

2011 Esri Developer Summit

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Redesigning Desktop Applications for the Web

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Agenda

- **The Web, GIS, and the ArcGIS Platform**
- **Case Study**
 - **Who, What, When, Why, How?**
 - **Design & Architecture**
 - **Lessons Learned**
- **Design Considerations & Process**

Why the Web?

- It's pervasive
- No client install

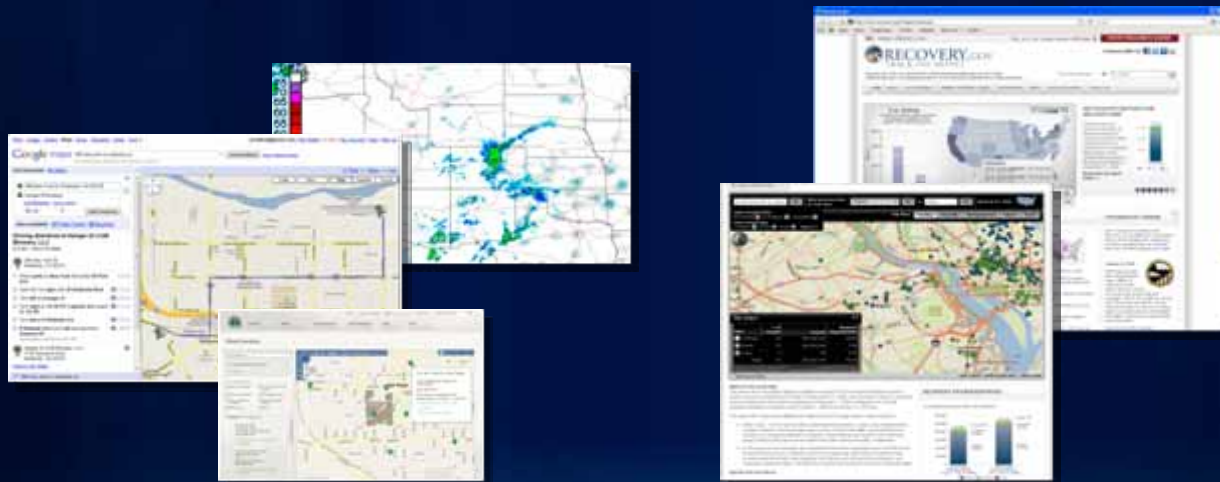
Why the Web Now?

- Infrastructure is **faster** and **cheaper**
 - Content is **more accessible**
 - Application development is **easier**
 - User experience is **richer**
 - User experience is **more collaborative**
- * It's become a great platform for integrating, sharing, and using information**

GIS and the Web

A Proven Platform for Web Mapping

- Web maps are everywhere
- Web maps are now familiar to everyone
- Web maps integrate geospatial information



GIS and the Web are Evolving Together

More Than Just Points on a Map



ArcGIS 10

Leverages Advances in Web Technology ...



... To Make GIS Available to Everyone

ArcGIS Server 10

Serves Multiple Clients Using Standards-based Web Services

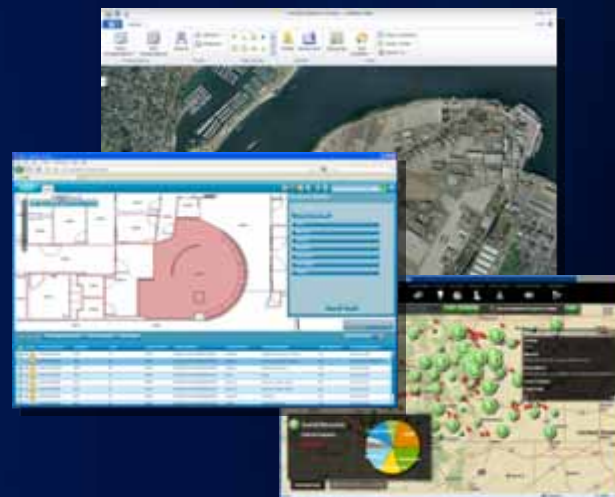
- Visualization
- Analysis
- Querying
- Extracting
- Editing



ArcGIS Server 10

Rich Web Applications and APIs Available Out-of-the-Box

- **Web Applications**
 - ArcGIS.com Viewer, ArcGIS Explorer Online
 - Flex and SharePoint Applications
- **Web APIs**
 - JavaScript
 - Flex
 - Silverlight/WPF
- resources.arcgis.com/web



ArcGIS Server 10

Provides Flexible Deployment Options

- On-Premises
- Hosted in the Cloud
- Both (Hybrid)



ArcGIS Online

A Web-Based Portal, Hosted in the Cloud

- High Quality Maps
- Sharing
- Search
- Communities
- Free Viewers
- Mashups
- Open Web API's
- Hosting

... On Premises (Coming)



*For Sharing, Discovery and Use....
...Providing a Ready-to-Use Geospatial Platform*

ArcGIS Desktop 10

Making Desktop GIS Easier and More Productive

The screenshot displays the ArcGIS Desktop 10 interface with several key components:

