



Icon Map PRO
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Icon Map Pro Security Whitepaper

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Introduction

Purpose of Whitepaper

The purpose of this whitepaper is to provide a comprehensive analysis of the Icon Map Pro Visual for Power BI, focusing on its architecture and security aspects. It aims to offer organizations detailed insights into the design, external resource interactions, and data security measures of the visual. Additionally, it outlines the requirements for Microsoft certification and explains how Icon Map Pro adheres to these standards where feasible. It also addresses why full certification with Microsoft is not possible, due to the visual's requirement to access external services. This document is intended to instill confidence in organizations about the secure and trustworthy use of Icon Map Pro within their Power BI environments.

Icon Map Pro Overview

Icon Map Pro is an advanced visualization tool designed for Power BI that enhances geographic and location-based data analysis. It offers extensive features, making it ideal for creating interactive and highly customizable maps. This visual supports a wide range of mapping data sources and integrates seamlessly within Power BI, providing robust tools for detailed spatial analysis. For more information, visit www.icon-map.com. Icon Map Pro is a Power Custom Visual developed and supported by Tekantis Limited, a Microsoft Partner.

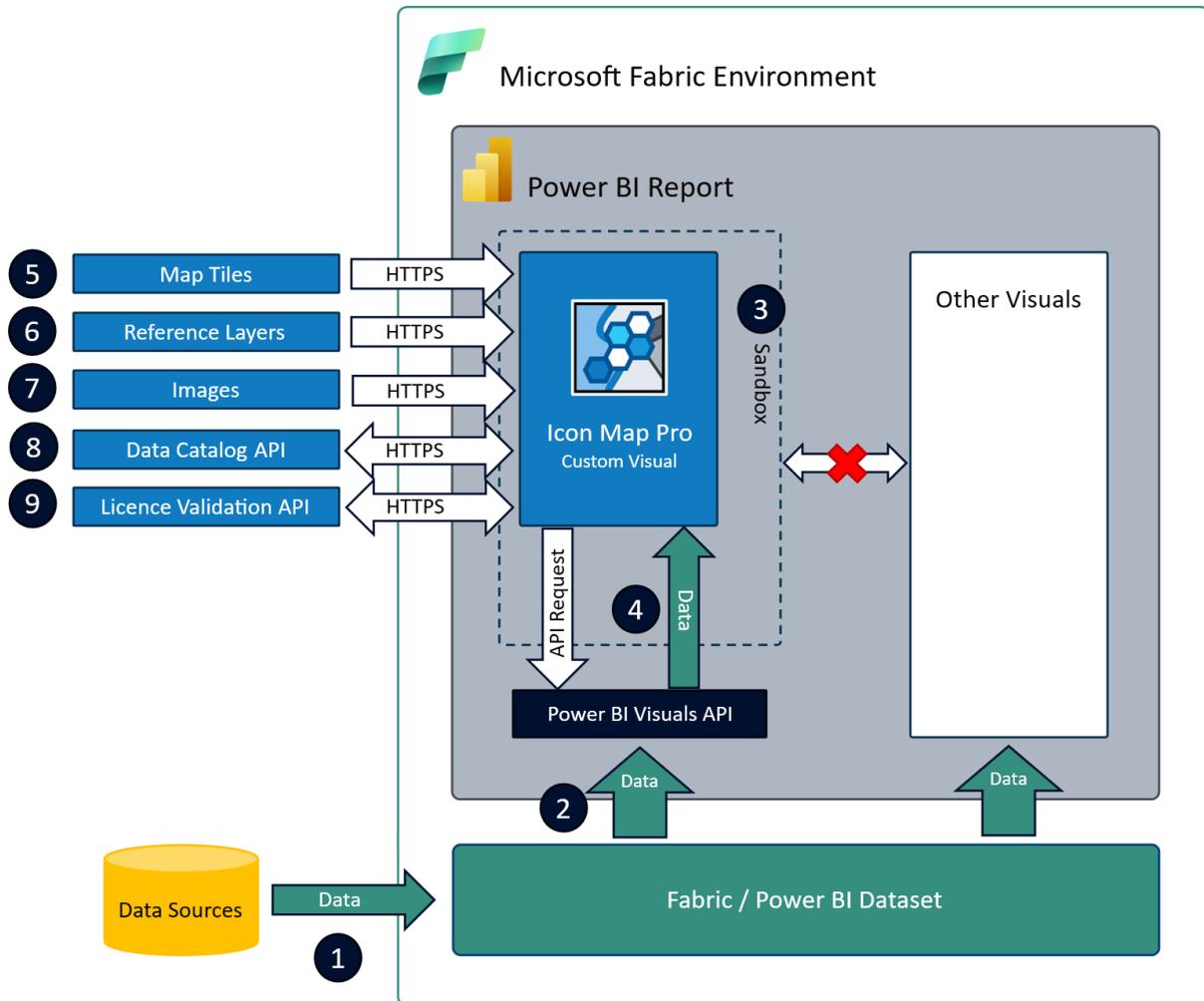
What are Power BI Custom Visuals?

