

Gaia WFS-T

Extender User's Guide

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1. Introduction

The Open Geospatial Consortium (OGC) Web Feature Service (WFS) standard provides an interface allowing requests for geographically referenced features across the web using open platform independent calls. The geographic features contain descriptive information. In contrast Web Map Services (WMS) or popular tile-based map services provide raster imagery which cannot be directly edited or spatially analyzed. The WFS usually uses the XML-derived Geography Markup Language (GML) standard to model the returned data.

While the basic WFS implementation supports reading features from the service, the WFS may also support the ability to perform client-driven data operations via a Transactions mechanism. The Web Feature Service Transactional (WFS-T) standard defines a set of operations that include insert, delete, and update of features. In most cases the changes will be published and be available to other end-users of the service.

Gaia¹ is a platform designed for geospatial interoperability and Spatial Data Infrastructure (SDI) needs. Based on the CarbonTools PRO² open-geospatial development toolkit, the application can access an array of geospatial sources, GIS files, and includes support for a wide variety of OGC standards. Gaia can read and 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 also allows anyone to develop new capabilities via the Extenders API. For example, the Gaia WFS-T Extender adds the ability to edit geometries and features and perform transactions to any WFS-T, including ESRI ArcGIS Server, CubeWerkx, Geoserver, Intergraph, ERDAS and others. This Extender adds a suite of tools for adding, deleting and updating of features using a graphical interface.

Other Gaia Extenders can also enhance Gaia WFS-T Extender operations. The Geometry Edit Snapping Tool is an Extender that provides robust snapping capabilities when editing geometries on the map. The CarbonCloud Sync Extenders enhance the WFS-T Extender with the ability to interact directly with The Carbon Project's geo-synchronization service – the CarbonCloud Sync³.

¹ www.TheCarbonProject.com/gaia.php

² www.CarbonTools.com

³ www.TheCarbonProject.com/Products/cloudsync.php



1.1. About The Carbon Project

The Carbon Project 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.

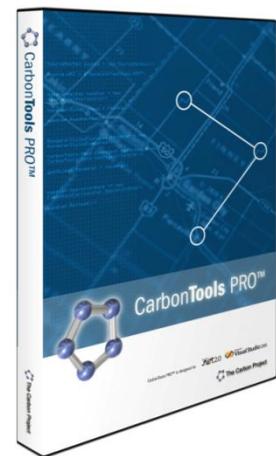
The Carbon Project develops mapping software solutions for government and commercial purposes. Our core clientele is in the Defense and Intelligence, Environmental and Infrastructure market sectors. Our customers include the US Department of Defense (DoD), US Army Corps of Engineers, UK Ministry of Defence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

Our core suite of products includes CarbonTools PRO, CarbonArc PRO, CarbonCloud Sync, Gaia and Gaia Extenders. These software products are provided 'off-the-shelf' to customers and users around the world and are available on the GSA Schedule 70 and the GSA Geospatial SmartBUY BPA⁴.

1.2. About CarbonTools PRO

CarbonTools PRO 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 WMS, WMTS, WFS, WCS, CS-W, 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 basic Gaia platform*.

⁴ http://www.onixgov.com/Carbon_Project/index.htm



1.3. About Gaia

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, KML/KMZ, DXF, MIF and the 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 vendor and schema-neutral OGC compatibility and content support. Through the powerful Geography Markup Language (GML) parsing capabilities of CarbonTools PRO, Gaia provides true interoperable access to geospatial features. Gaia also supports schema validation of GML for deep and complex GML variations as well as 'fast' parsers optimized for the best performance when using common GML profiles. In addition, the sophisticated rendering and symbology engine allows extensive styling of the GML layers for more meaningful and informative features presentation, comparable to the most advanced GIS.

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.



2. Installing the Extender

2.1. System Requirements

.NET Version

- Windows 2000/2003/2008/XP/Vista/Windows 7
- Gaia 3.4.1 (or latest available version) for Windows
- Microsoft .NET version 2 or later

Mono Version

- Linux/Mac OS
- Mono 2.4 or later
- Gaia 3.4.1 (or latest available version) for Mono

2.2. 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).

2.3. Installing or Upgrading the Extenders

The Gaia WFS-T Extender is in fact a collection of two .NET software libraries, called Assemblies (three if using the CarbonCloud Sync Extender). The main assembly **GaiaExtender_WFST.dll** adds the user interface and functionality needed for the transactional operations. The second assembly **GaiaExtender_GeometryEdit_SnapTools.dll** is an Extender that adds geometry snapping tools when in



geometry edit mode. Starting with Gaia version 3.4.1 these assemblies are included with the basic Gaia platform along with an evaluation license that allows testing the functionality on a trial basis.

The process of adding these Extenders is straight forward and technically unobtrusive, as there is no system registration or registry manipulation (see the *Gaia User's Guide* and *Gaia Extenders Developers' Guide* for more information about Extenders). To manually add the Extenders, or upgrade to a newer version, simply open the Extenders Manager dialog from the Gaia "Files" menu and click the "Import Extender" button. A files browsing dialog will ask for the assembly file or files to add. You may select and add both assembly files. Once the files are added they will be marked as "<new>" (or "<Upgrade >" if updating the Extenders) 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 www.TheCarbonPortal.net for free to download numerous Extenders developed by The Carbon Project and other contributors.**

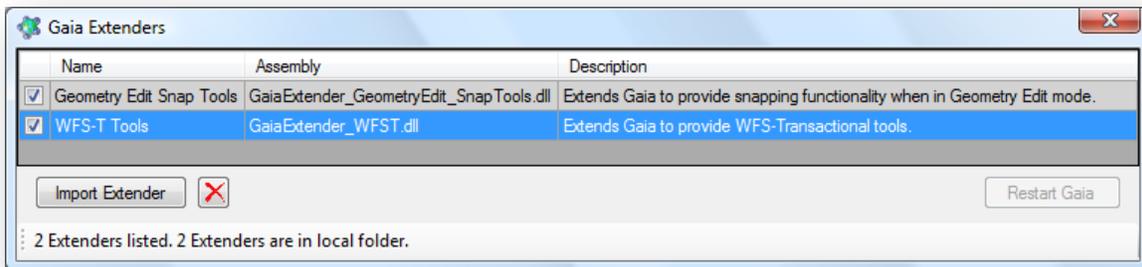


Figure 1: The WFS-T Extender and Geometry Edit Snapping Tools Extender as they appear in Gaia's Extender Manager.



2.4. License

The Gaia WFS-T Extender requires a valid license. The license is issued and provided by The Carbon Project in the form of an XML file. To install the license file open the Gaia “WFS-T” menu item in the main menu and select the “Product License” item (Figure 2). This will open a form allowing you to review the currently active license (if any) and applicable expiration information (Figure 3).

To install a new license file click the “Read License File” button and select the valid license. If successful the WFS-T functionality will become available as long as the license is active.



Note: The Gaia WFS-T Extender trial license provides the complete and full functionality of the product.

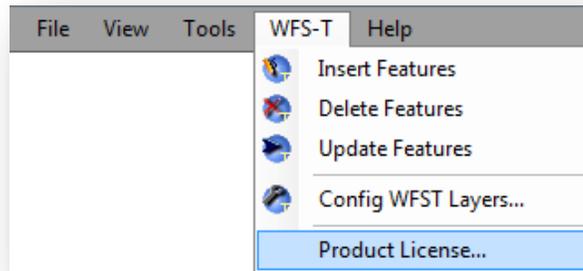


Figure 2: Opening the Gaia WFS-T Extender license manager.

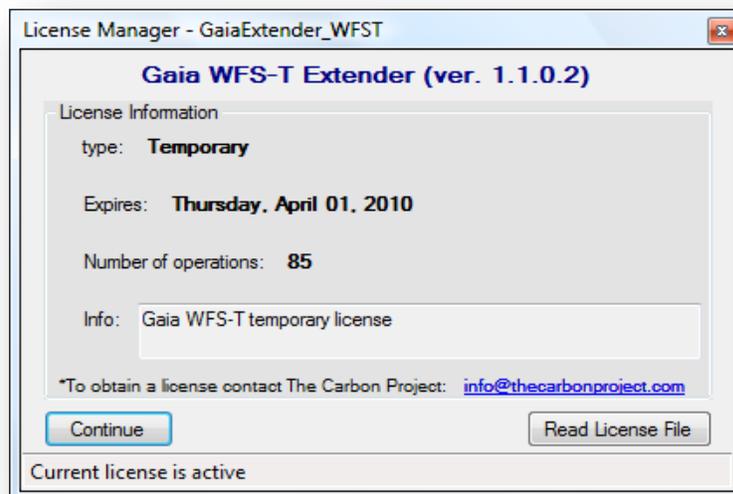


Figure 3: Gaia WFS-T Extender license manager form.



3. Tools Overview

The Gaia WFS-T Extenders add toolbars and menu items to the Gaia user interface. The main WFS-T extender adds a suite of tools for configuring and performing the data operations and transacting with the WFS. The geometry snapping tools Extender adds an additional toolbar with tools that set the snap functionality when editing or creating geometries on the map (for more about snapping tools see page 42).

- 💡 **Tip:** Like other Gaia toolbars you can relocate the Extenders toolbars using the left grip region of the toolbar (notice the cursor will change when you move the mouse above the grip area). Drag and drop the toolbar to any region around and the toolbar will be docked. You can organize multiple toolbars in a variety of ways, including a stacked formation. This layout setting will be preserved for future Gaia sessions after you close the application.

When one of the operation tools (i.e. “Insert”, “Update”, “Delete”, or “Commit”) are activated using the toolbar buttons the tool panel will open to the right of the map. Clicking once more on the toolbar button, or using the panels close button, will close the panel and Gaia will resume normal functionality. The tool panels can be resized using by gripping a splitter and dragging its location to change the width of the tool. All tool panels however have a minimum width that cannot be surpassed.

- 📄 **Note:** Some tools have a table-editing capability (e.g. “Config”, “Insert” etc.). To change the value in an ‘editable’ table cell, simply click in the cell. This start a cell-edit mode and the value will not be set until the edit mode is finished. To exit the table-cell edit-mode simply click outside the cell or use the keyboard’s ENTER, TAB, UP, or DOWN Arrow keys.



3.1. WFS-T Toolbar



-  The “Insert” tool activates a panel where new features can be added to an applicable feature layer.
-  The “Delete” tool activates a panel that enables the removing of features from an applicable layer.
-  The “Update” tool activates a panel where existing features can be modified.
-  The “Commit” tool activates the current transactions management and submission panel.
-  The “Config” tool opens a dialog that manages WFS-T layers schema templates and features rules.

These tools are also available via the Gaia main menu bar under the “WFS-T” menu item (Figure 4).

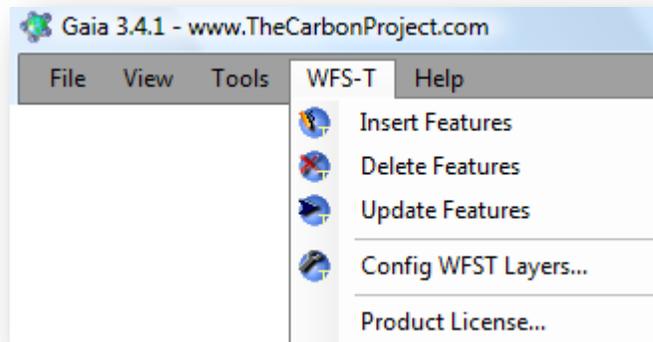
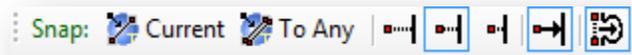


Figure 4: The WFS-T menu item.



3.2. Geometry Editing Snap Tools



Snap Mode

The snapping can be either set as “Current” or “To Any”. The Current mode applies to the currently used feature layer, as selected within the WFS-T operations panel.

 When “Current” setting is active the node will snap to geometry only in the currently used layer.

 When “To Any” setting is active the node will snap to any feature available in the map session.

Snap Distance

 Allow snapping to far features.

 Allow snapping to features over a medium distance.

 Allow snapping only to very close features.

Edge Usage

 When active allows snapping nodes to edges. When not active only node to node snapping is made.

 When active the system will try to create a fitting edge between a new node and the previous one.



4. Using the WFS-T Extender

The Gaia WFS-T Extender offers the ability to add, delete, edit and commit features as part of the Gaia session. This allows the full use of Gaia's powerful interoperability and map viewing capabilities as an integral part of features production. Natively supported sources such as imagery from a Web Maps Service (WMS), Web Coverage Service (WCS) or tile based services (Bing Maps, Yahoo! Maps, WMTS, or OpenStreetMap) can be used as a reference base to the geographic edits.

Figure 5 illustrates the creation of a new feature using the "Insert" tool with high resolution aerial imagery as a base reference.

