

Improving Access to GIS Data With Targeted Web Apps

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Improving Access to GIS Data with Targeted Web Apps

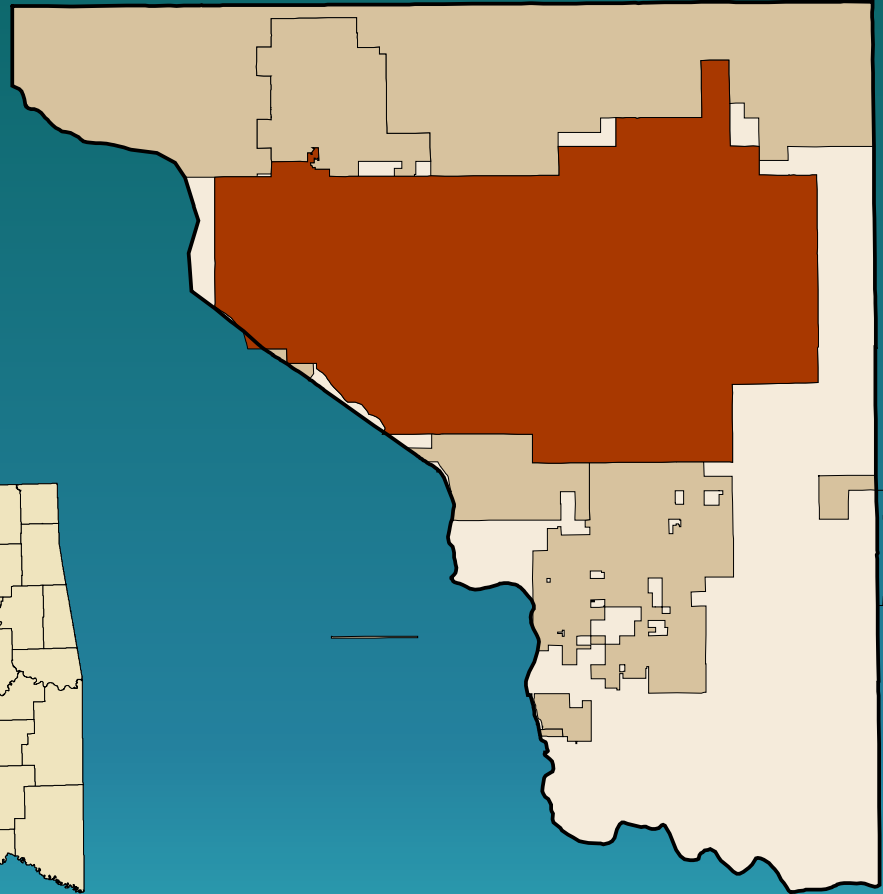
- Background
- Objective
- Development Environment
- Development Strategy
- Challenges
- Current Status
- Future Plans

The Setting...

Oklahoma in USA...



Norman in Cleveland County...



Cleveland County in Oklahoma...



The Setting

- Third largest city in Oklahoma
 - Land Area ~ 189 Square Miles
 - Population ~ 115,000
 - Home of the University of Oklahoma
 - ESRI User Since 1992



GIS Profile – Beginning of Project

- Version of ArcGIS before project: 9.2
- Enterprise ArcSDE for SQL Server
- External web apps: ArcIMS
- No internal web apps
- Number of ArcGIS Desktop users: 80+
- Third party applications: 2
 - Cityworks by Azteca
 - CrimeView by Omega

Project Objective

- **Provide easy to use targeted web apps to access GIS data**
 - **Replicate business practices in web browser**
 - **Minimize the number of ArcGIS Desktop installs**
 - **Maximize the number of users of GIS data**
 - **Minimize the amount of training required**

Development Environment - System Overview

- **Two Systems**
 - **ArcGIS Production Server**
 - Internal use only
 - Supports:
 - Desktop users
 - Web maps to support City business practices
 - Third party applications
 - **DMZ**
 - External
 - Not linked to production server
 - Supports
 - Externally facing web maps
 - External access to City GIS data through map services

