

Web-based Envision Tomorrow 1.0 Technical Documentation

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Background

Envision Tomorrow allows planners to create and evaluate multiple land use scenarios. The user changes the development type for selected parcels and views the effects of their scenario on a number of metrics. The web-based Envision Tomorrow application complements the desktop Envision Tomorrow by providing a simple user interface for displaying and editing your scenario over the Internet. Your scenario data can be transferred between the web-based and desktop Envision Tomorrow software. This is accomplished through a set of tools that allow you to upload and download data to and from the server, as well as tools to load data into the desktop Envision Tomorrow software.

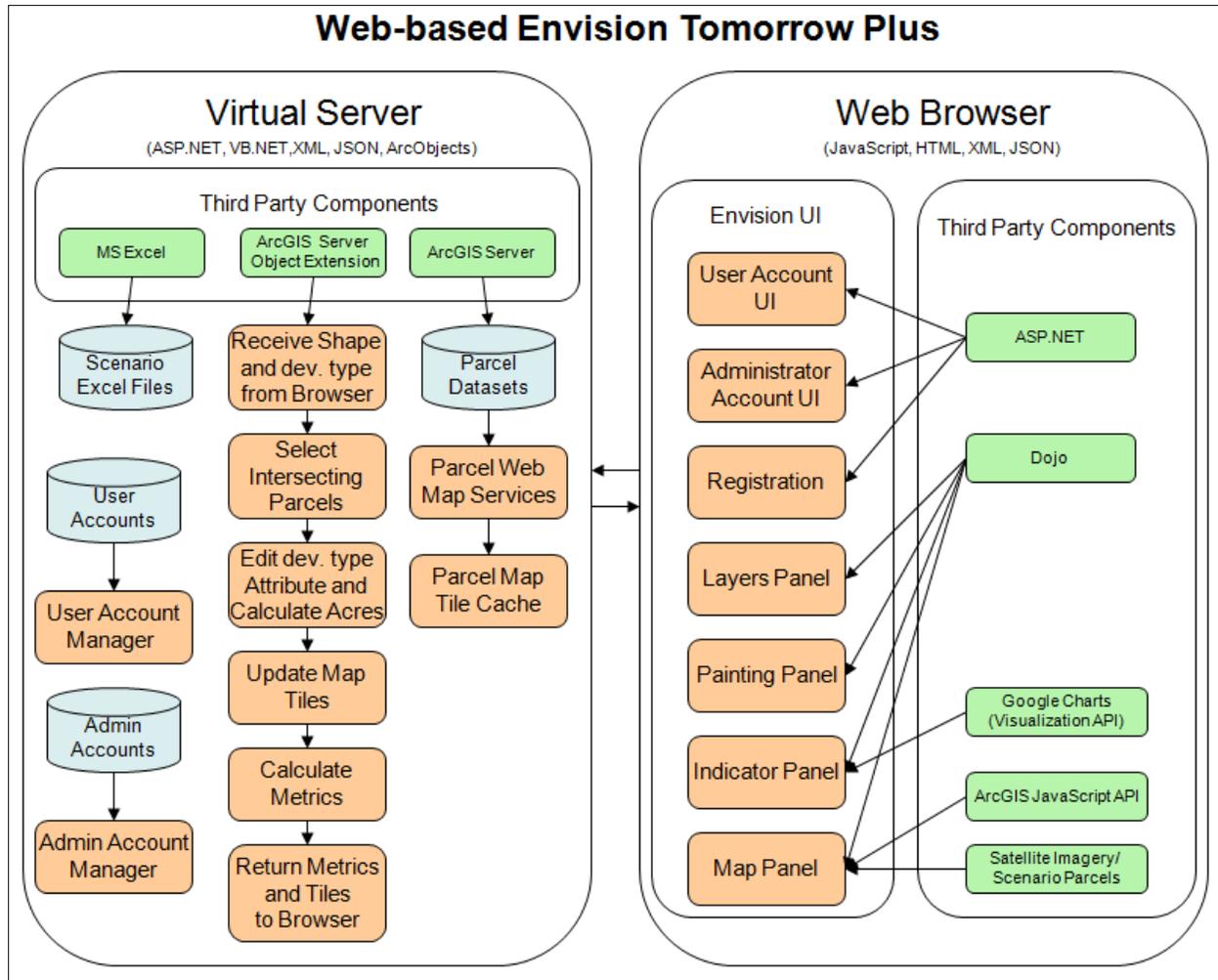
The desktop Envision Tomorrow is an ArcMap extension and toolbar that requires an ArcGIS local installation and license. The web based Envision tomorrow was created to make the application more accessible to users without GIS expertise. The web based version can be used independently of the desktop version, although there are fewer options in the web based version. To support users with advanced capabilities, the web based Envision allows downloading the edited scenario GIS dataset for use in the desktop version of Envision Tomorrow.

