Using Near Real-Time Data to Follow the Pony Express Re-Ride

National Trails

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Background

The National Pony Express Association (NPEA) runs an annual re-ride of the Pony Express National Historic Trail that commemorates the mail delivery business operated between April 1860 and October 1861.
Pony Express National Historic Trail

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Background

The National Pony Express Association (NPEA) runs an annual re-ride of the Pony Express National Historic Trail that commemorates the mail delivery business operated between April 1860 and October 1861.

Every year, riders carry a mochila saddle bag filled with mail, following the designated route of the National Historic Trail over a span of 10 days and more than 1,800 miles.

This past year, the ride was held June 10, 2019 to June 20, 2019 from St. Joseph, Missouri to Sacramento, California. The NPEA is one of the many partners our office works with to promote, identify, and develop the National Historic Trails. The association was formed in 1977 as a volunteer organization to identify, establish, and mark the Pony Express Trail. Since 1985, the partner organization has been conducting the Re-Ride between Sacramento and St. Joseph.
Our Project

Collaboration with the National Pony Express Association to redevelop the workflow for displaying near real-time data for the re-ride.

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Step 1 - Using the SPOT Device XML Feed

Step 2 - Translating the XML tags to spatial data with the Data Interoperability Extension in ArcGIS Pro

Step 3 - Developing a python script to aggregate XML Feed to a feature service

Step 4 - Creating the web application

Previous Re-Rides

In the past, our office used NPMAP to display the SPOT data.
Previous Re-Rides

In the past, our office used NPMap to display the SPOT data.

The SPOT ID was used to obtain the data instead of the XML feed.
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SPOT Device XML Feed

Spot Device

4 Tags:
1. id
2. dateTime
3. latitude
4. longitude
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Data Interoperability Extension

The data interoperability extension on ArcGIS Pro uses the FME workbench application

What is FME Workbench?

FME has the core concept of Reader -> Transformation -> Writer

Reader

The reader has two inputs: the XML API feed and the feature service

Transformation

For new GPS points, it needs to go through the transformation process

Three XML tags are getting read: dateTime, latitude and longitude

The AttributeManager tool is reading the dateTime tag while...
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Reader

The reader has two inputs: the XML API feed and the feature service.

Transformation

For new GPS points, it needs to go through the transformation process.

Three XML tags are getting read: date\text{tTime}, latitude and longitude.

The AttributeManager tool is reading the date\text{tTime} tag while the VertexCreator, GeometryExtractor and CoordinateSystemSetter are creating the spatial data.

Writer

Once the data goes through the transformer, it needs to be written out to a format using a Writer.

Before it goes through the Writer, the detector tool will read the data to see if there has been any changes. Based off of what it detects, it will UPDATE, INSERT or DELETE data to the hosted location.
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Rider Location Feature Service Creation

Pony Express National Historic Trail
Using Near Real-Time Data to Follow the Pony Express Re-Ride

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Rider Location Feature Service Creation

Python Script utilizing ArcGIS API for Python runs at the shutdown of the FME workbench model.

- XML hosted feature downloaded locally in a geodatabase
- Local XML hosted feature of rider locations is compared to the Rider Locations feature service
- New features are uploaded into the Rider Locations feature service

Feature Service Creation...
all_features = fme_fset.features
all_features[0]
print("ALL Features")
print(fme_fset.spatial_reference)
for id in overlap_rows['id']:
    original_feature = [f for f in all_features if f.attributes['id'] == id][0]
    print(str(original_feature))
    features_to_be_added = []

# get a template feature object
template_feature = deepcopy(original_feature)

# loop through each row and add to the list of features to be added
for row in new_rows.iterrows():
    print(row)
    new_feature = deepcopy(template_feature)
    print("Creating " + str(row['id']))
    
    # get geometries in the destination coordinate system
    input_geometry = {'y':float(row['latitude']),
                     'x':float(row['longitude'])}
    output_geometry = geometry.project(geometries = [input_geometry],
                                        in_sr = 4326,
                                        out_sr = fme_fset.spatial_reference['latestWkid'],
                                        gis = gis)

    # assign the updated values - adding in values that are within poex_spot_backup
    # (by way of poex_spot_backup_csv) that are not in Spot_XML_PoEx_Display_Backup
    # hosted feature.
    new_feature.geometry = output_geometry[0]
    new_feature.attributes['dateTime'] = (row['dateTime'])
    new_feature.attributes['id'] = int(row['id'])
    new_feature.attributes['latitude'] = (row['latitude'])
    new_feature.attributes['longitude'] = (row['longitude'])

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Feature Service Creation....