Custom visuals are user-created extensions designed to enhance the visualization capabilities of Power BI. These visuals offer the flexibility to create bespoke visual representations tailored to specific business needs, extending the default options available in Power BI. Notably, out-of-the-box visuals in Power BI lack robust geospatial functionality, highlighting the need for Icon Map Pro.

The custom visuals are constructed using the [Power BI Custom Visual Developer SDK](#) and written in the TypeScript language. These visuals are sandboxed in iframes, ensuring isolation from other visual components and enhancing security by restricting access to the host document and other visuals. This sandboxing mechanism protects the wider workload by preventing potentially malicious code within a visual from affecting other parts of the Power BI report or dashboard, while also providing memory and compute isolation to ensure that resource-intensive visuals do not impact the performance of the overall Power BI tenant.

Icon Map Pro High-Level Architecture

The following diagram shows a high-level overview of the Icon Map Pro architecture.



1 Core Data

Like any other Power BI report, access to organizational data is provided via a Fabric/Power BI Dataset. This data is typically structured as a standard dimensional model, including a set of measures and dimensional attributes. The data model may also contain geospatial data, such as latitude/longitude for points, or more complex data like lines or polygons, usually stored as string representations in either Well-Known Text (WKT) or GeoJSON formats.

2 Data Access

As per standard Power BI, the report accesses the data via one of four available modes:

- a. **Import Mode** – The data is imported into Power BI and stored in a compressed semantic model associated with a Power BI Desktop file.
- b. **Live Connection** – The data is referenced from an existing semantic model, either within the Power BI Service, Azure Analysis Services (AAS) or an on-premises instance of SQL Server Analysis Services (SSAS)
- c. **Direct Query Mode** – The data remains in the source system and is queried by Power BI as needed, e.g., PostgreSQL or KustoDB, which are effective as GIS databases.
- d. **Direct Lake Mode** – The data is prepared and stored within Microsoft Fabric One Lake as optimized Delta tables. The Power BI report accesses the data directly via the Fabric SQL Warehouse endpoint.

3 Sandbox

One or more instances of the Icon Map Pro custom visual can be present in any Power BI report. Each instance is automatically sandboxed by the Power BI framework, placing the visual code within an isolated iframe.

This prevents the visual from directly accessing the data in the underlying dataset, the Power BI service, and any other visual in the report without going via Microsoft's Power BI Custom Visual API.

Interactions with the Power BI infrastructure for operations outside the sandbox such as opening hyperlinks in the browser, opening dialog boxes within Power BI or showing tooltips are handled via Microsoft's Power BI visuals API.

4 Visual Data

Data can only be accessed via the [Power BI Custom Visual API](#). Data is pushed to the Icon Map Visual through the standard field wells in Power BI. For example, in the screenshot below, we see four data fields assigned to the visual: "ID", "Longitude", "Latitude", and "Data Value". In this scenario, the visual will only have access to these four fields and cannot see any other data unless it has been explicitly assigned to the visual within a field well.