Web based Envision Tomorrow allows any user to register and create a scenario without any fees. A personal editable scenario data package is stored on the server for your use. You have exclusive access to this scenario through your login.

Design Overview

The web-based Envision Tomorrow Plus application is hosted on a Windows virtual with ArcGIS for Server 10.2 installed. The server side code is written using ASP.NET /VB.NET and utilizes ArcObjects for GIS functionality. ArcGIS for Server provides support for web map services. The client application runs in any standard web browser and utilizes JavaScript libraries for mapping and other functions.

Office 2007 is installed on the server to allow reading and writing to Excel files using automation. ArcObjects is utilized on the server to select polygons, edit polygon attributes, and calculates acres. The ArcGIS "Manage Map Server Cache Tiles" tool is used to update map tiles for the extent of the selected polygons. The ArcGIS JavaScript API library drawing tools allow the user to draw shapes on the map.



Windows Web Server

The web server for this application is a virtual server hosted at the Texas Advanced Computing Center (TACC). The operating system is Windows Server 2008 R2 (64 bit).

In addition to JavaScript and HTML running in the client browser, the application contains considerable code written in ASP.NET / VB.NET that runs on the server.

The server contains an install of Primary Interop Assemblies for Microsoft Office to allow reading and writing to Excel files. Microsoft SQL Server is installed and used to manage accounts and scenario data packages uploaded to the server.

ArcGIS for Server

ArcGIS for Server 10.2 is installed on the server to provide web map services for scenario GIS datasets. This version of ArcGIS Server has a new ArcGIS Server Administrator API. This API is used for automating the creation of a new web map service for each user account. The ArcGIS installation makes ArcObjects available for GIS functionality on the server. The ET software uses multiple Server Object Extensions written in VB.NET that run on the server in order to access ArcObjects functionality.

System Requirements

The web based Envision Tomorrow is publicly available at the following URL: <http://et.tacc.utexas.edu>. The application runs on any popular web browser, requires no plugins, and has no license or usage fees. Users need to register to create and edit a scenario.

Account and File Organization

Each user account gets a separate copy of the selected scenario GIS dataset to work with that is stored in a separate folder created when the account is set up. Since the layers are edited, there could be issues with multiple users logged in under the same account simultaneously editing the scenario. This is not the intended use or a likely scenario since each user should have a separate account.

Since we are allowing admin accounts to upload files, and user accounts to effectively make copies of files, the system could run out of disk space. If needed, we will add additional disk space to the web server.

Accounts are stored in a MS SQL Server database table on the server with the following fields:

- Username – The supplied username will be the name of the folder containing the user’s copy of the polygon dataset and scenario workbook.
- Password
- Email

A table called ETUsers stores user specific information with the following fields:

- UserName – The supplied username.
- PackageName – The name of the workbook/polygon dataset package selected. Blank if the package was not selected yet.
- WMSName – The name of the web map service created for this user. Blank if the package was not selected yet. This will also be the name of the folder containing the user’s copy of the polygon dataset and scenario workbook.
- Admin – True if admin account, false otherwise.
- NumScenarios – The number of scenarios for the account.

A table called ETPackages stores list of scenario workbooks/ polygon dataset packages in a MS SQL Server database table with the following fields:

- Name – The user supplied name of the package.
- FolderName – The system created folder name for the package. A folder will be created using this name and files will be stored under this folder.
- Description – A long description of the package.
- GeodatasetName – The original name of the polygon dataset uploaded for this package.
- ScenarioWorkbookName – The original name of the scenario workbook uploaded for this package.
- NumScenarios – The number of scenarios for the account.

A table called ETLayers stores a list of layers included in all maps in a MS SQL Server database table with the following fields:

- Name – The descriptive name of the layer.
- URL – The url to the ArcGIS Server REST endpoint for the layer.

Polygon datasets uploaded by administrators are converted to a file Geodatabase named “parcels.gdb” and a featureclass “parcels”. Scenario workbooks are renamed to “ET_Scenario.xlsx”. Scenario workbooks and polygon dataset packages are stored together in a separate folder on the server, using the FolderName field value from the table above. When the user selects a package, a copy of these files will be stored in the user folder (username) on the server. Scenario package and user account folders are stored in the App_Data folder of the application.

