Gaia 3.4

## User's Guide

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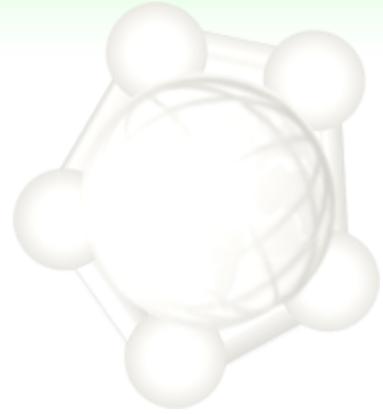
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1. About The Carbon Project

The Carbon Project® (www.TheCarbonProject.com) is an innovative, high-energy software and technology company, specializing in mapping, geospatial interoperability and geosocial solutions. Our company serves geospatial professionals, software developers, government agencies and businesses that develop mapping solutions or use geospatial data from many sources.

The Carbon Project develops mapping software solutions for government and commercial purposes. Our core clientele is in the Defense and Intelligence, Environmental and Infrastructure market sectors. Our customers include the US Department of Defense (DoD), Army Corps of Engineers, UK Ministry of Defence (UK MOD), National Geospatial Intelligence Agency (NGA), Joint Forces Command, United States Geological Survey (USGS), British Geological Survey, Canada's GeoConnections, defense integrators including BAE Systems, SRA International, and Lockheed Martin and more.

Our core suite of products includes CarbonTools™ PRO, CarbonArc® PRO, and Gaia® Extenders. These software products are provided 'off-the-shelf' to customers and users around the world.

1.1. About CarbonTools PRO

CarbonTools PRO (www.CarbonTools.com) is an extension to the Microsoft .NET Framework that supports advanced location content handling and sharing and is the foundation for the Gaia application.

Based on the Source-Handler-Data® technology, CarbonTools PRO provides a unified framework for geospatial interoperability with an array of location content and services. This means Microsoft Bing Maps, Google Earth, OpenStreetMap, Yahoo! Maps, OGC SDI, GML, GMLsf, ESRI Shapefiles and more can be used in your open-geospatial .NET applications...seamlessly!

With CarbonTools PRO, .NET developers can extend existing geospatial systems, including but not limited to Gaia, with new capabilities and content sources or build exciting new open-geospatial .NET applications. Furthermore, the package contains numerous code samples and extensive documentation, including the *complete project and source code of the latest Gaia version*.

CarbonTools PRO is now available and includes many new features to support your open-geospatial .NET development projects.
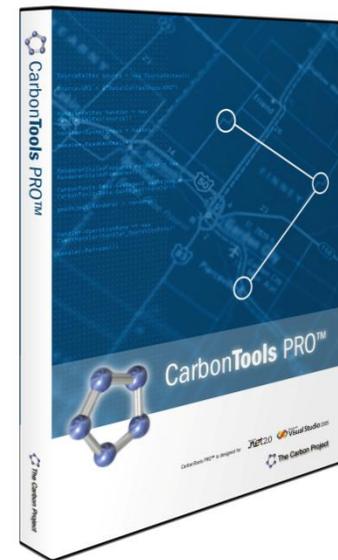
2. Introduction

Gaia® is a platform designed for advanced geospatial needs. Based on the **CarbonTools PRO** open-geospatial development toolkit, this viewer can access an array of geospatial sources such as the *Open Geospatial Consortium* (OGC) Web Mapping Service (WMS), Web Map Tile Service (WMTS), Web Coverage Service (WCS), and Web Feature Service (WFS), commercial services such as *Microsoft Bing Maps*, and *Yahoo! Maps*, not for profit services from OpenStreetMap (OSM), as well as file formats such as *ESRI* Shapefiles, *Google Earth* KML/KMZ, DXF, MIF and Geography Markup Language (GML).

With Gaia you can use geospatial content from different sources and overlay them into a single map view, with each layer individually configured and styled. The Gaia multi-layer view allows seamless use of multiple layers of different types. Panning, zooming and other mapping tools provide a fast and convenient tool for browsing the map. Gaia uses dynamic caching of content to memory, providing enhanced mapping performance.

Gaia offers the best available OGC compatibility and content support with robust multi-vendor access. Through the powerful Geography Markup Language (GML) parsing capabilities of CarbonTools PRO, Gaia provides support to these open specifications. Gaia also supports schema validation of GML for deep and complex GML variations as well as quick parsers optimized for the best performance when using common GML profiles. In addition, the sophisticated rendering and symbology engine allows robust styling of the GML layers.

The Symbology and Rendering engine of CarbonTools PRO allows for a more meaningful and informative features presentation. Styling options are extensive and the composed styling of the data is preserved within saved sessions.

You may also add your own mapping annotation in the form of geospatial notes. User generated notes can be uniquely styled; they may contain textual information as well as an embedded picture. Gaia also supports geo-tagged (EXIF) images that can be automatically placed on the map using the spatial location embedded in the picture.

With Gaia you may save, import and load Geospatial Session Files (GSF) seamlessly. These files can be shared with most CarbonTools PRO based applications. GSF stores the cached content, source information as well as the styling and layer configuration. With Gaia you can use the GSF even when no internet connection is available; Gaia uses the loaded cached data offline and refreshes it when a connection becomes available again.

Gaia is also a highly extendable platform. Its open Extenders API offers developers a way to use .NET and CarbonTools PRO to enhance and transform Gaia with new operations and functionality. Extenders are easy to develop and install and have limitless possibilities.
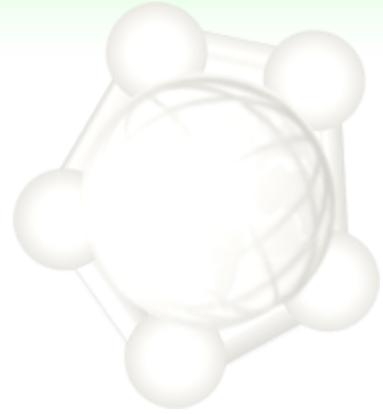
3. Installation

3.1. System Requirements

- Windows 2000/2003/XP/Vista/Windows 7

- Microsoft .NET 2.0 or later

- Windows installer (usually built-in in Windows)

> 💡 **Tip: The Microsoft .NET Framework 2.0 can be installed and run side-by-side with other .NET Framework versions. There is no need to uninstall any versions (e.g. .NET 3.x) when installing the required version.**

3.2. Installing the Application

To install Gaia simply run the *Gaia3Setup.msi* file (Microsoft Installer type file) and follow the onscreen instructions. When the installation process is finished a shortcut will be created on the desktop and another will be added to the "Gaia 3" folder in the user's Programs list.

Installing Gaia will associate the following extensions with this application:

GML	Geography Markup Language. GML may be used from local files with Gaia.
GSF	Geospatial Session File. This file includes a complete session in Gaia, including access connections, settings, styling and any cached data. These files can be used from any CarbonTools PRO based application.

# 4. Using Gaia
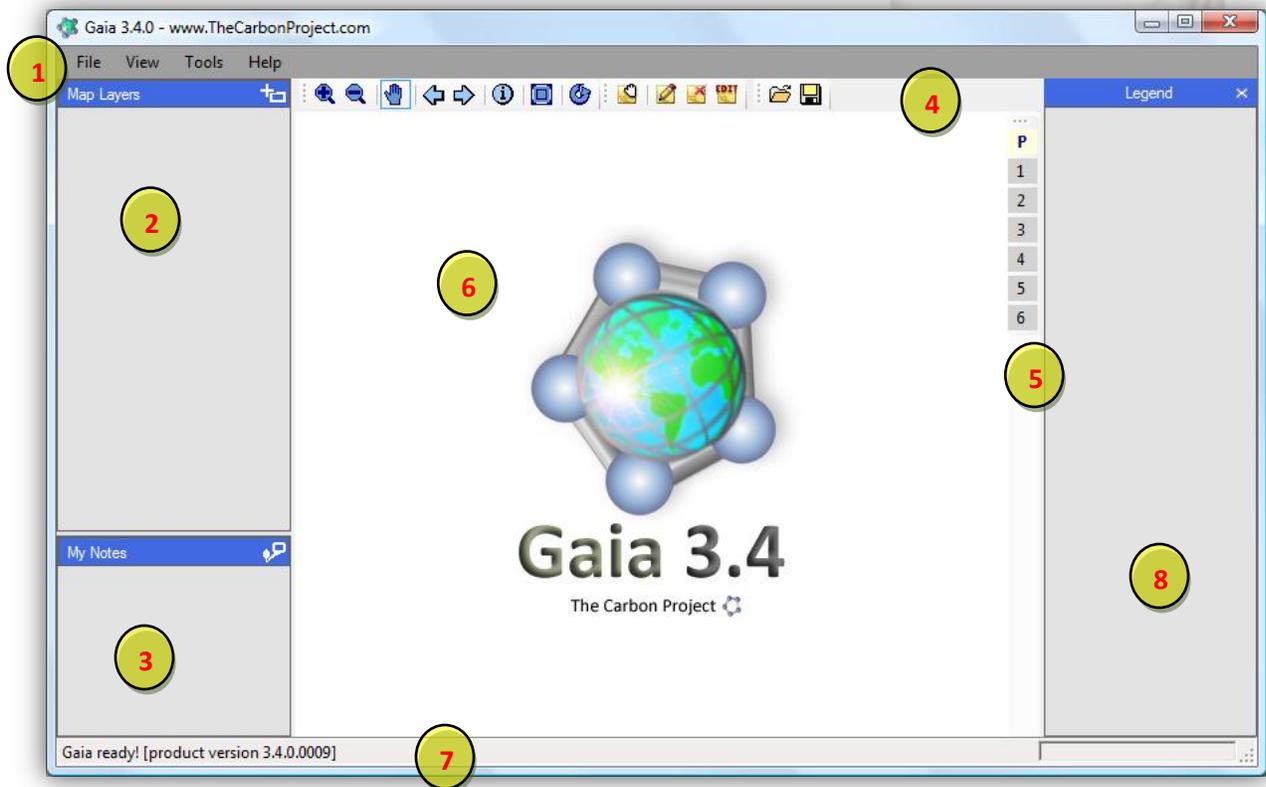
The Gaia main view (Figure 1) contains six general sections:

1. Main menu

2. Map layers panel

3. My notes panel

4. Tools toolbars (tools can be docked anywhere around the map)

5. Location bookmarks toolbar

6. Map view (shows the splash image if no map layers are set)

7. Status bar

8. Feature layers symbols legend
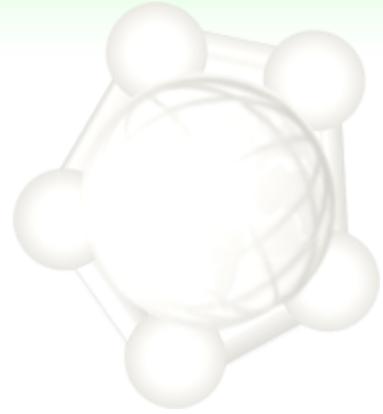
4.1.   Supported Geospatial Services and File Formats

