ArcGIS API for JavaScript: Creating Custom Layers and Layer Views
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Agenda

- Introduction to layers in 4.x
- Building a custom dynamic layer
- Building a custom tile layer
- Layer loading and attribution
- Custom Elevation Layer
- Using web workers
- Future work
Introduction to Layers

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Introduction to Layers extensibility in 4.x

• They don’t have a visual representation, they are a data access
• Create a custom layer
  - To connect to a service not supported (or not yet) by the API
  - To work on the data client-side before it’s being displayed
  - Because you can 😊
• We will cover:
  - Dynamic layer
  - Tile
  - Elevation
• 4.4 with introduce new layer classes designed for extensibility
Custom Dynamic Layers

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Dynamic Layer

- displays an image that covers the view. At the end of a user interaction, a new image is requested.
  - 1 export in MapView
  - 2 exports in SceneView
- Pro: One export on the service
- Con: Export is different each time, so cannot be cached in the browser cache
Dynamic Layer

- **Extensibility hooks:**
  - `BaseDynamicLayer.getImageUrl`
    - Easiest method that creates a url for a extent and size
  - `BaseDynamicLayer.fetchImage`
    - Method that do the actual image fetching
    - To extend if you need to transform data.
    - Default implementation fetch the image at the URL returned by `getImageUrl`

- **Example:**
  - WMS Layer from GeoBretagne.fr
    - [http://geobretagne.fr/mapfishapp/](http://geobretagne.fr/mapfishapp/)
    - [http://geobretagne.fr/geonetwork/apps/georchestra/?uuid=048622c5-b333-4c2b-94ec-40a41608dc06](http://geobretagne.fr/geonetwork/apps/georchestra/?uuid=048622c5-b333-4c2b-94ec-40a41608dc06)
Custom Tile Layers

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Tile Layer

- Displays adjacent images stitched together to cover the view.
- New tiles are requested as the user interacts with the view.
- Pro: really efficient as tiles are cacheable resources on the server and web browser.
- Con: a tile resource has to be less dynamic to have an efficient layer.
Tile Layer

- **Extensibility hooks:**
  - `BaseTileLayer.getTileUrl`
    - Easiest method that creates a url for a tile id: level / row / col
  - `BaseTileLayer.fetchImage`
    - Method that do the actual image fetching
    - To extend if you need to transform data.
    - Default implementation fetch the image at the URL returned by `getTileUrl`

- **Example:**
  - Tiled WMS Layer from GeoBretagne.fr
  - Tint Stamen tiles
loading and integration

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Loading and integration

• Layers are loadable resources
• They need to fetch some information from a service before being ready
• Is the service exists and valid?
• What are the properties of the layer?
  - Extent
  - Title
  - Attribution
  - Others…
Custom Elevation Layers

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Custom Elevation Layers

- Derive from BaseElevationLayer and override fetchTile()
- Return a Promise that resolves to

```javascript
{
  values: Array | Float32Array; // height values in meters
  width: number; // this.tileSize[0] + 1 (e.g. 257)
  height: number; // this.tileSize[1] + 1
  noDataValue: number; // Must be equal to options.noDataValue
}
```
Custom Elevation Layers

- Map tiles
  - \([x_0, y_0, x_1, y_1] = \text{this.getTileBounds}(\text{level, row, col})\);

- Number of values in one row or column: e.g. **256**
Custom Elevation Layers

- **Elevation tiles**
  - Pixels/samples are located at the corners of cell grid
  - Number of values in one row or column: e.g. 257
  - But: tileInfo.tileSize[*] = 256 !
Custom Elevation Layers

- Elevation tiles
  - Neighboring tiles have one row of overlapping samples

Tile \((l, r, c)\)  
Tile \((l, r, c + 1)\)
Custom Elevation Layers

- Elevation tiles
  - Don’t forget: Y coordinates are upside down

Map coordinates

\[ y_0 + 4 \times \text{resolution} \]
\[ y_0 + 3 \times \text{resolution} \]
\[ y_0 + 2 \times \text{resolution} \]
\[ y_0 + \text{resolution} \]
\[ y_0 \]

Pixel coordinates

Row 0
Row 1
Row 2
Row 3
Row 4
Custom Elevation Layers

- For more information on Esri Tiled Elevation Services: https://developers.arcgis.com/documentation/tiled-elevation-service/
Using Web Workers

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Using Web Workers

- Use worker to execute expensive work on data
  - Avoid blocking the main thread
- We developed a worker framework
- Example: Generating contour lines from elevation data
  - http://blog.bruce-hill.com/meandering-triangles/
Future work
Future work

- Building useful examples
  - Loading a TPK and other file types
  - Drawing vector data on canvas
  - Which ones would you like to see?
- Data refresh / update
- Custom LayerViews