Esri Developer Summit

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Vector Tiles in the ArcGIS Platform

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Overview

- Why vector tiles?
- Vector tiles in ArcGIS
- ArcGIS vector tile basemaps
- Consuming and styling vector tiles
- Overview of creating vector tiles
- Authoring a map for vector tiles
- Common questions

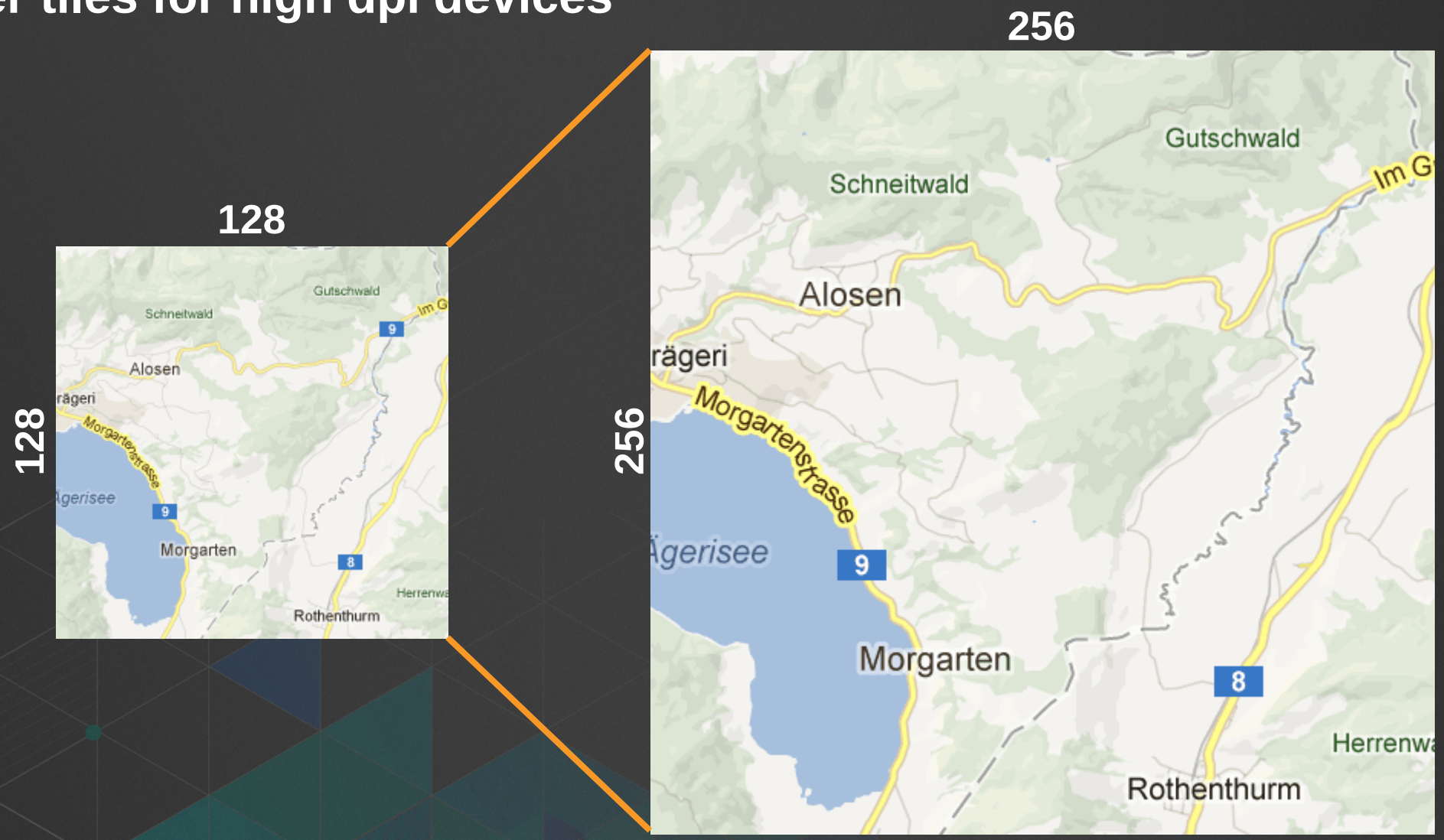
Web and mobile mapping over the last 10+ years

- Typically vector content (points, lines, polygons)
- Displayed on top of basemaps
- Since ~2005, basemaps have usually been raster tiles

- Dynamic updates of the map consist of two things:
  - Updating overlay content as drawn in client
  - Changing the basemap

- Paradigm is changing

Raster tiles for high dpi devices



Example from Google Maps

Why vector tiles?