Gaia supports the following services and file types:

Services

- ➢ Web Map Server (WMS)
- ➢ Web Map Tile Service (WMTS)
- ➢ Web Feature Service (WFS) – including WFS-G (Gazetteer)
- ➢ Web Coverage Service (WCS)
- ➢ Bing Maps
- ➢ Yahoo! Maps
- ➢ OpenStreetMap (OSM) tiles at home services.

File Formats

- ➢ Geography Markup Language (GML) – GML L0, GML L1, GML 2, GML 3.1, GML 3.2
- ➢ ESRI Shape Files (*.shp)
- ➢ MapInfo Files (*.mif)
- ➢ Autodesk Files (*.dxf)
- ➢ Google Earth (*.kml, *.kmz)
- ➢ Geo-tagged EXIF imagery (used in notes)

Note: Various Extenders (see page 35 for more information about Gaia Extenders) can enhance the platform with new formats and services as needed. For example, The Carbon Project demonstrated during the OGC Web Services 6 (OWS-6) testbed Extenders for the aviation oriented spatiotemporal AIXM 5 format and the weather oriented WXXM format.

4.2. Main Menu
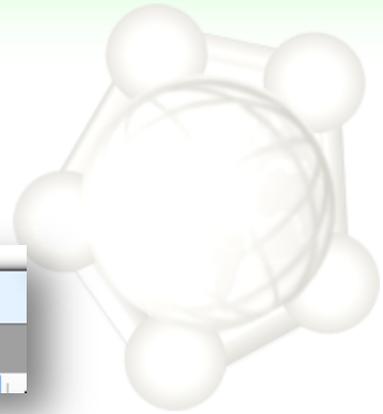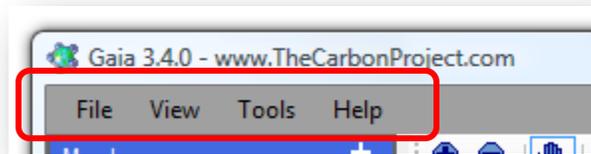
The main menu has four categories:

File – Save, load and other operations related to the current session.

View – View the messages log and control several visual display properties.

Tools – Map tools and configuration settings.

Help – Redirect to online information such as this user guide and online video tutorials.

> **Note: When opening the messages log a new Log file is created in the Gaia work folder. The saved log is opened using Gaia's text reader dialog.**

> **Tip: Some menu items have a keyboard shortcut, e.g. to save the current GSF simply press CTRL+S, add new layer with CTRL+A.**

4.2.1. Saving and Loading Geospatial Session Files (GSF)

To save and load work sessions or partial sessions (e.g. exporting the layers without the notes) Gaia uses the **CarbonTools PRO** Geospatial Session File (GSF) format (see www.CarbonTools.com). This format allows the preservation of the data and the way it is handled and rendered. This means the GSF files not only includes all cached data (features, raster and tiles) but also the information on how to access and process it (e.g. using a layer from a Web Feature Server) and how to display it with the set symbology preferences (page 30).

This mechanism allows you to use Gaia offline and online seamlessly. It also allows map collaboration with other Gaia users and other CarbonTools PRO based applications by sharing GSF files.

Note: For security reasons user authentication is not preserved in a GSF. When loading a session that includes secured services you must use the Security tab in the layer properties (page 33) to set the user name and password.

Note: CarbonTools PRO uses .NET serialization and compression in order to preserve sessions.

4.2.2. File Menu Item Options

In addition to a full session save and load you may export and import partial views of the session using the Export and Import commands under the File menu item (Figure 2).

The following options are available:

- ➢ **"New"** – Start a new session. Empty all notes and layers.
- ➢ **"Open"** – Open a new GSF, replacing the current one.
- ➢ **"Import GSF"** – Open a new GSF and append the layers and notes to the current session.
- ➢ **"Recent Gaia Sessions"** – A list of recent sessions used by Gaia.
- ➢ **"Save GSF"** – Save the current session using the file name it was opened with.
- ➢ **"Save GSF As"** – Save the GSF using a new file name.
- ➢ **"Export Layers without Notes to GSF"** – Save the current session layers excluding the notes.
- ➢ **"Export My Notes to GSF"** – Save the notes to a GSF excluding the layers.
- ➢ **"Export Current View to Image"** – Export the current map view to an image file in common imagery formats (PNG, JPG, TIF, etc.).
- ➢ **"Print"** – Print the current session view.
- ➢ **"Print Preview"** – A simple print preview tool.
- ➢ **"Extenders"** – Extender modules manager (for more about Gaia Extenders see page 35).
- ➢ **"Exit" -** Close the application.
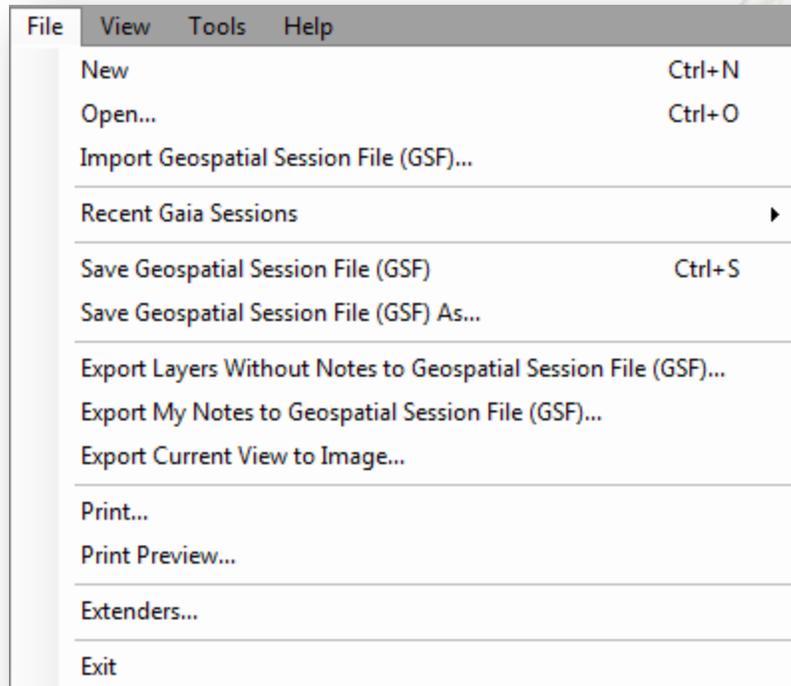
Figure 2 - Under the File menu item there are several options on how to save and load sessions

Tip: When exporting a GSF all internally cached data is preserved. Performing a Refresh on the view may clear out some irrelevant cached content and reduce the GSF file size. In addition, switching map type on Bing Maps or Yahoo Maps will clear any preserved tiles and add only tiles relevant to the current view location and zoom. Therefore, switching to another style and back may remove unused tiles and reduce the overall GSF file size. Alternatively, the number of tiles cached can be reduced from the default 1000 (this can be done in the "Add Layer" dialog, see page 23).

4.3.   Map Layers Panel

The layers added to the map view are managed in the *Map Layers* panel (Figure 3). Each layer is represented by a rectangular container that displays a thumbnail image and the name of the layer. The order in which the layers are drawn on the map view is determined according to the order of the layers in this panel. The bottom-most layer item represents the layer that is rendered first and the top most layer item represents the layer that is rendered last.

Right-clicking in a layer container will open a context sensitive menu that allows operations specific to that layer type. The options provided by this menu depend on the type of layer, for example a Microsoft Bing (Virtual Earth) layer will allow changing the map style to Roads, Aerial or Hybrid map. Most layers will offer a Properties option which opens the Layer Properties form and provides various settings and configurations regarding the corresponding map layer (page 26). The context-menu also allows removal of the layer from the map or removal of all layers in the container.

> **Note: To change the order of layers simply use your mouse to drag and drop a selected layer item anywhere in the layers container panel.**

Each layer container has a checkbox that allows turning on or off the layer view in the map. Checking and un-checking the visibility box for a layer will have an immediate result on the map view with no need to refresh the map's content.

Most layers also allow the opening of the Properties dialog by double clicking on the layer name. Double clicking on the symbol thumbnail of feature type layers will open the Symbol Selector dialog.