Data fields can also be assigned to the visual via the standard Power BI conditional formatting panes, e.g. the following screenshot shows the “Value” measure being used to determine the fill color of GeoJSON polygons within a data layer.

No data from the Power BI semantic model is sent to Tekantis’ servers.

Unlike core map visuals, Icon Map Pro does not offer a geocoding service to convert data items into longitude and latitude coordinates. This feature was intentionally excluded to avoid unnecessary security risks, as it could potentially expose sensitive address details outside of Power BI.

5 Map Background Layers

Icon Map Pro offers the option to load background layers, i.e. the base map.

The base maps are delivered either as raster images (png or jpg), vector images (protobuf or svg) depending on the provider. They provide a detailed representation of the entire world broken up

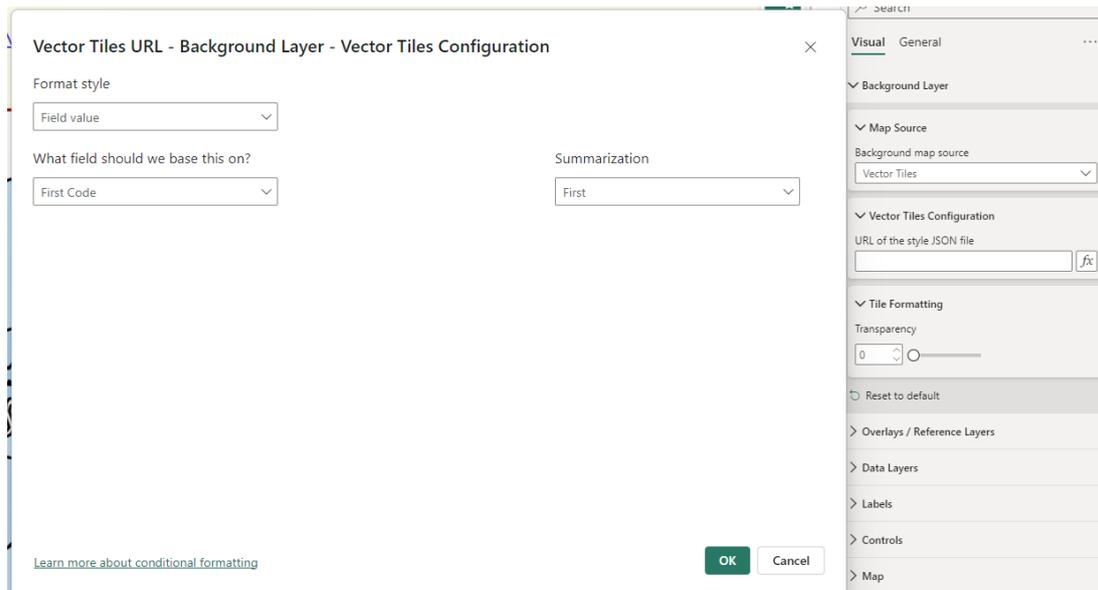
into 256 or 512 pixel squares at multiple zoom levels. These data sets are very large and cannot fit within the custom visual file. Instead, they are provided via a mapping tile service, which delivers the relevant images on the fly as the user zooms and pans around the map. Protobuf vector mapping services also call a JSON file describing the required style and formatting of the vector images – e.g. which colors should be used to represent roads, buildings, rivers etc.

As part of Icon Map Pro, Tekantis provides a vector tile service hosted in Microsoft Azure, based on publicly available OpenStreetMap data. The read-only endpoint is a scalable shared service using Azure Front Door to cache map background requests in a region close to the end user. A dedicated instance can be arranged for larger enterprise customers or for on-premise, air-gapped deployments. When creating a report, Icon Map is selected as the background map provider by default. Calls are made to styles.iconmappro.com to retrieve the available map styles (this provides the ability to add additional map styles without releasing new versions of the visual). The actual map tiles and style configuration files are served from styles.iconmappro.com. The Icon Map background maps make use of the PMTiles format and make use of HTTP Range Requests to only return the portion of the map being viewed. When requesting map tiles, the required tile coordinates and zoom level are passed to the background map endpoint. No data from the Power BI dataset is sent as part of this request.