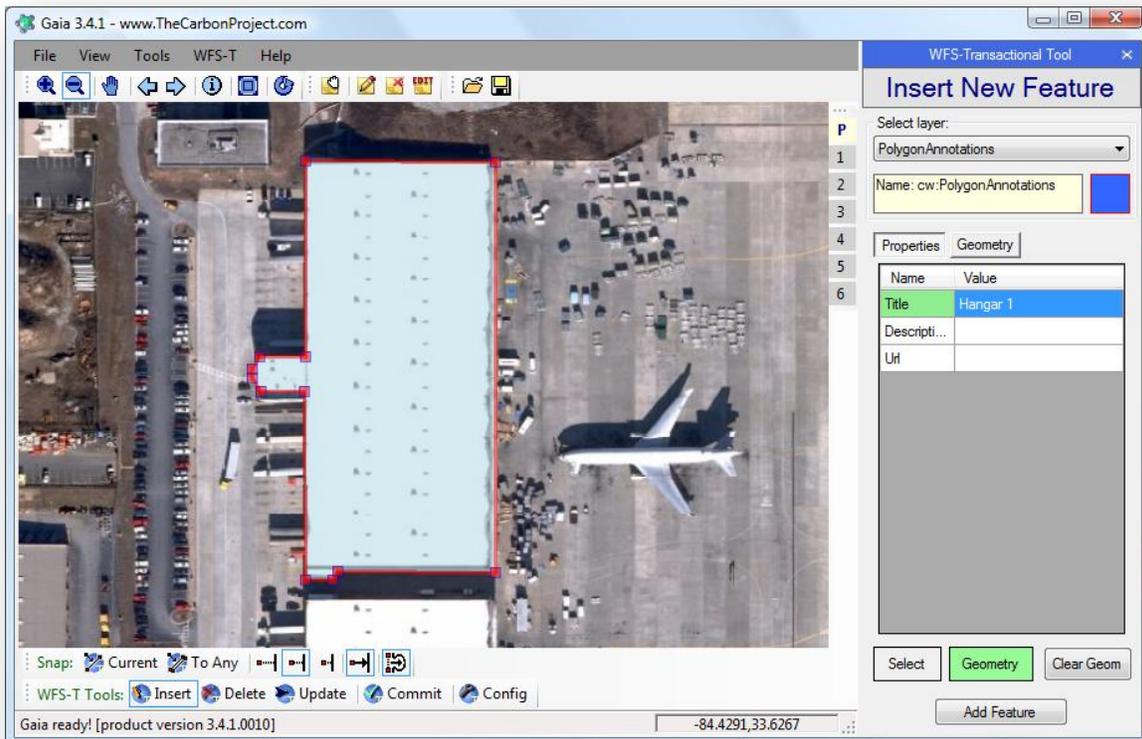


Figure 5: New feature with a polygonal geometry created on top of an aerial imagery source



4.1. Configuring a Transactional Feature Layer

Before Gaia can make changes or additions to a feature layer the system must be acquainted with the desired layer as a transactional one belonging to a Web Feature Service Transactional (WFS-T) source. In addition, a description of the layer properties and a set of rules need to be set. To satisfy these requirements the layer's Geography Markup Language (GML) schema must be read and processed. The Gaia WFS-T Extender makes this as easy as a single mouse click.

To configure a transactional layer the desired layer must be available in Gaia's session (to learn how to add layers in Gaia see the Gaia User's Guide available on The Carbon Project website). When the layer is available in the Gaia session select the "Config" tool () from the WFS-T toolbar to open the configuration form (Figure 6). The form will list all relevant *feature* layers in a pull-down list. When selecting a feature layer from the pull-down list the form will display information known about the layer, including the operations supported. This information is gathered from the layer's parent service published Capabilities (the service Capabilities are actually read when selecting the WFS from the "OGC Services" list in Gaia's "Add Layer" form).

If the selected layer supports transactional operations (indicated by the gray check-boxes) the "Refresh from Schema" button will be enabled. Clicking this button will start an automated process where the layer's GML schema is read from the service, analyzed, and converted to a local table along with data rules parsed from the schema.

 **Tip: The "View XML" button provides a way to view the raw schema XML as read from the service. Note that this will only show the root schema file and not any referenced files.**

Once the layer table is created it is managed as an internal template file, any change made to it is recorded and preserved by the application. Therefore, the next time the "Config" tool is used and the layer is selected the layer's template and rules will be displayed by the form. Additional changes will be recorded automatically; there is no need for a specific save command to do so.



Diving Deeper

The Gaia WFS-T Extender transaction profiles are found under the user's roaming folder. For example in Window Vista and 7 the file location will most likely be (assuming 'user name' is the name of the Windows user account used):

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

The `wfs_transactions_model.xml` file is where the aggregated layers configuration information is saved. The following snippet illustrates the file format:

```
<Gaia_WFST_Transactions_Model>
  <Layers>
    <Layer ns="http://www.service.com/wfs" lockFeatures="false" cloudSync="false" version="1.1.0"
      gml="GML3" insert="true" update="true" delete="true" lock="false">
      <Url>http://www.service.com/wfst</Url>
      <Name>Points</Name>
      <CRS>urn:ogc:def:crs:EPSG:6.9:4326</CRS>
      <Fields>
        <Field allowed="false" name="OBJECTID" type="LONG" />
        <Field allowed="true" name="GEOM" type="POINT" geomtype="PointPropertyType" />
        <Field allowed="true" name="Title" type="TEXT" length="255" />
        <Field allowed="true" name="Description" type="TEXT" length="4000" />
      </Fields>
    </Layer>
    <Layer>
      ...
    </Layer>
  </Layers>
</Gaia_WFST_Transactions_Model>
```

Notice the attributes on the `<Layer>` tag represent the operations supported on the layer as well as the transactional layer's traits and behavior. The 'lock' attribute represents the locking capability as received from the service while the 'lockFeatures' represent the user setting whether the transaction operation will attempt a *GetFeaturesWithLock* prior to the transaction itself.

The `<Url>` tag is a link to the transaction address specified by the service Capabilities. The `<Name>` tag represents the layer name and the `<CRS>` tag indicates the relevant coordinate reference system. Note that the Gaia WFS-T layer configuration form offers a text-box allowing the override of the CRS manually. This is useful if the service fails to report the value in its Capabilities.

The `<Fields>` tag includes information on properties and geometry, including any rules set for the data. The geometry field references the original GML schema type name in the 'geomtype' attribute.

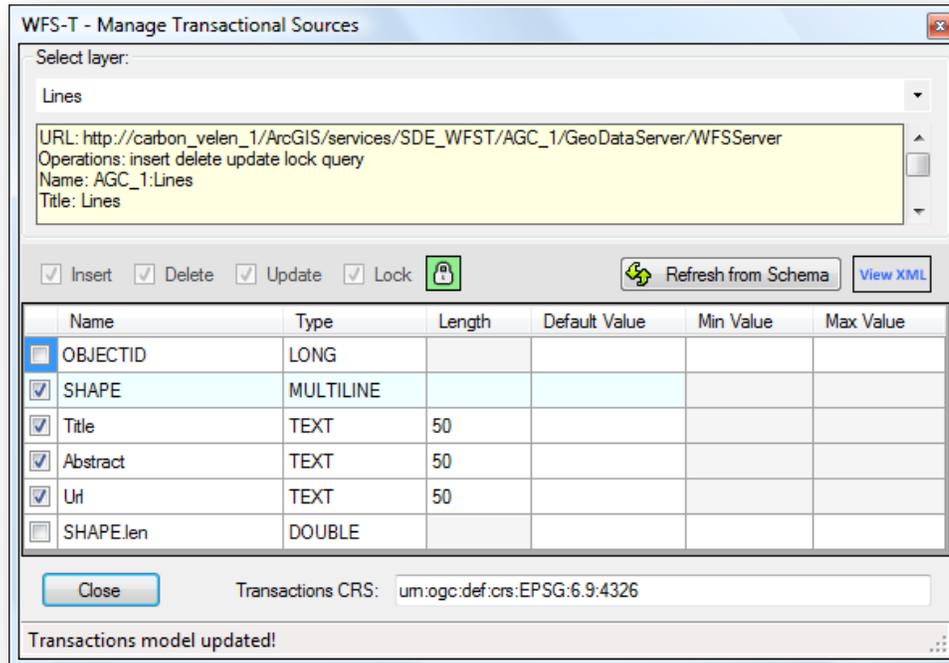


Figure 6: Configuring a transactional layer using the GML schema

Diving Deeper

The Open Geospatial Consortium (OGC) standards are sometimes a little confusing when trying to decide the order of lat-long coordinates. Gaia addresses the variations according to the following CRS values (EPSG version in the 'urn' notation is disregarded):

EPSG:4326	Longitude, Latitude
urn:ogc:def:crs:EPSG::4326*	Latitude, Longitude
urn:ogc:def:crs:OGC::CRS84	Longitude, Latitude

* Note that this order of coordinates is used for the following 'urn' codes 4326 (WGS84), 4122 (ATS 77), 4267 (NAD 27), 4617 (NAD83), 4269 (NAD83), 4955 (NAD83 3D).

Since Gaia is agnostic about coordinate projections the longitude is referenced as X value and latitude is Y. Therefore when a latitude-longitude order is concluded Gaia reverses the reading and writing order of coordinates to generate the X, Y order used throughout the system.



4.1.1. Setting Transaction Rules

The following layer properties rules can be modified manually when applicable:

- Availability of the property. Using the check box control any property can be disregarded. Note that at least a single geometry must be selected for the template to be valid. Only checked properties will appear in the operations user-interface and the generated service transactions.
- Property Type. Can be one of UNKNOWN, TEXT, FLOAT, DOUBLE, SHORT, LONG, POINT, LINE, POLYGON, MULTIPOINT, MULTILINE, MULTIPOLYGON, or GEOMETRY. This value is read-only if the system managed to obtain it from the schema. If no clear type was concluded from the schema you may manually adjust this value.
- Maximum allowed length of text. Parsed from the schema, this value applies only to TEXT type properties and can be set or overridden manually for properties of this type. Typing text value for the property with more characters than allowed by this rule when adding or updating a feature will pop an alert and the operation will not be allowed until the error is fixed. This cell can be empty indicating that no limit will be enforced on the text's length.
- Default property value when creating a new feature. This value is automatically populated for the property when a new feature is being created in the "Insert New Feature" panel. If the schema describes enumeration values this field will appear as a pull-down list of all available values (Figure 7). This cell can be empty for any non-enumeration based values.
- Value range of numerical fields. If set, the minimum or maximum value is enforced by the "Insert" or "Update" panels and the feature operation will not be allowed until a valid numerical value is assigned.

These rules are enforced by the system when editing or creating a feature. If a rule is not met the feature operation is considered not valid and completing the operation will not be allowed as long as the invalid values are not corrected.



Note: Some services, such as ESRI's ArcGIS Server, may describe properties that are internally considered read-only and may cause the transaction to fail. These properties must be unchecked in the configuration in order for the transactions to succeed. For example: OBJECTID and SHAPE.len in Figure 6 must be unchecked (see the Diving Deeper section bellow).



Diving Deeper

The Gaia WFS-T Extender represents the best effort to automate a relatively complex process in a highly vendor and platform neutral way. However, there are frequently issues that may affect the process and cannot be resolved automatically. The layer configuration mechanism provides some flexibility by allowing manual adjustments that can alleviate these problems. However, in some cases it may be necessary to consult with the service administrator in order to understand the cause for failed transactions and how to resolve the problem.

The following list reflects some of the problems that may affect WFS transactions and describes how they can be resolved using the configuration tool:

- Setting values to properties that should not be set through transactions. Although some the schema specifies these properties setting their value through a transaction will cause a failure. An example for such properties can be found in ESRI's ArcGIS Server WFS-T where common schemas include properties such as 'Shape.len' and 'Shape.area'. These properties are internally maintained and should not be checked for use.
- Setting values to feature ids in many cases may either fail the transaction or cause an unexpected behavior (such as being assigned to a different value than the one set by the transaction). The behavior of the service when trying to assign an object id to a feature depends on the vendor implementation and the current data set used. It is recommended to uncheck any property that reflects an id.
- System not allowing null (empty) values. In some cases setting an empty value or not setting any value to a property is forbidden. If the service mandates a value it may be a good idea to assign a proper one as a default value to improve the user experience with the system.
- Coordinate system is wrong or not specified. As discussed before, some coordinate reference systems defined by OGC require reversal of the internally maintained longitude-latitude order. Make sure the correct CRS is specified for the layer.
- Schema configures properties in a way that the tool did not manage to parse. For example, vendors may publish data sets using schemas with substitution groups that the parser cannot read correctly. This may cause the parser to not understand that a geometry property is in fact that. You will manually need to resolve such cases. Usually this is a relatively intuitive process as the layers' feature data can be reviewed using Gaia's basic feature tools (see illustrated example in Figure 8 based on data published by Intergraph).

There are numerous reasons why a WFS-T rejects or fails on transactions. The best way to get a handle on a failure is to review the messages returned. In many cases looking at the error message, even in some of the more cryptic ones such as Java exceptions, there will be hints or outright explanation to shed light on the problem.