> **Note: A layer that is checked off will not be available for selection in the Identify dialog when using the identify map-tool.**
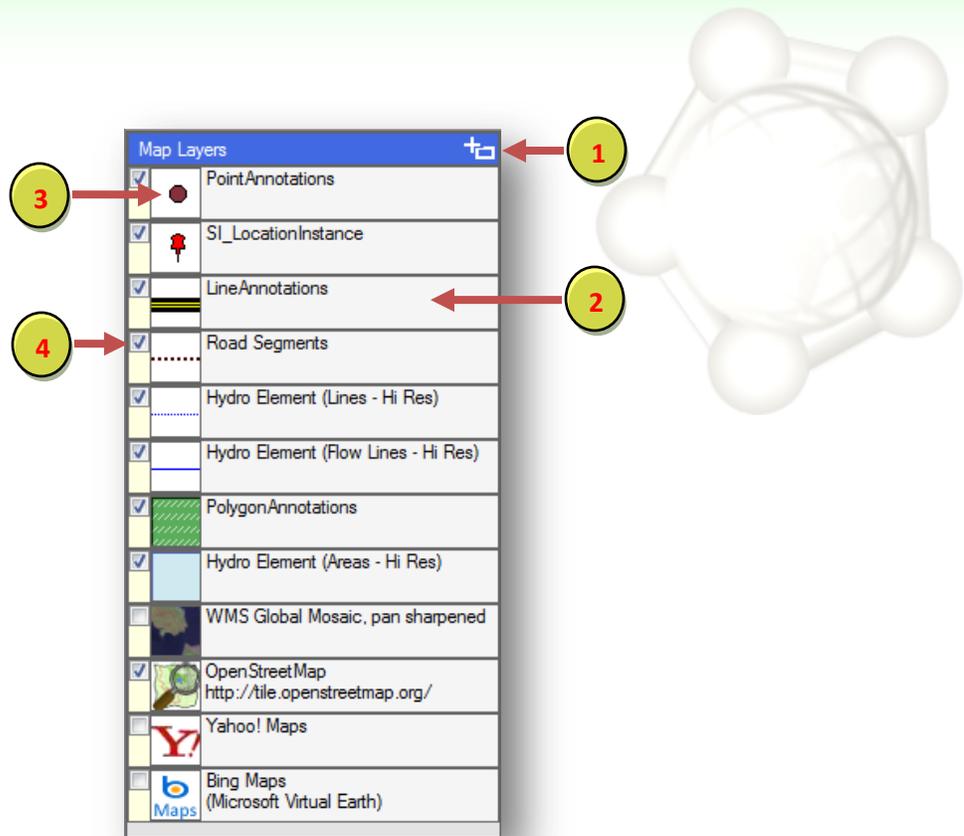
Figure 3 – The Map Layers panel

1. **Add layer** – Click to open the "Add Layer" form (alternatively use CTRL+A).

2. **Layer name** – Shows the name of the layer (file name, feature type, vendor etc.)

3. **Thumbnail** – Geometry symbol or map thumbnail view. If layer is from a WMS the image will show a thumbnail of the map, features will show the default symbol used by the layer. Double clicking will open the symbol selection dialog.

4. **Visibility** – A check box that represents whether the layer is drawn on the map.

💡 **Tip: For feature based layers (e.g. Shapefiles, KML etc.) double-click on the symbol preview to open a quick symbol selection dialog. However, if the layer is not drawn using the simple renderer, this may not directly affect the styling. For example, a KML file is automatically rendered using "Styled Renderer".**

4.4. My Notes Panel

The My Notes panel shows all the notes entered in the session. Similar to the Map Layers panel, each note is represented by a rectangular container. The context-menu of a note allows you to center the map to the note location, edit or delete the note.

On the title bar of the panel a 3-state button allows a quick change in the visibility of all the notes in the map:

Show all notes

Show just the notes point symbol

Hide all notes

> 💡 **Tip: To open or close individual notes, double-click on the note's body or thumbnail in the map view while in Pan Mode.**
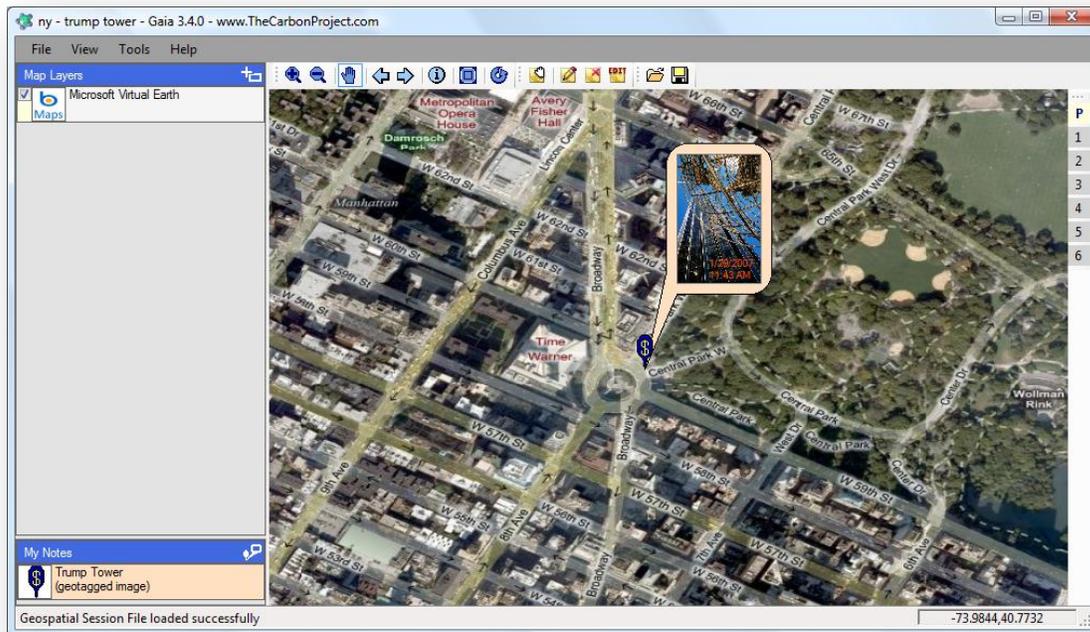

Figure 4 – A geo-tagged image used to with a note

4.5. Toolbars

Many of the map functionalities are provided using the quick access toolbars. Three toolbars provide map tools, note tools and session saving and loading.

Toolbar: Map Tools

Zoom in (click on the map, or drag the mouse to set a zoom-to box)

Zoom out (click on the map, or drag the mouse to set a zoom-out box)

Pan (press left-button on the map and drag the mouse)

Go to previous region

Go to next region

Click on the map to get information about the location from each visible layer

Zoom to world (the combined maximum extent of all shown layers)

Refresh data of all layers

Toolbar: Notes Tools

Click on a note on the map and drag it to a new location

Click on the map to create a new note

Click on a note on the map to edit its content

Click on a note on the map to delete it

Toolbar: Session Files Tools

Open a new Geospatial Session File (GSF)

Save current session to Geospatial Session File (GSF)

4.6.   Bookmarks Toolbar

The location bookmarks toolbar allows preserving locations browsed in Gaia and quickly accessing these locations with a one-click operation. A preserved location is recorded according to the currently viewed region. Therefore recalling a bookmark will return the view to the exact region, including the zoom level and bounding box.

To set a location bookmark simply click the "Program" button (shown as the "P" button). The six bookmark buttons will change color to red (previously set buttons will have a lighter shade). Select the button to represent the currently viewed region, the button will turn green. Clicking on that button will now set the map to the programmed location.

Note: The   bookmarks   are   session   neutral.   They   are   preserved   and maintained as part of the application configuration and do not change with different GSF sessions.

Tip: You can dock the bookmarks toolbar on any of the toolbar containers (top, bottom, left or right of the map). The tool bar will change from vertical to horizontal view accordingly.
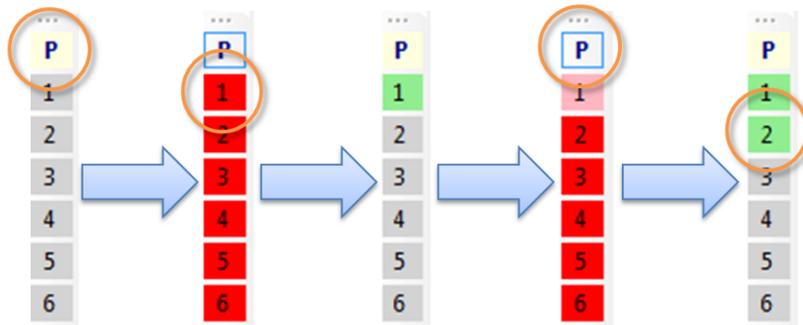
Figure 5 - Various states of the Location Bookmarks toolbar

4.7. Map View

The map in Gaia displays all the visible layers in an integrated view. The map will pan or zoom, depending on the map tool selected. In addition notes can be selected and dragged, corresponding to the currently selected tool (see full list of map tools on page 16).

When no layers are available a splash image is presented instead of the map. You may change this image to any picture file desired. To alter the splash image use the View→Splash Image command from the main menu. You may disable the splash view or replace the image with a different one.

> **Note: Some Gaia Extenders will override the Splash Image with a custom one. In such a case the menu will disable the Splash Image configuration item thus showing a grayed out menu item.**

> **Tip: Using the mouse wheel you may quickly zoom the map in and out.**

4.7.1. Coordinates Reference Systems

The Gaia viewer uses a *single* coordinate reference system in the multi-map view. There is no limitation on whatever system is utilized. However, Gaia does not re-project coordinates and all layer sources must be able to support the same system. One exception to that rule is the tile-based services which are automatically projected from the Mercator system to WGS84. For example, using OpenStreetMap, which is based on Mercator system and converted to WGS84, with an EPSG 4326 based WFS feature layer will show the layers requested. However, a UTM based WFS layer will not yield the mash-up desired as one of the map layers will not be displayed depending on the coordinate system being used.

