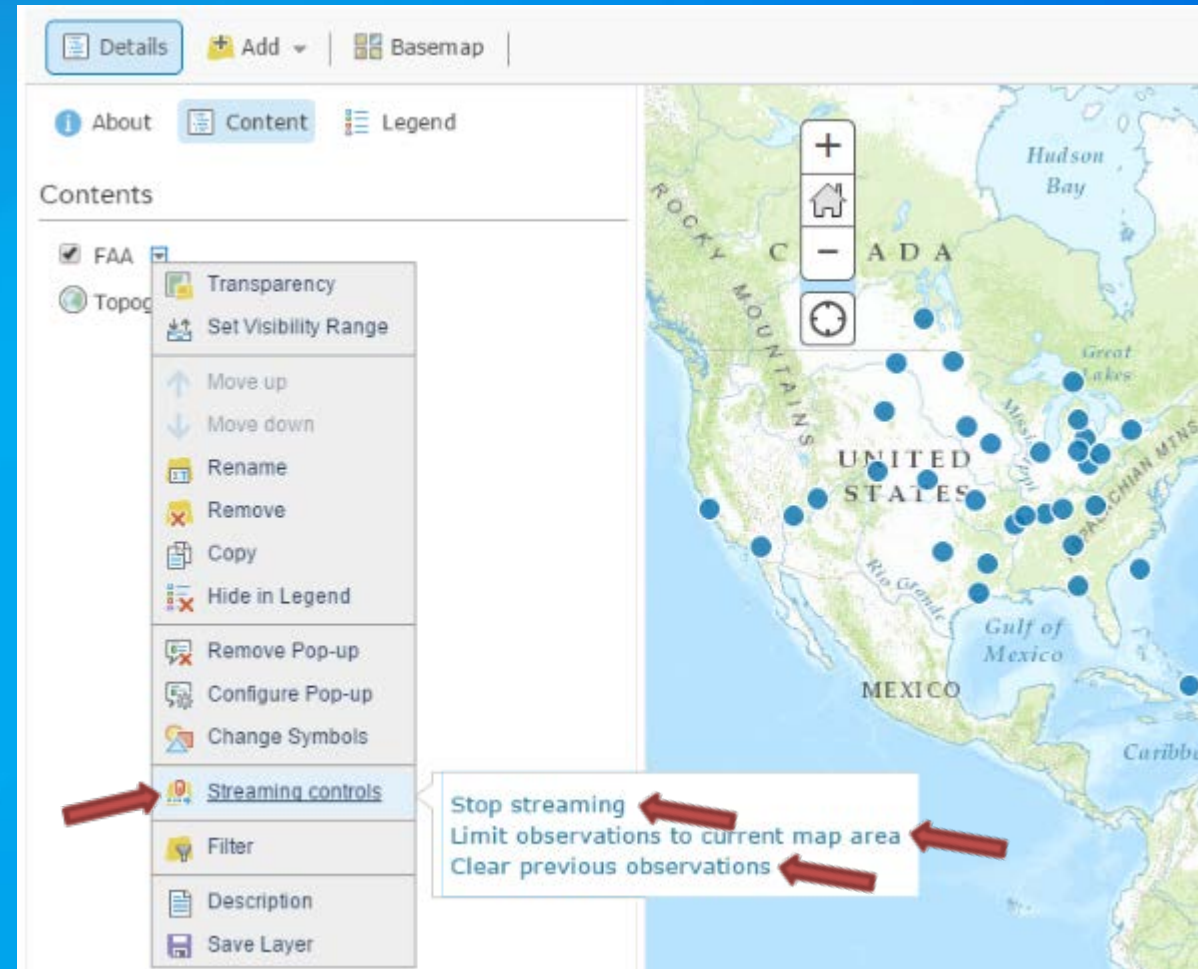
Real-Time Data in Portal Web Map



Real-Time Data in Portal Web Map

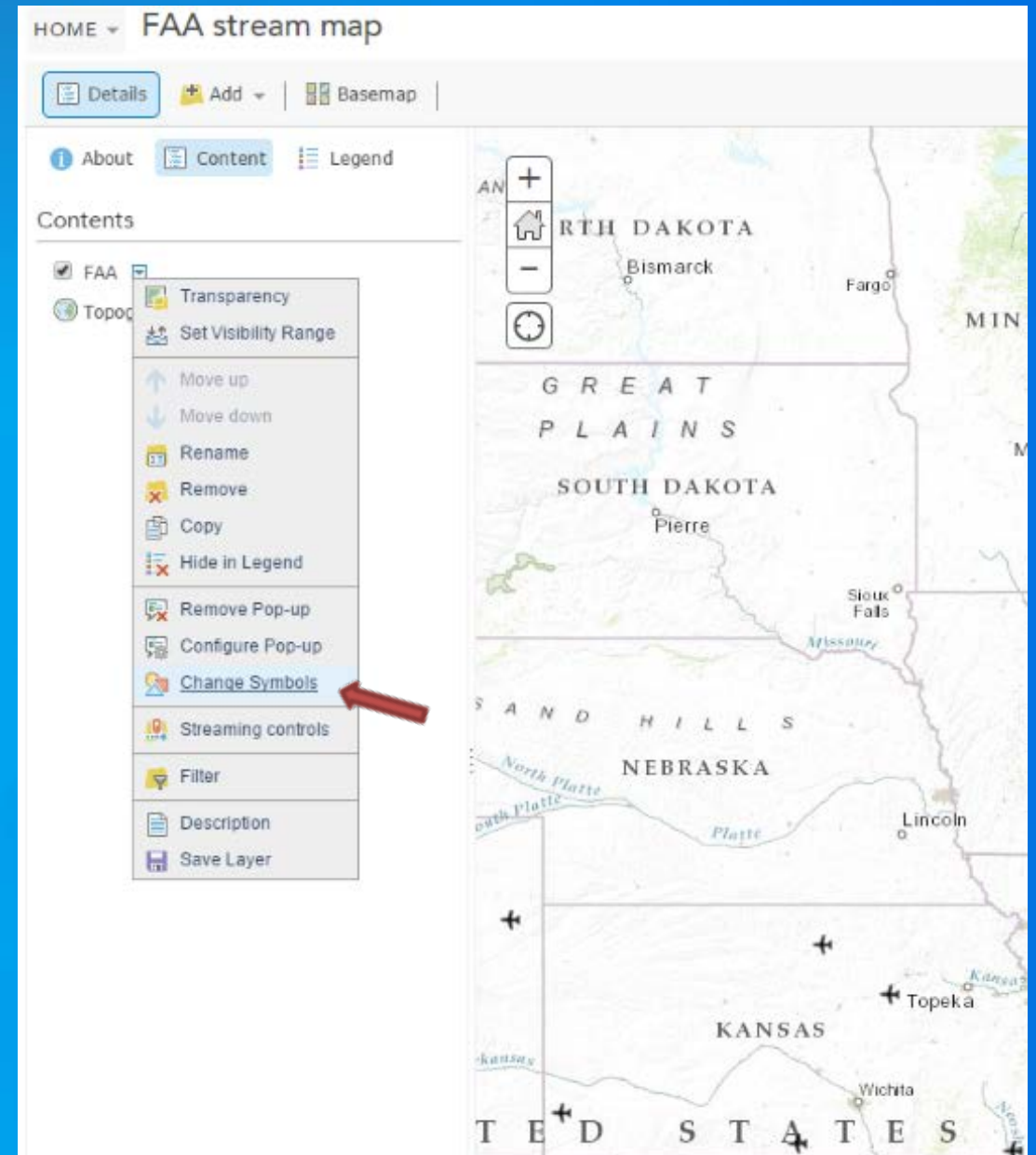
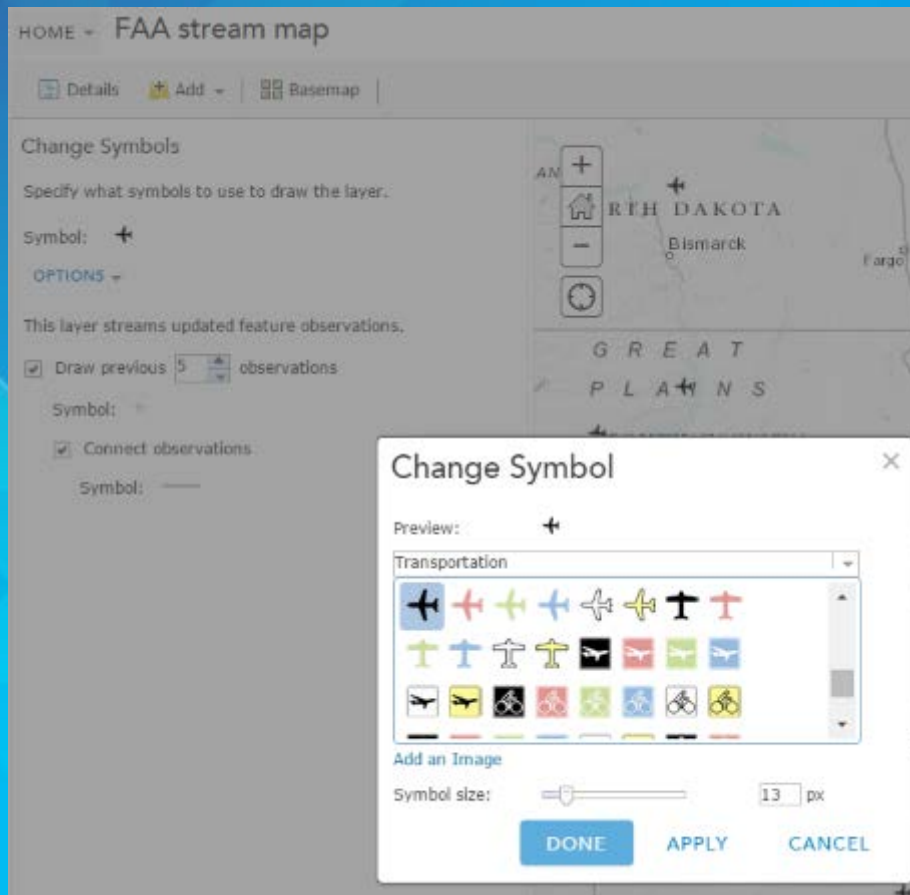
Streaming Controls