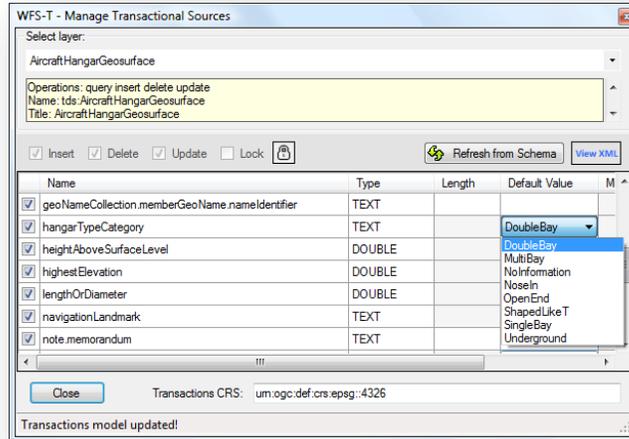


Figure 7: Layer template configuration with schema defined enumeration values

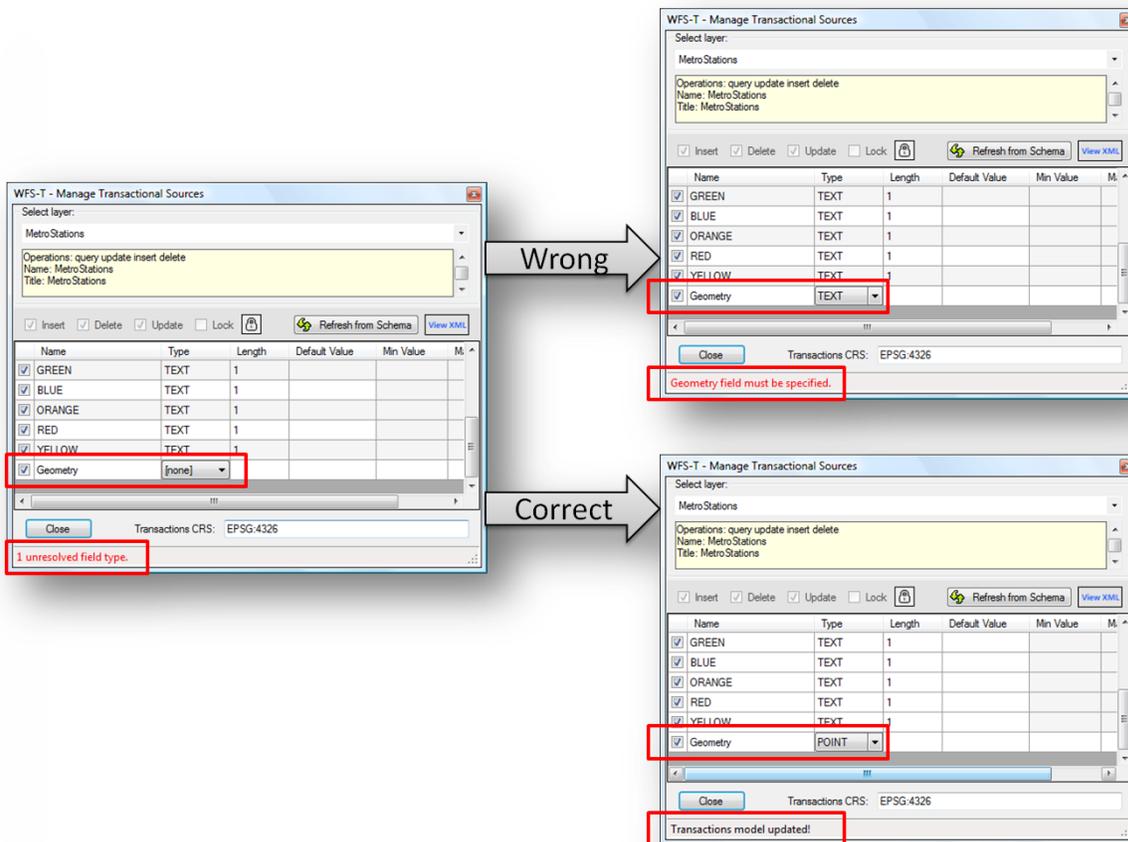


Figure 8: Manually configuring a geometry property value that was not parsed correctly from the schema



4.1.2. Configuring the Lock Operation

A service supporting Lock operations will publish support to this operation via its Capabilities. The configuration form will show a grayed-out checked “Lock” check-box and activate the lock button (🔒), shown with green background (as seen for example in Figure 6). If supported by the WFS the system sets the locking operation as active; you may click the “Lock” button to deactivate this option (although not recommended as some transactions may fail as explained in the tip bellow).

When the locking action is set to active the transaction process will perform *GetFeatureWithLock* on all deleted and changed features. This will return the features along with a lock id. The supplied lock code will then be automatically used with the transaction (see more information in the “Commit” section on page 34).

💡 Tip: It is recommended to leave the default setting of the lock option if the service supports it. Various WFS-T platforms including the ESRI ArcGIS/ArcSDE based WFS-T require the underlying database to be locked in order to delete or update features. Disabling the Lock may result in operations being rejected and ultimately failing.

Note that the supported operations are parsed from the WFS capabilities. This data is obtained when the layer is added to the Gaia session. However, if the service parameters have changed the capabilities must be read again in Gaia’s “Add Layer” form and the layer must be added and configured once more.

Diving Deeper

As discussed on page 15 the Gaia WFS-T Extender transaction profiles are found under the user’s roaming folder. The *wfs_transactions_model.xml* file is where all the configuration information is managed. Although not recommended you may edit the file manually.

To manually change the lock availability and overwrite the server’s Capabilities you can edit this file and change the ‘lock’ attribute value to either **true** or **false**.

Other parameters can be changed in a similar manor. Note however that using incorrect values may corrupt the file and may cause Gaia to fail. It is highly recommended to back up this file before making any changes.



4.1.3. Configuring Layers for CarbonCloud Sync Service

The Carbon Project's **CarbonCloud Sync** is a Cloud or Web-hosted service that allows synchronization of geospatial content across a federated deployment of services. The system can use any existing deployment of Open Geospatial Consortium (OGC) Web Feature Services with transactional capabilities (WFS-T) without changing the services or their configuration. The CarbonCloud Sync package includes an additional Gaia Extender to support the operations synchronization. This extender adds the user interface and functionality to handle the synchronization tools. It also enhances the functionality of the WFS-T Extender by allowing it to direct the operations to the synchronization service.

When the CarbonCloud Sync system is used and the Gaia CarbonCloud Sync Extender is installed the Gaia WFS-T Extender's configuration form will show a "Sync" button () . Setting this button to active (Figure 9) will cause any operations on the configured layer to be transmitted to the synchronization service via the CarbonCloud Sync Extender.



Note: For more information about geo-synchronization and Gaia please see the **CarbonCloud Sync user's guide** or visit the **CarbonCloud Sync Website** at:

www.TheCarbonProject.com/Products/CloudSync.php

WFS-T - Manage Transactional Sources

Select layer:
PointAnnotations

URL: `http://www.cubewerx.com/demo/cubeserv/cubeserv.cgi?CONFIG=annotations&DATASTORE=Annotations&Operations=query insert update delete`
Name: `cw:PointAnnotations`

Insert Delete Update Lock  Refresh from Schema [View XML](#)

Name	Type	Length	Default Value	Min Value	Max Value
<input checked="" type="checkbox"/> GEOM	POINT				
<input checked="" type="checkbox"/> Title	TEXT	255			
<input checked="" type="checkbox"/> Description	TEXT	4000			
<input checked="" type="checkbox"/> Uri	TEXT	4000			

Transactions CRS:

Ready...

Figure 9: Layer template of a layer to be synchronized with CarbonCloud Sync



4.2. Insert Feature

Prior to inserting a new feature to a transactional layer the layer must be included in the Gaia map session and properly configured (as discussed in the previous section). Pressing the “Insert” tool () opens the “Insert New Feature” panel (Figure 10) and the layer should be listed in the pull-down selection (for example Figure 11 shows a preconfigured layer named Lines as it appears in the “Insert” panel).

The layers list in the pull-down control includes all feature layers properly configured for transactions. Selecting the desired layer sets the properties table with the corresponding parameters and values. If the layer was set up to have default values these values will be populated in the “Value” column. Accordingly, if the property is based on enumerations the cell will appear as a drop-down list containing all possible values.

 **Tip: The yellow information box appears in most of the Gaia WFS-T Extender panels and forms. This control is actually a read-only text box containing the service’s transaction URL and the name of the layer. This control provides some user orientation regarding the selected layer, which is significant especially if working with multiple transactional layers for a variety of sources. You may copy and paste the text from this box.**

Once a layer is selected from the drop-down list its information will appear in the information box and the layer’s geometry type will be indicated next to the information box as one of the following icons:



The layer features consist of point or multi-point type geometry.



The layer features consist of line or multi-line type geometry, including curves.



The layer features consist of polygonal or multi-polygonal geometries, including surfaces.

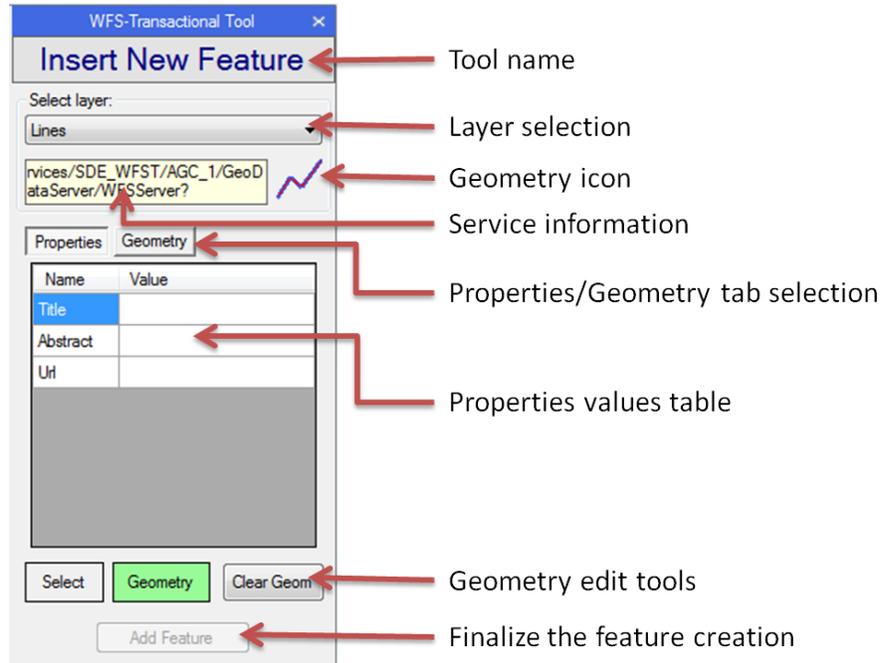


Figure 10: The "Insert New Feature" panel.

Setting properties values is done via the properties edit table. To edit values simply click on the table cell, edit the text (or select a value if enumerated) and either click the keyboard ENTER, TAB, Up Arrow or Down Arrow keys, or click the mouse anywhere outside the edited table cell.

Notice that the values added succumb to the rules set forth in the layer configuration. If a value is deemed illegal a message box will pop explaining the problem and the table row will be set to a red background. For example, exceeding the maximum text length allowed for a text element will pop a message notifying that the text cannot be longer than the number of characters allowed. Setting a property value which is valid according to the layer configuration will set the table row's background to green, signifying a value set by the user.



Note: The "Add Feature" button will remain disabled as long as no geometry was set or some of the properties remain invalid.

The on-map geometry editing tools allow the creation of a new geometry. The geometry can be either drawn from scratch or be copied from an existing one. The simplest way to create the feature geometry is by selecting the "Geometry" button and drawing on the map. According to the layers configuration



the editing tools will allow to draw point, line or polygon. Gaia WFS-T offers a suite of tools to create and edit the geometry. Moreover, the accompanying Geometry Edit Snap Tools Extender offers tools to help improve data digitizing accuracy (for more information about drawing and editing geometries and using the snapping tools see page 39). Notice the “Geometry” tab selection in the tool’s panel allow the manual editing of the geometry nodes.

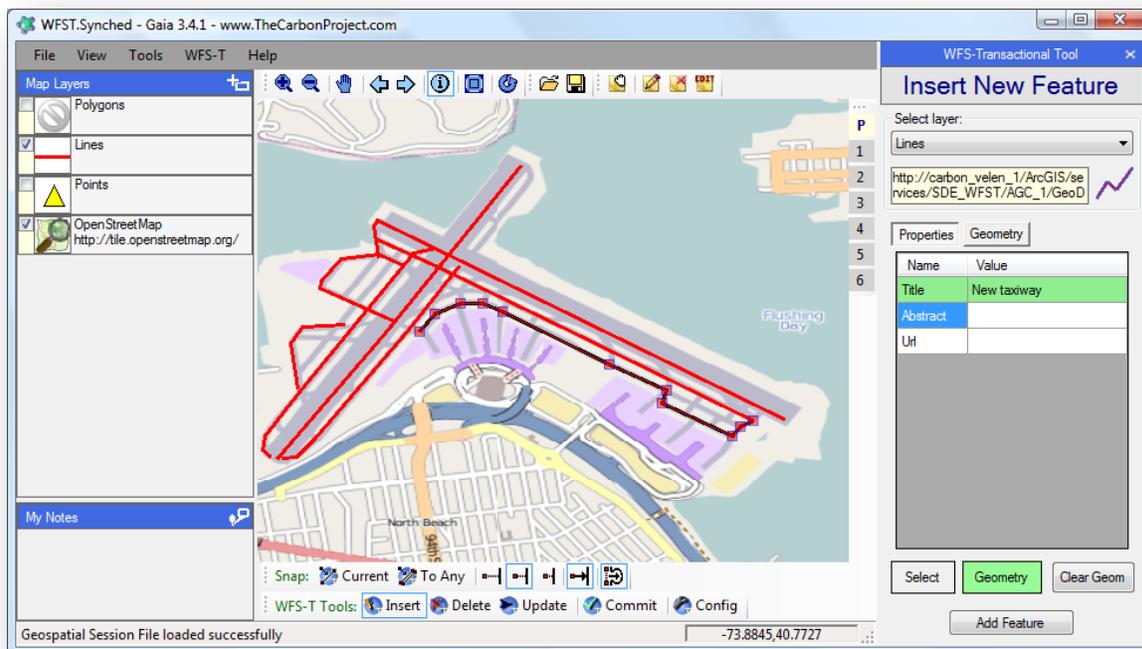


Figure 11: Gaia session that includes a "Lines" layer configured for transactions and an open "Insert New Feature" panel.