Raster is Faster, but Vector is Corrector

– Joseph Berry

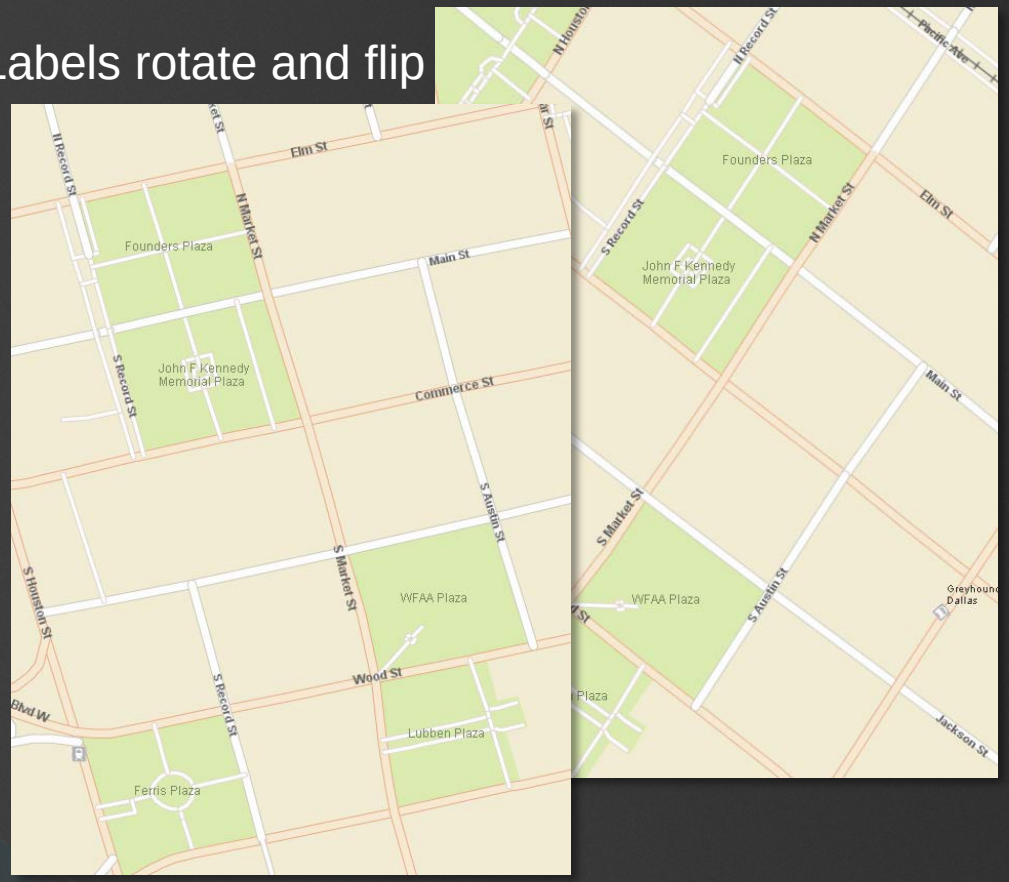
Why vector tiles?

- GPUs have changed the landscape
  - On your devices (OpenGL)
  - In your browser (WebGL)
  - On your desktop (DirectX, OpenGL)
  - Even in virtualized systems (vGPU)
- Vector data can remain vector, draw at native resolution
- Raster data still best served as raster in most circumstances

Advantages of vector tiles

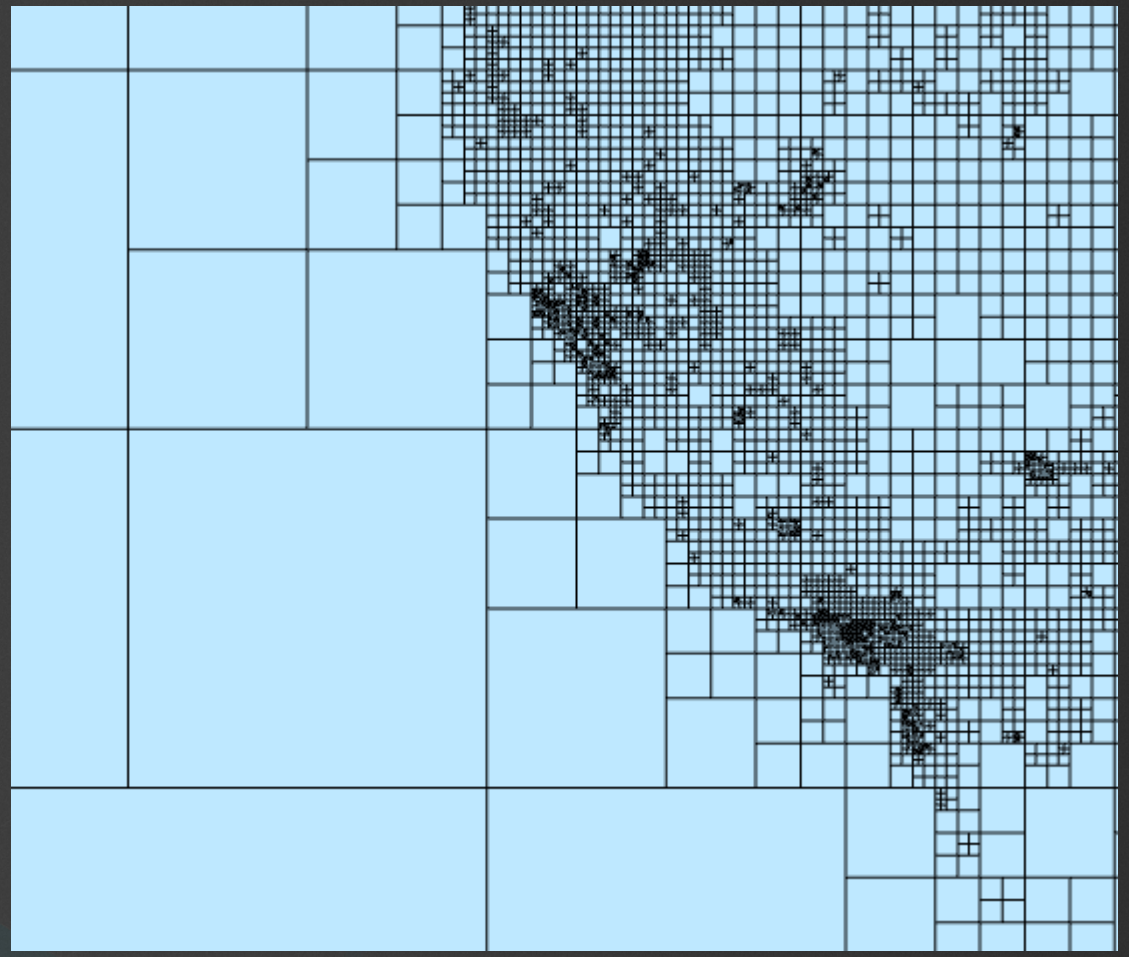
- **Display quality**
  - Best possible resolution for Retina displays
  - Small efficient format
- **Dynamic labeling**
  - Clearer, more readable text
  - On the fly labeling for heads up display
- **Map Styling**
  - Streets, Topo, Canvas from one tileset
  - Day and Night mode
  - Restyling

Labels rotate and flip



Vector tiles in ArcGIS

- Tiles produced in ArcGIS Pro 1.2
  - Use the Mapbox vector tile spec
    - Which uses Google protocol buffers
  - Styling converted to Mapbox gl style spec
- More aggressive overzoom
  - Builds on generalization work done in past ArcGIS releases
  - Support for traditional tiling also exists