- Stop/Start
- Spatial Filter (map extent)
- Clear



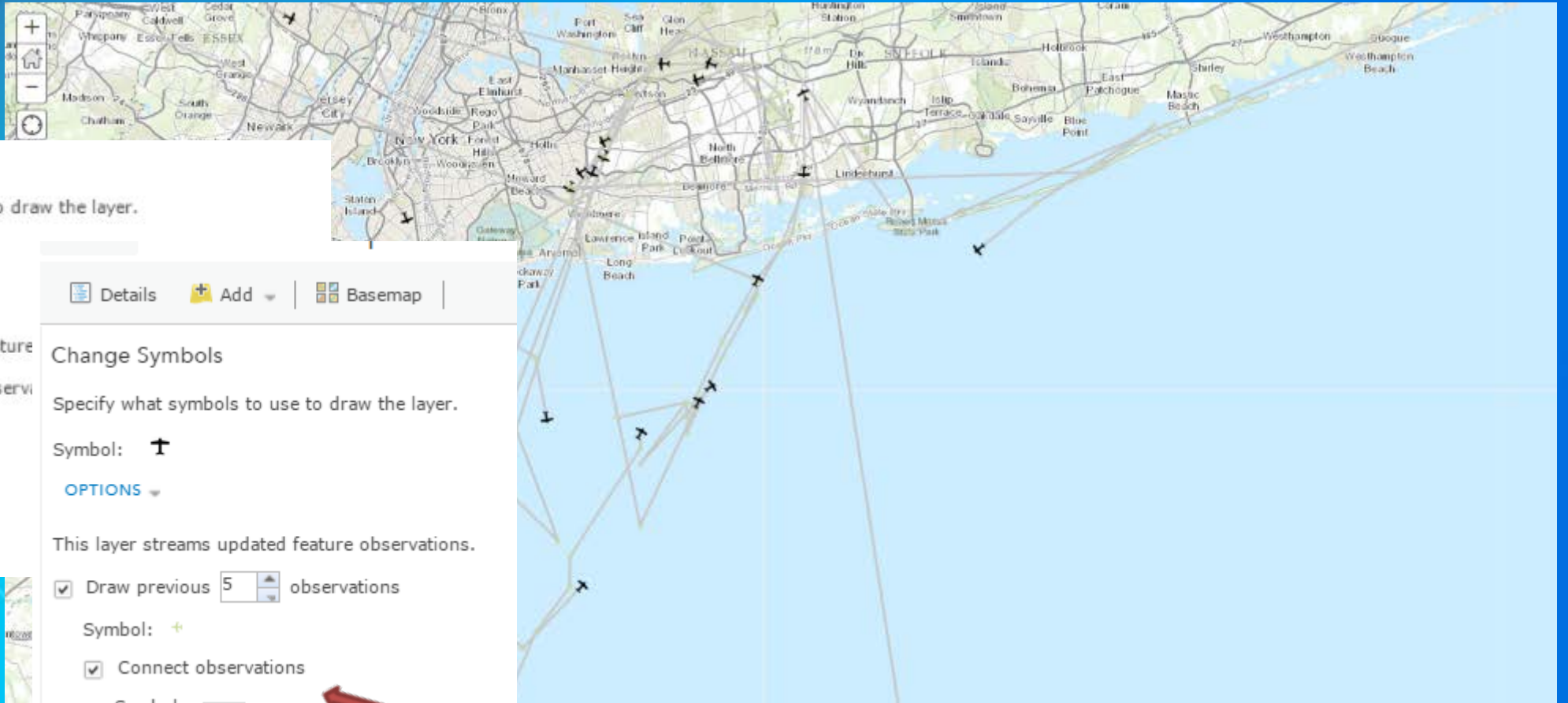
Symbology

- Editable, like other layers
- “Change Symbols”



Symbology

- Heading
- Tracks



Real-Time Data in Portal Web Map

Streaming Controls

- Filter on data content
 - i.e. “WHERE” clause

Filter: FAA

Create

[+ Add another expression](#) [Add a set](#)

Display features in the layer that match the following expression

GroundSpeedKnots is less than 200

Ask for values

Value Field

[APPLY FILTER](#) [CLOSE](#)