Administrator and User Accounts

In order to use the application, users need to create an account. There are two types of accounts, a normal user account, and an administrator account. There are no fees associated with any of the accounts. User accounts are available to the general public. To create a user account, users need to register at [http:// et.tacc.utexas.edu/pub/NewUser.aspx](http://et.tacc.utexas.edu/pub/NewUser.aspx). The process of only requires a user name, password, email, security question, and security answer. Users can create as many user accounts as they choose. After a new user account is created, users are asked to select a scenario data package from a list of uploaded packages.

Administrator accounts cannot be created like a user account. Currently, there is one administrator account with the following credentials: user name: “etadmin”, password: “dfop65rr@t”. If this login does not work, users need to get the latest login credentials from Fregonese Associates. The predefined administrator accounts are set up and shared with specific users for the purpose of managing users, uploading scenario data packages, and managing map layers. While logged in as an administrator users are not able to use the mapping and scenario editing interface.

Uploading a Scenario Data Package (administrators only)

When users login using an administrator account they are directed to the scenario data packages page. This web page allows users to upload and delete scenario data packages. A data package contains both

a scenario GIS dataset representing parcels, and an Excel workbook containing data and metric reports for your scenario.

The Excel workbook was developed by Fregonese Associates and contains several worksheets containing input data that can be modified. The input data defines the available development types as well as other values that will affect the output metric reports. The uploaded scenario Excel workbook is validated by the system to ensure it has the required data elements.

Preparing the scenario data package may require the use of ArcGIS Desktop and should be done by advanced users with GIS experience. There is a validation process to ensure the scenario GIS dataset and Excel workbook are in the correct format. The requirements for the scenario data package are:

- **Less than 100 MB.** The data package file should be less than 100 MB in size. This limit is meant to conserve system resources on the server.
- **Compressed file with a .zip extension.** The data package should be stored in a compressed .zip file. There is no requirement on the filename. You will be asked to browse your local system to locate the file before it is uploaded.
- **Contains 1 Excel workbook file with a .xlsm extension.** There should only be one Excel workbook file and it needs to have the .xlsm extension.
- **Contains 1 file geodatabase containing 1 polygon featureclass.** There should only be one file geodatabase (a folder ending in .gdb) and one polygon featureclass within this geodatabase.
- **Workbook and geodatabase are at the top level directory.** The Excel workbook file and the Geodatabase folder should be at the top level directory in the zip file.
- **Workbook and geodatabase are compatible with each other.** The Excel workbook and geodatabase files should be created for the same geographic area.
- **Workbook and geodatabase are for the latest version of Envision Tomorrow.** Both the Excel workbook and the geodatabase should be for the latest version of Envision Tomorrow.
- **Projecting the polygon featureclass to the WGS 1984 Web Mercator (Auxiliary Sphere) coordinate system will improve performance.** This is not strictly necessary but will improve performance in the map. This can be accomplished using the ArcGIS ArcToolbox application. Use the Project tool located under Data Management Tools – Projections and Transformations – Feature. The WGS 1984 Web Mercator projection is located under Projected Coordinate Systems – World.

Once the data package file is created, users can browse their system to locate the file in the data packages web page. Users will also need to specify a name and an optional description for the data package. The name and description will be displayed to users when they select their data package for use in their scenario. The “Upload Data Package” button will upload the package. This process may take a few minutes to complete. Users can upload as many data packages as they want.

The uploaded data packages will be used as a starting point for user scenarios. Users will select a data package for use with their scenario. Edits by users to their scenario will only be made to copies of the scenario data package files.

Managing User Accounts (administrators only)

When you login using an administrator account, you will be directed to the scenario data packages page. At the top of the page there is a “Users” link that takes you to the users page. This page displays the user name, data package name, and map service name for all user accounts. You can select a user by clicking the “Select” link for that user in the left column.

There are two buttons at the bottom of the page that apply to the selected user. The “Copy Data to Demo” button will copy the data from the selected user to the “Demo” user. All edits to the scenario made by this user will be included in the data copied to the “Demo” user.

The “Delete” button will delete the user account and all associated data and map services on the server. This process cannot be undone and should be used with caution. The purpose of deleting a user account is to allow cleaning up system resources used by old accounts no longer in use. Before deleting an account, it may be wise to create a backup of the user edits to the scenario by clicking the "Download Scenario Files" link at the bottom of the the user account page.

Managing Map Layers (administrators only)

When you login using an administrator account, you will be directed to the scenario data packages page. At the top of the page there is a “Layers” link that takes you to the layers page. This page displays the name, URL, and default visibility for each layer. Each of these values can be edited directly in the list by clicking the “Edit” link to the left of the layer.

You can click the “Delete” link to the left of the layer to remove the layer from the list. You can click the “Add New” button to add a new layer.

You can click the “Select” link to the left of a layer in order to place it in selected mode. After a layer is selected, you can click the “Move Up” or “Move Down” buttons to move the selected layer up or down in the list.