The projection system used for forming the OGC services dynamic queries is decided by the first layer added to the map or according to the last layer whose "zoom to" function was used. For OGC services all legacy and current reference-system forms are supported: EPSG:xxxx, urn:ogc:def:crs:XXXX:[#.#]:xxxxx, or http://www.opengis.net/gml/srs/espg.xml#xxxx.

In some GML 3 versions the use of urn:ogc:def:crs:EPSG::4326 mandates a latitude-longitude reading order which requires a reversal of the X, Y coordinates whereas the other systems will usually use a longitude-latitude order. Gaia will automatically detect a need to reverse the coordinates reading order. However, a manual "reverse X/Y" checkbox allows overriding the mechanism.

Note: OGC notation of coordinates reference system (as used by some of the latest WFS services) describes WGS84 as either "urn:ogc:def:crs:EPSG::4326" (mandating a latitude-longitude coordinates order) or "urn:ogc:def:crs:OGC::CRS84" (using longitude-latitude coordinates order).

Tip: Prior to the "urn" notation the "EPSG:4326" based services commonly, but not in all cases, returned coordinates using a longitude-latitude order. In case a Web Feature Service or GML interprets the projection differently you may check the "Reverse X/Y" checkbox.

Mercator based tile services, including OpenStreetMap, Yahoo! Maps, Microsoft Bing Maps and some WMTS services, are projected on the fly to the WGS84 system (equivalent to EPSG code 4326). This creates a slight deformation of the shape of tiles from square to rectangular, allowing these source to mash-up correctly with other lat-long based sources. This usually affects tiles in very low zoom levels and most notably closer to the earth poles. Gaia re-projection of the tile is logarithmic in nature thus allowing a good match to native WGS84 based sources, such as GML or KML sources. The "Info" map-tool will show the original tile when queried.

Tip: WGS84 is the most common lat-long projection and is also referenced as EPSG code 4326 (European Petroleum Survey Group coding used by many OGC services).

4.8. Status Bar

The status bar provides messages regarding Gaia's activities. The right side of the status bar shows the location of the mouse on the map in the coordinate system used by the view.

Tip: The full version and build of the Gaia application appears in the Status bar when Gaia first loads. The application will pop a notification when a new version is available.

4.9.   Feature Layers Symbols Legend

The Legend panel shows the symbols of feature layers as they are available according to the selected renderer. Notice that raster maps (WMS, tile based services etc.) are not shown in this panel. The legend will include all feature layers (file or service based) displayed as groups of symbols according to their order in the map.

For layers using the Simple or Unique Value renderers you may double-click on the corresponding legend item to change the symbol. However, for layers using "Styled Renderer" the legend shows thumbnails of images and icons that are used by the layer.

Layer using a Unique Value renderer will display a list of symbols starting with the default symbol (a symbol used in case no match was found). The list group header displays the layer name and the property name on which the renderer is filtering on. Each symbol will show the value it is representing. In case value sets are used a value range will be displayed.
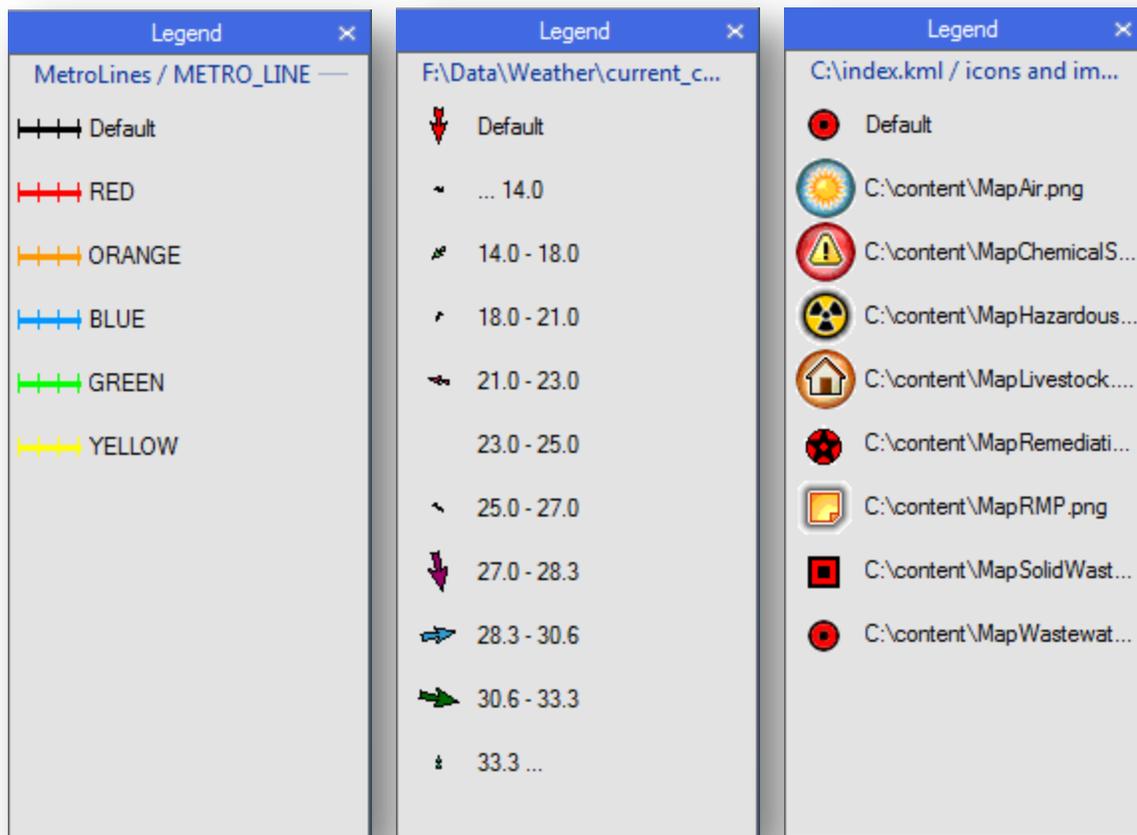

Figure 6 - Various layers rendered using different renderers as shown in the Legend panel (from left to right: set values, value range and styled KML)

5. Add Layer Dialog

To add a layer to the map use the "Add Layer" dialog. You may open this dialog either by using the button at the top-left corner of the Layers panel (), using the Ctrl+A shortcut, or the Tools→Add Layer menu item. Once open, this dialog allows layers to be configured and added to the map view. A selected layer is previewed and the "Add Layer" button becomes enabled. Clicking on the "Add Layer" button will add the layer to the map. If the layer was not added clicking the "OK" button will add it and close this dialog, while the "Cancel" button will simply close the dialog without adding the layer.

5.1.   Content from OGC Services

To add a Web Mapping Service (WMS), Web Feature Service (WFS) or Web Coverage Service (WCS) you will need to add the service to the list. In the "OGC Services" tab you may add, remove or edit services.

To add a new service to the OGC services list use the Add Service button () and set the appropriate service parameters. Notice that you may specify a user name and password; this allows access to authenticated services. To edit the service information you may right-click on the service item and select "Edit" (Figure 7).
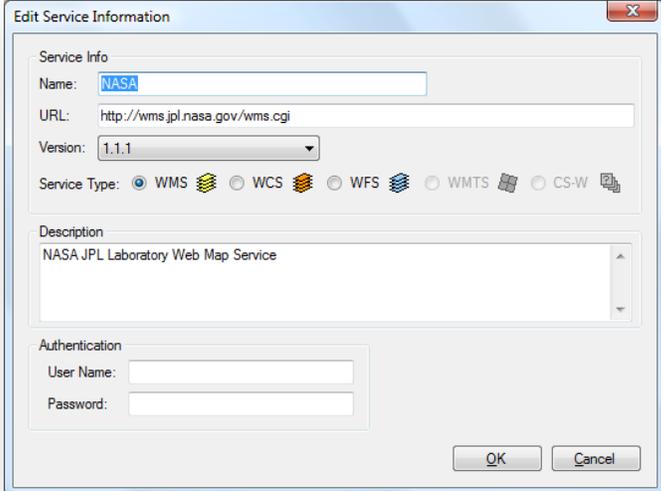
Figure 7 – The Add and Edit Service information form provides a way to specify the URL, type, description as well as authentication properties.

Once a service is added to the list simply select it to retrieve its capabilities. The service's Capabilities are presented as a tree-view from which the requested layer can be selected. Once a layer is selected, a preview will be shown (Figure 8).

Prior to adding the selected layer to the map you may set a few parameters regarding the layer, such as styling parameters, GML version, spatial operator and many others. After the layer is added to the map

these parameters can be changed from the layer's property pages. Notice that the list of spatial-operators available for WFS 1.1 layers is generated from the filtering capabilities reported by the service.

Tip: When reading a WFS layer Gaia requires a preview in order to support the spatial filtering, therefore adding the layer is disabled until the preview is ready or the "Use bounding-box filter" is un-checked.