Details Add Basemap

About Content Legend

Contents

FAA

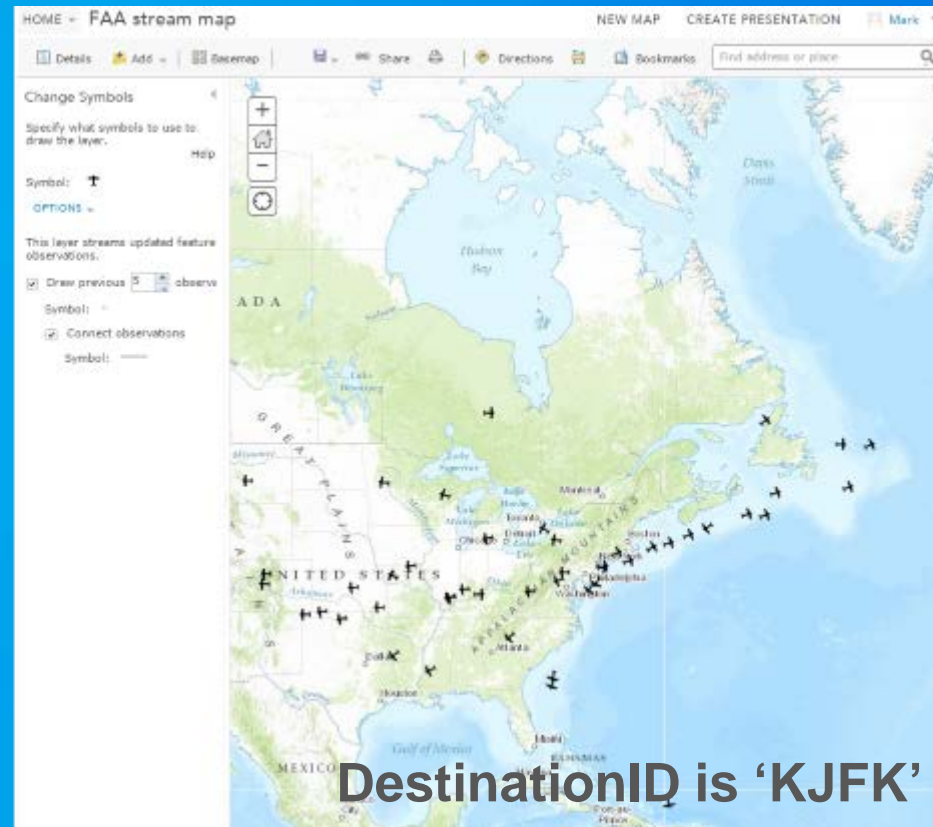
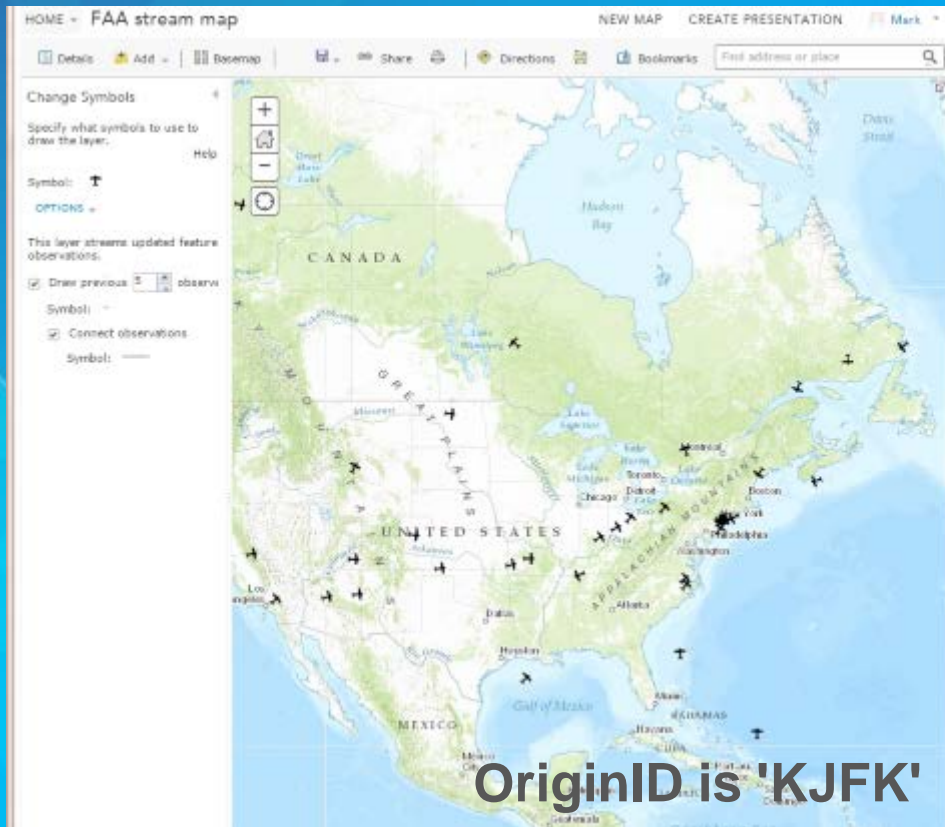
Topog

- Transparency
- Set Visibility Range
- Move up
- Move down
- Rename
- Remove
- Copy
- Hide in Legend
- Remove Pop-up
- Configure Pop-up
- Change Symbols
- Streaming controls
- Filter**
- Description
- Save Layer