Vector tile format

- Vector tiles are stored using protocol buffers
  - Compact binary format for transferring data
  - Data is organized into layers of geometry with key/value pairs of attributes

- A style file defines
  - The layer order
  - Definition query for each symbol layer
  - Symbol information for each symbol layer

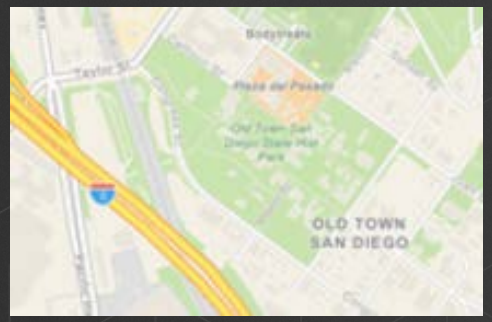
Tile creation process: Esri basemaps

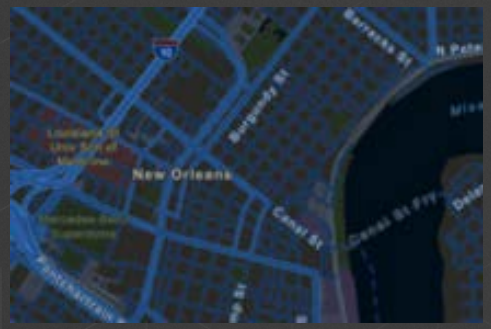
- Entire world
  - ~ 8hrs on a desktop machine
  - Tiles ~ 13 GB
  - Multiple styles can use the same tiles

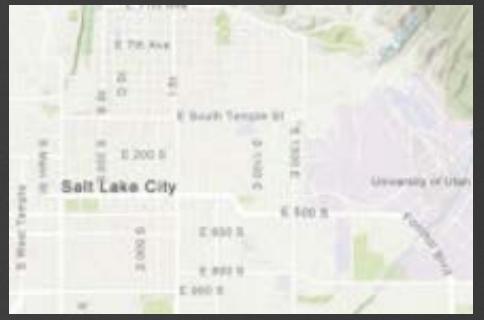
- Compared to raster for the entire world
  - ~ many weeks on a server cluster per map style
  - Tiles ~ 20 TB

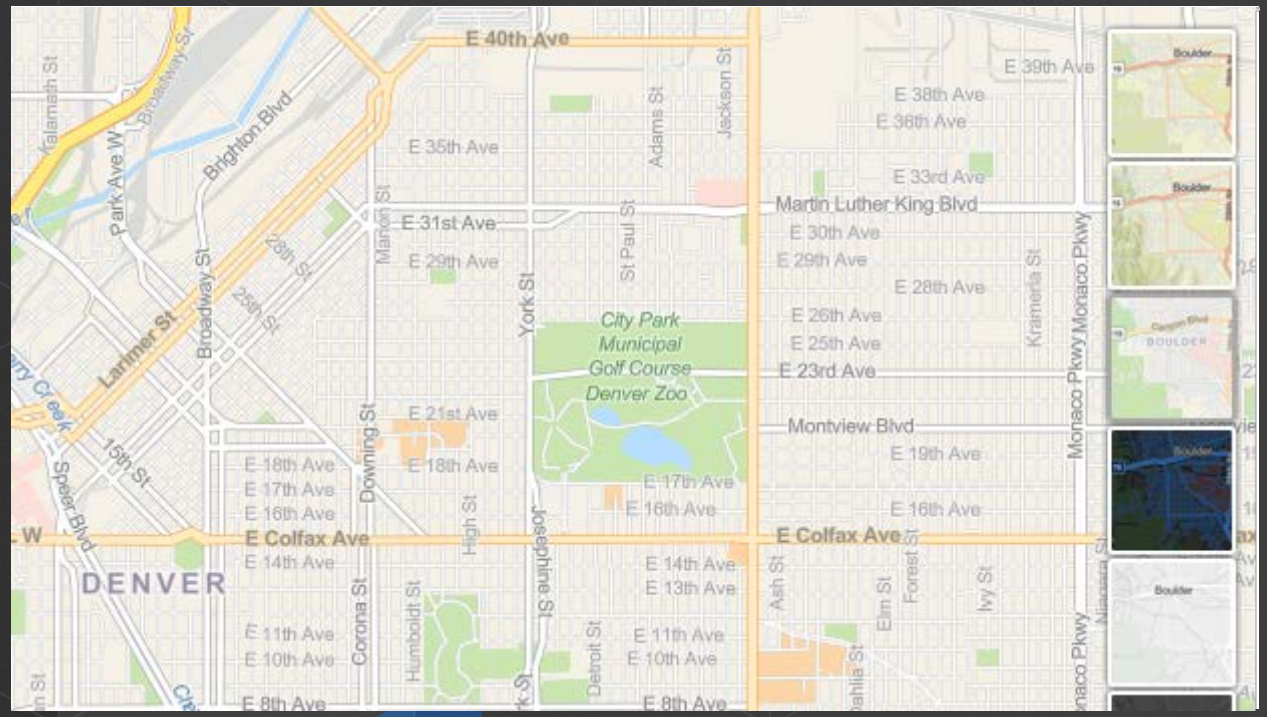
Vector tile basemaps

- Available on ArcGIS.com since November 2015
- Street (with and w/o relief), Topo, Night, Navigation, Dark Canvas, Light Canvas, Hybrid