All layers are expected to be ArcGIS Server map services, and the system will verify this by checking that the url ends in “MapServer”. The layers can come from any ArcGIS Server that is publicly available. For example,

http://server.arcgisonline.com/ArcGIS/rest/services/Reference/World_Boundaries_and_Places/MapServer would be considered a valid layer url.

After you click the “Save” button, these layers will be available to all users and all scenarios. Users will only be able to specify which layers are visible in their maps, and these settings will be saved per user between browser sessions.

Selecting a Data Package

When you create a new user account you will initially be directed to the user account page. This web page will allow you to select your scenario GIS dataset and workbook from a list of data packages uploaded through the administrator account. You can select a package by clicking the “Select” link for

that package in the far left column. After you make your selection and click the “Create Scenario from Package” button, the contents of the data package will be copied to your account on the server. Map services will also be set up for your account using the selected data package. If the data package supports multiple scenarios, a copy of the scenario GIS dataset will be made for each scenario. This process may take some time so please be patient and avoid refreshing the browser during the process. When the process is complete, your selected package will be displayed at the bottom of the page.

Once you have created your scenario, you can delete the scenario by clicking the “Delete My Scenario” button. This process may take some time so please be patient and avoid refreshing the browser during the process. After you have deleted the scenario, you will then be able to select a data package again and create a new scenario. Note that only one scenario package can be selected at a time for each user account. To change the package used by your account, you need to delete the scenario first before creating a new scenario.

This same web page will also let you download the scenario files used by your account by clicking the “Download Scenario Files” button. The downloaded file will contain a scenario GIS dataset representing parcels, and an Excel workbook containing data and metric reports for your scenario. This data can be loaded directly into the Envision Tomorrow Desktop software application as needed. The downloaded file can also serve as an emergency backup of your work.

After you have created your scenario, a “Map” link will appear in the upper right corner of the web page. You can click this link to go to the scenario map user interface. The “Logout” link located next to the “Map” link will allow you to logout and login as a different user.

Scenario Map User Interface

The web map is built using the ArcGIS JavaScript API and the ArcGIS App Templates. This relies on the Dojo JavaScript library. The map displays the users parcel map symbolized on the development type field. The symbol colors and the list of available development types are stored in the Excel workbook and read by the ET software when the user creates their scenario. A template ArcMap document is edited during this process to define the symbols for the user’s scenario. This ArcMap document is used as the basis for a new ArcGIS server map service that is created for the user. For reference layers, we combine map services from ArcGIS Online and other sources.

The web map is fully compatible with all major browsers and requires no plugins. It is a thin client that strives to limit the size of the application source code that needs to be downloaded. The compact build of the ArcGIS JavaScript API was used as the starting point. The result is improved performance for the initial display of the map. After the first visit to the web site, the application components are cached locally for some time in order to improved performance in subsequent visits.

To provide expandable and collapsible panels we use the Dojo JavaScript framework with the ArcGIS JavaScript API. The painting and layers panels are combined as separate tabs in a single panel in order to maximize space available for the map.

Web map layers consist of tiled map images stored in a server side cache as well as a local browser cache. This results in improved performance over time when panning and zooming in the map.

The scenario map user interface will appear immediately after you login and after you have selected a scenario data package. To go to the account page, click the “Account” link in the upper right corner of the map page. The “Logout” link located next to the “Account” link will allow you to logout and login as a different user.

The map page contains three sections or “panels”. The section on the left contains the painting and layers panels combined as separate tabs on a single panel. This allows you to choose a drawing tool and development type, as well as turn layers on and off. The section in the center contains a map where you draw in order to change the development type for selected parcels. The section on the right (metrics or indicator panel) displays metric reports updated for the changed development types. Both of these panels can be resized or collapsed. The painting, layers, and metrics panels are described in more detail below.

A slider tool at the top right of the map allows you to change the transparency level of the parcels map in order to see the satellite imagery behind it. You can navigate the map in the following ways:

- The upper left corner of the map contains a tool with plus and minus buttons. Click the plus button to zoom in, and click the minus button to zoom out.
- Hold down the <Shift> key and draw a rectangle using the left mouse button. The map will zoom in to the specified rectangle.
- Double click the map to zoom in.
- Using the mouse scroll wheel, scroll back to zoom out, and scroll forward to zoom in.
- Click and drag with the left mouse button to pan the map. This will change the viewing area of the map.

If you are having trouble navigating the map, you may need to click the “Navigate Map” button at the top of the painting panel. This will take the map out of painting mode and into navigate mode.