Icon Map Pro also allows integration with the following widely used external mapping services via the relevant vendor SDKs. All SDKs and custom URLs must use endpoints encrypted via HTTPS. Where applicable authentication is via by a customer-supplied API key that is configured within the visual in Power BI desktop:

- **Azure Maps** - Tiles are served from atlas.microsoft.com
- **ESRI Arc GIS Online** - Calls are made to basemap-api.arcgis.com, basemap.arcgis.com and static.arcgis.com in order to serve the background maps.
- **Mapbox** - Tiles are served from api.mapbox.com
- **Google Maps** - The Google Maps API is loaded at runtime from maps.googleapis.com which includes a number of JavaScript libraries. The tiles are served from maps.googleapis.com.
- **MapTiler** - Tiles are served from api.maptiler.com
- **Mappable** – Tiles are served from tiles.mappable.world
- **Ordnance Survey** - Tiles are served from api.os.uk
- **Custom raster, vector and WMS sources** - Users have the ability to specify URLs for custom map servers to source tiles.
- **Custom image** – Users have the ability to specify a URL of an external image file, or upload an image file to use as the map background.

No data is pushed to these external services, with one possible exception. When using Custom URLs, the URL can be specified as a data field or measure value using Power BI's conditional formatting functionality, providing flexibility such as dynamically switching backgrounds based on slicers and report context. This is a powerful feature but must be used with consideration. Dynamic URLs can be generated based on fields in the underlying dataset and provided within the conditional formatting pane (see screenshot below). Care should be taken where sensitive data may potentially be exposed to the external services within the URL.



6 Reference Layers

In addition to the background layer, Icon Map Pro provides the ability to add reference layers; these are overlays that display supplementary data such as boundaries, routes, and points of interest. The layers could be based on either relatively static data, e.g. flood maps, or continuously updating data, e.g. traffic or weather.

The following reference layer types require access to external services:

- **Map Labels:** Place names are sourced from **Tekantis** tile service, **Azure Maps**, or **Esri ArcGIS**. To enable right to left text display for map labels, the Mapbox RTL text JavaScript library is loaded at runtime from <https://unpkg.com/@mapbox/mapbox-gl-rtl-text@0.2.3/mapbox-gl-rtl-text.min.js>.
- **Traffic:** Traffic information is overlaid from **Azure Maps** or **Google Maps**.
- **Weather:** Weather layers are provided by **Azure Maps** and **OpenWeatherMap** (tile.openweathermap.org).
- **GeoJSON / Esri Shapefile / KML files:** Files can be referenced as external URLs, which must be served from an HTTPS address with CORS enabled. Alternatively files can be uploaded directly into the visual, which are then compressed and stored within the PBIX file, removing the need for an external endpoint.
- **Esri ArcGIS Feature Layer:** Provides access to map features within the customer's Esri server. The Esri URL is provided by the user, which they can copy and paste from their Esri developer account. The following endpoints are supported:
 - **ArcGIS Platform / Online** – Esri provided host
<https://services3.arcgis.com/{organizationID}/ArcGIS/rest/services/{serviceName}/FeatureServer>
 - **ArcGIS Enterprise** – Customer provided host
<https://your.server.com/webadaptor/rest/services/Hosted/{serviceName}/FeatureServer>
- **WMS Layer:** Tiles are provided by a WMS server that must support HTTPS and have CORS enabled. An option CORS proxy service may be introduced at a future date.
- **Custom Raster Layer:** Custom raster tiles are displayed using an **XYZ template URL**.