Real-Time Data in Portal Web Map

User-specific

- Each user has unique session
- Stream service knows what to send to each user





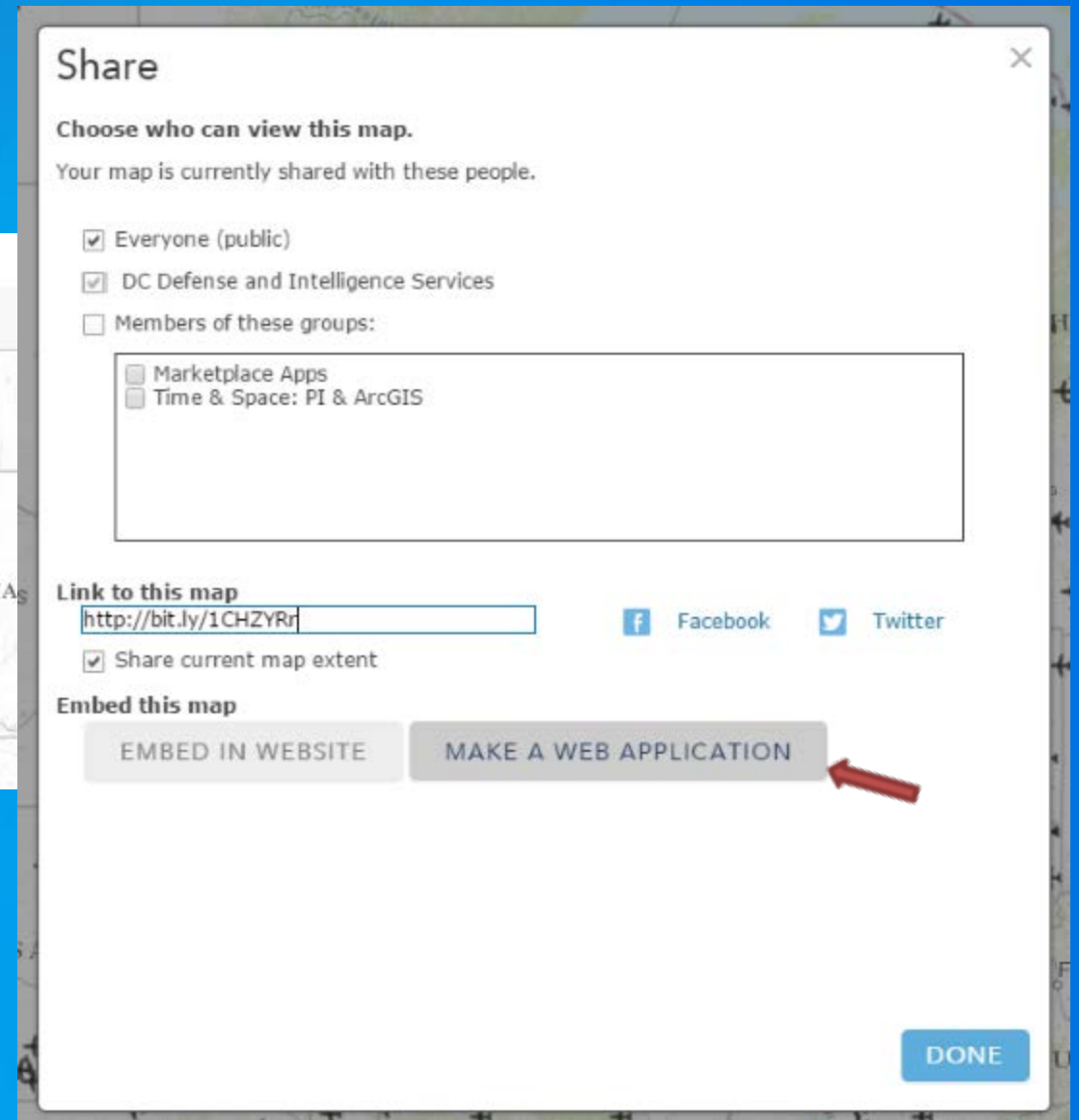
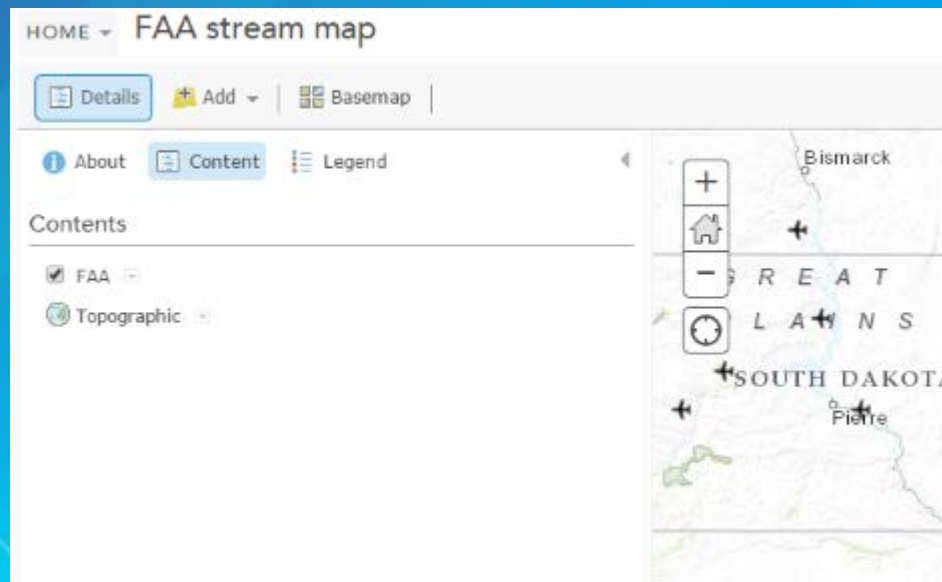
Web Maps and Apps