Development Environment - System Architecture

- **Servers – VMware vSphere**

- **Production**

- **ArcGIS Server Enterprise 10.1 and IIS**

- Windows Server 2008 R2 Datacenter
- 8GB RAM,
- 80GB hard drive

- **Database Server ArcSDE on SQL Server 2008**

- Windows Server 2008 R2 Datacenter
- 8GB RAM,
- 80GB & 800GB hard drives

- **DMZ**

- **ArcGIS Server Workgroup, IIS, and Sequel Express database**

- Windows Server 2008 R2 Datacenter
- 12GB RAM
- 80GB, 500GB, 600GB hard drives

Development Environment: Platform

- **ArcGIS API for Javascript**
 - Started with version 3.5 and “legacy” style coding
 - Now using version 3.9 with the AMD style coding
- **Use ESRI hosted APIs for both versions**
- **Other libraries**
 - **Shp-write**
 - Javascript library to read and write shapefiles
 - **JSZip**
 - Javascript library to read, write and edit zipfiles
 - **XLSX**
 - Javascript library to read, write and edit Excel (xlsx) files

Development Strategy

- **Server initialization**
 - **ESRI Jumpstart**
 - Installed software
 - Assisted with initial services
 - Gave advice on data loading
 - **IT Department**
 - Built servers
 - Set up domain
 - **Third party vendor**
 - Upgraded Cityworks software from desktop to server
- **Application Development**
 - In-house by GIS staff

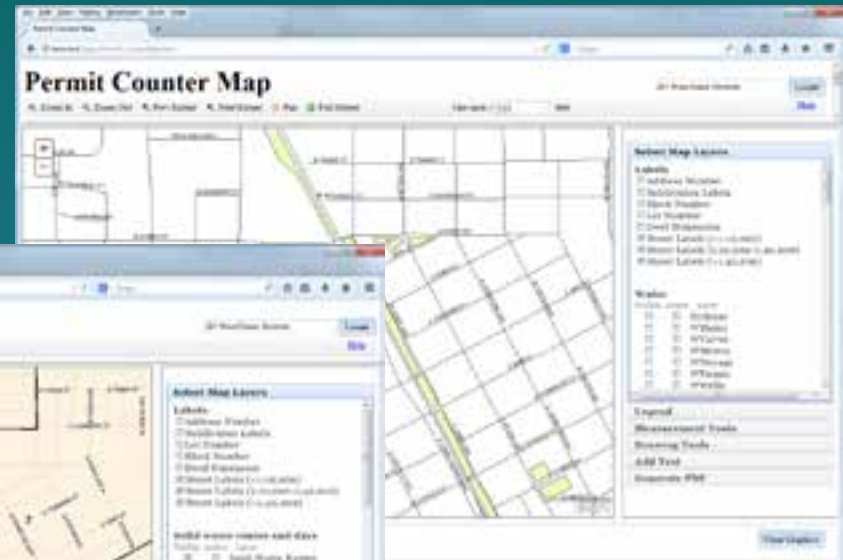
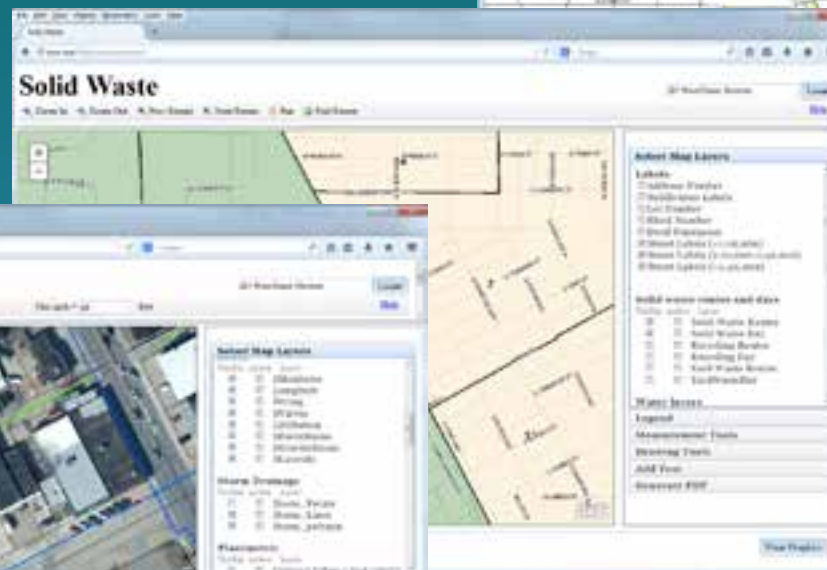
Application Development