The “Select” button provides another option for creating the geometry using existing layer features and duplicating their shapes. By activating the “Select” option and clicking on a feature belonging to the currently edited layer, that feature’s geometry will be duplicated and will be set as the new geometry. You may then perform edits on the geometry as necessary either on the map or using the geometry values table (selecting “Geometry” in the panel’s tab selection).

The “Insert” selection tool offers the ability to select multiple geometries and create a unified shape. This is done by holding the CTRL button while clicking on the features on the map (CTRL click on a



selected geometry will remove it from the selection). When finished selecting, release the CTRL key and click anywhere on the map. The Gaia WFS-T extender will calculate a unified geometry and open the new shape for edit on the map (a sequence describing this mechanism is illustrated in Figure 12).

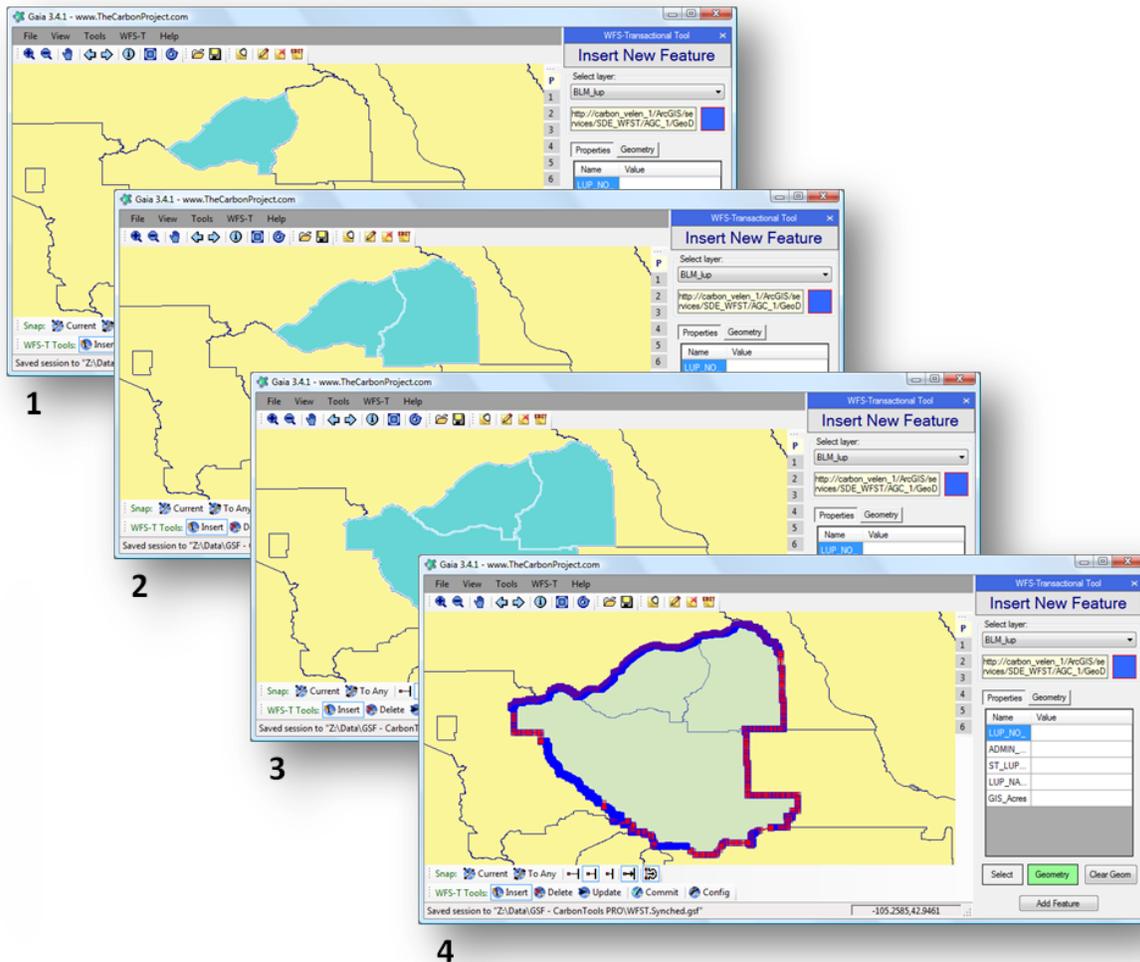


Figure 12: This image shows selection of three polygons using the CTRL-click selection feature to generate a unified polygon.

The “Insert New Feature” panel will not allow the completion of the operation until all new values are legal and geometry is assigned. Once the tool is satisfied the “Add Feature” button will be enabled. When the new feature geometry and property values are set you may add the new feature using the “Add Feature” button. This will insert the feature to the corresponding local layer, marked internally in



Gaia as a new item. Note that the new feature will not be added to the WFS-T until the transaction process was successful (committing operations to the service is discussed on page 34). Also notice that when the new feature is selected by the Delete or Update operations a label will inform that this is a new feature. Be aware that if Delete is performed on a new feature, that was yet to be committed to the service, the feature will be removed permanently from the session without being transacted.

Diving Deeper

The “Insert” tool creates and adds a new feature that is added to Gaia session with a Tag indicating that the feature is in fact INSERTED along with a timestamp of the operation. The “Commit” tool will later scout the selected layer for appropriately tagged features.

The feature’s properties and geometry will be restructured to an Insert transaction using the layer configuration information. The assembled transaction form is compliant with the WFS-T specifications as published by the OGC.

The following XML snippet is an example to a generated transaction from Inserted items:

```
<Transaction service="WFS" version="1.1.0" xmlns="http://www.opengis.net/wfs" ...>
  <Insert>
    <ns:Layer xmlns:ns="http://www.xx.com/wfst" xmlns:gml="http://www.opengis.net/gml">
      <ns:Title>New taxiway</ns:Title>
      <ns:Abstract />
      <ns:Url />
      <ns:SHAPE>
        <gml:MultiCurve srsName="urn:ogc:def:crs:EPSG:6.9:4326">
          <gml:curveMember>
            <gml:LineString srsName="urn:ogc:def:crs:EPSG:6.9:4326">
              <gml:posList srsName="urn:ogc:def:crs:EPSG:6.9:4326">
                40.771280721 -73.8581056959999 40.7709600053434 -73.8587980304853 40.7704543334115 -
                73.8592404934258 40.7722241851733 -73.8630330329154 40.7729194840797 -
                73.8627801969494 40.7743100818926 -73.8658774375326 </gml:posList>
              </gml:LineString>
            </gml:curveMember>
          </gml:MultiCurve>
        </ns:SHAPE>
      </ns:Layer>
      <ns:Layer xmlns:ns="http://www.xx.com/wfst" xmlns:gml="http://www.opengis.net/gml">
        . . .
      </ns:Layer>
    </Insert>
  </Transaction>
```



4.3. Delete a Feature

The “Delete Feature” panel is activated using the “Delete” toolbar button or menu item () . Once open, the tool allows the ‘on map’ selection of features from a transactional layer and allocating them for deletion (Figure 13). A selected feature will be highlighted on the map (Figure 14) and its property values will be displayed in the panel using a tree view form common to various Gaia functionalities such as the “Feature Info” view. If a prior operation was performed on the selected feature, but not committed, a red label will indicate the type pending operation for the item; otherwise the text will read: “No operation assigned”.

After choosing the appropriate layer from the pull-down selection the panel will update the service information and the icon indicating the geometry type used (this is common to other Gaia WFS-T Extender tool panels such as the “Insert New Feature” section discussed on page 22).

Selection of a feature for deletion is done by activating the “Select” button. The on-map cursor will change to a selection tool (). Clicking on a relevant feature on the map will select it, highlight its geometry, and populate the information in the tool’s panel. If the clicked location has overlapping geometries from multiple features the tool allows browsing through the features and selecting the desired one for removal. Scrolling through the features will highlight the current feature selection on the map.

Once the feature is chosen clicking on the “Delete Feature” button will mark it for deletion. The feature will now be marked and appear in the “Commit” list of transactions (see section 4.5).



Note: Deleting a feature that was newly created but was not committed to the service will permanently remove that feature from the session.



Tip: The “Delete Feature” selection tool provides an easy way to verify operations on layer features. The operation label will indicate whether the selected features is inserted, updated or marked for deleting, along with the time stamp of the operation.



Diving Deeper

The “Delete” tool tags features to be DELETED along with the operations timestamp. According to the WFS-T standard deleting a feature requires a filtered reference. The Gaia WFS-T uses a simple *FeatureId* type filter.

The following XML snippet is an example of a generated transaction from Deleted items:

```
<Transaction service="WFS" version="1.1.0" xmlns="http://www.opengis.net/wfs"
  xmlns:ns="http://www.xx.com/wfst" ...>
  <Delete typeName="AGC_1:Lines">
    <ogc:Filter>
      <ogc:FeatureId fid="F131__28" />
      <ogc:FeatureId fid="F131__29" />
    </ogc:Filter>
  </Delete>
</Transaction>
```

Since this operation is done on an existing feature services that require the Lock operation will need to lock any feature used by this transaction. Locking is done using the *GetFeatureWithLock* operation filtered according to the feature id.

As discussed before, transaction failure will leave the locked features in limbo until the service unlocks the features automatically (see page 20).

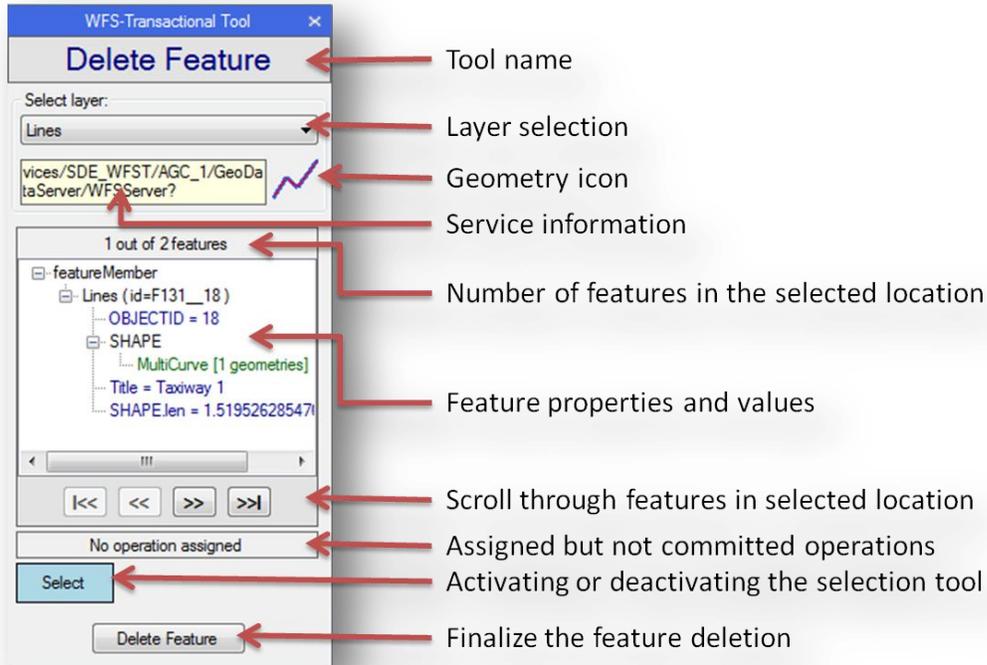


Figure 13: The "Delete Feature" panel.

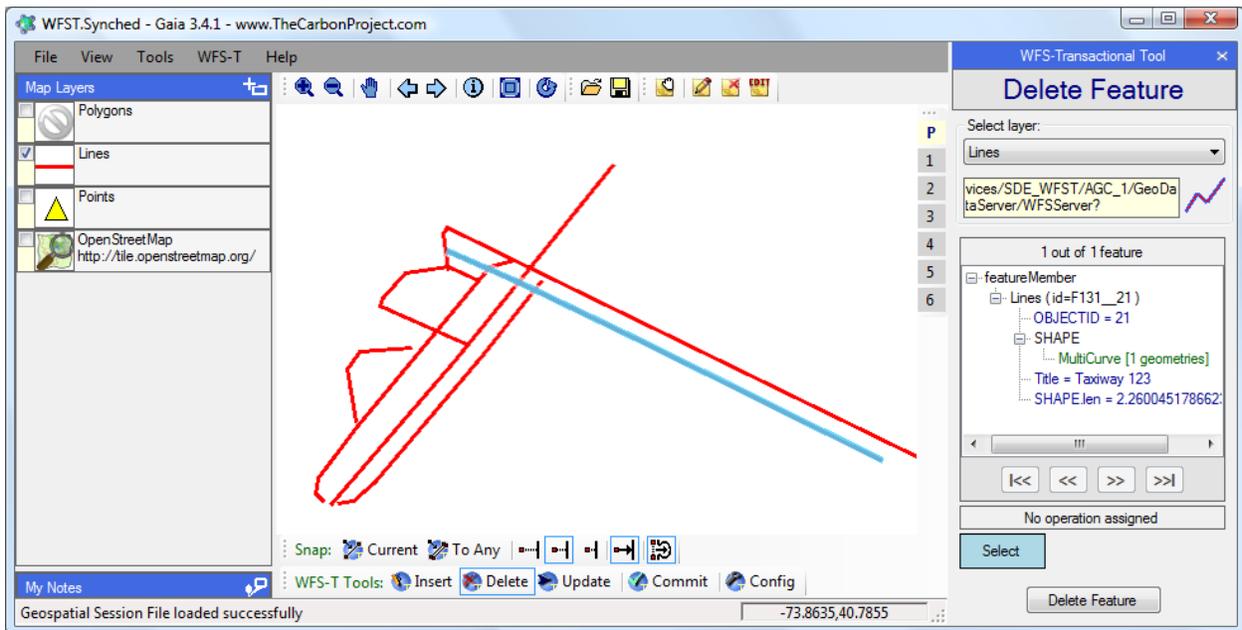


Figure 14: Selecting a feature for deletion.