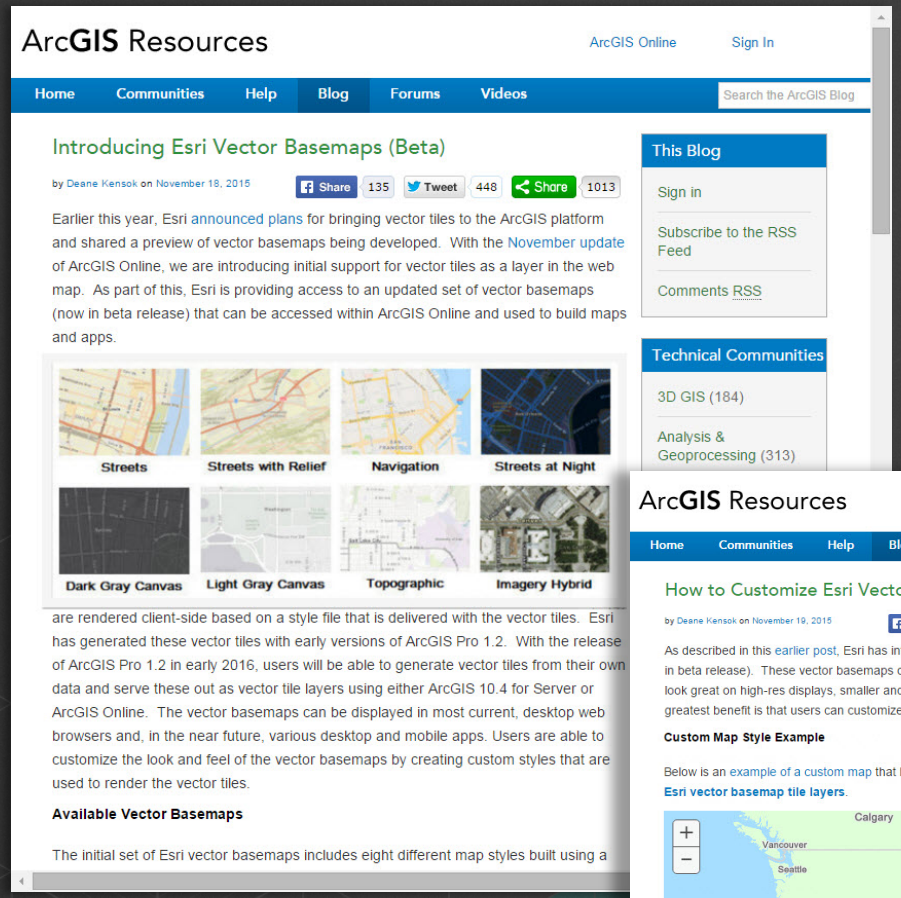


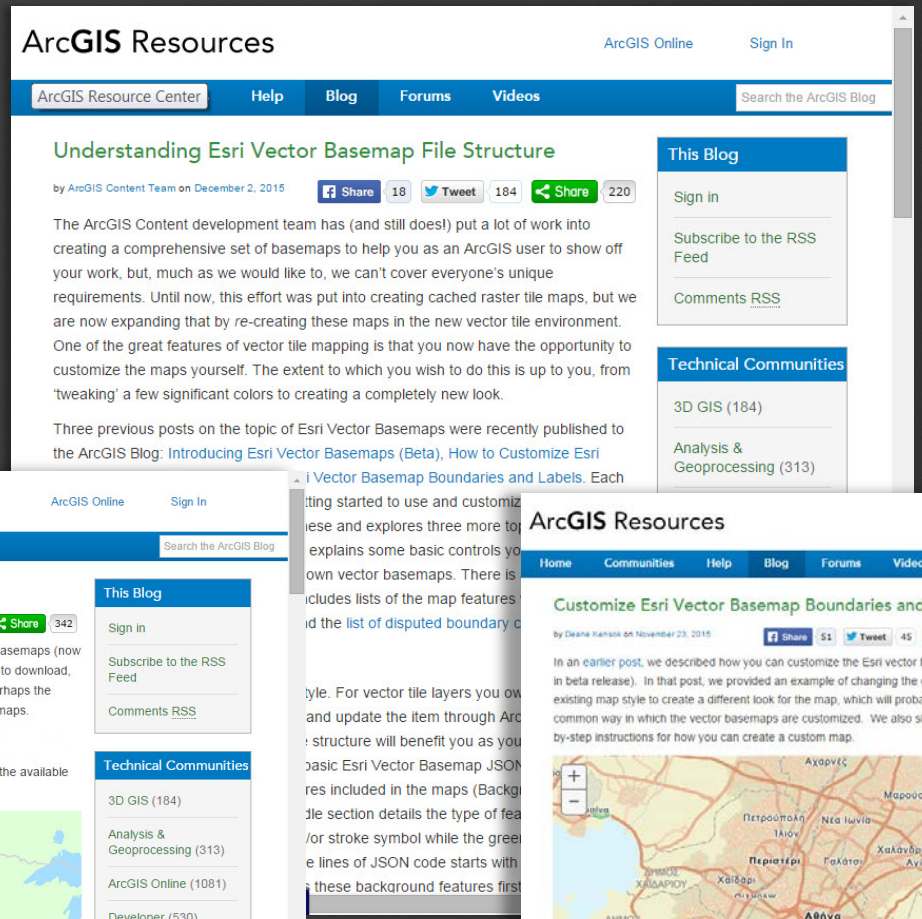


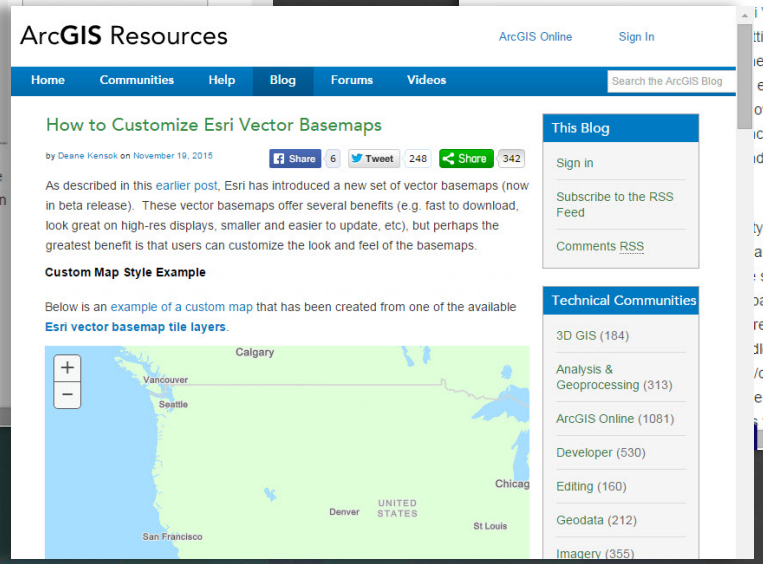


Case study: ArcGIS Basemaps

Vector basemap blogs







ArcGIS vector tiles – creation and consumption

- Tile consumption
  - ArcGIS JavaScript 3.15+ and 4.0 APIs
    - Currently uses the mapbox-gl-js library
  - ArcGIS Runtime Quartz – Beta 2
    - Ground up implementation
  - ArcGIS Pro 1.3
    - Will share Runtime implementation