- Design considerations
 - Customer expectations



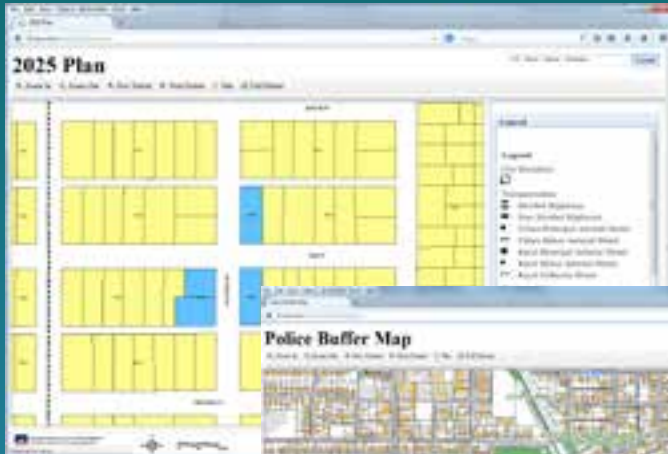
Application Development

- Design Considerations
 - Business practices of workgroups
 - Performance



Application Development

- Design considerations
 - Focused tasks



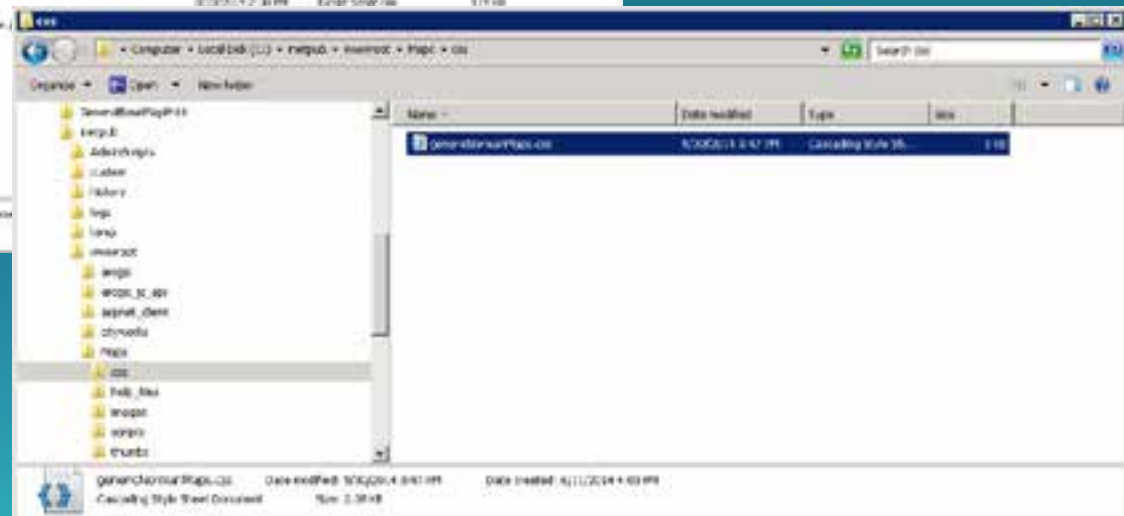
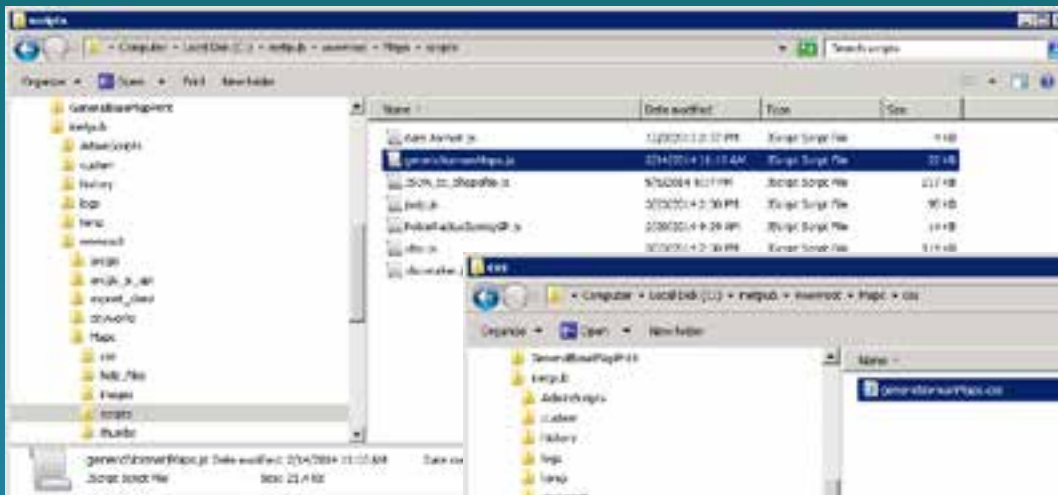
Application Development