4.4. Update a Feature

The “Update” button in the Gaia WFS-T Extender tools () opens the “Update Feature” panel (Figure 15), which allows changing the values of properties and adjusting the geometry of an existing feature.

After choosing the appropriate layer from the pull-down selection the panel will update the service information and display an icon representing the geometry type used (for more information see the “Insert New Feature” described on page 22).

 **Tip: The “Update feature” panel has a somewhat crowded interface. You can adjust the controls layout using a splitter in the middle of the panel between the feature tree view and the “Properties” / “Geometry” tab buttons.**

Selecting a feature for update activates the “Select” button, and the map tool will switch to selection mode indicated by the select cursor (). Clicking on a feature on the map will select it, highlight the geometry and fill the panel’s view with the relevant information. If multiple feature geometries are available for the selected location the tool allows browsing through these features using the navigation arrow controls under the current feature view. Scrolling through the available features will update the panel and select the geometry on the map accordingly.

Once a feature is selected you may edit the geometry by activating the “Geometry” button on the bottom of the panel (not the “Geometry” tab where you may manually edit node values). This will switch Gaia’s map view to geometry-edit mode with the feature’s current geometry ready for edit (Figure 16). You may adjust the existing geometry or draw a new one by clearing the current geometry using the “New Geom” button (for information about drawing and editing geometries and using the snapping tools see page 39). Notice that the tool will maintain a highlighted map reference of the original geometry while the changes are made.

Changing properties values is done via the properties edit table. Notice that the values edited succumb to the layer template rules as set by the layer configuration (similar to the “Insert New Feature” panel discussed on page 22). If a value is deemed illegal a message box will be shown explaining the problem



and the corresponding table row background color will change to red. An updated property with a legal value will change the corresponding table row's background color to green.

Once the updated feature has legal property value updates or geometry adjustments the update process should be completed using the "Update Feature" button. This will mark the feature for update and will ensure the operation appears in the "Commit" panel (see page 34).

Note that if the feature being updated was already marked with a previous operation, yet to be committed, the operation effect will be as follows:

- If the feature is new and marked as INSERT when selected it will remain as such with the updated properties and geometry values taking effect. In effect, this tool allows corrections to be made on newly inserted features.
- If the feature was assigned for removal and is marked as DELETE its status will change to be UPDATE with the current operation taking place.
- If the feature is marked as UPDATE there will be no status change and the new values will apply to the next transactions commit.



Note: The logic behind having two interfaces showing the feature properties – the tree view and the table – is that the tree-view is a reference of the current feature in its native state prior to the changes made. The tool aims to provide a comparison between the original and the changed feature values. Similarly the highlighted on-map geometry shows a visual reference to the origin feature state.

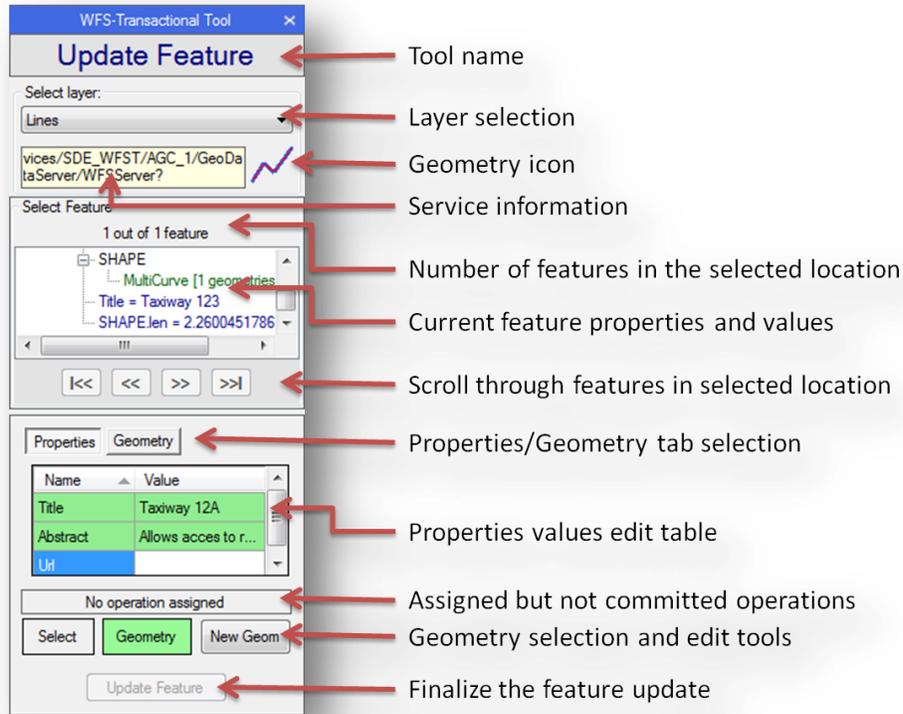


Figure 15: The "Update Feature" panel.

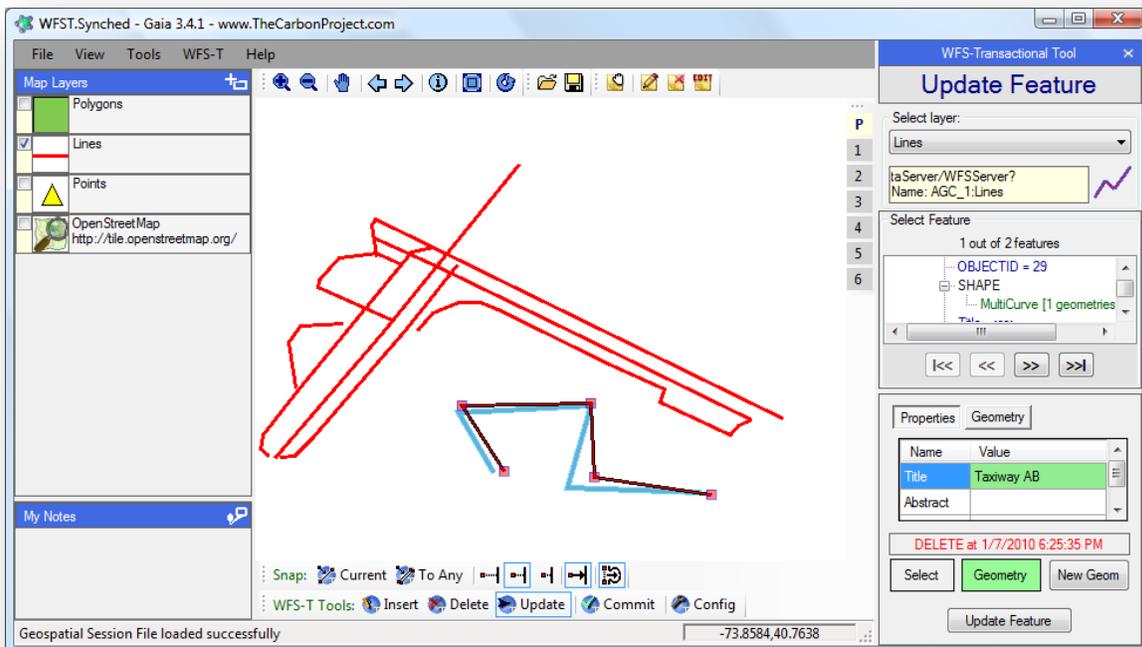


Figure 16: Using the "Update Feature" tool.



Diving Deeper

The “Update” tool tags features as UPDATE along with the operation’s timestamp. According to the WFS-T standard updating a feature requires a filtered reference along with the updated properties. Similar to the “Delete” operation the Gaia WFS-T Extender uses a simple *FeatureId* type filter accompanying each operation. Property changes, including the geometry, are referenced according to a name and value.

The following XML snippet is an example of a generated transaction from an Update item:

```
<Transaction service="WFS" version="1.1.0" xmlns="http://www.opengis.net/wfs"
  xmlns:ns="http://www.xx.com/wfst" ...>
  <Update typeName="ns:Lines">
    <Property>
      <Name>Title</Name>
      <Value>Taxiway AB</Value>
    </Property>
    <Property>
      <Name>SHAPE</Name>
      <Value>
        <gml:MultiCurve srsName="urn:ogc:def:crs:EPSG:6.9:4326"
          xmlns:gml="http://www.opengis.net/gml">
          <gml:curveMember>
            <gml:LineString srsName="urn:ogc:def:crs:EPSG:6.9:4326">
              <gml:posList
srsName="urn:ogc:def:crs:EPSG:6.9:4326">40.7672762979688 -73.860203022425
40.7682263103361 -73.8665997723642 40.7722163622783 -73.8667264406798
40.7720896939627 -73.8737565321971 40.7685429811251 -73.871413168358</gml:posList>
              </gml:LineString>
            </gml:curveMember>
          </gml:MultiCurve>
        </Value>
      </Property>
      <ogc:Filter>
        <ogc:FeatureId fid="F131__29" />
      </ogc:Filter>
    </Update>
  </Transaction>
```



4.5. Commit Changes to the WFS-T

The “Commit Transactions” tool is used to inform the Web Feature Service with the changes made to the data. Activating this tool using the “Commit” toolbar button or menu item () opens the tool’s “Commit Transactions” panel (Figure 17). Using this panel, the created feature operations can be reviewed and chosen for a transaction to the WFS-T.

Similar to other tools, the appropriate layer should be selected from the pull-down list. Once the layer is chosen the panel displays the service information and an icon indicating the geometry type used (for more information see the “Insert New Feature” section on page 22). All operations made on features within the selected layer will be populated in the table along with the type of operation and a timestamp indication when the user action was performed.

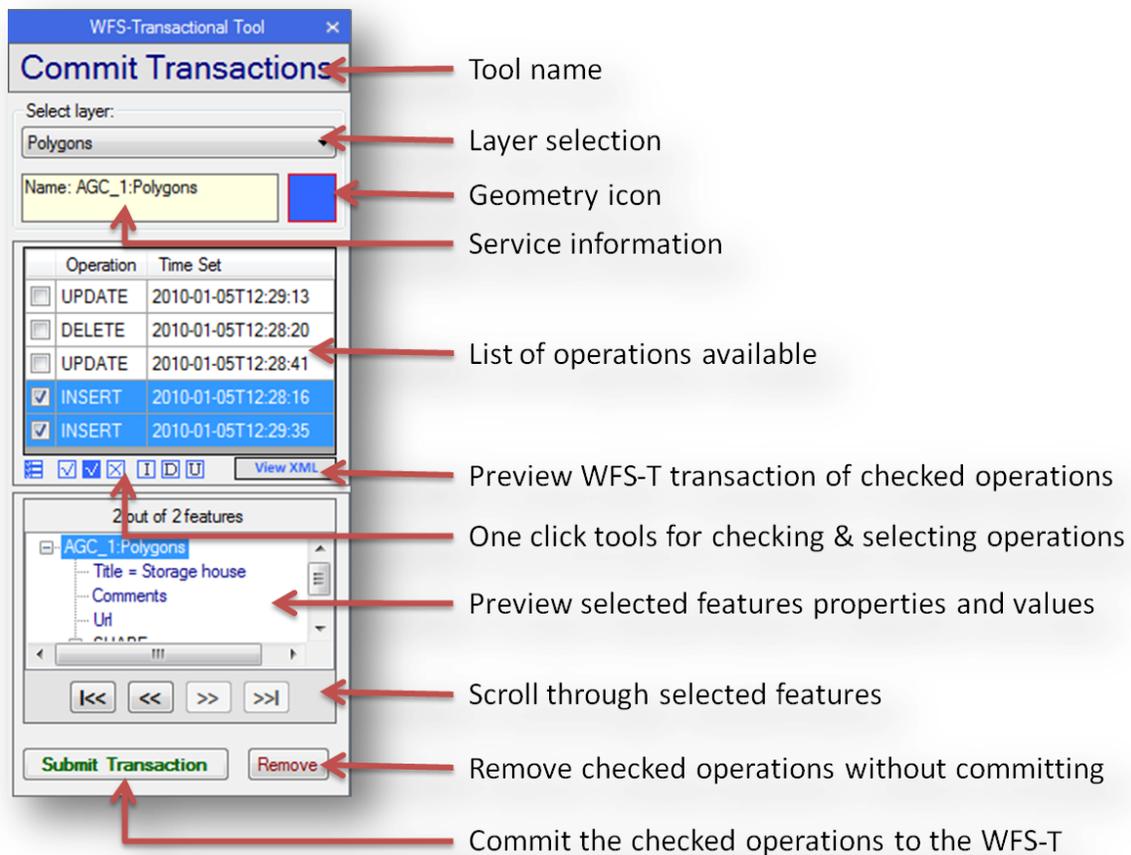


Figure 17: The "Commit Transactions" panel.



The tool allows choosing one or more of the locally managed operations to be included in the transaction sent to the WFS-T. Selecting rows from the table provides a preview of the feature properties as well as highlighting the correlating geometries on the map (Figure 18). You may select multiple rows by holding the CTRL or SHIFT buttons. Notice that selecting rows in the table *is not analogous* to checking them for transactions but rather a preview method. Only operations whose check-box is checked will be used in the transaction operation.