If your account supports multiple scenarios, a scenario dropdown list will be displayed above the map. You can select the scenario that you would like to view or edit from this list.

Specifying Layer Visibility with the Layers Panel

The layers panel is one of two tabs on the resizable and collapsible panel to the left of the map. This panel displays a list of possible layers in the map. All layers can be turned on or off by selecting or deselecting the checkbox. These layer visibility settings will be saved on the server and restored the next time you open your map. The layer visibility settings apply to all scenarios for your account. For example, if you change the visibility of a layer in scenario 1, it will also be changed for scenarios 2 through 5. The order in which the layers are listed in the layers panel is the same order in which the layers are stacked in the map.

You can change the width of the layers and painting panels by holding the mouse pointer over the border between the left panel and the map until the mouse pointer changes to indicate resizing mode. Click and drag the mouse to move the position of the border left or right. You can also collapse the panel by clicking the small collapse icon in the upper right corner of the panel.

Editing Your Scenario with the Painting Panel

The “painting” panel is located to the left of the map. This panel allows you to select a drawing tool (paint brush) and development type (paint color). The drawing tool dropdown list at the top of the panel contains tools to draw the following shapes on the map:

- Freehand Polygon. Draws a polygon without the need to click for each polygon vertex. The shape of the polygon follows the mouse pointer position as you move the mouse over the map.
- Polygon. Draws a polygon by letting you specify each vertex. You will need to double click to finish the polygon.
- Freehand Polyline. Draws a polyline without the need to click for each vertex. The shape of the line follows the mouse pointer position as you move the mouse over the map.
- Polyline. Draws a polyline by letting you specify each vertex. You will need to double click to finish the polyline.
- Line. Draws a single straight line between two points you specify on the map.
- Point. Draws a point on the map with a single mouse click.
- Multipoint. Draws multiple points in one step. You will need to double click to stop adding points. Note that this tool is more efficient than the point tool when you need to draw multiple points with the same development type. All the points are sent to the server in one step, avoiding the need for multiple scenario edits on the server.
- Rectangle. Draws a rectangle by clicking and dragging with the left mouse button.
- Circle. Draws a circle by clicking and dragging with the left mouse button.

Each drawing tool has a unique behavior during the drawing process. While you are drawing on the map, a tooltip next to the mouse pointer will display helpful hints regarding the drawing process.

The list of development types, and the colors used for each type, come from the Excel workbook. To select a development type, click anywhere within the row for the type you want. The row will appear selected. To get further information on a development type, hold the mouse pointer over the information button in the far right column. The following information is provided:

- Housing Units / Gross Acre
- Jobs / Gross Acre
- Mixed Use Score (Entropy)
- Redevelopment Rate

After the drawing tool and development type are selected, you can “paint” on the map to change the development type for parcels overlapping the shapes you draw. This process involves back and forth

communication with the server for each shape you draw. The overlapping parcels change color to the selected development type. This is done using a temporary feature layer created for each paint process. The user drawn shape and selected development type (color) are sent to the server for processing. The server edits your scenario and sends back updated metrics. The updated metrics are displayed in the metrics panel to the right of the map. The parcel map is then updated from the server to include your edits, and the temporary feature layer is removed. Server processing information is displayed below the drawing tool dropdown list. At any time during the painting process, you can change the drawing tool or the development type.

To allow zooming and panning the map, click the “Navigate Map” button at the top of the panel. This will turn off painting mode and turn on navigate mode for the map. To take the map back into painting mode, select a drawing tool or a development type.

You can change the width of the layers and painting panels by holding the mouse pointer over the border between the left panel and the map until the mouse pointer changes to indicate resizing mode. Click and drag the mouse to move the position of the border left or right. You can also collapse the panel by clicking the small collapse icon in the upper right corner of the panel.

Painting Process

The painting process consists of the following steps:

1. User picks a drawing tool (brush type or shape type) and paint color (development type) from the painting panel.
2. User draws a shape on the map.
3. Browser application displays a message below the drawing tool dropdown list that the scenario is being edited.
4. The shape and development type are sent to the server from the browser application.
5. Server selects polygons in the featureclass using the shape that was drawn on the map.
6. Server loops through the selected polygons, edits the development type attribute, and calculates total acres.
7. Server opens the user’s scenario workbook and edits the total acres value for the specified development type.
8. Server reads the new output of the scenario workbook.
9. Server empties the tile cache for this scenario’s map service.
10. Server returns the scenario outputs to the browser application.
11. Browser application displays the scenario outputs in the indicator panel.
12. Browser application forces an update to the map tiles. The local browser tile cache will essentially be invalidated so that the new updated tiles will be loaded from the server.
13. Browser application will close the working indicator.