Using and styling vector tiles

Using vector tiles in your applications

- Multiple ways to use vector tiles:
  - A) Use Esri provided vector tiles / styles
  - B) Style Esri vector tiles for your own use
    - Change colors
    - Drop features
    - Match the needs of your application
  - C) Create your own vector tiles from your own data

Styling vector tiles

- **Simple Style Copy**
  - **Save tile layer to your Portal or Online account**
- **Hand editing JSON**
  - **Update map item**
- **Two additional sample Vector Styling Apps simplify this:**
  - **Vector Style JSON Editor - GitHub**
  - **Vector Basemap Style Editor - GitHub**

Creating vector tiles

Creating vector tiles

- Tile creation in ArcGIS Pro 1.2
- Publish tile layers in ArcGIS Online and ArcGIS Server/Portal 10.4

- Created with GeoProcessing tools
  - Create Vector Tile Index
  - Create Vector Tile Package

- Accessory tools:
  - Share Package updated to support vector tiles
  - Extract Package updated to support vector tiles

ArcGIS vector tiles service

http://<catalog-url>/<folder>/<serviceName>/VectorTileServer

|--root.json
|--tilemap/
|--tile
|--resources
    |--fonts/
    |--styles/
    |--sprites/
    |--info/

Service example

Authoring vector tiles

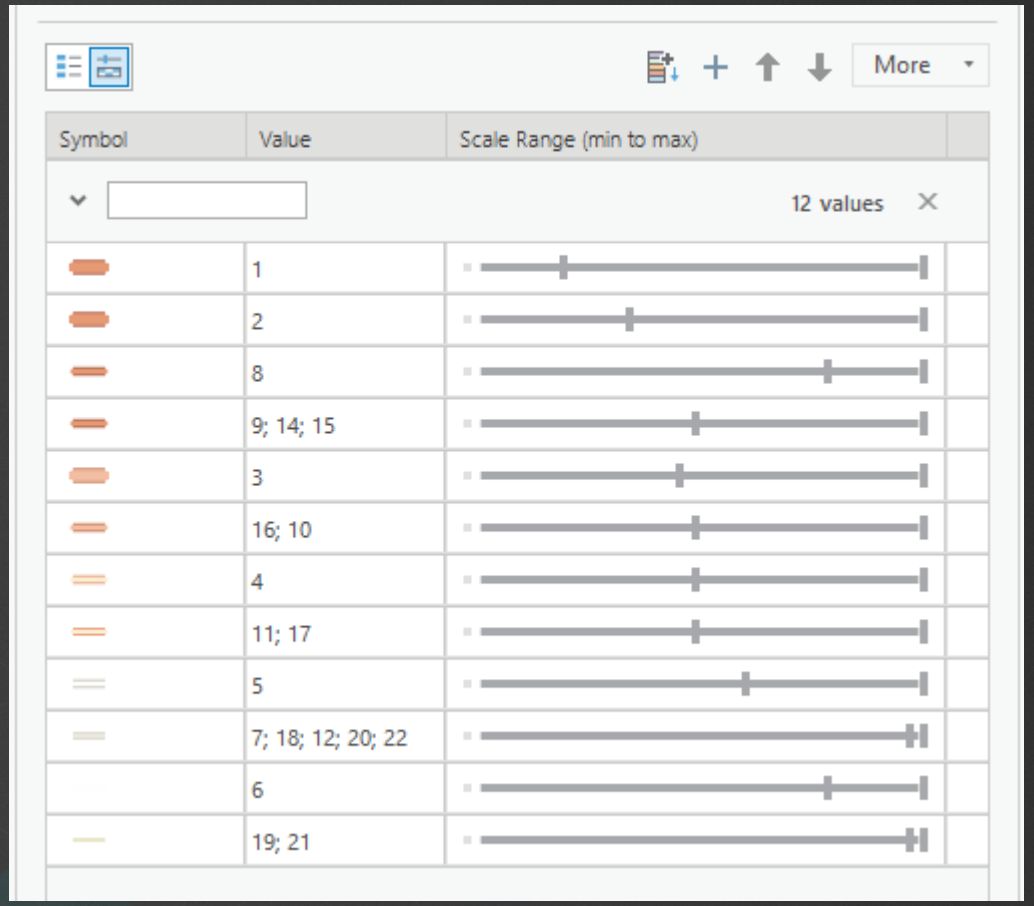
Authoring maps

- Only feature layers with simple, unique value, graduated, or class breaks renderers supported
- Maps should be re-authored for vector tiles
  - Limit number of layers
  - Limit duplication of content
- Several improvements have been made in ArcGIS Pro to assist with this
  - Scale dependent capabilities added to renderers
  - Scale based sizing added to renderers
  - Improvement to scale logic