💡 Tip: You can click on the table's column headers to sort the operations by type or time. The timestamps are displayed using a year-month-day-time format thus allowing chronically correct sorting order.

The tool's panel offers a few one-click check and selection action buttons. These buttons provide a quick way to select multiple operations:

- Check all selected rows.
- Check and select all rows.
- Inverse all selection and check selected.
- Uncheck all items and clear all selections.
- Check and select all **I**nsert operations.
- Check and select all **D**elete operations.
- Check and select all **U**ppdate operations.



 **Note:** Feature operations are maintained locally by Gaia until a successful transaction to the service (i.e. performing the transaction and getting confirmation of success from the WFS-T). Saving and reading Gaia's session files (*.gsf) will preserve the data operations if not yet committed.

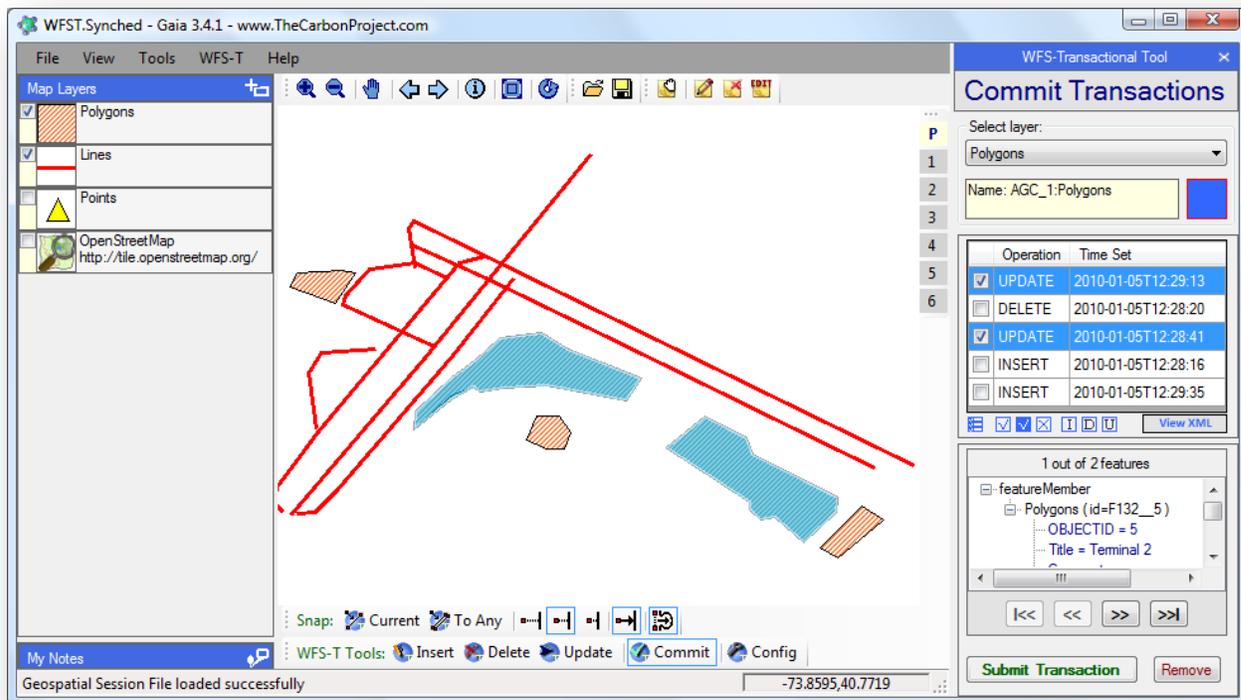


Figure 18: The "Commit Transactions" tool allows preview of operations prior to committing them to the server.

Once the operations are checked you may commence using the "Submit Transaction" button, or dispose of these operations without a transaction using the "Remove" button. Notice that removing operations without committing to the service will clear these operations and refresh the features layer. The removed operations will be lost and there will be no way to recover them.

Clicking the "Submit Transaction" starts the transaction process and opens a new dialog providing information on the process progression (Figure 19). The beginning of the messages text log (with the light yellow background) will inform on the types and amount of operations performed in the



transaction. The Gaia WFS-T Extender constructs a bulk transaction from all check operations. Therefore the tool makes only a single transaction call to the WFS-T.

If the layer is configured to perform a *Lock* (see page 20) and the transaction includes one or more Update or Delete operations a preliminary query obtaining a corresponding Lock Id from the server will be performed. This Lock Id is then used in the consecutive transaction operation.

💡 Tip: If the transaction failed after the data was locked you may need to wait a few minutes for the database to unlock the relevant features before attempting another transaction. Most services will inform that the operation failed due to locked features and the message will be displayed in the dialog's information text box. Consult the service administrator regarding the time span assigned for a lock operation to dissipate.

When the transaction operation is complete the form's title text will either spell a success message in green font or a failure message in red. In some rare cases a partial success will appear in orange font, this should be regarded as a failed transaction. The information text will include information regarding the process along with any errors returned from the service.

The transaction dialog offers tools to inspect the transaction XML queries and the service response. If locking is used the "Show Lock Query XML" button will display the *GetFeatureWithLock* WFS-T query. The "Show Transaction XML" button shows the WFS-T *Transaction* query. The "Show Results XML" opens the exact response received from the service. The response is usually in the form of a *TransactionResponse*, or a service exception XML message in case of a failure.

After a successful operation the Gaia session will remove all features associated with the transaction from the map and refresh the corresponding layer from the service. Deleted features will be removed; updated and new features will no longer be marked as local operations. Operations not checked for transaction will not be affected. This process ensures smooth continuation of work by synchronizing the current session with the state of the features on the service, while preserving any feature operations not yet committed to the WFS-T.



- 💡 **Tip:** Make sure to set the layer filter to an appropriate filtering (for example a large enough or disabled MaxFeatures). Otherwise updated or new features may be filtered out during the refresh operation and will not appear in the map. In addition, it is recommended to disable the Gaia layer caching capability to avoid artifacts where duplicates are created due to changes.

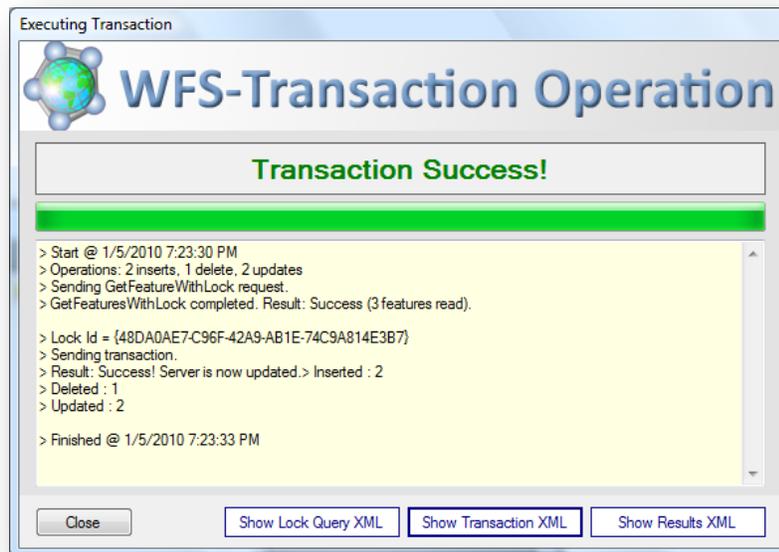


Figure 19: The transaction dialog informs of the progression of the transaction process and displays relevant messages.



5. Geometry Editing

The Gaia WFS-T Extender adds to Gaia extensive on-map geometry creation and editing capabilities. These tools allow the user to visually digitize the feature geometries seamlessly on the Gaia's multi-layered map display. In addition the included Geometry Snapping Tools Extenders enhances the process of geometry editing even further by providing tools to accurately snap edited geometry nodes onto existing map features.

Geometry editing in the Gaia WFS-T Extender is utilized in two cases, when creating a new feature using the "Insert" tool (see page 22) or when updating an existing feature using the "Update" tool (page 30). The on-map editing process is similar in both cases.

Diving Deeper

Geometry editing on the Gaia map is not a unique feature to the Gaia WFS-T Extender, in fact it is part of the **CarbonTools PRO MultiMap** control. The control offers a list of API commands and events; all begin with the *GeometryEdit* name.

In an attempt to avoid collision with future Extenders or features involving geometry editing and to make the product more intuitive the Gaia WFS-T Extender activates the geometry editing mode only when the "Insert" or "Update" panels are active and a geometry-edit mode was initiated. When the tools are deactivated Gaia reverts to the last map tool used.

5.1. Drawing and Editing a Geometry

When Gaia is in geometry-editing mode the map cursor is set to a cross-hair (✕) with a hot-spot in the center of the cursor. The shape being edited is easily distinguishable on the map as it is rendered as an overlay shape with nodes displayed as red squares, edges as red lines, and a transparent-blue fill for polygonal surfaces. Notice that when the feature operation is completed the geometry will assume the symbology assigned to the corresponding feature layer.

Geometry editing consists of two modes. The first mode is for geometry creation where the user adds new nodes to the generated line or polygon (a point is by nature more straight forward to add or edit). Gaia initiates this mode by default when creating a new geometry, or when the edited geometry is cleared of any nodes to start anew. When creating a new line or polygon each mouse click on the map



will add a new node to the shape. Moving the mouse over the map drags a ‘floating’ node dynamically redrawing the geometry as the mouse moves. To complete the geometry simply double-click on the map to set the final node’s location, or alternatively hold the CTRL button and double-click anywhere on the map to finalize the geometry *without* adding the mouse’s location as the final node.

The second mode of operation is the edit mode. This mode applies to an existing geometry or a completed new geometry (after the double clicking action). Clicking on the map will not add a new node to the shape; instead you may change existing nodes location by clicking on a visible node and dragging the mouse while holding the left mouse button. You may also add new nodes to an existing line or polygon by clicking on an edge. Adding a node to an edge will automatically split the clicked-on edge to two. You may also delete nodes by holding the CTRL button and clicking on the desired node. When editing a polygonal geometry you may also click on the polygon’s surface and drag the whole geometry around the map dropping it in a new location.

The sequence in Figure 20 shows how a line is created by clicking on the map to add a node (step 1) and finalizing a three node line by double clicking on the map (step 2). Next steps illustrate the edit mode functionality by adjusting the geometry. A new node is added by clicking on an edge (step 3) and then modified by clicking and dragging the node to a new location (step 4).



Note: Clicking or double-clicking normally refers to the left mouse button.

Dragging and dropping action requires leaving the left mouse button down while moving the mouse and releasing it when the cursor is at the correct location.

An optional way to manually edit the geometry nodes is using the Geometry table. To access the table in the “Insert New Feature” or “Update Feature” panels, simply click on the “Geometry” tab button (next to the “Properties” button). The geometry nodes are displayed as a table where each row lists the X and Y coordinates (which correlates with longitude and latitude) of a node. The order of rows represents the first node in the geometry on top to the last node on the bottom. You may edit the coordinates in the table cells. Furthermore, you may delete and add rows to change the geometry. Manual changes using the geometry table will dynamically update the on-map view.

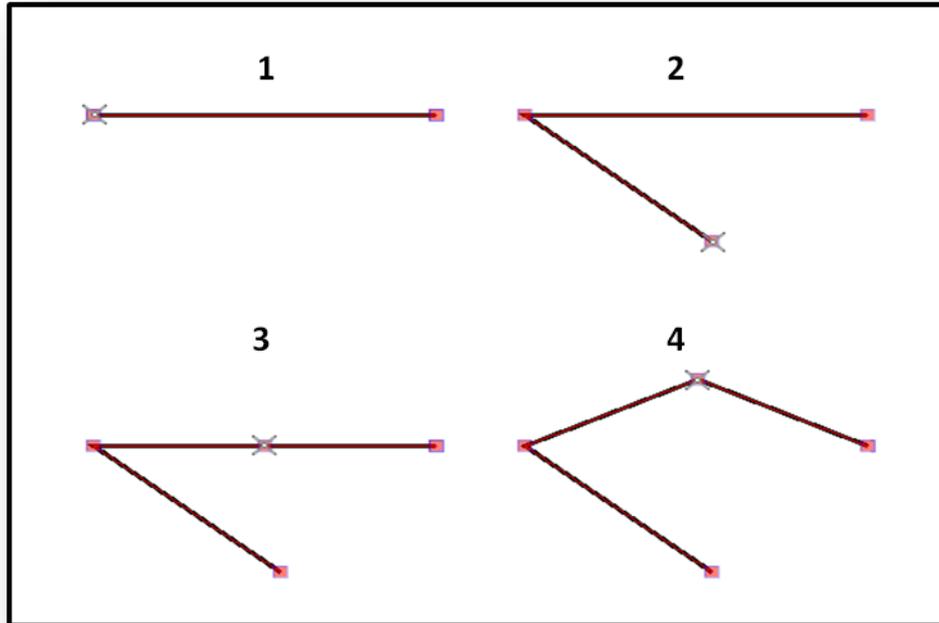


Figure 20: Creating and editing line geometry

Diving Deeper

On-map geometry editing does not offer a visual way to create interior ‘holes’ in polygons. There is however a way to do so, albeit cumbersome.

Notice that when using the tabular view of a polygon the panel becomes split to two panels (you may need to drag a splitter to expose the bottom panel). The bottom panel includes the somewhat cryptic message “Geometry collection is empty” which refers to a collection of one or more interior rings. Below the bottom panels are the “Add” and “Remove” buttons allowing adding or removing interior rings. After a ring is added you will need to manually add nodes at a minimum of three nodes per ring. Note that GML does not care about the ring orientation, as for example the Shapefile format.