The painting process is handled in an asynchronous manner. This means that after the user paints on the map, the information will be sent to the server and before the server returns the results, the user can continue to interact with the application.

Scenario Development Process Flow Review

Since each development type is displayed on the map with a unique color, the process of editing the development types is comparable to “painting” the map. This process consists of the following steps taken by the user:

14. Select a drawing tool. This is the “brush” type or the type of shape you will draw.
15. Select a development type. This is the “paint” color.
16. Draw on the map over the parcels you want to edit.

The application will process this information and make the following changes:

- Change the colors of the parcels that overlap the shape you drew on the map. Parcels are changed to the color of the selected development type.
- Update the metrics displayed in the panel to the right of the map. Your edits are sent to the server, and the server processes the data and sends back updated metrics.

You can repeat steps 1 -3 as many times as you want. You don't need to reselect the drawing tool or development type unless you want to change them. At any time, you can also click 'Navigate Map' to change from painting mode to map navigation mode, so you can zoom and pan the map. If you are in map navigation mode, you need to reselect a development type or drawing tool in order to return to painting mode.

Viewing Metrics in the Indicator Panel

The metrics or indicator panel is located to the right of the map. This expandable and collapsible panel displays tables and charts for metrics on your scenario.

After you edit parcel development types using the painting panel, the information on the changed parcels is sent to the server and processed with calculations in the scenario workbook. The server will calculate updated metrics which are sent back to the user. The tables and charts in the metrics panel will be updated based on this information. Every time you draw on the map to change parcel development types, the metrics are recalculated and updated in the metrics panel.

The charts in the metrics panel are created with the free Google Visualization API. Server side code reads a list of all charts in the Excel file. The name of the chart, chart type, and current series values are sent to the browser in a JSON object. JavaScript code in the browser creates the charts using the Google Visualization API.

You can change the width of the metrics panel by holding the mouse pointer over the border between the metrics panel and the map until the mouse pointer changes to indicate resizing mode. Click and

drag the mouse to move the position of the border left or right. You can also collapse the panel by clicking the small collapse icon in the upper left corner of the panel.

When you click the “View Metrics” button, the same metrics that are in the metrics panel are displayed in a separate browser window, and the metrics panel is automatically collapsed. This option is provided as an alternative to the metrics panel to maximize the map viewing area on displays with small screen resolutions. It also provides greater screen width to improve the display of charts. If you have multiple monitors on your system, it is useful to have a separate metrics window on one monitor and the main map interface window on the other. With the metrics panel collapsed there is more screen space for the map. The separate metrics browser window is automatically updated in the same manner as the metrics panel as you edit your scenario.

Demo Map

A demo map is available for public use at <http://et.tacc.utexas.edu/pub/DemoMap.aspx>. This map requires no login and can be edited in the same manner as a user scenario. The demo map does not allow viewing account information.

Web Map Service Strategy

Most web map layer services send static cached .jpg or .png files to the client browser. These image files are simply displayed in the map as is. This means the client browser does not know anything about the shape of polygons displayed in the map. It is also possible to create what is called a vector layer. The vector layer is built in the browser application using information stored in a kml or GeoJSON file. These web map layers download and store feature vertices in the client browser. Since the Envision Tomorrow application requires the user to select and change the color of individual polygons, a vector layer would allow the selection process to be performed in the client browser. In addition, acres could be calculated and polygons could be redrawn using the selected color inside the browser without the need to contact the server.

For the above reasons, we originally thought it made sense to use a vector layer for the web based Envision application. However, there are performance issues (depending on system resources) with polygon vector layers in a browser that have more than 1000 polygons, or about 10,000 total vertices. Performance can be so poor as to make the application unusable. This issue was recently investigated by Kingbird Software. We realized that polygon layers containing as many as 200,000 polygons would not be unusual. We thoroughly researched some ways to get around this performance issue, such as simplifying the polygons, limiting the zoom level at which the polygon layer was visible, etc. Although the performance issue is likely to improve over the next few years, at this point the specified workarounds would have to be employed in order to use the vector layer strategy.

The above mentioned workarounds were thoroughly researched. We determined that there would be a considerable level of effort required to implement the workarounds. In addition, the workarounds would result in reduced functionality and usability of the application for its intended purpose. We were

also made aware that the University of Austin is providing an ArcGIS Server license at no cost for use with the application. The use of ArcGIS would make it much easier to select and modify the polygons, to use polygon datasets other than shapefiles, and to also update web map service tiles on the server. Furthermore, the server would still need to be contacted for calculating the scenario outputs through the workbook based on the changed polygons. This minimizes the vector layer advantage of being able to select and change the color of polygons without contacting the server. For these reasons, we determined it would be better to use a web map service that sends tiled images to the browser rather than a vector layer.