Note: Where the path for an external resource is not specified, it utilizes the same endpoints as those mentioned in the background layers section above

As with background layers, no client data is pushed to these services, with the exception of dynamic URLs via conditional formatting. Conditional formatting is supported for GeoJSON / Shape / KML Files, Esri ArcGIS Feature Layers, and Raster Layers. Care should be taken where sensitive data may potentially be exposed to the external services within the URL, see [above](#) for more information.

7 Images

Icon Map Pro provides the ability to display images on the map. The images can be hosted on a publicly facing website as long as it is over HTTPS, e.g.

<https://www.publicwebsite.com/imageurl.png>

Alternatively images can be embedded within the power BI dataset as either 64bit encoded strings, or as SVG representations, removing the need to access an external service.

Image URLs are specified by providing the URL in the Image / WKT / GeoJSON field in the field wells area of the visual, and via conditional formatting options, for example specifying an image to appear at the end of a line.

The user may also choose to use Icon Map's inbuilt Icon Library. This is a repository of images in SVG format hosted at: <https://iconmappublictiles.blob.core.windows.net/images/>

8 Data Catalog Layers

Icon Map Pro will include a data catalog to enable additional pre-defined layers to appear on the map.

During report creation, report authors search for available map layers using an API at <https://catalogapi.icon-map.com>. No data from the Power BI dataset is sent during these requests – only the search terms entered by the report author.

Map layers added from the catalog, hosted by Icon Map, are retrieved from catalogapi.icon-map.com as PMTiles using the same PMTiles technology as the background maps. No Power BI data is sent in requests for the map layers.

9 Icon Map License Validation

In order to validate Icon Map Licenses and track visual usage for usage-based license plans, Icon Map Pro makes requests to the Icon Map license API at: <https://validate.iconmappro.com>

Requests to the API include the Icon Map license key, current Power BI environment type, (eg Power BI Service, Power BI Desktop etc) and user-defined reference information to enable a breakdown by reference in the usage statistics in the Icon Map portal. No email addresses or company names are included in these requests as we do not store this information in the visual.

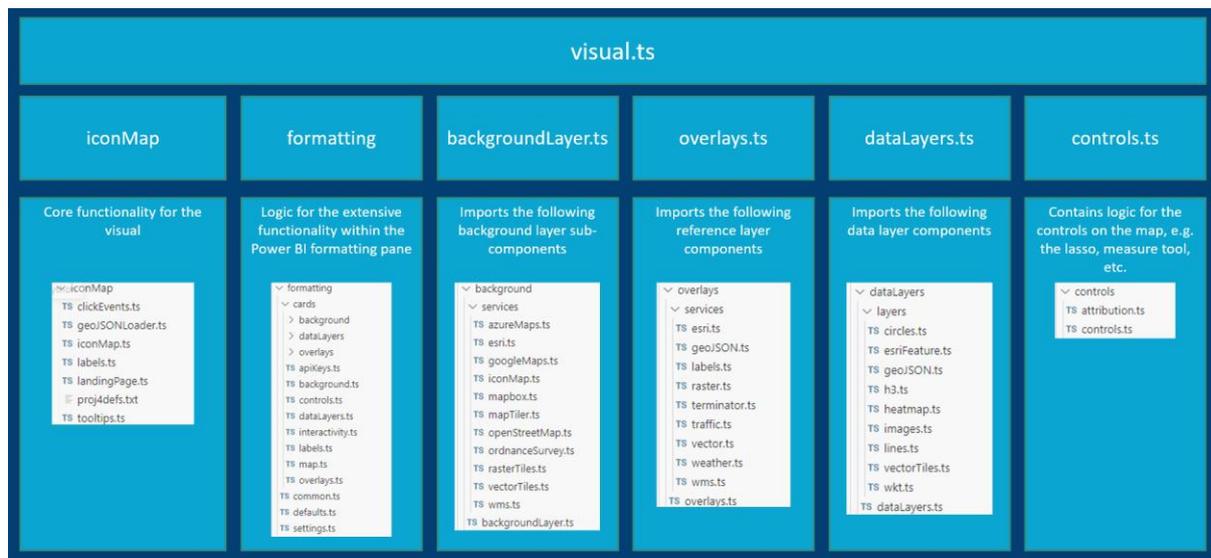
Icon Map also makes use of Application Insights to track errors and feature usage. No Power BI data is included. The visual settings enable report creators to opt out of error reporting.