Note: Any imagery format supported by .NET 2.0 will be shown by Gaia. However, some formats such as JPEG 2000 and some GeoTIFF variations are not supported by the Microsoft .NET Framework and cannot be displayed.
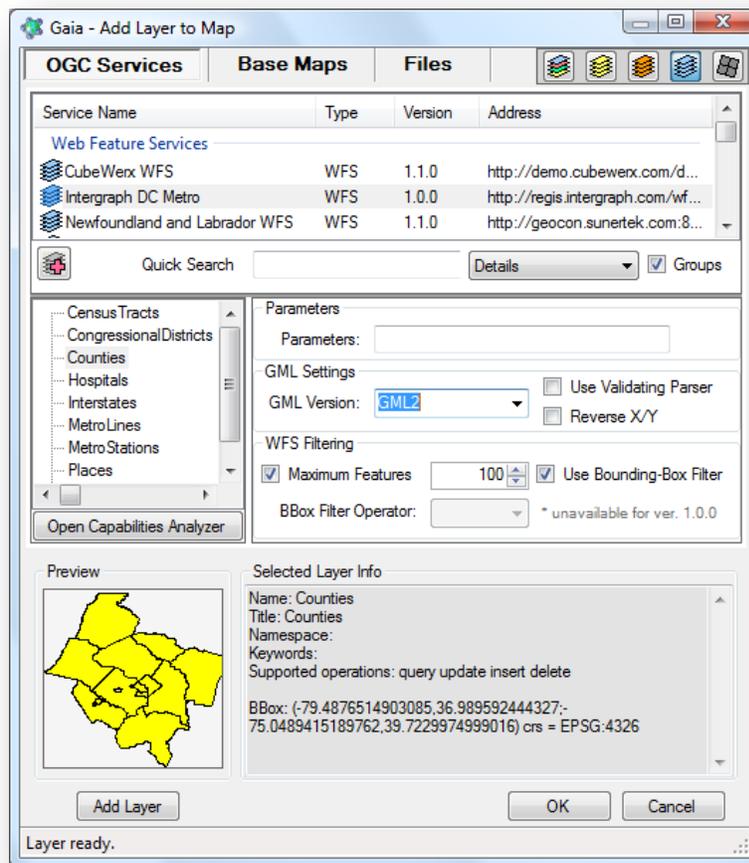
Figure 8 - Add an OGC layer

5.2.   Maps from Tile-Based Web Services

Two commercial mapping services are supported: Microsoft Bin Maps (formally known as Virtual Earth) and Yahoo! Maps. In addition, Gaia supports the *Tiles @ Home* system from the OpenStreetMap organization (http://wiki.openstreetmap.org/wiki/Tiles@home).

Select the map type (Roads, Aerial etc.) to generate a preview and enable the addition of the layer to the map. After adding the tile-service to the map you may change the map-type by right clicking on the layer name in the layers collection in the main application view.

Notice that you may change the number of cached tiles. Remember that a lower amount of cached tiles will increase the number of Web calls, while a higher value will increase the capped memory consumption and thus the potential size of saved sessions.
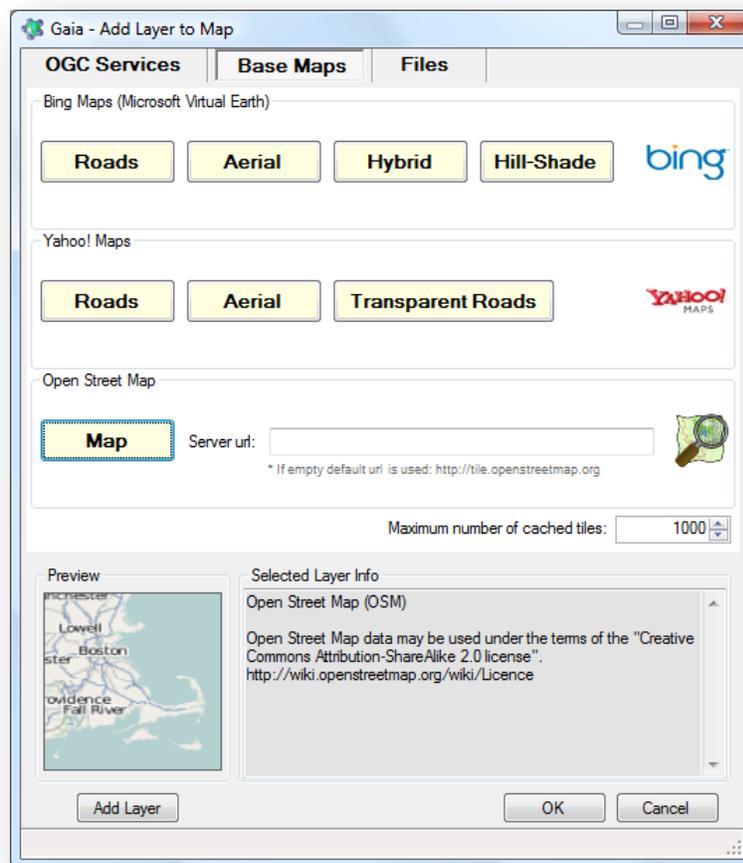
Figure 9 - Add layer from a tiles-based Web service

5.3.   Content from Files

To add a content layer from a file you need to first add the file to the history list by clicking on the "Open File" button ( ). To preview the content of any file in the history simply select it from the list. To preview a selected file double-click on the row to generate a preview.

You may remove a row from the history using the "Remove" button ( ), however the file will not be deleted from storage. In addition you may clear the history using the "Remove All" button ( ).

The following file types are supported by Gaia:

- ➢ OGC's Geography Markup Language (GML)

- ➢ Google's Keyhole Markup Language (KML/KMZ)

- ➢ ESRI Shapefiles (SHP)

- ➢ Autodesk (DXF)

- ➢ MapInfo (MIF)

Note: The list of files history is preserved in the user's settings and will be available in future sessions of Gaia.

Tip: To force Gaia to use a specific GML version the following file extensions are supported: GML2, GML3 and GML3_2 (GML 3.2).

Tip: Check the "Reverse X/Y" box to force reading the coordinates in reverse order. This is mostly used for data using the EPSG 4326 projection as urn:ogc:def:crs:EPSG::4326 where the order of coordinates is latitude then longitude.

💡 **Tip: Click on the column headers of the files history list in order to alphabetically sort the list.**
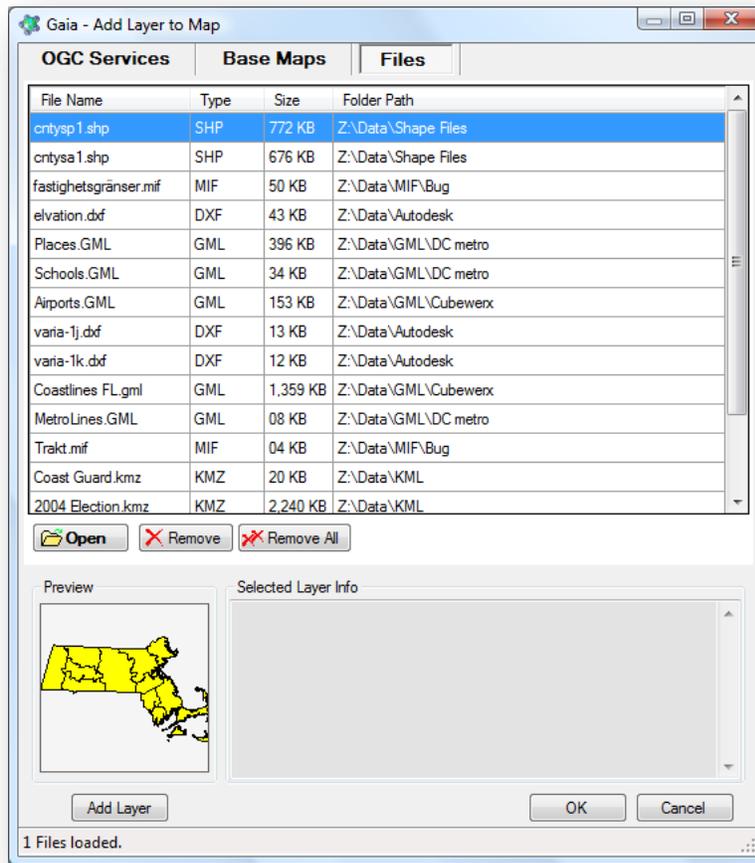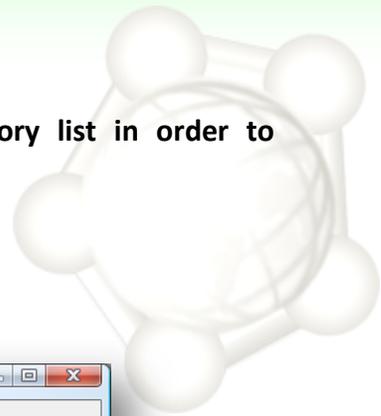
Figure 10 - Add Content from file

6. Properties Dialog

Most layers in the Layers Panel offer a context-menu by right clicking on the layer's container. Usually the "Properties" option is available. Selecting the Properties for a layer opens a "Layers properties" dialog that contains several tabs of options and settings. The tabs available for a map layer depend on the type of layer it is, for example a WFS layer shows the following tabs: Query, Extents, Filters & Schemas, Symbols, Labels, Temporal and Security (Figure 11).
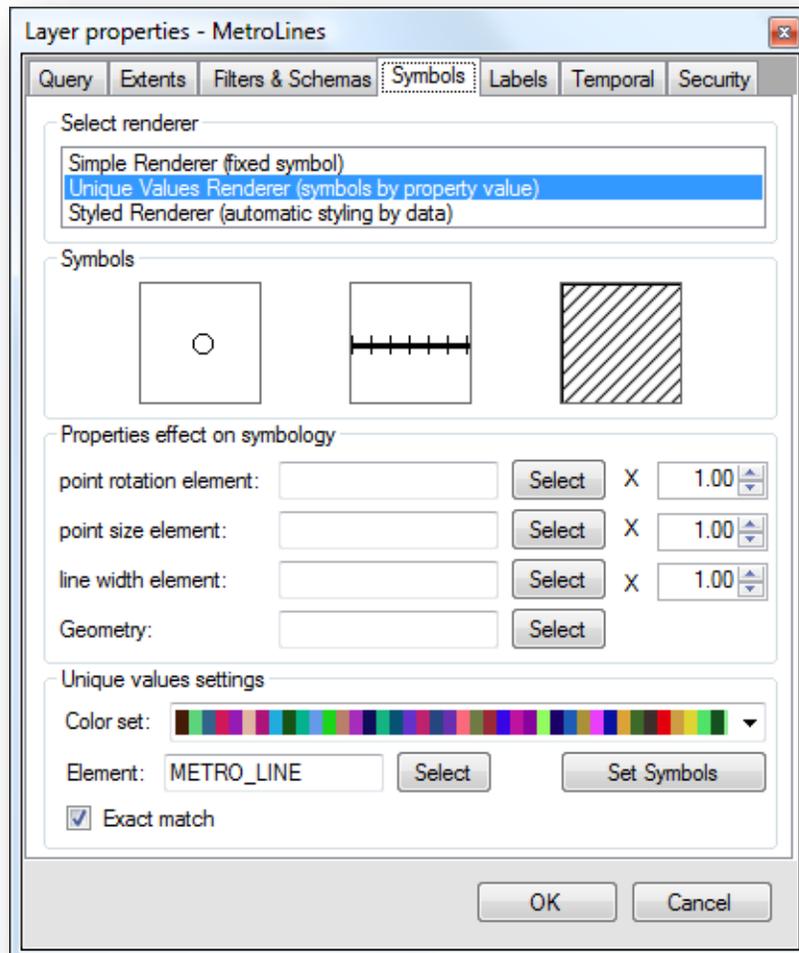
Figure 11 – Properties form with Symbols tab selected