Scale dependency on renderers

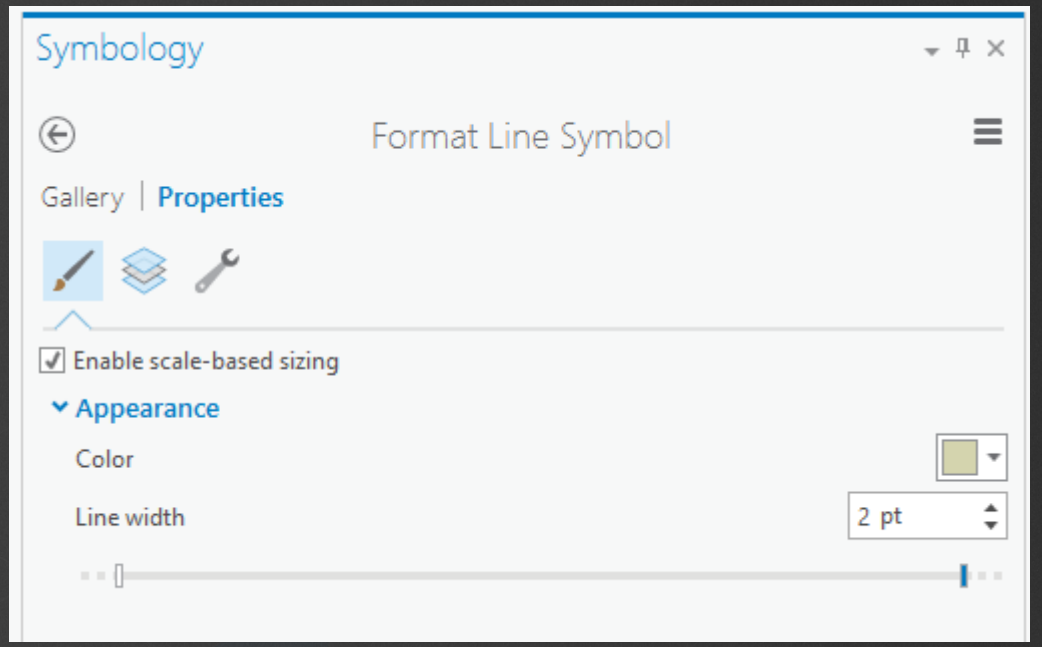
- Each symbol class can be assigned a scale range
  - Unique value
  - Class breaks