Web Application Templates

Real-Time Data in Web App Templates

Share in ArcGIS Online

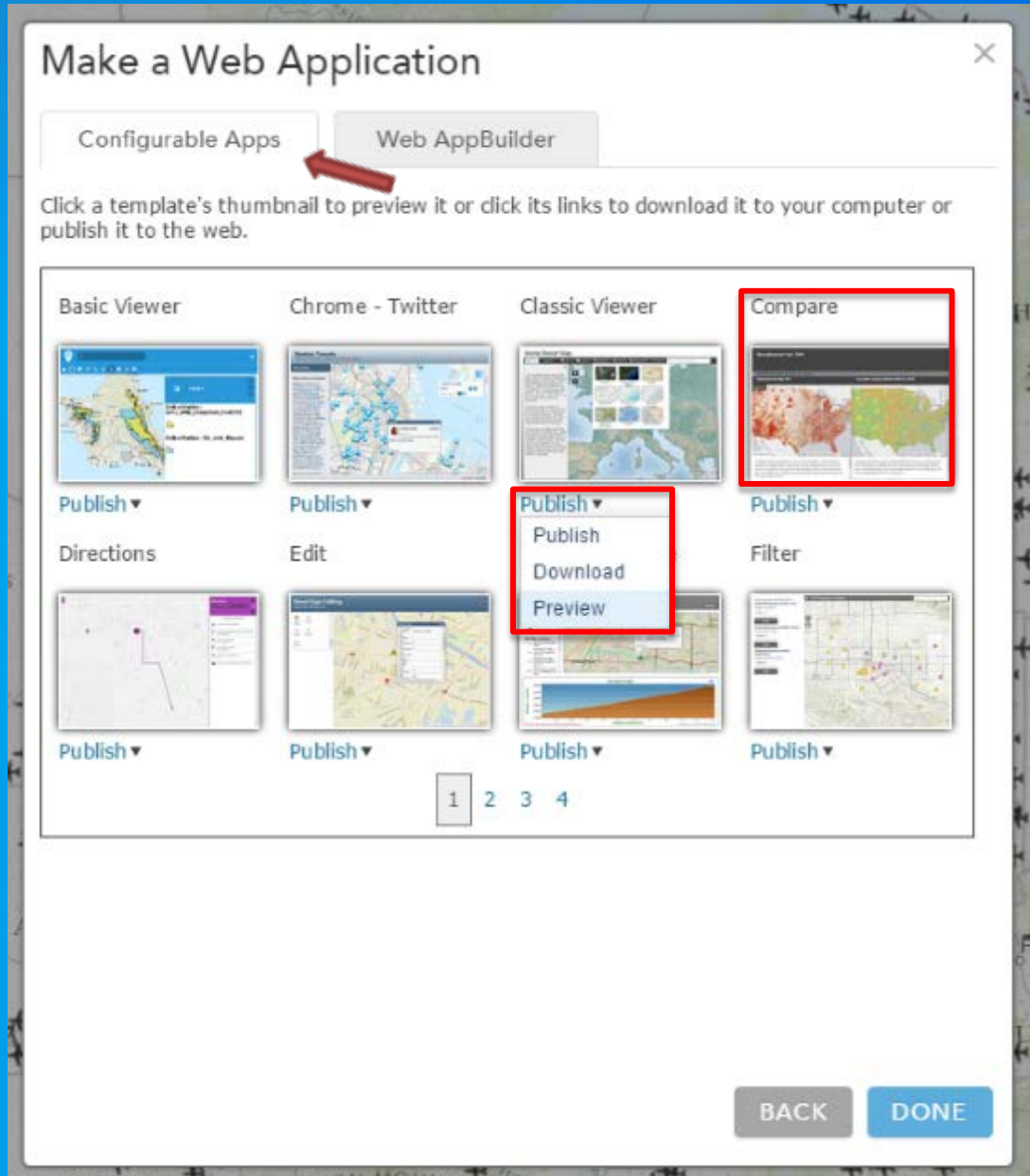
- “Share” button



Web App Templates

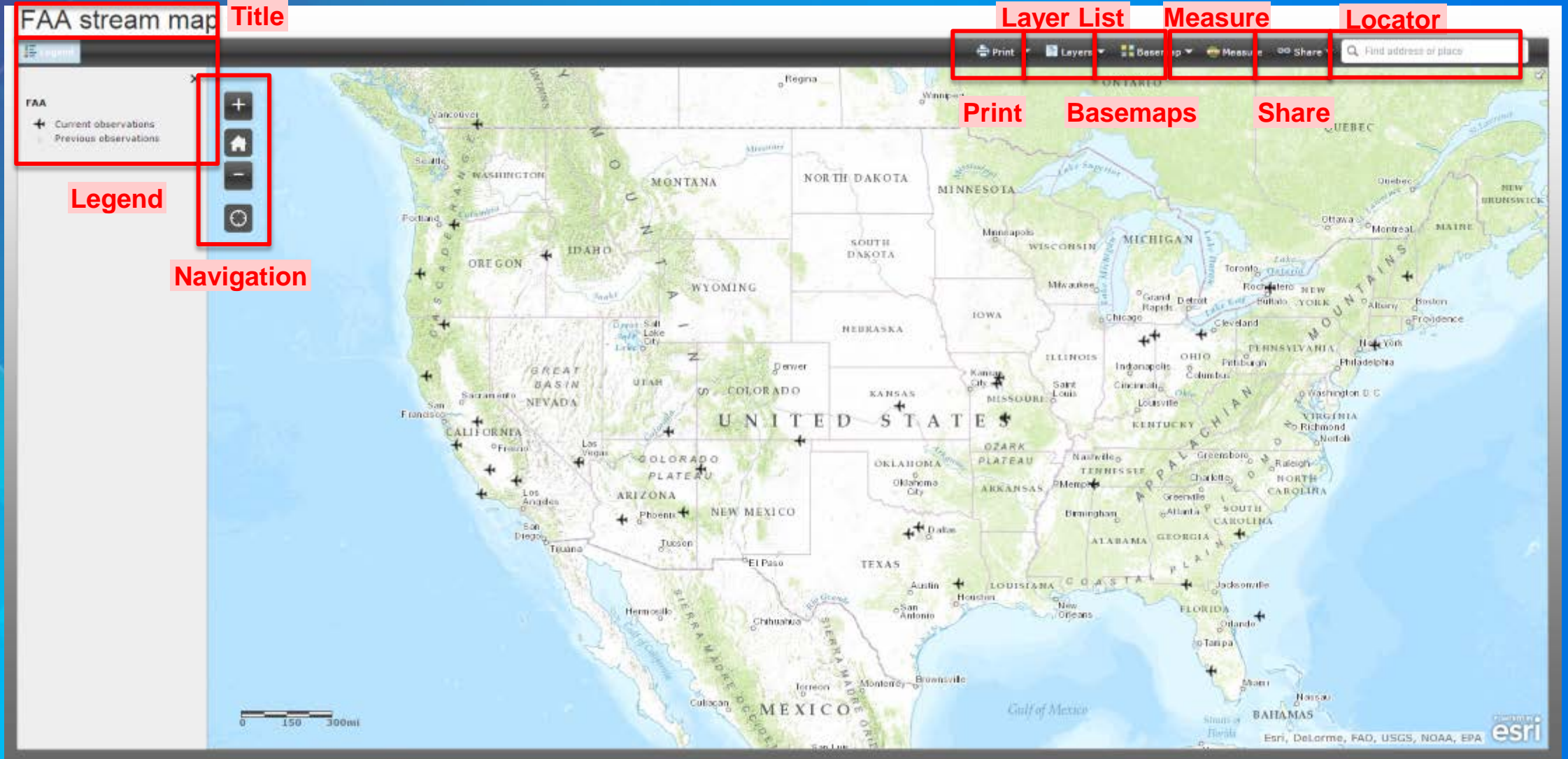
“Pre-packaged” Web Apps

- “Configurable Apps” tab
- Many to choose from
- Many are theme-focused
 - Compare
 - Elevation Profile
 - Impact Summary
- Can publish, download or preview



“Classic Viewer” Web App Template

Preview



Web App Templates

Publish

- Enter a title, add some tags, write a summary...
- “Save & Publish”
- Saves app to your content

The image shows two screenshots from a web application interface. The top screenshot is a form titled "Make a Web Application" with a red box highlighting the "Title" field containing "FAA stream app", the "Tag" field containing "stream", and the "Summary" field containing "app using the stream service". The bottom screenshot shows the "My Content" page with a table of items. The "FAA stream app" item is highlighted with a red box. A red arrow points to the bottom right corner of the page.

HOME GALLERY MAP SCENE GROUPS MY CONTENT MY ORGANIZATION Mark

My Content

+ Add Item Create Share Delete Move Change Owner

Title	Type	Modified	Shared
FAA stream app	Web Mapping Application	Jan 22, 2015	Everyone
FAA stream map	Web Map	Jan 22, 2015	Everyone
ISS stream app	Web Mapping Application	Jan 22, 2015	Everyone
ISS stream map	Web Map	Jan 19, 2015	Everyone
iss-stream	Feature Layer	Jan 18, 2015	Not Shared

1 - 5 of 5 results

Web App Templates

Published

- Discoverable

The screenshot shows a web application interface with a search bar at the top right containing the text 'FAA'. A dropdown menu is open below the search bar, listing search filters: 'Search All Content', 'Search for Maps', 'Search for Layers', 'Search for Apps', 'Search for Tools', 'Search for Files', and 'Search for Groups'. The main content area displays 'Search Results' with a navigation bar (HOME, GALLERY, MAP, SCENE, GROUPS, MY CONTENT, MY ORGANIZATION) and a 'Mark' button. Below the navigation bar, there are search filters: 'All Results' (Maps, Layers, Scenes, Apps, Tools, Files), 'Show ArcGIS Desktop Content' (unchecked), and 'Only search in DC Defense and Intelligence Services' (checked). The search results are listed in a table with columns: Relevance, Title, Owner, Rating, Views, Date. Two results are shown: 'FAA stream map' (Web Map by mbramer_DI, 3 views) and 'FAA stream app' (Web Mapping Application by mbramer_DI, 0 views). Two red arrows point from the search results to the dropdown menu.

Relevance	Title	Owner	Rating	Views	Date
	FAA stream map map using FAA bstream service Web Map by mbramer_DI Last Modified: January 22, 2015 ☆☆☆☆☆ (0 ratings, 0 comments, 3 views)			3	
	FAA stream app map using FAA bstream service Web Mapping Application by mbramer_DI Last Modified: January 22, 2015 ☆☆☆☆☆ (0 ratings, 0 comments, 0 views)			0	