5.2. Using the Geometry Snapping Tools

The Gaia Geometry Snapping Tools Extender is an optional extension that comes prepackaged with the Gaia WFS-T Extender. This Extender adds a new toolbar (see page 12) with a suite of geometry snapping functionalities.

Initially all buttons of this Extender will be disabled and grayed out. To activate the snapping functionality a layer must be selected from the pull-down control in the “Insert New Feature” or “Update Feature” panels. Choosing a transactional work layer enables the geometry snapping tool’s “Current” () and “To Any” () buttons. Checking one of these modes will activate the appropriate snapping mode. The “Current” mode will snap nodes only to geometry elements belonging to the currently selected feature layer. The “To Any” mode will snap nodes to any geometry element visible in the current Gaia session from any layer of any source (i.e. the snapping target does not need to be a WFS any feature data will be tested). Notice that the “To Any” option allows snapping to geometries of any type to any type, for example the node of an edge of a polygon can be snapped to a linear entity and vice versa.

When a snapping mode is active adding or changing a node location will automatically trigger a search for a nearby node or edge according to the current snapping setting. If a match is found the node location will automatically adjust to the proper position based on an existing on-map node or edge.

The various modes allowed by the Geometry Snapping Extender toolbar enable fine-tuning of the sensitivity of the tool. You may select from three levels of sensitivity indicating the radius of search around the node location used to seek a matching geometry element.

You may also turn on or off the snap-to-edges capability (). When active this capability will look for nearest location on geometry edges in addition to nodes. Note that by design the snapping mechanism will prefer matched nodes to edges even when this mode is active. In other words, if the tool confronts a choice between a close edge or a close node, both with similar proximity, the matched node will be the preferred target placement.

Another more sophisticated snapping mode is the fit-to-edge (). When this mode is active the snapping tool will try to find an edge on a geometry which lies between the previously digitized node and the current one. When a match is found the snapping tool generates a set of nodes that follow the matched edge. The fit-to-edge function performs edge-matching overcoming direction mismatch or circular break (passing the first node in a ring). Furthermore, snapping functionality works with polygon



interior edges (edges of holes). This snapping feature allows accurate creation of adjacent geometries with maximum accuracy.

Figure 21 illustrates how the fit-to-edge should be used. The user snaps a node to the location representing the beginning of the adjacent geometry's edge (step 1). The user then selects the second node which represents the end of the adjacent edge (step 2) causing the system to traverse the edge and add it to the digitized geometry. The user then draws the rest of the new polygon geometry (step 3).



Note: The fit-to-edge mechanism will always use the shortest distance on a closed polygon. If there is a need to 'wrap' a large part of a closed polygon simply use a set of short edges along the desired path.

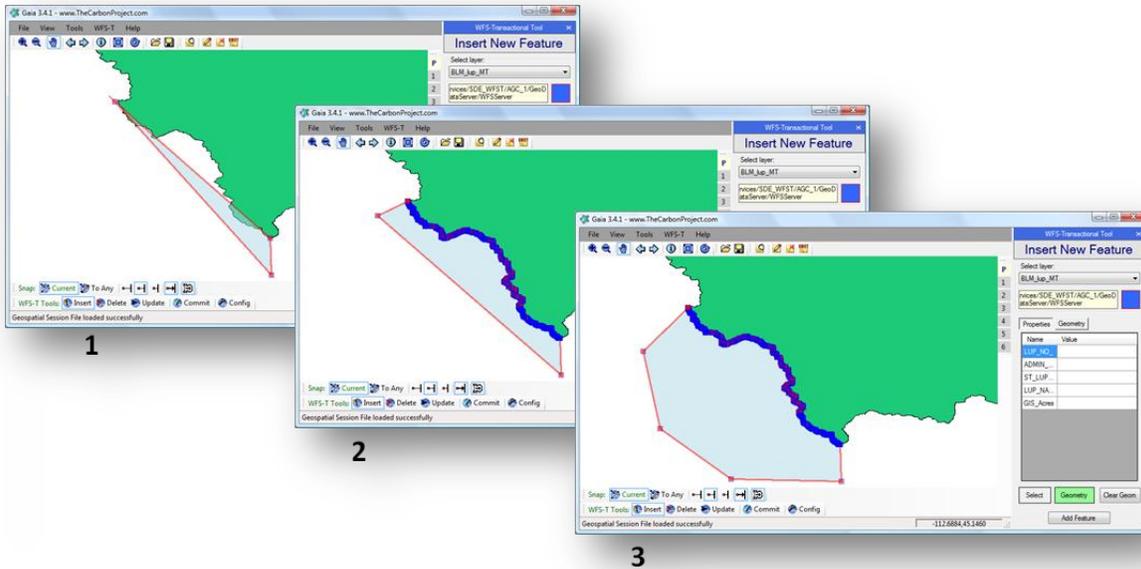


Figure 21: Digitizing a polygon using the fit-to-edge option

Diving Deeper

The Gaia Geometry Snapping Tools Extender is in fact a self contained Gaia Extender. The tool was developed using **CarbonTools PRO** using the **MultiMap** control's geometry editing API. Essentially the tool 'listens' to events involving changes in the geometry edit nodes locations.

When such an event is detected the Extender takes over scouting the session for candidate matches and using the best one based on the tool's settings. When a match is found the Extender rewrites the MultiMap edited geometry current node's location. The fit-to-edge functionality is a little more involved but basically uses the same mechanism.

Since this Extender is self contained its functionality applies to any other Extenders that may take advantage of the MultiMap geometry editing capabilities.



6. Tutorial

The following tutorial shows a step by step use case when working with the Gaia WFS-T Extender. The scenario includes a Gaia map session based on WMS base maps as a reference and a WFS-T based on ESRI ArcGIS Server 9.3.

To demonstrate the tool we can examine an ArcGIS Server 9.3 with an underlying ArcSDE 9.3. The data layer is based on a Shapefile representing regions in the state of Montana (Figure 22). We added the Shapefile to the ArcSDE as a versioned layer, opening it for edits via the WFS-T. The result is transactional polygonal layer that we will add to our session and perform operations and transactions on (Figure 23 shows the ArcGIS Server Manager application with the WFS-T).

 **Note:** This walkthrough is not intended to be replicated step by step as we use internally set WFS-T and available data. However, this should provide a reference point on how to use the product's features and functionalities.

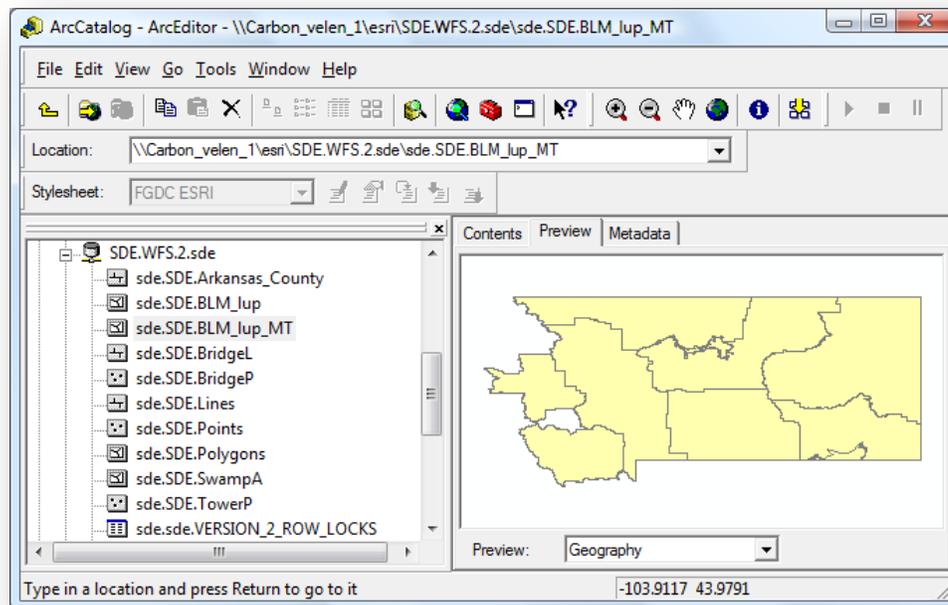


Figure 22: ArcCatalog showing the polygonal layer we will transact against

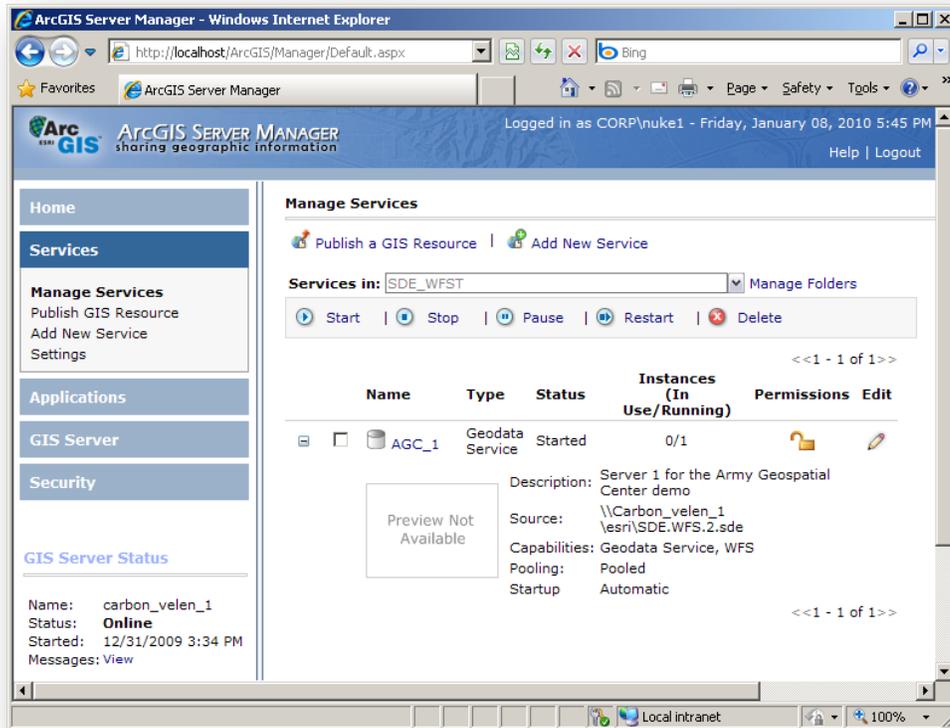


Figure 23: ArcGIS Server 9.3 Manager showing the WFS-T service

Once the WFS-T is ready for action we can assemble our Gaia session. In this tutorial we will demonstrate editing of the polygonal Montana Counties layer with visual help from a couple of Web Map Service (WMS) based layers from the United States Geological Survey (USGS). Notice that the WMS layers are image based and will not be shown in pull-down lists of feature layers. Also, the WFS-T layer will be rendered using opaque orange fill.

We are now ready to use the Gaia WFS-T tools to add, change and delete counties from the state of Montana (Figure 24).

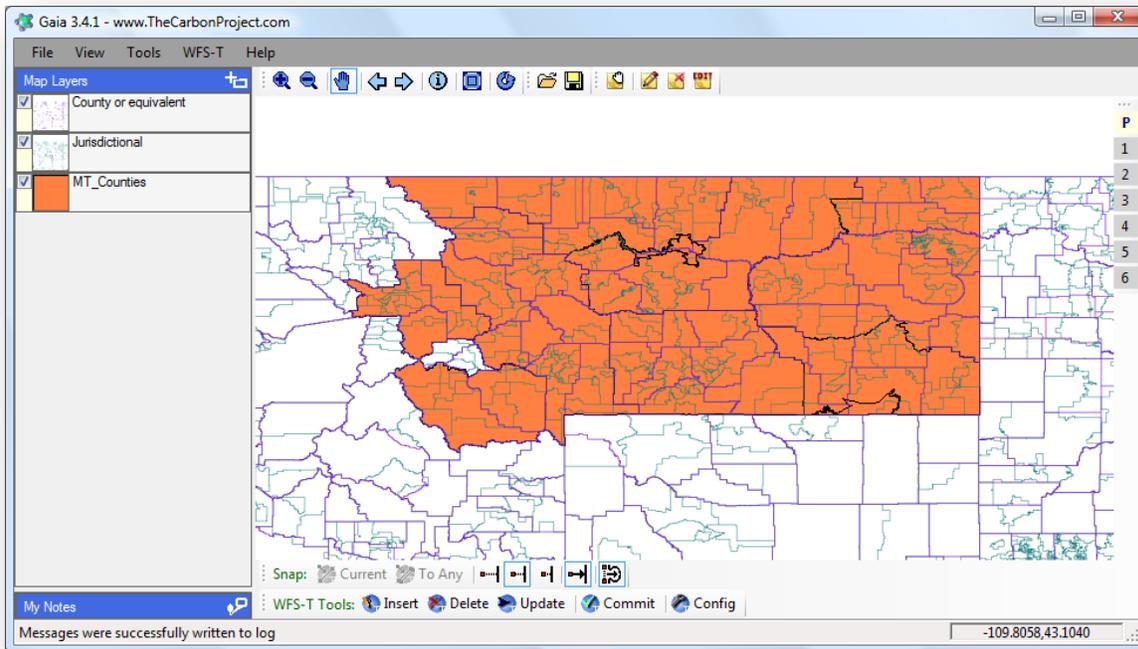


Figure 24: Gaia session with the transactional layer "MT_Counties"

Step 1 – Configuring the feature layer

Clicking on the “Config” tools opens the configuration form. Since we have only a single feature layer from a WFS (the other two layers are imagery based from WMS) the “MT_Counties” layer will be selected and the pull-down list will have only it as an option.