- Approach
 - Learn by example
 - Forums
 - ArcGIS API for JavaScript
- Bluefish Editor
 - Javascript development
 - Open source
 - Used by IT department
- IDLE Editor
 - Python scripts



Application Development

- Modular design
 - Shared css
 - Shared JavaScript functions



Application Development

- Example of generic JavaScript functions

```
31 | function getCurrentScaleInchesToFeet(){
34 |     var theScale = null;
35 |     try {
36 |         theScale = Math.round(map.getScale()/12);
37 |     } catch(err) {
38 |         alert(err);
39 |     }
40 |     return theScale;
41 | }
42 |
43 | function zoomToScaleInchesToFeet(selectedScale){
44 |     ratioScale = selectedScale*12;//convert to ratio scale
45 |     map.setExtent(esri.geometry.getExtentForScale(map, ratioScale));
46 | }
47 |
48 |
49 | function activateTool(type){
50 |     ExportSelectionToolbar.activate();
51 | }
52 |
53 |
54 | function buildExtractFormatLayerList(mainMapService) {
55 |     var currentHeader = "";
56 |     var items = dojo.map(mainMapService.layerInfos, function(info, index){
57 |         if (MainMapServiceLegendHeaderNums.indexOf(info.id)>=0){
58 |             currentHeader = info.name + "\n";
59 |         }
60 |         theLayer = currentHeader + "\\* " + info.name;
61 |         layerNames.push(theLayer); //Layer name list used for the data extract
62 |     });
63 | }
64 |
65 | function buildLayerList(mainMapService) {
66 |     buildExtractFormatLayerList(mainMapService);
67 |     var items = dojo.map(mainMapService.layerInfos, function(info, index){
68 |
69 |         for (var i = 0; i < MainMapServiceLayerNums.length; i++) {
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```


Application Development

- **Services built on geoprocessing tasks**
 - Extract and export data
 - High quality printing
 - Export webmap
- **Customized from ESRI tutorials and models**
 - Clip and ship
 - Advanced high-quality web map printing/exporting



Application Development

- HTML

- Designed for easy editing and customization.
- User defined parameters as variables at top