6.1. Query Tab

Shows the OGC query used to access the data from the service. In this page a Parameters text-box allows adding specific parameters to the service query. The URI text shows the address where the query is sent to.

Note: WMS and WCS use GET type query while WFS uses a POST type query. The query is constructed using all set parameters of the layer. This feature is useful for debugging these services.

Tip: You can copy the GET type queries and paste them as a URL into a Web browser.

6.2. Extents Tab

This page allows selection of the layer's extent and coordinates projection system. Some layers will contain one or more extents as detailed by their content. You may select an extent from the list or set it manually. Once an extent is chosen and the dialog is closed, the map will zoom to the selected extent (adjusted to the correct aspect ratio). The "Zoom to layer" option in the layer's context menu (right clicking in the layer panel) will adjust the map view according to this extent.

The "Default" button will reset the extent according to the settings selected when the layer was added. The "Map" button sets the layer's extent to that of the current viewed extent of the map.

6.3.   Filters and Schemas Tab

Applies to layer types: WFS

This tab page provides settings for filters used when querying a Web Features Service. The sections in this page include:

- Maximum limit on the number of features returned.
- Spatial bounding-box filter. This filter is dynamically altered according to changes in the map region (e.g. due to pan or zoom actions). When using WFS version 1.0.0 a BBox filter is used, when the WFS is of version 1.1.0 a pull-down list allows the selection of the spatial operator to be used with this filter.
- The Geography Markup Language version can be either GML2 or GML3. This section also allows the use of a schema based parsing. When schema is used, Gaia also allows appending an external schema that may not be referenced within the GML contents.
- The filter builder tool allows setting a more complex filter according to the OGC Filter Encoding specifications. You may use the text-box to paste a filter XML snippet (exclude the <Filter> tag). The Filter Builder tool opens a tabular filter building dialog that is populated with relevant properties and allows a visual construction of a filter.

Note: Due to schema incompatibility with W3C specifications, most GML schemas prior to version 3.1.1 will not parse in .NET 2.0. Therefore, using the validating parser may report errors when parsing (logged in the messages log).

Tip: Using GML without schema parsing (CarbonTools PRO Quick Parser) is about twenty (20) times faster (depending on the content and complexity of the schema) than using schema validation.
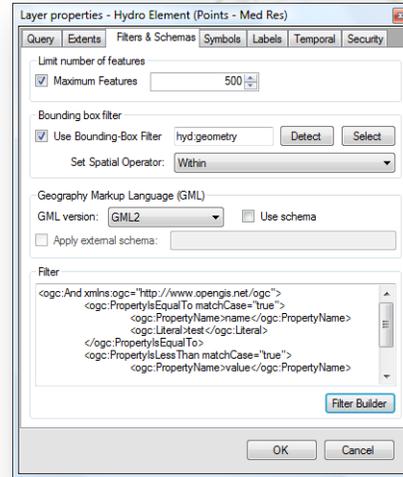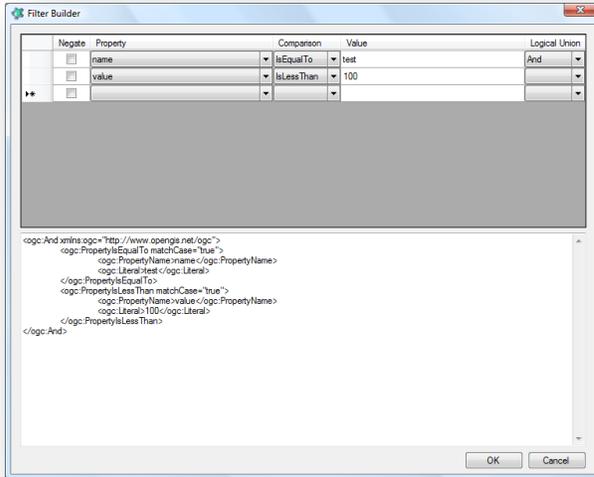
Figure 12 - WFS filter created using the Filter Builder is appended as XML to the query

After using the Filter Builder tool an XML snippet is created representing the filter according to the OGC Filter Encoding Specification (FES). When closing the Filter Builder dialog the created filter XML will appear in the "Filter" text region. Advanced user may alter the XML manually to change the formulated WFS query.

Note that the dynamic bounding-box filter (this filter changes according to the maps region when zooming or panning for example) can be used with the XML filter. The two will be unified using an "Add" operator in the final query. To observe the full query for a layer see the "Query" tab in layer's Properties dialog (page 27).

```xml
<?xml version="1.0" encoding="utf-8"?>
<GetFeature xmlns="http://www.opengis.net/wfs"  xmlns:ogc="http://www.opengis.net/ogc"
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" xmlns:gml="http://www.opengis.net/gml" service="WFS"
version="1.0.0" outputFormat="GML2" maxFeatures="100" handle="" >
 <Query typeName="MetroLines" srsName="EPSG:4326" >
  <ogc:Filter>
   <ogc:And>
    <ogc:PropertyIsEqualTo matchCase="true" xmlns:ogc="http://www.opengis.net/ogc">
     <ogc:PropertyName>METRO_LINE</ogc:PropertyName>
     <ogc:Literal>RED</ogc:Literal>
    </ogc:PropertyIsEqualTo>
    <ogc:BBOX>
     <ogc:PropertyName>GEOMETRY1</ogc:PropertyName>
     <gml:Box srsName="EPSG:4326">
      <gml:coordinates>-79.4876514903085,36.7081663751639 -75.0489415189762,40.0044235690647</gml:coordinates>
     </gml:Box>
    </ogc:BBOX>
   </ogc:And>
  </ogc:Filter>
 </Query>
</GetFeature>
```

Static filter

Dynamic filter

6.4. Symbols Tab

Applies to layer types: WFS, GML, Shapefiles, KML, KMZ, DXF, MIF

The symbols tab provides advanced symbology and rendering settings of the features based layer (Figure 11). There are three renders to select from:

➢ **Simple Renderer** – Each of the geometries in the layer will be displayed according to the selected default symbol. Properties effect on the symbology is used with this renderer.

➢ **Unique Values Renderer** – Geometries in the feature are displayed according to a correlation between a certain property value and a designated symbol. Use the unique values setting to assign symbols according to a property value. Properties effect on the symbology is used with this renderer.

➢ **Styles Renderer** – This renderer uses the content of the feature to decide how to portray it. For example a MIF file may contain information on a symbol's shape, size and color; a KML file can use an online image as a symbol for points and a text to be displayed near it. When adding MIF, KML or KMZ files this style is set by default.

Three default symbol types can be selected in the Symbols region: Point symbol, line symbol and area symbol for polygon types. Gaia can handle multiple geometries within a single feature (e.g. a feature layer portraying hospitals layout as polygon with chopper landing site as points).

The "Properties effect on symbology" region allows you to adjust certain symbols drawing characteristics according to certain property values:

➢ **Point rotation element** – Allows a property value to affect the rotation of a point symbol. The rotation is in degrees and the value may be adjusted by the factor value (e.g. a value in thousands of a degree can be multiplied by 0.001 to get a value between 0 and 360). An example for using the property can be a feature that contains wind sensor data with a property representing wind direction. Setting the default point symbol to an arrow type and the point rotation to the wind direction will cause the layer to show arrows rotated according to the wind direction.

➢ **Point size element** – Allows a property value to affect the size of a point symbol. Similar to the direction element, this value will affect the scale of the point symbol drawn.

➢ **Line width element** – Allows a property to affect the width of a line symbol. This will only affect line type geometries.

➢ **Geometry** – If the features layer contains more than one geometry this will enable you to screen out and display only a single geometry from that layer and ignore any other geometries in the features.

The "Unique values settings" region allows the setting of correlation between specific property values to a unique symbol associate with that value. The default color sets can be used to quickly allocate unique colors to the values. If the "exact match" box is checked Gaia will look for all the values of the selected element available in the current layer and assign each a unique symbol. The default symbol will be used if newer values are encountered after this has been set. If the "exact match" box is not checked only ten symbols are assigned and the element values are split to 10 evenly allocated ranges. This can only be used for numeric type of property values.

Once the unique value element is selected you may click on the "Set Symbols" button to view the assigned symbols. You may change individual symbols by double-clicking in the symbol icon (Figure 13).

Note: Once the unique symbology is set you will need to use the Reset button in the unique symbols list view to adjust the symbols to the new selection. However, this will clear any previous customization done to the selection.