The visual includes the ability for Power BI developers to sign up for an Icon Map developer license and free trial within the visual. This process uses an Icon Map API at iconmapprolicensingfunction.azurewebsites.net. This functionality is not relevant for customers who have purchased licenses.

Icon Map Pro Code Structure

Icon Map Pro follows the standard Microsoft recommended project structure for custom visuals, as outlined in the [Microsoft documentation](#). This section provides a high-level overview of the way the project has been structured to provide confidence it has been built to a high standard.

Given the complexity and size of the visual, the project is broken down into logical TypeScript component files to separate the numerous functional areas. The following diagram outlines the structure of the main “src” folder, showing how the entry component “visual.ts” imports the various subcomponents of the visual.



Note: The code is evolving with each subsequent release so the above diagram may not be the complete up-to-date picture.

Packages Dependencies

Icon Map Pro utilizes several open source packages to provide the required functionality. These are grouped into three main categories as follows.

Core Framework Packages

The following table lists the core framework packages that Icon Map Pro uses. These packages are the standard additions required to build Power BI custom visuals according to Microsoft coding standards.

Package Name	License	Author	Description
npm	Artistic-2.0	npm, Inc.	A package manager for the JavaScript programming language.
typescript	Apache-2.0	Microsoft	A language for application-scale JavaScript development.
powerbi-models	MIT	Microsoft	A collection of PowerBI models.
powerbi-visuals-api	MIT	Microsoft	API definitions and documentation for Power BI visuals.
powerbi-visuals-utils-colorutils	MIT	Microsoft	Utility library for working with colors in Power BI visuals.

powerbi-visuals-utils-dataviewutils	MIT	Microsoft	Utility library for working with data views in Power BI visuals.
powerbi-visuals-utils-formattingmodel	MIT	Microsoft	Formatting model utility for Power BI visuals.
powerbi-visuals-utils-formattingutils	MIT	Microsoft	Formatting utility for Power BI visuals.

Geospatial Packages

Icon Map Pro is primarily based around Leaflet, a widely-used, open-source JavaScript library for interactive maps. It is maintained by an active developer community, ensuring regular updates and security patches. The following table lists the core leaflet library and sub libraries along with other open source geospatial packages used by the visual, with links to the underlying project repos.

Package Name	License	Author	Description
leaflet	BSD-2-Clause	Vladimir Agafonkin	An open-source JavaScript library for mobile-friendly interactive maps.
leaflet-lasso	MIT	zakjan	A plugin for Leaflet to select markers, polygons, polylines, circles, and rectangles.
leaflet-rotatedmarker	MIT	bbecquet	A Leaflet plugin to rotate marker icons.
leaflet-vector-tile-layer	BSD-2-Clause	Leaflet	A plugin for rendering vector tiles with Leaflet.
leaflet-webgl-heatmap	MIT	danwild	A WebGL heatmap layer for Leaflet.
leaflet.gridlayer.googlemutant	MIT	Iván Sánchez	A Leaflet plugin for Google's basemaps.
leaflet.markercluster	MIT	Dave Leaver	Provides beautiful animated marker clustering functionality for Leaflet.
leaflet.nauticscale	MIT	Jakob Miksch	A Leaflet control plugin for nautical mile scale.
leaflet.pattern	MIT	teastman	A plugin for using pattern fills with Leaflet.
leaflet.polylinemeasure	MIT	ppete2	A Leaflet control plugin for measuring distances and areas.
leaflet.vectorgrid	BSD-2-Clause	Leaflet	A Leaflet plugin for displaying vector tiles.
mapbox-gl-leaflet	BSD-3-Clause	Mapbox	A plugin to use Mapbox GL JS as a Leaflet plugin.
proj4leaflet	MIT	kartena	A plugin to use Proj4js with Leaflet.
proj4	MIT	Mike Adair	A JavaScript library to transform point coordinates from one coordinate system to another.
shapefile	BSD-3-Clause	Mike Bostock	A JavaScript library for parsing shapefile.
simplify-geojson	MIT	Max Ogden	A JavaScript library to simplify GeoJSON.
wellknown	MIT	mapbox	A JavaScript library to parse and stringify Well-Known Text (WKT).
@types/leaflet	MIT	DefinitelyTyped	TypeScript definitions for Leaflet.
@types/google.maps	Apache-2.0	DefinitelyTyped	TypeScript definitions for Google Maps JavaScript API.