Rider Location Feature Service is now updated by the Python Script.
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<table>
<thead>
<tr>
<th>dateTime</th>
<th>id</th>
<th>latitude</th>
<th>longitude</th>
</tr>
</thead>
<tbody>
<tr>
<td>12:26PM</td>
<td>1,214,488,530</td>
<td>39.75638</td>
<td>-94.84769</td>
</tr>
<tr>
<td>06-10-2019</td>
<td>1,214,488,601</td>
<td>39.75651</td>
<td>-94.84623</td>
</tr>
<tr>
<td>12:35PM</td>
<td>1,214,499,586</td>
<td>39.75012</td>
<td>-94.86789</td>
</tr>
<tr>
<td>01:04PM</td>
<td>1,214,409,448</td>
<td>20.74828</td>
<td>-94.85024</td>
</tr>
</tbody>
</table>

Web Mapping Application

Develop the web map for the application. Set up the various options for the look and feel of the web map:

- Feature Service Layers
  - XML Feed feature service
  - Rider Location feature service
  - Exchange Station Locations
  - Expected Re-Ride Route
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Web Mapping Application

Develop the web map for the application. Set up the various options for the look and feel of the web map:

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  - XML Feed feature service
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  - Expected Re-Ride Route
  - Pony Express NHT

- Set the symbology and configure the pop up windows for the displayed features.

Customize the Web App

Build and Configure:
- Branding
- Style
- Widgets
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Task Scheduler Automation

Task Scheduler Setup:
- Setting up

Edit Action

You must specify what action this task will perform.

Action: Start a program

Settings

Program/script: C:\Program Files\ArcGIS\DataInteroperability for ArcGIS
Add arguments (optional): e_update_20190509.fmx
Start in (optional): C:\Users\user\
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Task Scheduler Automation

Task Scheduler Setup:
- Setting Action and Schedule

Edit Action

You must specify what action this task will perform.

Action: Start a program

Settings
Program/script: `C:\Program Files\ArcGIS\Data Interoperability for ArcGIS\e_update_20190509.fmx`
Add arguments (optional): 
Start in (optional): 

OK Cancel
Finalized Web App

The finalized web app has updated locations of the Pony Express Re-Ride rider approximately every 10 minutes.

External Embedded Content

External website embedding of content enables our office to engage with even more of the public and association members. Here is the NPEA website for the Re-Ride:
https://nationalponyexpress.org/annual-re-ride/follow-the-ride/

Success of the Web App

- Over 20,000 views
- 14,180 views from NPEA website with embedded web app
- Partner Usage/Public Usage
  - Following along with the Re-Ride
  - Estimating Time to Arrival for City/Town ride throughs and station exchanges
The Re-Ride is Coming Soon on June 3rd–13th 2020 from California to Missouri!

Mobile Device Users/Full Screen – please click here
Recent Locations of the Pony Riders:

Bridgeport-Scotts Bluff, Nebraska

The mail has arrived!

St. Joseph to Sacramento in 50 days

2019 Re-Ride Map

Use this map to find out where the riders have been during the 2019 Re-Ride. Best viewed on Desktop or Mobile Device (Landscape Mode). Please click here to view the full map in a new window.

(You will need to accept the conditions in order to view the map – all times are in PCT)

2019 Pony Express Annual Re-Ride

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  - Increasing safety along the Re-Ride

Issues Identified during the 2019 Re-Ride

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Issues Identified during the 2019 Re-Ride

- Loss of SPOT signal in a few locations
- Duplication of Rider Locations

Improvements

- Changing Python Script to run independently of the SPOT Feed translation
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- Incorporating Delete Identicals within Python Script to remove duplicates
- Adding NOAA time-enabled weather radar data
- Enabling the App to zoom to the newest Rider location upon web app loading
- Adding GPS Coordinates for exchange locations
- Utilizing Arcade expressions for symbology and pop up windows
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Questions

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