- Allows a multiscale map to be authored without duplicating content



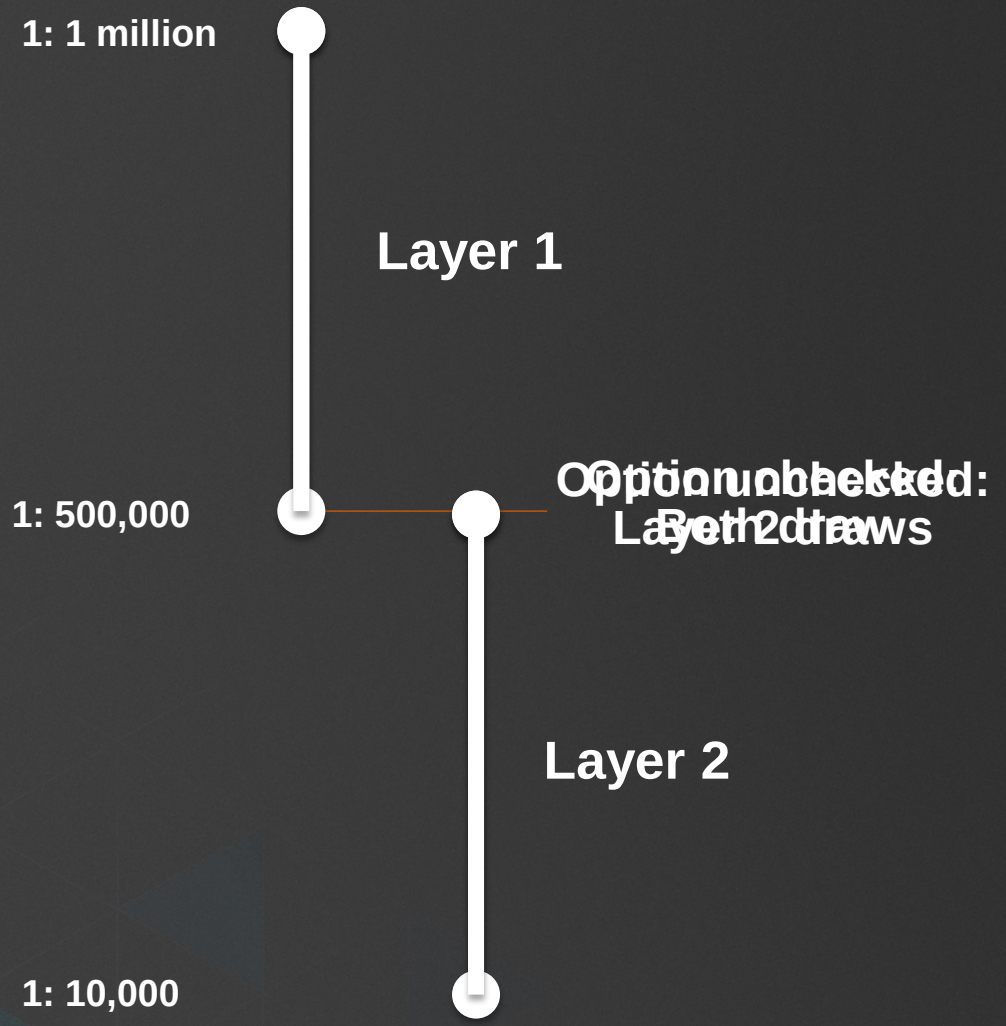
Scale based symbol sizing

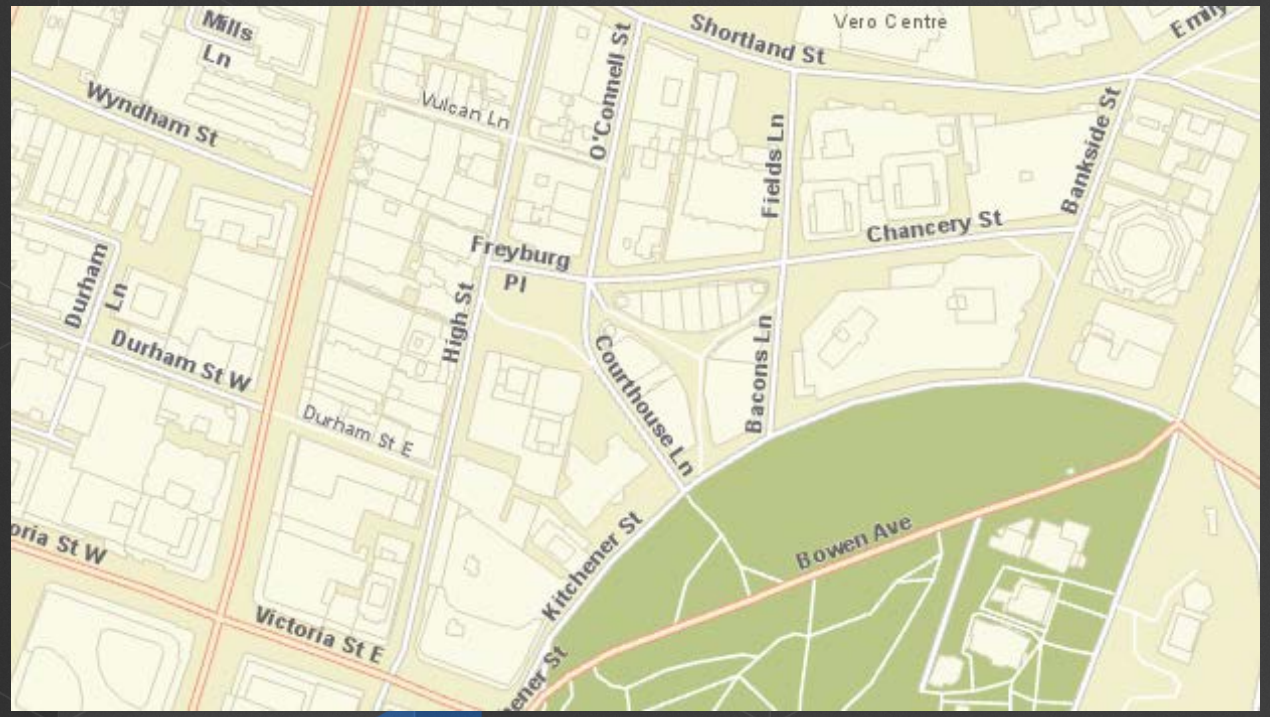
- Each symbol can have scale based sizing configured
  - Single symbol
  - Unique value
  - Class breaks
- Allows for small changes to symbol size across scales



Scale logic changes

- ArcMap and ArcGIS Pro 1.1
  - Layers will draw AT and BETWEEN minimum and maximum scales
- ArcGIS Pro 1.2, layers don’t draw at max scale by default
  - -Check “Draw up to and including the maximum scale in scale ranges” to revert to old behavior
    - This is checked for old Pro projects or imported ArcMap maps



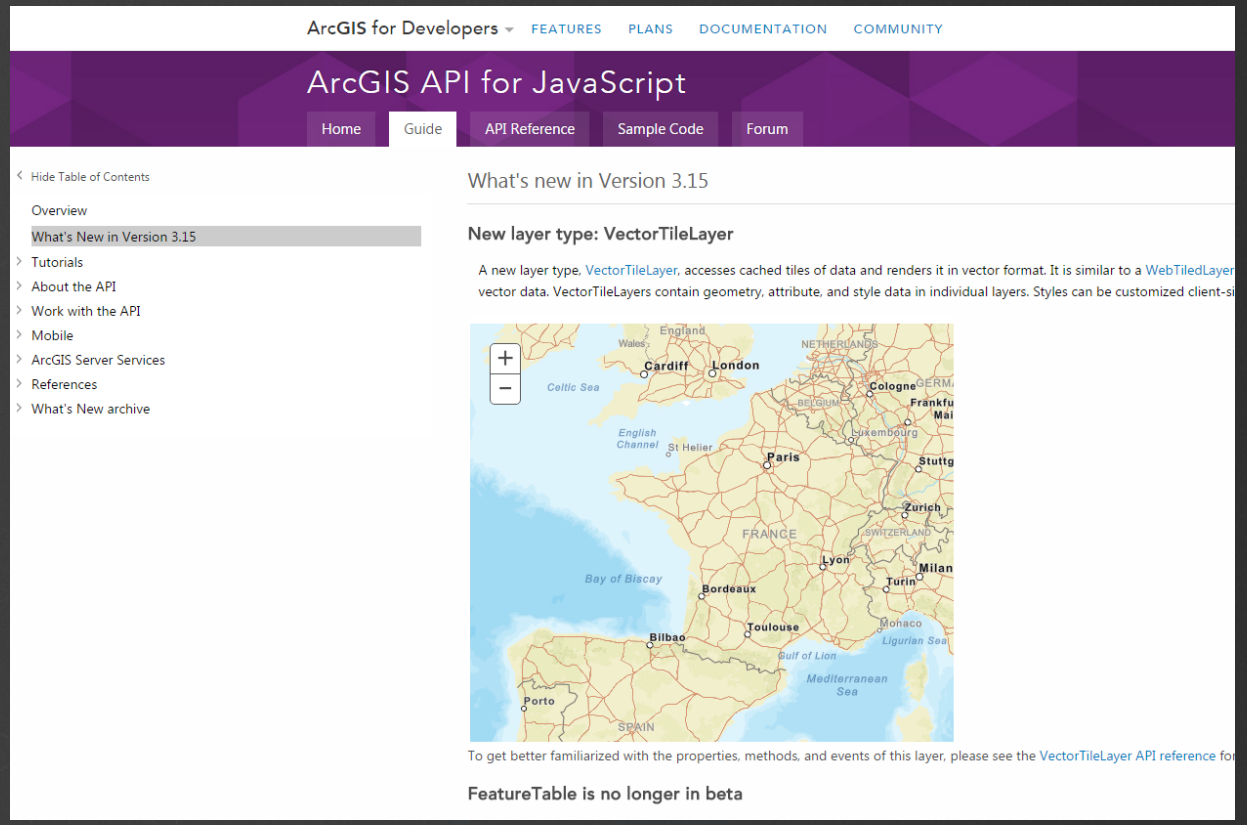


Demo: Authoring and creating vector tiles in ArcGIS Pro

Vector tile in APIs

Vector tiles in the JavaScript API

- JavaScript API samples in SDK
- Developers can use Tile Layers published to Portal in custom apps



Vector tiles in the JavaScript API

- Available in both 3.x and 4.0
- Works with all published Vector Tiles
- Tiles drawn in WebGL
- IE 11+

Common questions

Q: Why would I need to create raster tiles anymore?