The layer we are using supports all the transaction operations. Moreover, since we are using an ArcGIS based WFS-T the lock operation is required and we will leave the “Lock” button checked. Initially the table is not configured; Figure 25 illustrates in step 1 the start state. Since the layer supports transaction operations the form reports in the status bar the “Layer may be added”. Clicking on the “Refresh from Schema” button, as shown is step 2, automatically reads the layer schema from the service and parses it to a table. In step 3 we uncheck the ‘OBJECTID’, ‘Shape.len’ and ‘Shape.area’, as these are properties that are managed internally by the service and should not be used in transactions (see more details in page 18). We also added a default values to some of the properties and a minimum value to a numerical ‘GIS_Acres’ property.



Please note that the objective of this walkthrough is to demonstrate the transactions functionality, we will ignore the meaning behind the feature properties and use arbitrary values to illustrate the template rules and various editing options.

We are now ready to perform operations on the data and the form should be closed.

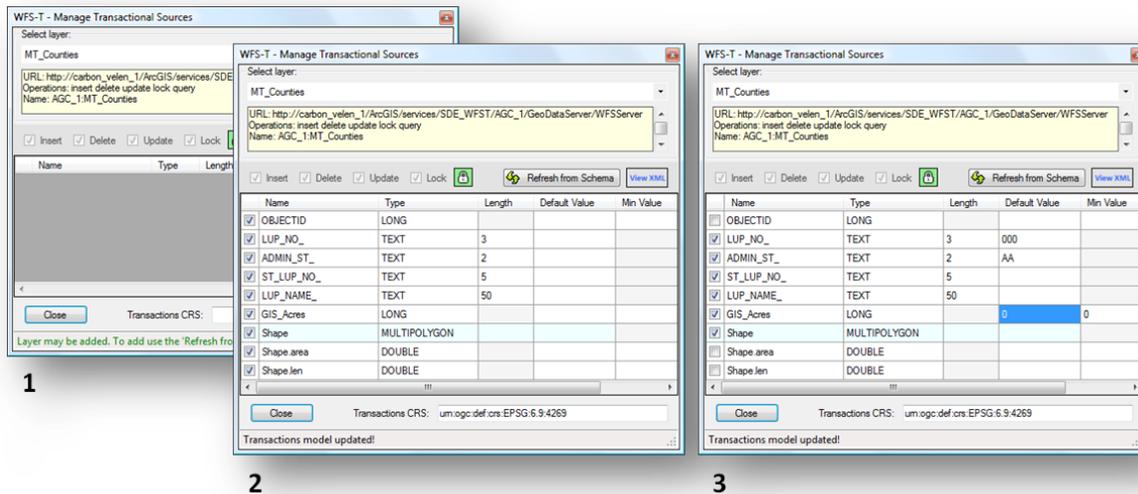


Figure 25: Configuring the feature layer

Step 2 – Insert new features

Now we may add a couple of new features. The first feature we are going to insert is a new county called Unity. Clicking on the “Insert” tool we will open the new feature panel and using the “Select” tool and while holding to CTRL button we choose three adjacent counties and create a unified geometry (see page 22 for more information about this technique).

We also add the “Unity” value to the appropriate property value cell. Note that some of the properties already have values based on the default settings specified in the configuration phase.

Figure 26 illustrates the process described. Notice that step 3 shows the added geometry using Gaia’s “Info” tool.

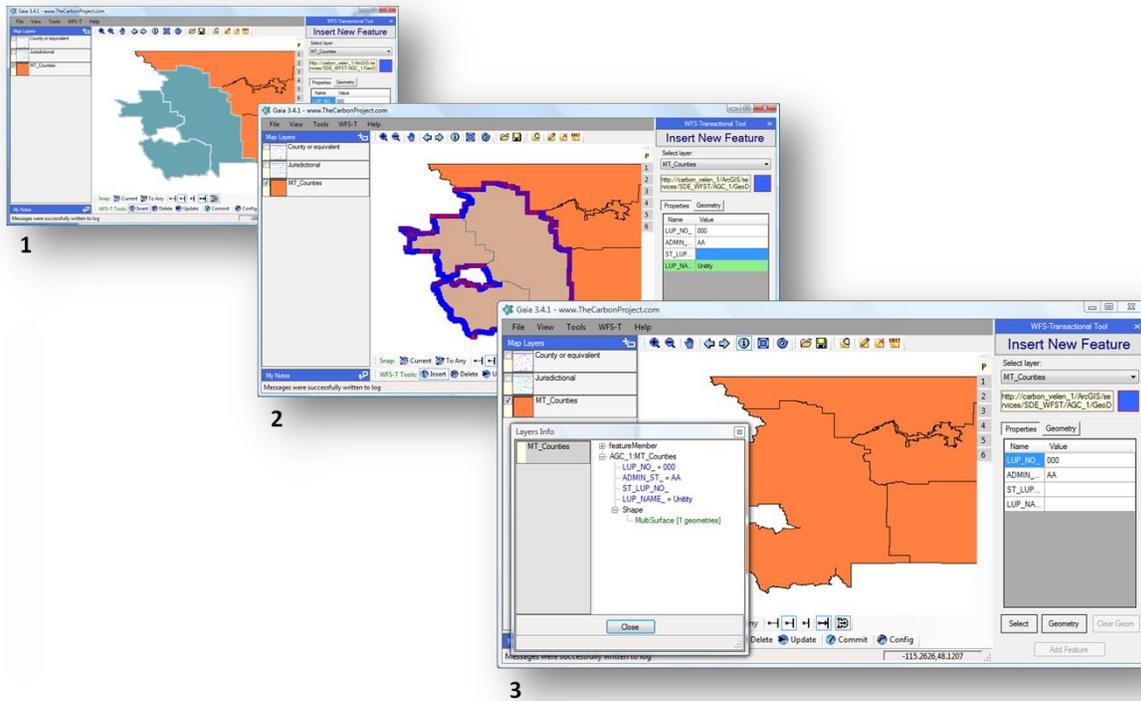


Figure 26: Adding a feature using the geometry copy and unification

Next we will add the county of Nexter which is adjacent to Unity County. In the table of properties trying to set 'GIS_Acres' property value of "-1" caused the table cell to be highlighted with a red background and a message informs that the value must be within the range allowed.

To generate the geometry we use the Snap tool with the fit-to-edge option enabled. We use this function to create the edge that is adjacent to the Unity County. Figure 27 illustrates the new geometry and the property changes as described (information on this technique is described on page 42).

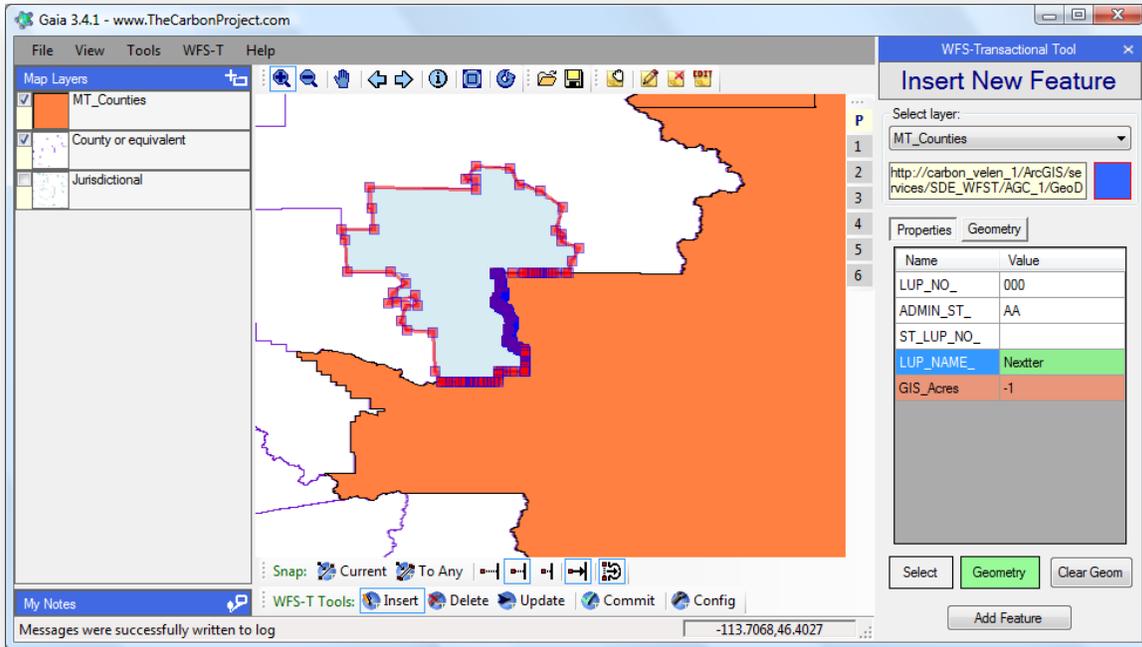


Figure 27: Adding a new feature using snap tools, with one illegal property value.

Step 3 – Committing the operations

We are now ready to update the WFS-T with the new features we created. Using the “Commit” button we open the tool panel and check the two operations. We can select the operations and view their corresponding feature geometries on the map (Figure 28). When the two operations are checked we can now begin the transaction operation by clicking the “Submit Transaction” button. The operation informs that two features are being inserted (Figure 29). Note that since no Update or Delete operations were made no locking of the database was needed and so the locking process did not take place.

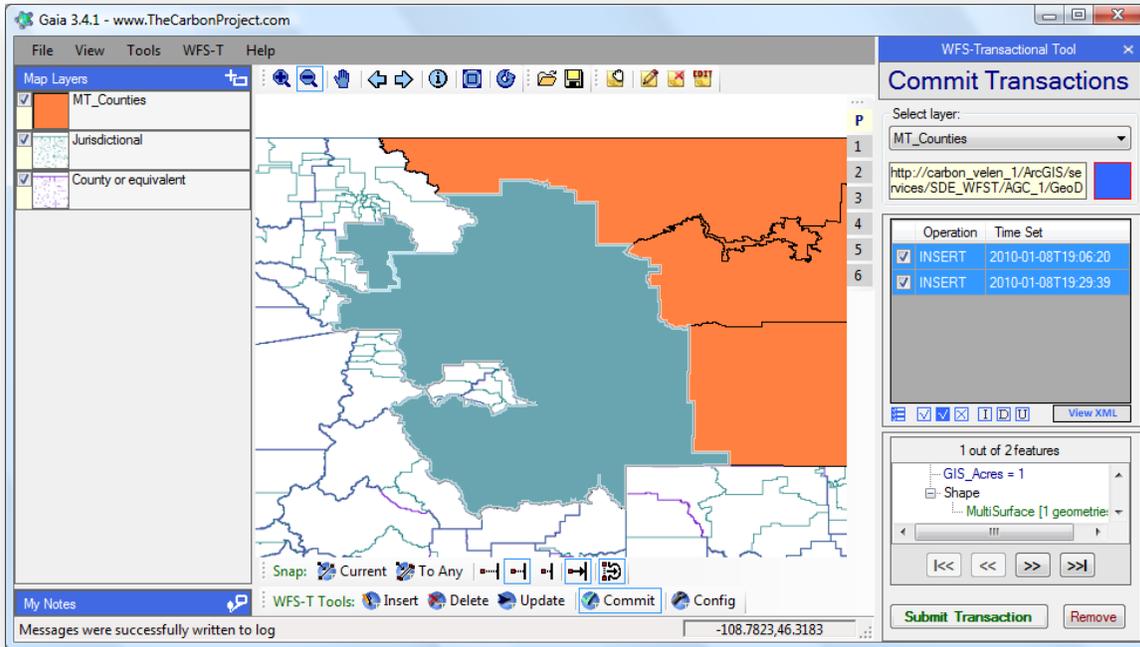


Figure 28: Selecting the operations to be used in the transaction

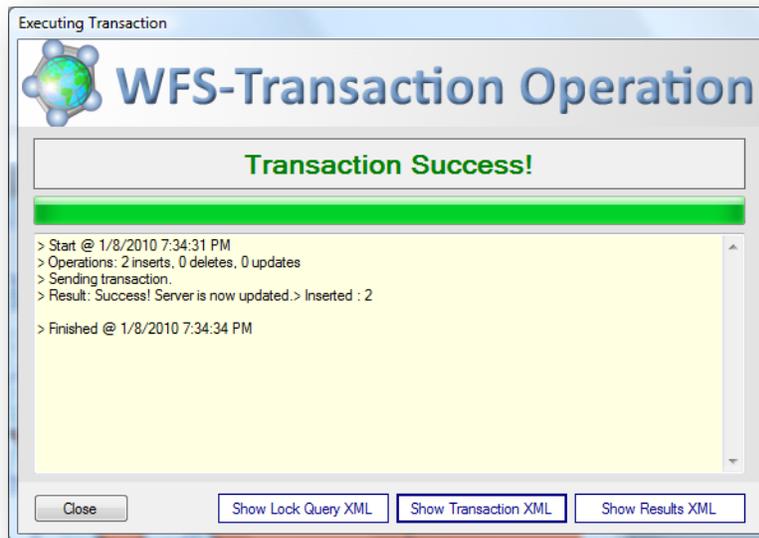


Figure 29: Transaction completed successfully