Helper Packages

Icon Map Pro also uses the following helper utility packages.

Package Name	License	Author	Description
jszip	MIT	Stuart Knightley	A library for creating, reading and editing .zip files with JavaScript.
pako	MIT	Vitaly Puzrin	A high-speed zlib port to JavaScript, works in browser & node.js.
pbf	ISC	Mapbox	A fast protocol buffers decoder and encoder for node and the browser.
rxjs	Apache-2.0	ReactiveX	A library for composing asynchronous and event-based programs by using observable sequences.
sync-request	MIT	Forbes Lindesay	Make synchronous web requests with cross-platform support.
then-request	MIT	Forbes Lindesay	A simple, flexible library for making HTTP requests in JavaScript.
uninstall	ISC	Rich Trott	A simple way to uninstall node modules.

The full list of opensource third-party modules is listed in Icon Map Pro's documentation:

<https://icon-map.com/documentation/pro/licensing/thirdparty/>

Code validation

At each release, a security audit of third party packages is run using '[npm audit](#)' to ensure there are no known vulnerabilities.

Following Microsoft's Power BI visual certification policy, the code is scanned to ensure adherence to Microsoft's set of coding standards for Power BI visuals using the [ESLint Plugin](#).

Security Code Reviews & Penetration / Load Testing

We are happy to support code security reviews. We are able to release the source code under NDA for your organization's IT Security team to perform a review of the source code. Please contact us at support@icon-map.com.

If you wish to perform penetration or load testing please contact Tekantis on support@icon-map.com to discuss your requirements. Icon Map Pro has an underlying map tile service and hence any significant increased load needs to be correctly planned to prevent you from being blocked from the service.

Bespoke Version with Locked Down External Access

As part of an enterprise deployment of the visual, we are able to provide a bespoke version of the visual that restricts access to specific URLs (such as those used by the background maps).

This capability uses the [Power BI visuals API to block all external requests](#) made to URLs that are not explicitly listed.

This does however limit the capabilities of the visual, so the consequences of this should be considered before requesting.

Microsoft Certification

Overview

Custom visuals, like any other software, can contain security vulnerabilities, or even intentional malicious code designed to steal data. To provide Power BI users confidence that a visual is trusted and secure, Microsoft set up a certification program for visuals developed by third-party vendors, such as Tekantis.

As part of the program, Microsoft has released a set of [certification requirements](#) and guidelines for Power BI visuals. Icon Map Pro has been built to adhere to these standards where possible - see the detailed requirements mapping below. However, due to the nature of a mapping application, it is not possible to meet the following requirement:

“A custom visual must not access any external services or resources. For example, no HTTP/S or WebSocket requests can go out of Power BI to any services.”

This is because a map visual has the requirement to load background and reference layers, which would be far too large to embed within the visual file. This requirement is also present in the Microsoft out-of-the box mapping visuals, i.e. the Azure Maps Visual calls into the underlying Azure Maps API and the Esri ArcGIS visual requires a connection to the Arc GIS Online external endpoints.

Certification Requirements Mapping

The following table outlines Microsoft's detailed requirements for developers to achieve certification and indicates whether Icon Map Pro meets these standards.