```
28 ////////////////////////////////////////////////////
29 //Define map services and layers to be used
30 ////////////////////////////////////////////////////
31
32 var hairMapServiceURL = "http://terra:6080/arcgis/rest/services/ServicesForWeb/PermitCounter_web/MapServer";
33 var printServiceUrl = "http://terra:6080/arcgis/rest/services/ServicesForWeb/ExportWebMap/GIServer/ExportAIGWeb";
34 var locatorServiceURL = "http://terra:6080/arcgis/rest/services/CompositeAddressLocator/GeocodeServer";
35 var geometryServiceURL = "http://terra:6080/arcgis/rest/services/Cutilities/Geometry/GeometryServer";
36 var dataextractionServiceURL = "http://terra:6080/arcgis/rest/services/ServicesForWeb/ExtractDataTask_web/GPSer";
37
38 var printTemplateID = "CurrentPlanning";
39
40 var imageLayerInfoArray = [
41   ["2013-Citywide", "http://maps.normanok.gov/arcgis/rest/services/AerialPhoto2013/ImageServer"],
42   ["2010-Citywide", "http://maps.normanok.gov/arcgis/rest/services/AerialPhoto2010/ImageServer"],
43   ["2007-Urban", "http://maps.normanok.gov/arcgis/rest/services/Imagery/AerialPhotoHalf2007/ImageServer"],
44   ["2005-Urban", "http://maps.normanok.gov/arcgis/rest/services/Imagery/AerialPhotoHalf2005/ImageServer"],
45   ["2001-Urban", "http://maps.normanok.gov/arcgis/rest/services/Imagery/AerialPhotoOneFt2001/ImageServer"],
46   ["1997-Urban", "http://maps.normanok.gov/arcgis/rest/services/Imagery/AerialPhotoOneFt1997/ImageServer"],
47   ["2007-Rural", "http://maps.normanok.gov/arcgis/rest/services/Imagery/AerialPhotoOneFt2007/ImageServer"],
48   ["2005-Rural", "http://maps.normanok.gov/arcgis/rest/services/Imagery/AerialPhotoOneFt2005/ImageServer"],
49   ["2001-Rural", "http://maps.normanok.gov/arcgis/rest/services/Imagery/AerialPhotoTwoFt2001/ImageServer"],
50   ["1997-Rural", "http://maps.normanok.gov/arcgis/rest/services/Imagery/AerialPhotoTwoFt1997/ImageServer"]
51 ];
52
53
54 var hairMapServiceLayerNums = [15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40, 41];
55 var hairMapServiceLegendHeaderNums = [15, 23, 32, 37, 40, 41, 45, 70];
56 var annotationLayerNums = [1, 3, 5, 7, 9, 10, 11, 14];
57 var annotationvisible = [10, 11, 14]; //visible at startup
58
59
60 var extractSpatialReference = {"wkid":1011};
61 var loadingImage = "images/loading.gif";
62
63
64 var initialScale=600; //Feet to inch
```

Challenges

- Asynchronous processes
- Syntax changes between legacy and AMD JavaScript APIs
- Designing modular services