A web map service is created automatically for each user using the ArcGIS Server Administrator API. This API is new for ArcGIS version 10.1 and provides complete control over managing web map services through automated methods. The service is created immediately after a user creates a new account and selects a polygon dataset. A tile cache is created on the server for the service. The tile cache will manage tiled images for a set of zoom levels that correspond to the zoom levels of the reference layers (Google, OpenStreetMap, etc.)

The web map service is based on the featureclass created in a file Geodatabase and stored in the user's folder. The service is further defined through an ArcMap document that references the featureclass. The ArcMap document will define the symbology and other layer properties. For the best overall appearance, these properties are customized for each zoom level in the web map service.

ArcGIS Feature Layer vs. ArcGIS Tiled Map Service

The newest version of ArcGIS Server (version 10.2) includes enhancements to vector layer (called feature layers) performance. For more information on these enhancements see the following discussions:

- <http://blogs.esri.com/esri/arcgis/2011/06/06/out-of-the-box-vector-tiling-using-feature-layers/>
- <http://blogs.esri.com/esri/arcgis/2011/06/13/feature-layers-can-generalize-geometries-on-the-fly/>
- <http://blogs.esri.com/esri/arcgis/2011/06/29/high-performance-web-apps-with-big-datasets-as-feature-layers/>
- <http://blogs.esri.com/esri/arcgis/2011/06/23/determining-limits-for-map-graphics/>

The above discussions made ArcGIS feature layers seem promising enough to justify further investigation and testing. A parcel dataset for San Diego County with around 260,000 polygons was used to test performance. An ArcGIS map service was created on the ET server. This same map service was used for creating both a tile map service layer and a feature layer in a browser based map. Two separate maps were created to demonstrate the differences in performance. The tile map service layer test application is located at <http://et.tacc.utexas.edu/ETMapDrawMapService.html> and the feature layer test application is located at <http://et.tacc.utexas.edu/ETMapFeatureLayer.html>. Both maps contain an ESRI image and reference base map with parcels displayed in green.

Performance is noticeable slower with the feature layer map, especially when zooming out from the initial map scale. You will also notice that the feature layer map is missing parcels in some areas when zoomed out. This is because the ArcGIS map service has a setting to define the maximum number of features that are downloaded to the browser client in a single request. ArcGIS developers set the default value for this setting to 1000 because they were aware of performance issues that result when more than 1000 polygons are downloaded. In order to test the potential for retrieving more than 1000 polygons at a time, I increased the value of this setting to 10,000. This increase resulted in the map displaying more polygons (less missing parcels), but also resulted in much poorer performance. Since the goal is to support layers containing up to 200,000 polygons, it is clear feature layer performance will be an issue, especially with small map scales (zoomed out). Performance is especially poor with the Internet Explorer browser, but is also unacceptable in other browsers such as Google Chrome and Mozilla Firefox.

It may still be possible to use a combination of feature layer and tile map service layers, where painting is only allowed at large map scales and a tile map service layer is used for smaller scales. However, this would result in a more complex application requiring software to support both layer types. Also, since the performance problem with feature layers is related to client computer specifications and browser type, it would be difficult to determine which map scales to use for painting. In addition, because of the differences in average parcel size between municipalities, it would be difficult to determine through software what map scales do not exceed the maximum number of polygons allowed. For these reasons, the ArcGIS feature layer will not be used for the Envision Tomorrow application.

Development Process

A remote administrator login is provided to this virtual web server for development and maintenance. Development is done primarily on Kingbird Software computers with periodic updates posted to the server for testing and review. Kingbird Software works closely with Fregonese Associates during the development process with frequent opportunities for testing and feedback during the stages of development. The application includes both server side and client side code. The server requires an ArcGIS Server license.

Security Changes on ET Server

- Followed instructions at <http://prashantd.wordpress.com/2011/03/31/retrieving-the-com-class-factory-for-component-with-clsid-00024500-0000-0000-c000-000000000046-failed-due-to-the-following-error-80070005/>

Retrieving the COM class factory for component with CLSID {00024500-0000-0000-C000-000000000046} failed due to the following error: 80070005.