**Tip: Symbols can also be changed from the Legend view (page 20)**
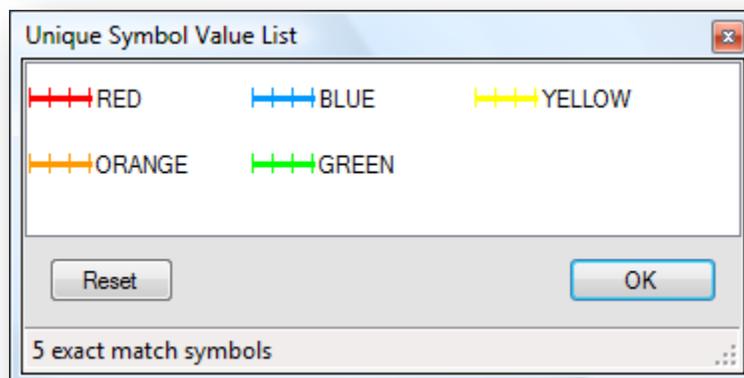
Figure 13 - Unique Symbol Value List showing string of values matched with custom symbols

6.5. Labels Tab

The labels page allows adding a text label to features. You may set the font, text color, horizontal and vertical offset from the symbol center and the property from which the text will be displayed. You may also specify if a line will be draw from the label corner to the center of the symbol.

To activate the labels on the requested layer make sure to check the "Use labels with this layer" check – box.
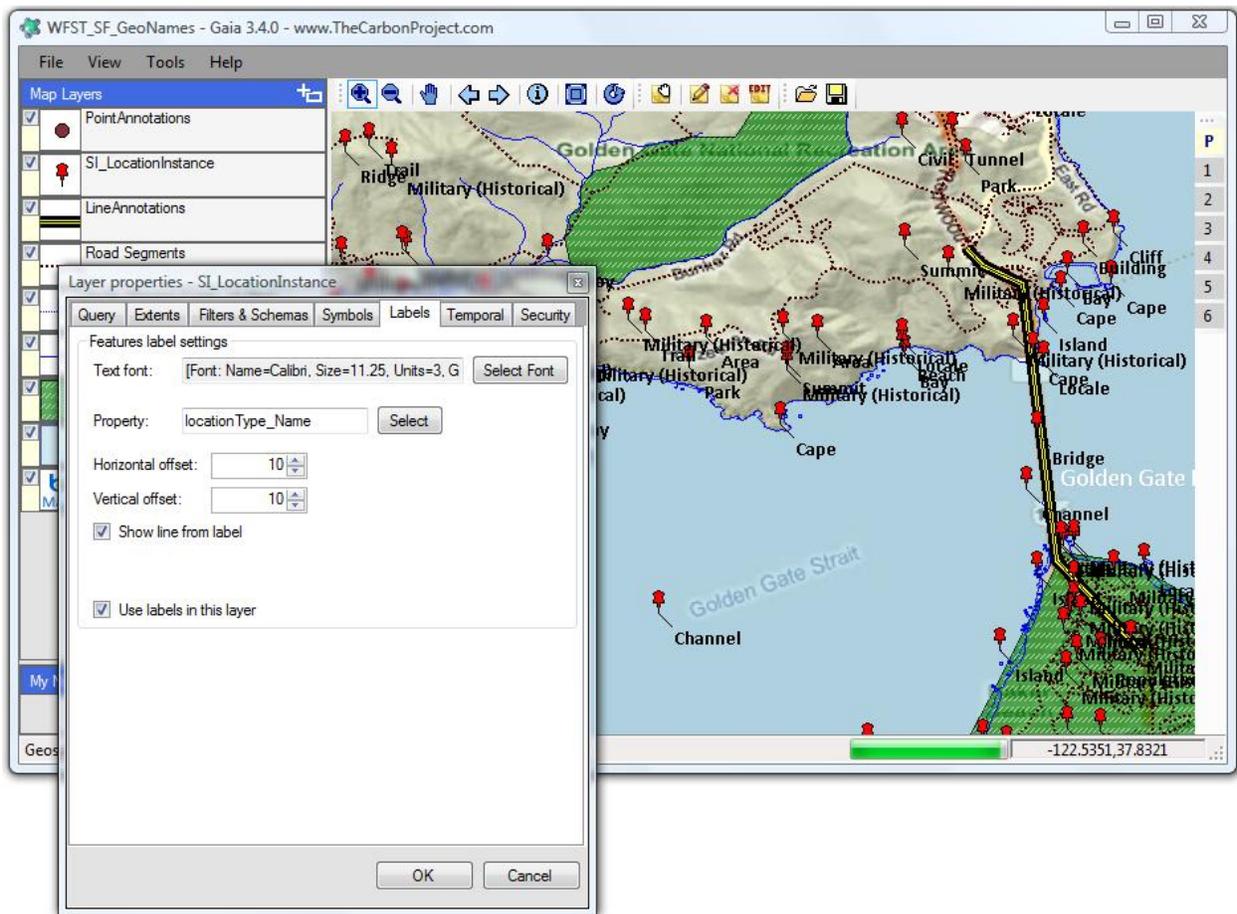
Figure 14 - Point features with labels

6.6. Style Tab

Applies to layer types: WMS, WCS

This allows the selection of the image format and style provided by the SLD name embedded in the service Capabilities.

You may also set a transparency on the layer using transparency track-bar.

6.7. Temporal Tab

Applies to layer types: WFS, WMS, WCS

This allows you to ask the layer to automatically update the content every set interval of time. For example, if a WMS layer provides real-time storm tracking that is updated every 5 minutes, using this feature will allow dynamic updates from the service.

6.8. Security Tab

Applies to layer types: WFS, WMS, WCS

Some services require authentication in the form of username and password. This tab allows setting or changing the authentication parameters.

Note: For security reasons the username and password are not preserved in the GSF. Therefore, when loading a GSF you must use this tab to re-set the authentication of the layer.
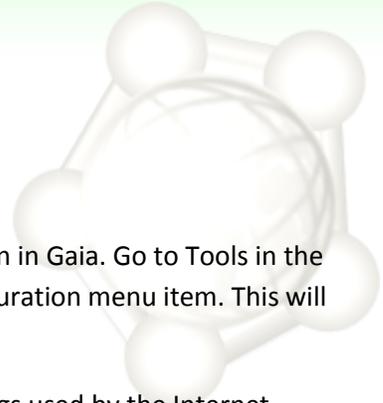
7. Configurations

7.1. Proxy Settings

When working behind a proxy server you must set the proxy configuration in Gaia. Go to Tools in the main menu and select Configuration. There you will find the Proxy Configuration menu item. This will open the "Set Proxy Configuration" dialog.

Set the proxy setting to "Use Default Proxy". This will use the same settings used by the Internet Explorer and should work for most users. However, in some cases more detailed information is required. If you do not know you proxy server address and authentication requirements please consult with your IT department.

7.2. User Settings and Files

Several files are used by Gaia and preserved in the local application folder. This folder is usually found at:

C:\Documents and Settings\[user name]\Application Data\The Carbon Project\Gaia 3

Or in Vista and Windows 7:

C:\Users\[user name]\AppData\Roaming\The Carbon Project\Gaia 3

Where *[user name]* represents the user's Windows account name.

The files found in this folder are:

> **files.xml** - List of files used in the "Add Layer" files tab.
> **services.xml** – List of services and their related information, used in the "Add Layer" OGC services tab. This file is saved each time an OGC service is added, removed or edited.
> **Log.txt** – A messages log file that is generated when the user views the messages log. This file is overwritten each time the log is viewed.

8. Gaia Extenders

The Extenders mechanism allows Gaia to be enhanced and morphed to perform more advanced or customized functionality. Extenders can offer support to new geospatial services and formats, add new tools and panels to the user-interface, apply new security measures, perform data processing and manipulation, extend Gaia with transactional and editing tools, and much more. There is no limitation to what Extenders can do as these are independent assemblies which can be deployed as free or for-pay products, open or close source. As long as the assembly follows a set of guidelines it will be implemented by Gaia. There is no SDK involved other than CarbonTools PRO (for hooking into Gaia's more advanced functionality and UI).

⚠ **Warning – The Extenders are self contained assemblies whose code is dynamically executed by the Gaia platform. To avoid running malicious code make sure you are familiar and trust the third party provider prior to adding an Extender.**

Developers can use the open API provided by Gaia to create their own extenders. Some API methods as pure .NET and do not require a CarbonTools PRO license, more advanced Extender development does require a CarbonTools PRO developer license (see www.CarbonTools.com). The open developers' guide specifies all API commands, distinguishing the ones that require a CarbonTools PRO license.

Note – CarbonTools PRO contains the full and open source-code for Gaia!
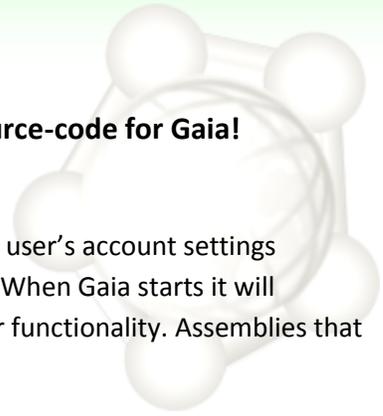
These Gaia Extenders are in fact .NET assemblies (.DLL) that reside on the user's account settings location in an "Extenders" subdirectory (see page 34 for the folder path). When Gaia starts it will automatically detect assemblies that are valid Extenders and include their functionality. Assemblies that are not recognized extenders will be ignored.