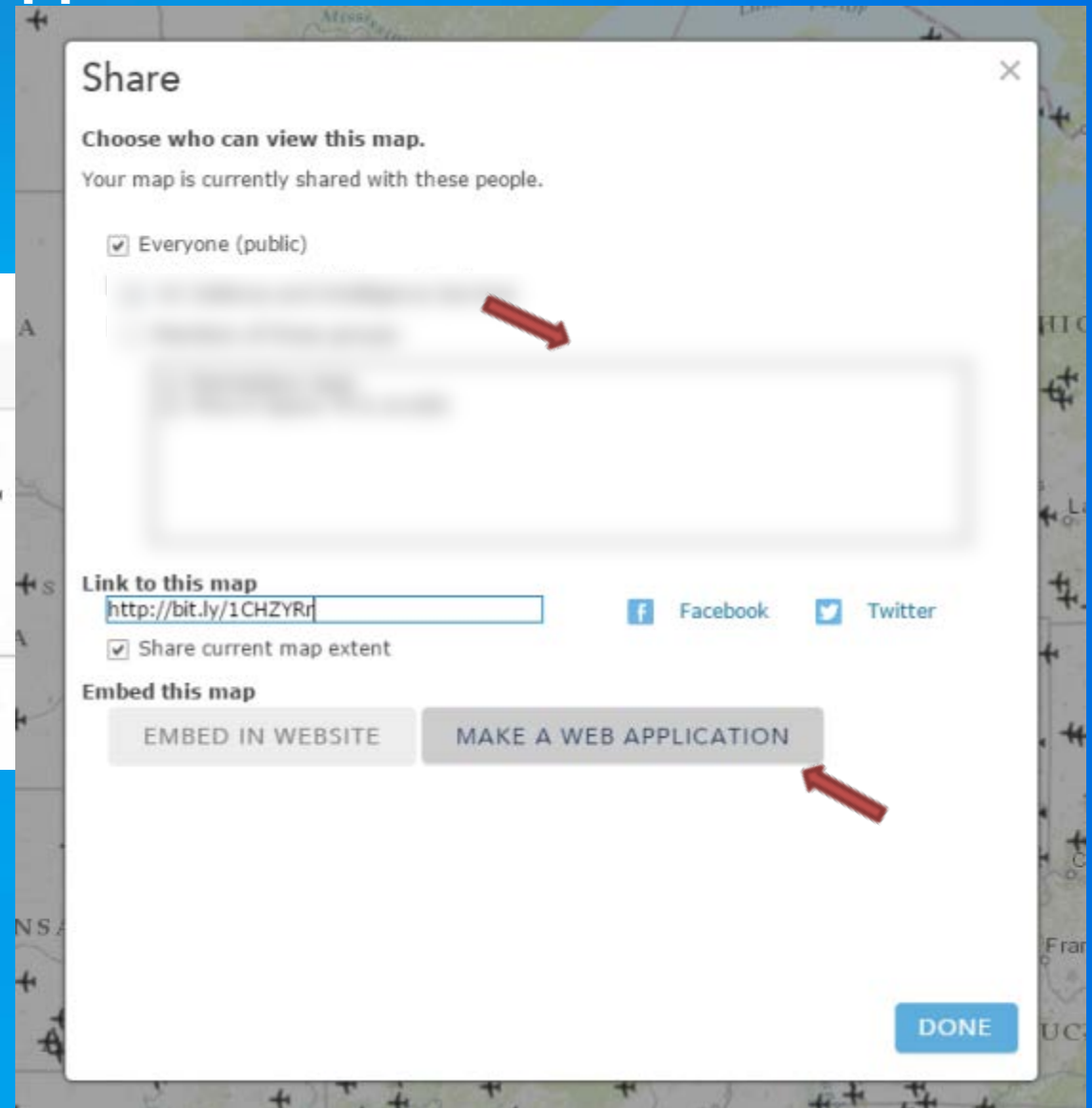
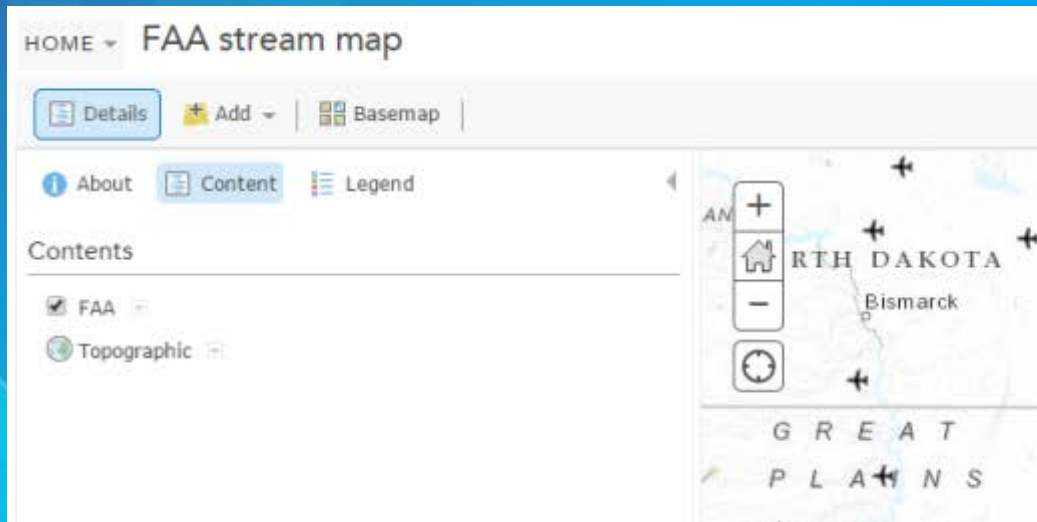
Web Maps and Apps

Web AppBuilder

Real-Time Data in Web AppBuilder Apps

Share in ArcGIS Online

- Also via the “Share” button
- Also use “Make a Web Application”



Web AppBuilder

Pre-packaged Web App ... **Builder!**

- “Web AppBuilder” tab
- Enter a title, add some tags, enter a summary
- “Get Started”

Make a Web Application

Configurable Apps Web AppBuilder

To create a new app with Web AppBuilder, enter a title, tags and summary.

Title: FAA stream map

Tags: stream x FAA x Add tag(s)

Summary: map using FAA bstream service

Save in folder: FedGIS_2015

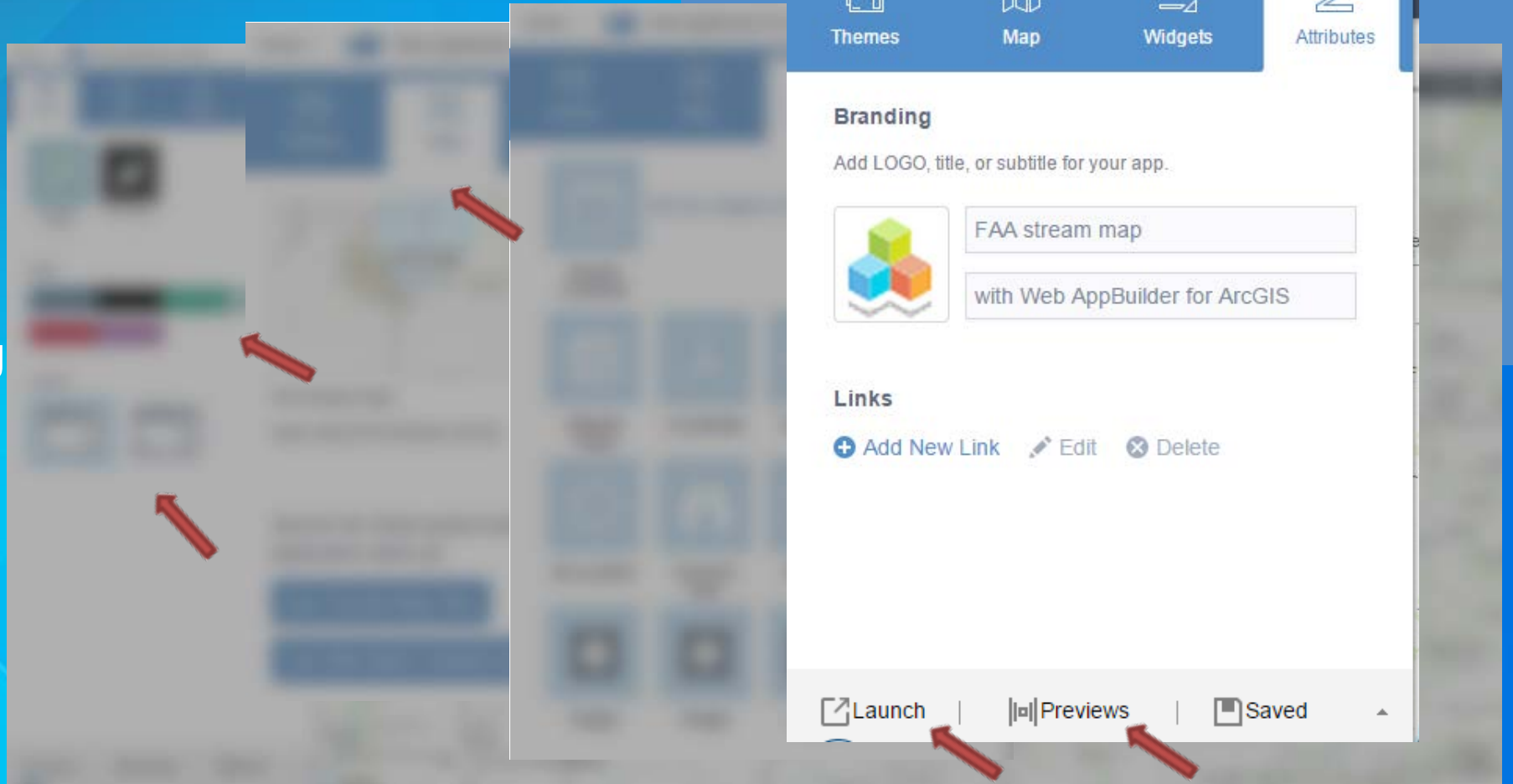
Share this app in the same way as the map (Everyone)