Posted on March 31, 2011

The issue has been resolved . It was permissions issue on COM Components. As It was 64 bit OS the steps are a bit different:

1. Start run -> cmd as administrator
 2. Type: MMC comexp.msc /32 :- to open DCOM settings for 32 bit applications
 3. Right click on My Computer and select Properties
 4. Select COM-Security Tab
 5. In Access Permissions click on EDIT DEFAULT button and give permissions to "et\arcgis" account and same for Launch and Activation Permissions
- To fix issue with saving the Excel file I followed the instructions from <http://social.msdn.microsoft.com/Forums/en-US/Vsexpressvb/thread/b6388275-b295-4e55-8c25-6d8788eac1ca/> from cloud45:

Fixing permissions (Windows server 2008). Windows 2008 Server x64

- Please make this folder:
 - C:\Windows\SysWOW64\config\systemprofile\Desktop
- And give write permissions to the "arcgis" user in these folders:
 - C:\Windows\SysWOW64\config\systemprofile\Desktop
 - C:\Windows\SysWOW64\config\systemprofile\AppData\Roaming\Microsoft
 - C:\Windows\SysWOW64\config\systemprofile\AppData\Local\Microsoft
- C:\inetpub\wwwroot\App_Data:

Security changed to add full control to ET\arcgis (ArcGIS Administrator Account) so that the paint SOE can edit files in this folder.

TACC Server Remote Desktop Login procedure

Following these steps to login with remote desktop:

1. RDC to et.tacc.utexas.edu. Login with your TACC credentials. Use PRODUCTION\<>user name> for the user name, and then enter your password.
2. Once connected to the Envision Tomorrow VM, you will need to logon using your RSA credentials. If you have not setup your PIN, enter the 6 digit tokencode on the key fob in the PASSCODE field. The Windows system will then prompt you to set your PIN at this point. Your PIN + tokencode is your passcode from now on. You will login with your username and passcode. Note, this step will timeout before authentication unless you move the mouse in the window while waiting.
3. Next, you will be prompted to enter your Windows password. This is your TACC account password, same as step 1. The first screen is just an OK button. After pressing OK, then enter your password.

Performance improvement ideas:

- Consider using low isolation for the map service instances. See http://webhelp.esri.com/arcgisserver/9.2/java/manager/administration/accom_users.htm for other ideas.
- Try accessing the featureclass for editing directly through `Imapserverdataaccess (directcast of serverobjecthelper.serverobject)` instead of editing a copy of it.
- Try using codes instead of long text for dev types to improve performance. If performance is poor on saving featureclass, I could use a code for the devtype field and a lookup table created when the service is created. I think this is a minor performance issue (small fraction of a second for the save process).
- Call Excel validate function only after initial set up and store the start and total cell locations in a database/xml. I may want to test performance of this to see if this would help. The initial SOE call after browser refresh is always slower than subsequent calls. I should test to see why this is and if anything can be done.
- Look into editing the grids for the spatial index on the featureclass.
- Design for strategy to allow draft editing without saving (no metrics) and a save and "save and close" buttons to send the edits to the server. We just need to modify the soe code to accept edits in batch mode. It would include an additional parameter (or figure it out on its own) to specify batch edits. We could just put everything we currently have in json list and modify the code to handle the list. This should not affect performance much. We would need to track in the javascript the edits (dev type and geometry), and also allow an undo button. The features would be downloaded into the browser and displayed as a featurelayer in selection mode. We would use multiple featurelayers since each layer can only have one fill symbol. We could also leave the graphic and allow the user to select the graphic on the map, or select it in a list (and highlight on map) to undo/delete. This would improve effective overall performance when users don't need to see the metrics immediately, and would not invalidate the server tiles.
- The first time a scenario is edited in a day, it is slower to run the SOE. This may be because the SOE needs to be created, or because of the validation of the Excel? Review and test this.
- Provision more memory to `et.tacc.utexas.edu`. Also faster CPU, etc? Ask Tomislav.

Miscellaneous

- **TACC Portal Account (use Envision server login):** <http://portal.tacc.utexas.edu>
- **Institution on account:** CAPCOG (<http://www.capcog.org/divisions/regional-services/cats/>)
- **Public website:** <http://et.tacc.utexas.edu> or <http://et.production.tacc.utexas.edu> or 129.114.61.5. It needs to have "et" and can't have "www".
- **ET ArcGIS Server Administrator Directory:** <http://et.tacc.utexas.edu:6080/arcgis/admin>. This provides an ESRI user interface for managing the ArcGIS Server. You can use this to delete unneeded map services, or update server object extensions.
- **ET Server Specifications:**
 - a. Windows Server Enterprise 2007, Service Pack 2
 - b. Processor: Intel Xeon CPU, X5650 @ 2.67GHz 2.66 GHz (4 processors)

- c. Memory (RAM): 4.00 GB
- d. System Type: 64-bit Operating System
- **ET Server Software Installed:**
 - Microsoft Office Professional 2007 (Excel)
 - Microsoft SQL Server 2008 RS (64-bit)
 - ArcGIS 10.2 for Server
 - Microsoft .NET Framework 3.5 SP1