- System performance

Challenges - Asynchronous Processes

- **Combining asynchronous processes**
 - **An example – An application to estimate proposed fees stormwater fees based on the amount of impermeable surfaces on a parcel**
 - **General Steps**
 1. **User selects parcel**
 2. **Overlapping features from a building layer, a pavement layer, a parking lot layer and a pool layer are selected**
 3. **The selected features are intersected with the selected parcel**
 4. **The impermeable area and fee are calculated when the intersections of all layers are finished**

Challenges - Asynchronous Processes

The screenshot shows a web browser window with the title "Storm Water Utility Rate Estimator". The address bar shows the URL "http://www.ci.norman.or.us/Maps/PermeabilityCalculator/Map.html". The page title is "Draft Storm Water Utility Rate Estimator". The browser's address bar shows "http://www.ci.norman.or.us/Maps/PermeabilityCalculator/Map.html". The page has a navigation menu with "Home", "About", "Contact Us", "Support", "GIS Data", "Weather", "Business", "News", and "Memberships". The main content area features an aerial map of a residential property with a dashed blue border. The map shows a house with a red roof, a yellow driveway, and a blue swimming pool. The ESRI logo is visible in the bottom right corner of the map area.

Draft Storm Water Utility Rate Estimator

201 West Dean River

Zoom In Zoom Out Print Enter Next Enter Previous Enter Full Screen

To use, select one or more parcels. The application will overlay the impermeable surfaces and output the estimated area and projected fee based on the selected land use category.

Results

Parcel Area: 12,916 sf

Impermeable Surfaces

Structures: 5,493 sf (10%)
Pavement: 2,102 sf (9%)
Parking Lots: 0 sf (0%)
Pools: 477 sf (4%)

Total: 8,072 sf (14%)

Projected Fee

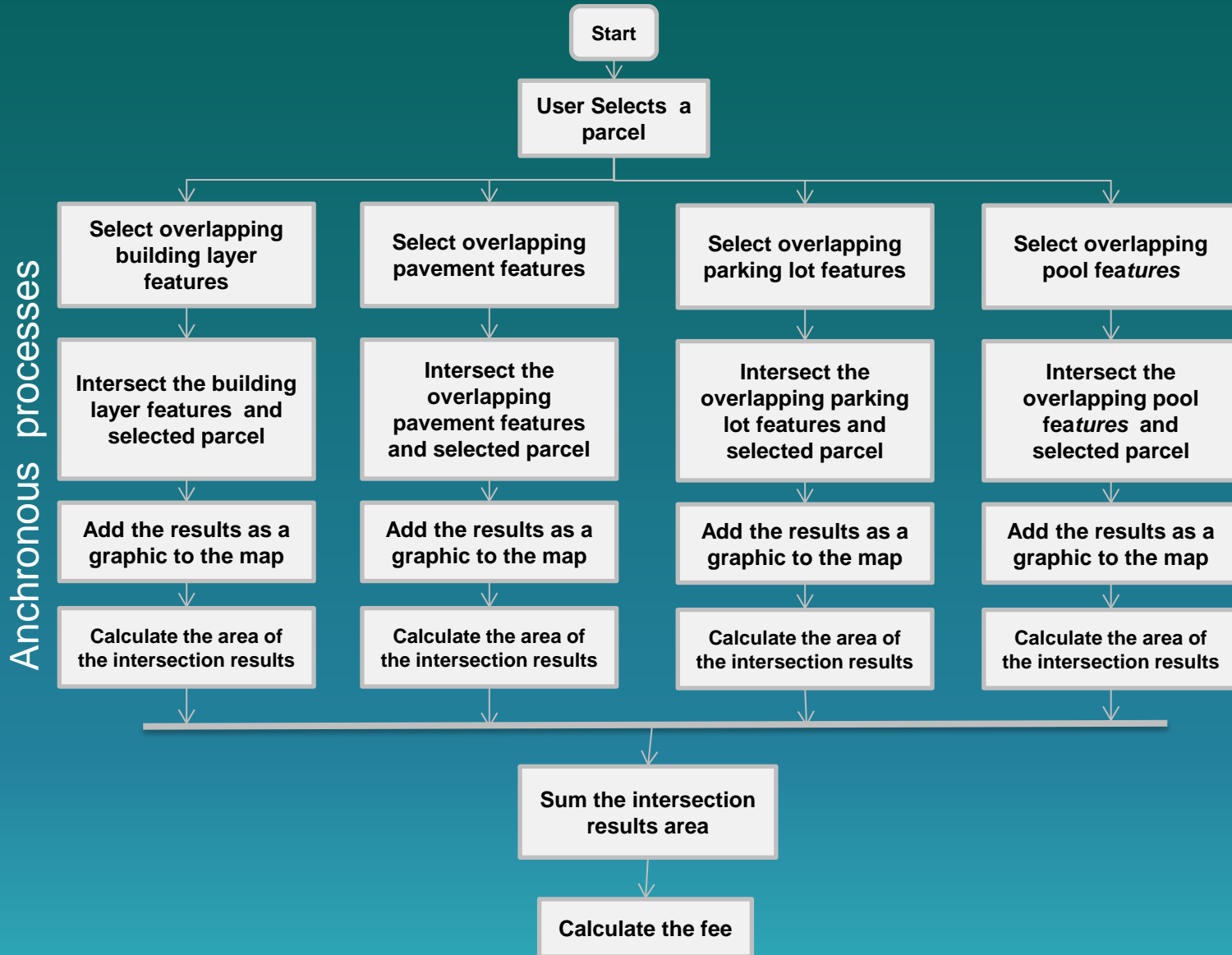
SF Residential
 Com/Inst/Multi-Family

\$8.00

Note: This tool provides a rough estimate of the permeability. The impermeable surfaces are derived from planimetry generated from the 2003 aerial imagery and have not been exhaustively reviewed.

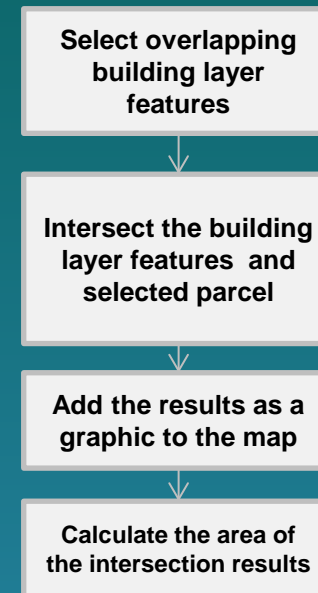
esri

Challenges - Asynchronous Processes



Challenges - Asynchronous Processes

- Each selection/intersection/area calculation consists of asynchronous processes
- ESRI processes contain callbacks which allow the process to occur synchronously for each feature type