BACK GET STARTED DONE

Web AppBuilder

WYSIWYG

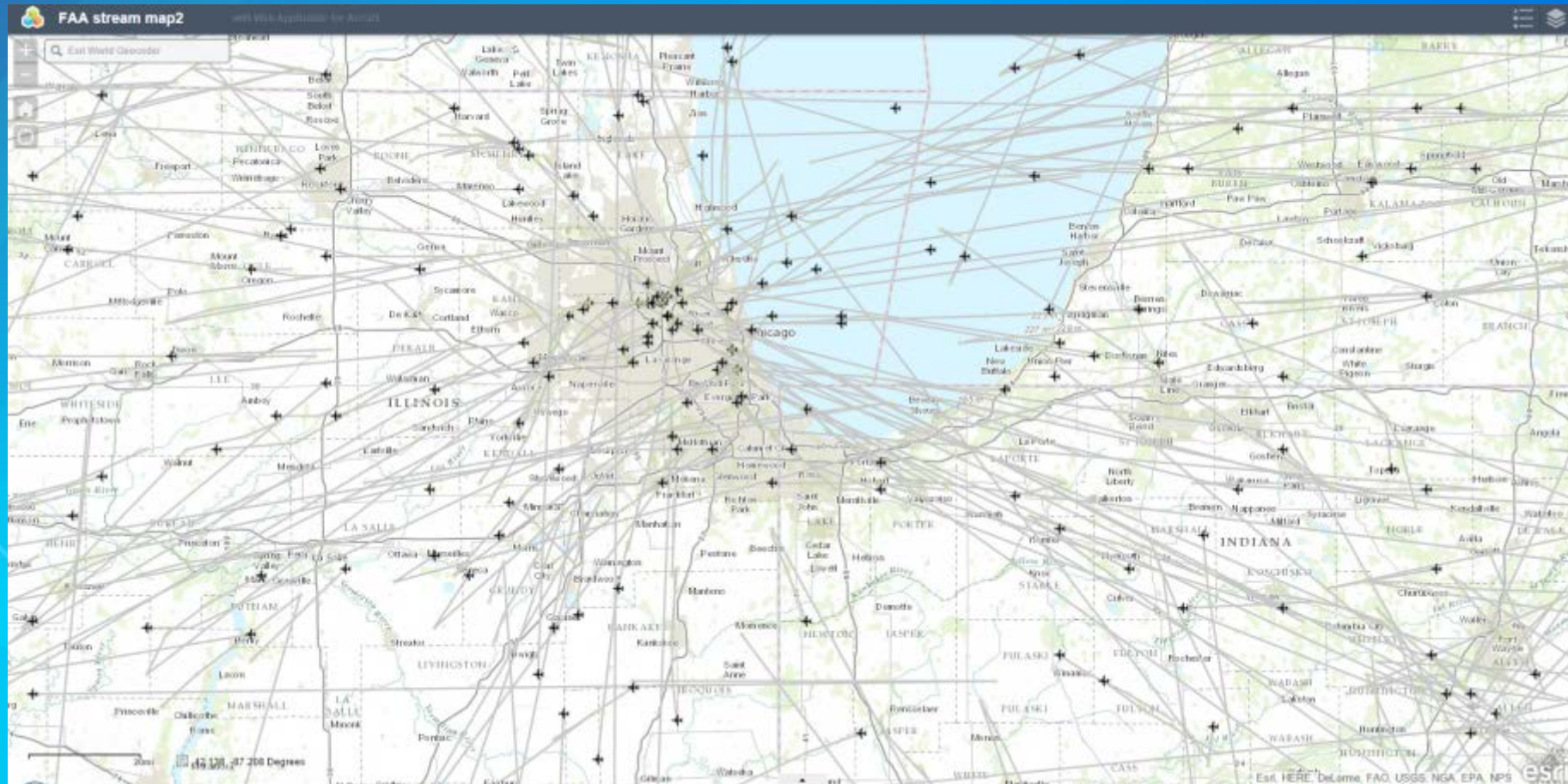
- “What You See Is What You Get” user interface
- Style/Colors
- Layout
- Widgets
- Map, extent
- Widget config
- Branding
- Previews
- Launch



Web AppBuilder

Launch (Preview)