A: Consider consuming clients and map requirements before committing to vector tiles. At this time, it’s not an answer for everything. Will never be a solution for many raster datasets.

Q: Can my data be extracted from vector tiles?

A: Think of vector tiles as generalized graphic derivations of your data. In many cases features are cut at tile boundaries, overlapped at tile boundaries, or are dissolved for optimal draw. Only a minimum number of attributes needed for feature draw are stored. It’s not raw data.

Q: Why don’t I see “Share as vector tiles” in ArcGIS Pro

A: The initial implementation is limited to Geoprocessing tools. A full sharing experience is planned for a future ArcGIS Pro release.

Q: Can I create vector tiles for any map projection?

A: Only Web Mercator (Auxiliary Sphere) supported for the initial release

Q: Should I re-author my maps for vector tiles?

A: Yes, start by reading the help topic titled Author a map for vector tile creation

Q: Will ArcMap support vector tiles?

A: It is unlikely that ArcMap will ever support viewing vector tiles. Creation of vector tiles will not be implemented in ArcMap.

Q: Can I do server side vector tile creation?

A: Not at this time, we have this on our roadmap for Portal / ArcGIS Online

Q: Vector tiles don’t draw correctly in my browser, is this a bug?

A: You’re likely experiencing a problem with WebGL support in your browser. Ensure you have the latest driver for your video card from the driver manufacturer

Do not rely on Windows Update on Windows machines for video drivers.

Q: Why aren’t Arabic and Hebrew labels drawing correctly?

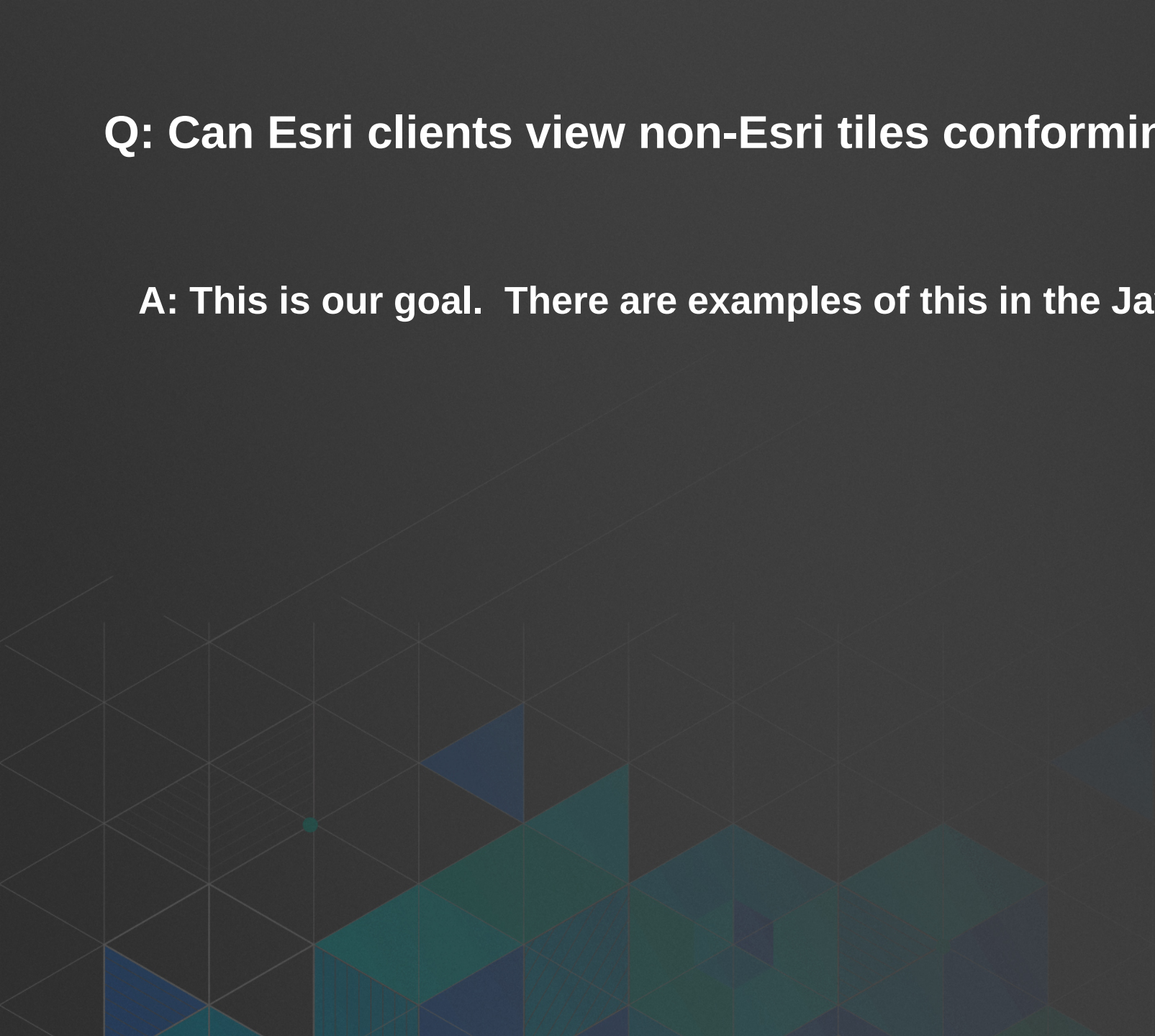
A: This is a limitation of the vector tile specification for fonts. We know this is a serious problem and are investigating solutions.

Q: Can I use any font for vector tiles?

A: From a technical standpoint any TrueType or OpenType font can be processed into the vector tile font format. However, font licenses vary widely and you should ensure you’re licensed for such use.

Q: Can Esri clients view non-Esri tiles conforming to the spec?

A: This is our goal. There are examples of this in the JavaScript API.



Q: Does the print service support vector tiles?

A: Not at this time, the ArcGIS JavaScript API will replace the Esri vector tile basemap layers with the Streets raster tiles. Custom services will be dropped. We hope to support vector tiles in the print service in a future release.

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Questions?

Please fill out survey

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