```
buildingLayer.selectFeatures(selectQuery, FeatureLayer.SELECTION_NEW);  
buildingLayer.on("selection-complete", function(){  
    //Do something here..  
})
```

Challenges - Asynchronous Processes

- **How to delay the final calculation until the processes for each feature type are completed?**
- **We use dojo deferred lists**

```
doParkingIntersectionTask = new Deferred();  
doPoolIntersectionTask = new Deferred();
```

```
deferred = all([getParcelAreasTask,  
               doBuildingIntersectionTask,  
               doPavementIntersectionTask,  
               doParkingIntersectionTask,  
               doPoolIntersectionTask]);
```


Challenges - Asynchronous Processes

- **Add a resolve statement for the functions used to calculate the areas for each of the feature types**

```
getParcelAreasTask.resolve(newArea);
```

- **Add a deferred.then function.**

```
deferred.then(function() {
```

```
//Code to do the calculations and display the results..
```

```
}// deferred.then(function() {
```

Challenges - Legacy and AMD Syntax Differences

- **ArcGIS API after 3.4 written in AMD style**
 - **ESRI recommends AMD style although “legacy” is still supported**
 - **Update requires more than simple cut-and-paste**
 - **Dependencies are defined differently**
 - **Other syntax differences**

Challenges - Legacy and AMD Syntax Differences

- Loading Dependencies

“Legacy”

```
dojo.require("esri.map");  
dojo.require("esri.tasks.locator");
```

```
function init(){  
    //code here..  
}
```

“AMD”

```
require(["esri/map","esri/tasks/locator",...],  
    function (map, Locator,...) {  
        //code here..  
    });
```

Challenges - Legacy and AMD Syntax Differences

- **connect vs .on for functions with callbacks**

“Legacy”

```
locator = new esri.tasks.Locator(locatorServiceURL);  
dojo.connect(locator, "onAddressToLocationsComplete", showLocationResults);
```

“AMD”