Requirement		Notes
Visual complies with guidelines for Power BI visuals		
Visual passes all required tests		
Compiled package matches the submitted package		
Code repository available for review by Power BI team		The code has not been reviewed to date but is available.
Repository contains code for only one Power BI visual		
Access provided to repositories containing private npm packages or submodules		
Use the latest version of the API		
Include required files (.gitignore, capabilities.json, pbviz.json, package.json, package-lock.json, tsconfig.json)		
"typescript", "eslint", and "eslint-plugin-powerbi-visuals" packages installed		

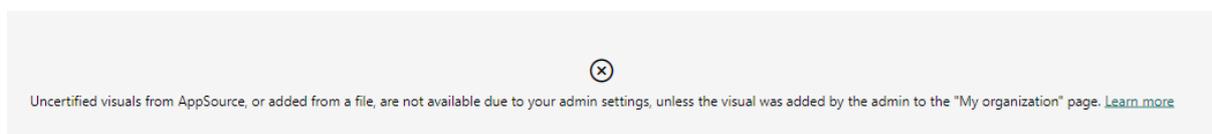
Command for running linter included in package.json	✓	
Commands npm install, pbviz package, npm audit, and ESLint return no errors	✓	
Use the latest version of powerbi-visuals-tools	✓	
Compile visual with pbviz package or provide npm run package custom build command	✓	
Use only public reviewable OSS components	✓	
Code supports the Rendering Events API	✓	
Ensure DOM is manipulated safely	✓	
Use the sample report as a test dataset	✓	
No accessing external services or resources	✗	As specified above the visual requires access to several external services.
No use of innerHTML or D3.html(user data or user input)	✓	
No JavaScript errors or exceptions in the browser console	✓	
No arbitrary or dynamic code (e.g., eval(), unsafe use of setTimeout(), etc.)	✓	
No minified JavaScript files or projects	✗	To support RTL (right to left) text in labels the following JavaScript file, authored by Mapbox is required. This file has been minified for performance reasons so breaks this requirement. https://unpkg.com/@mapbox/mapbox-gl-rtl-text@0.2.3/mapbox-gl-rtl-text.min.js . The unminified version of the file can be reviewed here: https://unpkg.com/@mapbox/mapbox-gl-rtl-text@0.2.3/mapbox-gl-rtl-text.js

AppSource Submission Validation

Icon Map Pro is added to Power BI reports via the Microsoft Commercial Marketplace – AppSource. As part of the process for submitting and publishing of Icon Map Pro in AppSource, Microsoft perform a series of tests before including a new release of the visual.

Uncertified visuals are not permitted in my organization

When you publish your report to the Power BI Service, you may see this message in place of the Icon Map Pro visual



This indicates that uncertified visuals have been disabled within your tenant, either for the whole organization or the current user. It is possible to create exceptions for specific custom visuals, which are then able to be deployed across the organization by adding them as Organizational Visuals.

Power BI / Fabric Tenant Settings

In order to use Icon Map Pro, the following tenant settings must be configured within the Microsoft Fabric Admin portal. All settings can be found in the “Power BI Visuals” section:

Allow visuals created using the Power BI SDK

This setting enables the use of custom visuals within Power BI reports. The setting can be applied for the entire organization or applied to specific security groups.

Disabling this setting requires Icon Map Pro to be added as an Organizational Visual

Add and use certified visuals only (block uncertified)

This setting prevents use of uncertified visuals, including Icon Map Pro, within the tenant. The setting can be applied for the entire organization or applied to specific security groups.

Enabling this setting requires Icon Map Pro to be added as an Organizational Visual

Organizational Visuals

Organizations have the ability to override the default and allow specific custom visuals within the Power BI tenant by adding them as an organizational visuals. These visuals are available to be added to and viewed within reports, even if custom visuals are otherwise disabled in the tenant settings.

Visuals must be added into the organizational visuals repository using the Power BI Admin Portal. After visuals have been added they can be discovered by report authors from the “Get More Visuals” option in Power BI.

Administrators have control of the organizational visuals repository and have the ability to temporarily disable visuals for all users.

Refer to the [Microsoft documentation](#) for more information.