8.1. Adding a New Extender

The process of adding an Extender is straight forward and completely unintrusive. Simply open the Extenders Manager dialog from the "Files" menu (see page 12) and click the "Import Extender" button (Figure 15). A files browsing dialog will ask for the assembly file or files to add. You may select multiple files to add. Once the files are added they will be marked as "<new>" in the "Description" column and the "Restart Gaia" button will be enabled. The newly added Extenders functionality will now be available and in the next Gaia session. Pressing the "Restart Gaia" button will prompt you to save the session before restarting the application.

Tip: Register to The Carbon Portal for free to download numerous Extenders developed by The Carbon Project and other contributors. www.TheCarbonPortal.net.
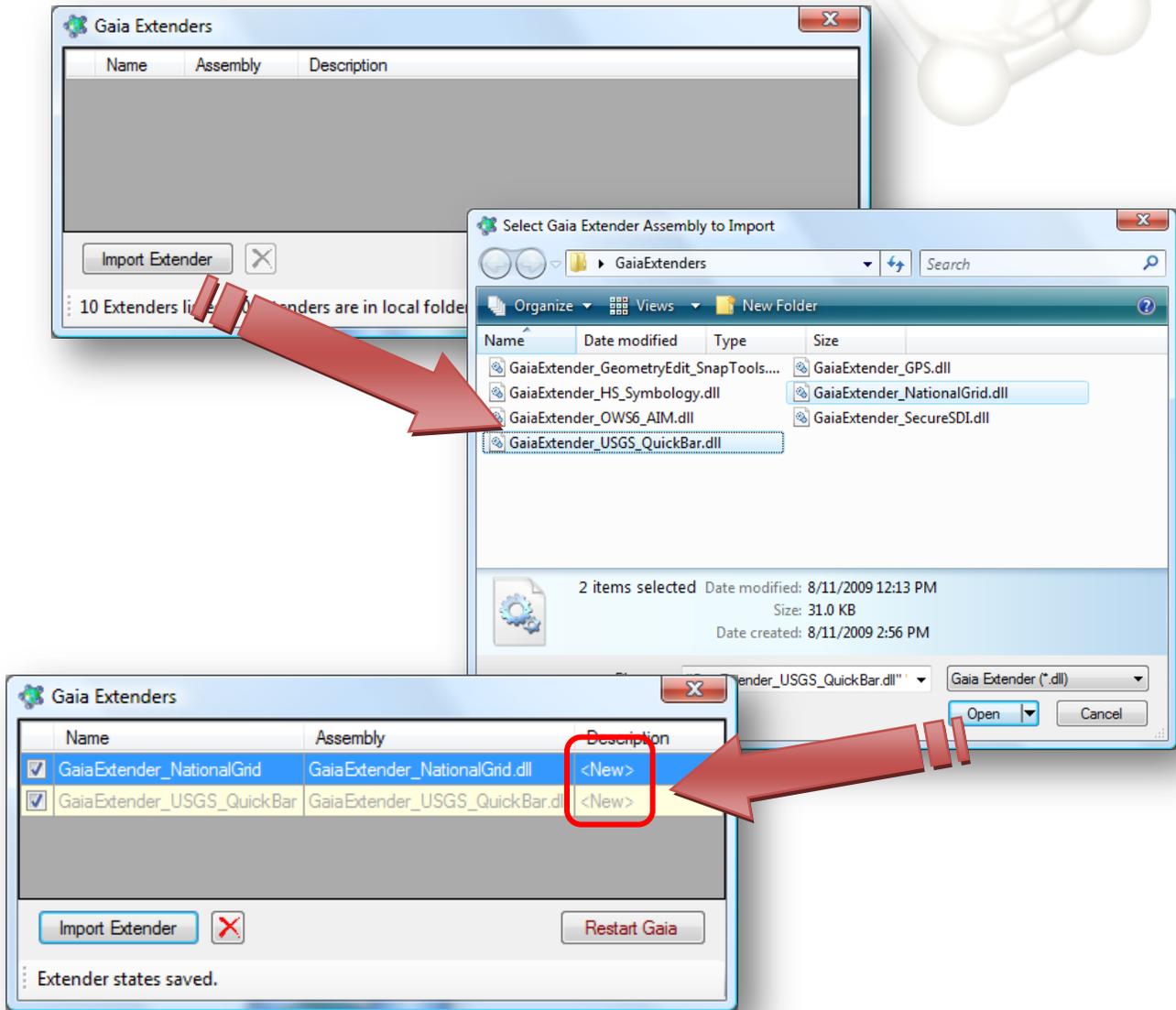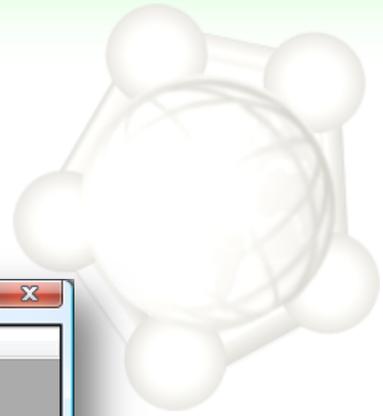
Figure 15 - Adding a new Extender to Gaia. The added Extenders are marked as "new" until Gaia is restarted.

8.2. Updating an Existing Extender

In case a new Extender version needs to be installed Gaia will mark the Extender as "<Upgrade>". The next time the application starts it will overwrite the old Extender with the new one. Make sure to close any other Gaia sessions before restarting since the old Extender may be in use thus not allowing the update process to succeed.
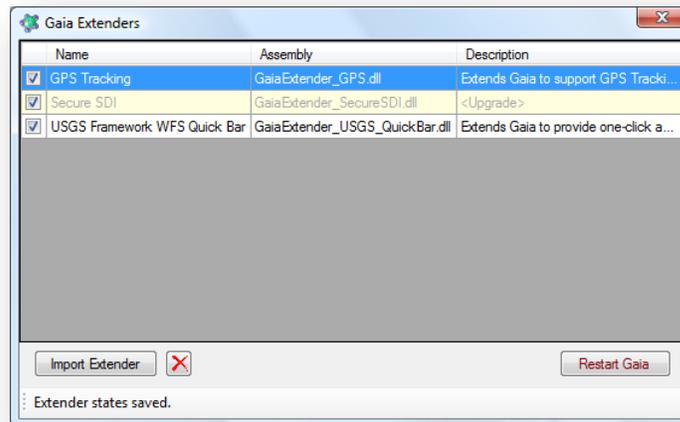

Figure 16 - Secure SDI Extender is used by Gaia and is marked for an update from a selected file location.

8.3. Deleting Extender Assemblies

To physically delete Extender assemblies from the disk select the Extenders in the table and click the "Delete" button (✖). Note that only unused Extender may be deleted.
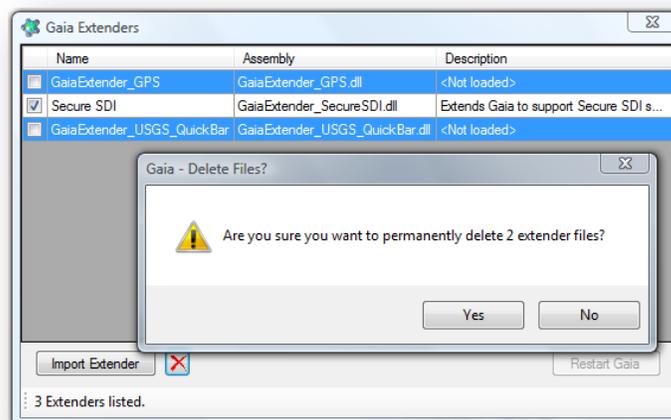

Figure 17 – Extenders are selected for deletion.
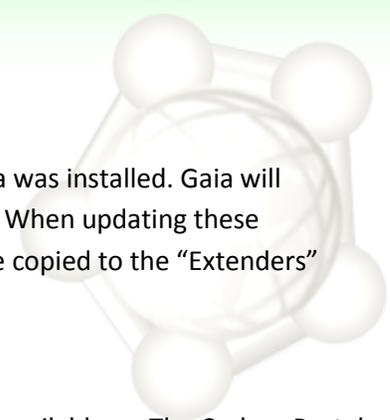
8.4. Backwards Compatibility

Gaia versions older than 3.4 used Extenders located on folder where Gaia was installed. Gaia will recognize these assemblies and mark them with a dark gray background. When updating these assemblies the old assembly will be deleted and the new Extender will be copied to the "Extenders" folder on the User's local account.

8.5. Examples of Available Extenders

The Carbon Project has developed numerous Extenders; some are freely available on The Carbon Portal. Contact us at info@thecarbonproject.com to find out more about available Extenders.

An assortment of currently available Extenders includes:

- ➤ **USGS Quick Bar** – adds a toolbar allowing one-click access to USGS Framework WFS with nationwide feature coverage for hydrology data and more.

- ➤ **GPS** – turns Gaia into a GPS device by automatically panning the map to the GPS location.

- ➤ **Homeland Security Symbolization** – turns Gaia point symbology to the official Homeland Security Emergency Management symbology set.

- ➤ **National Grid** –latitude-longitude to the US National Grid transformation (NAD27 or NAD83) added to the Gaia status bar coordinates view.

- ➤ **Secure SDI** – support to a token based OGC security and user management system offered by the CubeWerx IMS.

- ➤ **WFS-T Extender** – an advance WFS-T extension that allows digitizing features, inserting, deleting, and updating features on any WFS-T including ArcGIS Server 9.3.

- ➤ **Geometry Snap Tools** – an add-on to the WFS-T digitizing tools that allows snapping of digitized nodes to current layer or any feature in the vicinity.

- ➤ **Here Client Extender** – an Extender that automatically detects the EPA HERE client KML output and adds it to the session.

- ➤ **Target Processing** – an Extender built for simulating Motion Tracking Indicator (MTI) data and performs various algorithms designed to detect Lines of Communications (LOC).