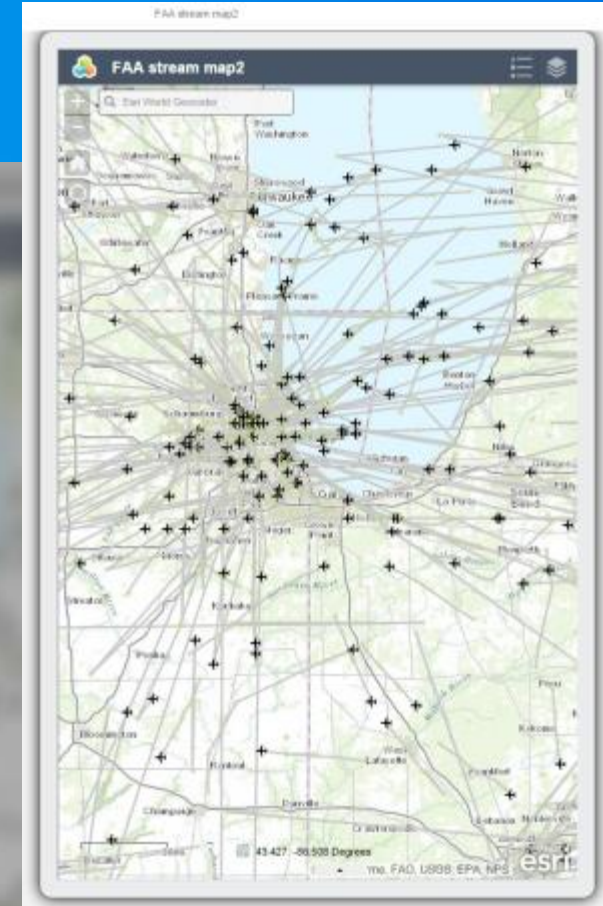
- “Launch” – shows preview of final app



Web AppBuilder

Previews

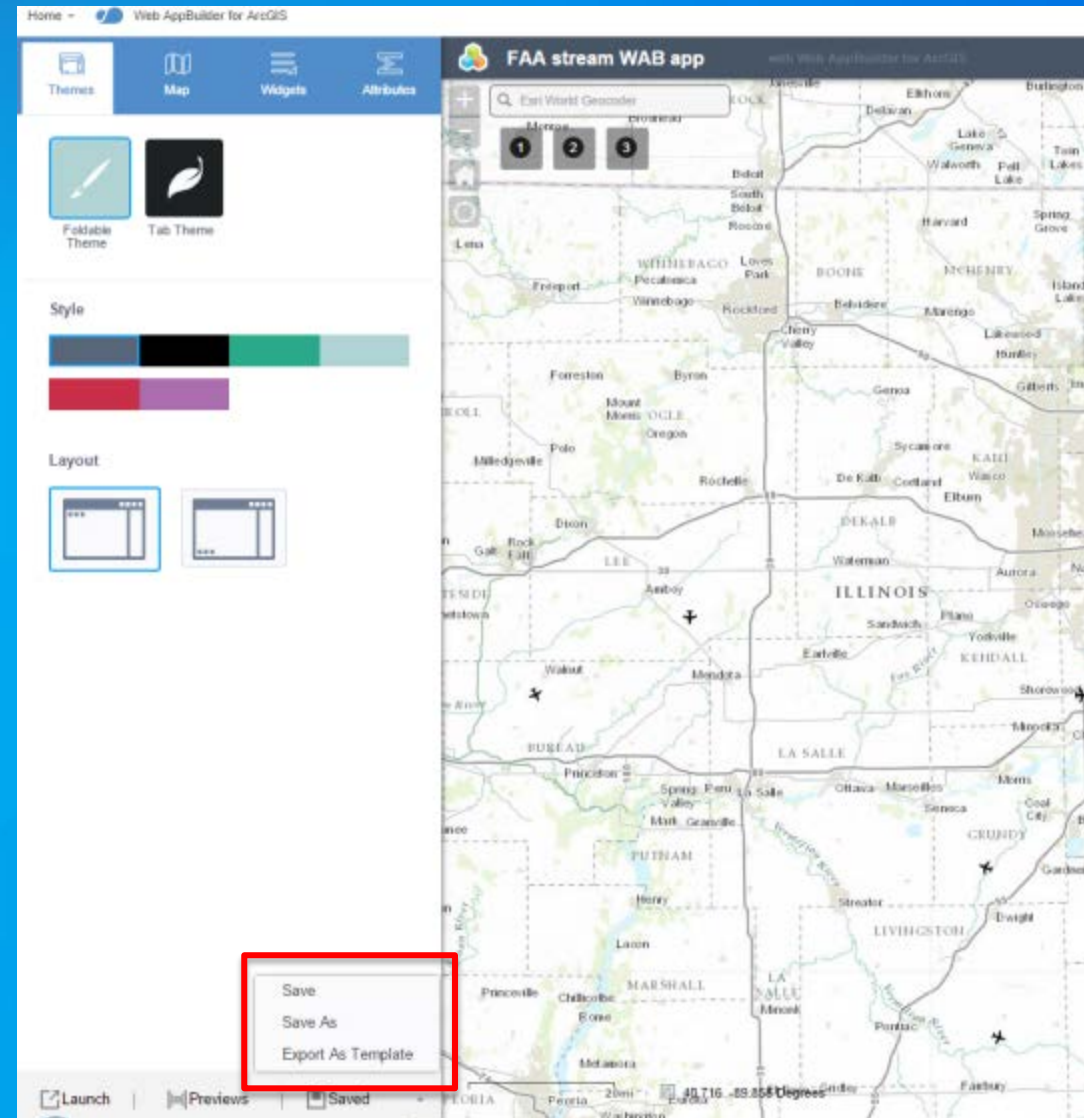
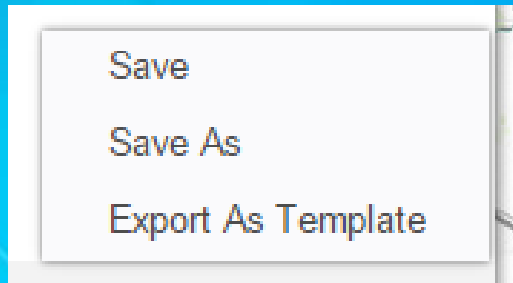
- Shows preview of final app on 16 of the most common devices
- iPad Air
- Samsung Note
- Nexus 7
- 13 more
- Real-time data is live



Web AppBuilder

Save

- Save
- Save As
- Export as Template
 - Create custom web app template by exporting the app



Web AppBuilder

Published

- Discoverable

The screenshot shows the Web AppBuilder search interface. At the top, a navigation bar includes links for HOME, GALLERY, MAP, SCENE, GROUPS, MY CONTENT, and MY ORGANIZATION. A search bar on the right contains the text 'FAA WAB' and is highlighted with a red box. Below the navigation bar is a banner image of a landscape. The main content area is titled 'Search Results' and shows '1 result'. The search results table has columns for Relevance, Title, Owner, Rating, Views, and Date. The first result is 'FAA stream WAB app' by 'mbramer_DI', last modified on January 28, 2015, with a rating of 0 stars. A red arrow points to the 'Details' link below the result. On the left, there are filters for 'All Results' (Maps, Layers, Scenes, Apps, Tools, Files) and search options like 'Show ArcGIS Desktop Content' and 'Only search in DC Defense and Intelligence Services'. On the right, there is a 'More Information' section with links for 'What types of items can I find here?' and 'Advanced search options'. A dropdown menu on the right side of the search bar lists search filters: Search All Content, Search for Maps, Search for Layers, Search for Apps, Search for Tools, Search for Files, and Search for Groups.

The background features a solid blue gradient. On the left side, there are several overlapping geometric shapes: a large purple triangle pointing upwards, a yellow triangle pointing downwards, and a purple triangle pointing to the right. These shapes are layered, with the yellow one appearing to be in front of the purple ones. The overall aesthetic is modern and abstract.

Conclusion

Advantages to using stream services vs. traditional feature services

Conclusion:

Leveraging Stream Services

- **What are stream services?**
 - How are stream services different from traditional feature services?
 - What are some advantages to using stream services?
- **What are stream layers?**
 - How are stream layers added to a web map?
 - How can stream layers be used to support real-time spatial analytics?
 - How can real-time web maps be incorporated into a web application?

Conclusion:

Leveraging Stream Services

- **We expect that you know and have probably used:**
 - Web maps and feature layers in web maps
- **This presentation will demonstrate and discuss:**
 - How stream services are published using the GeoEvent Manager
 - How stream services are discovered in the ArcGIS REST Services Directory
 - Advantages stream services provide vs. traditional feature services
 - Support for stream services available in the 10.3 and 10.3.1 product releases

Please submit your session evaluation



Understanding our world.