```
locator = new Locator(locatorServiceURL);  
locator.on("address-to-locations-complete", showLocationResults);
```

Challenges – Modular Services

- **Used working units MXDs for initial map services**
 - **Resulted in data being published multiple times**
 - **Easy to deploy, but degrades performance**
- **Need to redesign Apps to use modular services**

Challenges – System Performance

- Monitor to determine where bottleneck is in system
- Add RAM
- Add additional machines to site

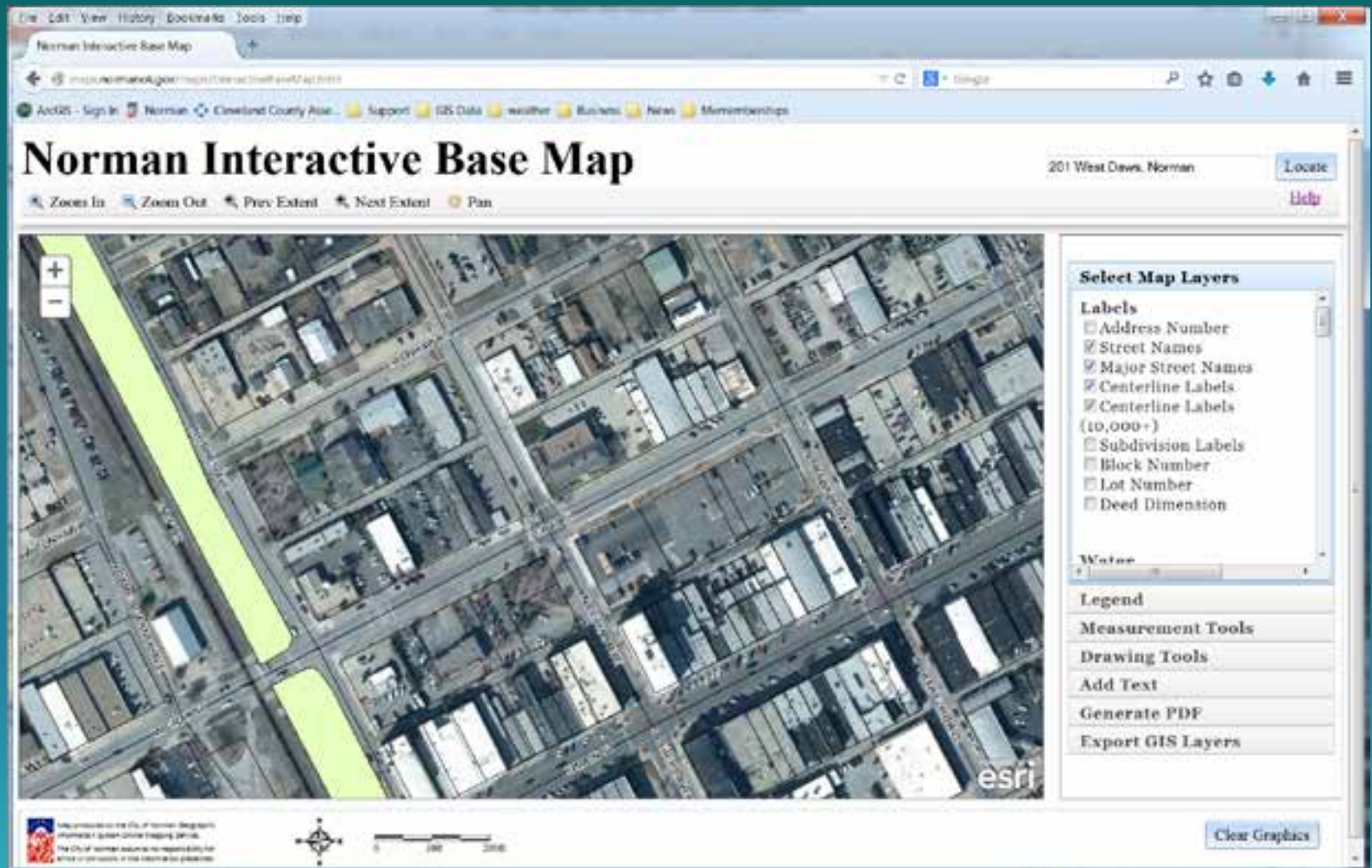
Current Status

- Eight services deployed internally

The screenshot shows a web browser window displaying the 'City of Norman Internal Online Maps' page. The browser's address bar shows the URL 'City of Norman Internal Online Ma...'. The page features a navigation menu with links for 'ArcGIS - Sign In', 'Norman', 'Cleveland County Asse...', 'Support', 'GIS Data', 'weather', 'Business', 'News', and 'Memberships'. The main heading is 'City of Norman Internal Online Maps'. Below the heading, a welcome message reads: 'Welcome to the City of Norman's internal mapping page! This page includes a variety of interactive maps linked to the City of Norman GIS. These maps reflect the current state of the GIS and include updates and additions as soon as they are posted.' The page displays eight interactive map thumbnails arranged in two rows of four. The first row includes: 'Permit Counter Map', 'Engineering Map', 'Solid Waste Map', and 'Zoning Map'. The second row includes: 'Norman 2025 Plan Map', 'Location Map', 'Police Buffer Map', and 'Road & Utility Summary Tables'. At the bottom of the page, a note states: 'In addition to the currently available thematic maps, we will be adding additional targeted maps and map applications. Please provide the GIS Division recommendations for changes to the current maps and/or ideas for additional maps or tools.'

Current Status

- One application deployed externally



Current Status

- Four maps deployed on ArcGIS Online



Current Status - GIS Profile

- **Version of ArcGIS before project: 10.1**
- **External web apps: ArcGIS Server for Workgroups 10.1**
- **Enterprise Database: ArcSDE 10.1 for SQL Server**
- **Internal web apps: ArcGIS Server 10.1 Enterprise**
 - **Permit Counter**
 - **Engineering**
 - **Solid Waste**
 - **Police Special Operations**
- **Number of ArcGIS Desktop users: 16**
- **Third party applications: 3**
 - **Cityworks by Azteca**
 - **CrimeView by Omega**
 - **New World Systems**

Future Plans

- Upgrade to 10.2.1 or latest version that works with third party apps in October 2014
- Deploy more external applications
- Deploy mobile apps
- Make greater use of ArcGIS Online

Demo & Questions

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John.McIntosh@NormanOK.gov

Website:

<http://maps.normanok.gov/index.html>

ArcGIS Online site:

<http://normanok.maps.arcgis.com/home/index.html>