- Main Menu:** File, Edit, View, Bookmarks, Insert, Selection, Geoprocessing, Customize, Windows, Help.
- Toolbars:** Add Data..., New Group Layer, New Basemap Layer, Search, and Create Features.
- Search Window:** Displays search results for "buffer", including "Buffer (Analysis)" and "Multiple Ring Buffer (Analysis)".
- Symbol Selector:** A window for choosing symbols and colors for map features.
- Create Features Window:** Lists various feature types such as "Light Rail, Tunnelled", "Light Railway", and "Tourist Railway".
- Catalog Window:** Shows a tree view of data sources, including "LargeScale_18K_1X.gdb" and various local layers like "Layer_18K", "BikeRoute_Local", and "Highways_Local".
- Table Window:** Displays a table of tax lots with columns: TLID, Land Value, Building value, Improved Value, Building SQFT, Year Built, and Tax Code. The table shows 3 rows of data.

TLID	Land Value	Building value	Improved Value	Building SQFT	Year Built	Tax Code
181W08C 000	\$13,400.00	\$283,200.00	\$296,600.00	3,330	1989	270
181W08C 006	\$152,800.00	\$98,400.00	\$251,200.00	1,110	1973	281
181W08C 001	\$23,500.00	\$163,300.00	\$186,800.00	1,160	1940	391

ArcGIS 10

Easier & More Pervasive

- Extends full GIS capabilities to the web
- Continues to improve desktop GIS

So then ...

- * **When should you redesign for the web?**
- * **How should you redesign for the web?**

Background

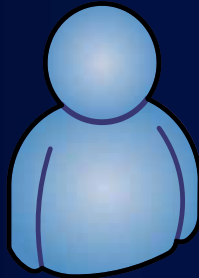
A political process relying on GIS data and workflows

- **Redistricting is the process of redefining electoral (or other political) boundaries**
- **Redistricting is tightly tied to the decennial census**
 - Updated population counts determine reapportionment
 - Updated demographics reveal gerrymanders
- **Redistricting occurs at many levels** *(Federal, State, Local)*
 - Congress & Legislature
 - Police, Schools, City Councils
- **Redistricting is an iterative process**
 - Requires collaboration, review, and revision

User Profiles

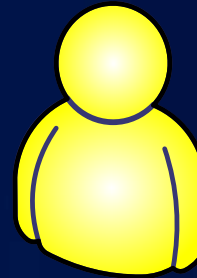
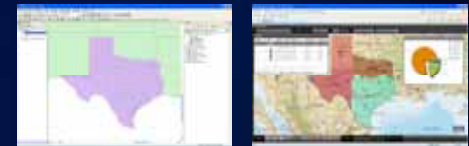
Federal Government

- Legal review of district plans submitted by specific, large states
- Collaborate securely



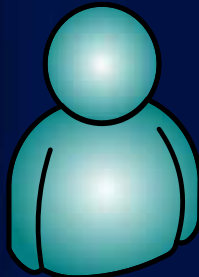
State & Local Government

- Create and publish variety of district plans (Congress, Police, Schools, etc.)
- Collaborate securely



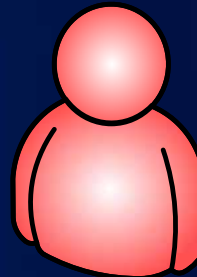
General Public

- Analyze, review, and comment on proposed district plans
- Create and share alternative district plans



Advocacy Groups

- Analyze, review, and comment on proposed district plans
- Create and share alternative district plans
- Collaborate securely



User Profiles – *Relative Sizing*

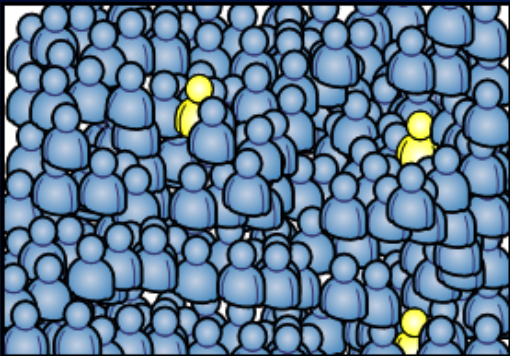
Federal Government



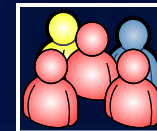
State & Local Government



General Public



Advocacy Groups



Business Problem

Meeting the needs of a broad spectrum of users

- There is a large, and growing, **public** interest in the upcoming process of redefining electoral districts following the 2010 census
- Need to provide a solution that will **empower both GIS and non-GIS stakeholders**
- Need to provide a solution that will **support all aspects of the political process**
 - Creating & Publishing
 - Sharing & Collaboration
 - Discovery & Review

Challenges

Extending the reach of Redistricting applications

- **Large pool of potential users, but they have a short attention span**
- **Wide range of ‘geospatial literacy’**
 - **GIS Professionals**
 - **General Public**
- **Largest potential user base is non-GIS community, but existing offerings are desktop-based applications for GIS professionals**
- **Collaboration and sharing of data must be secure**

Why Redistricting for the web?

- **Cost**
- **Accessibility**
- **Sharing & Collaboration**

Why Redistricting for the web NOW?

- The platform is ready
- The next major push is 10 years away

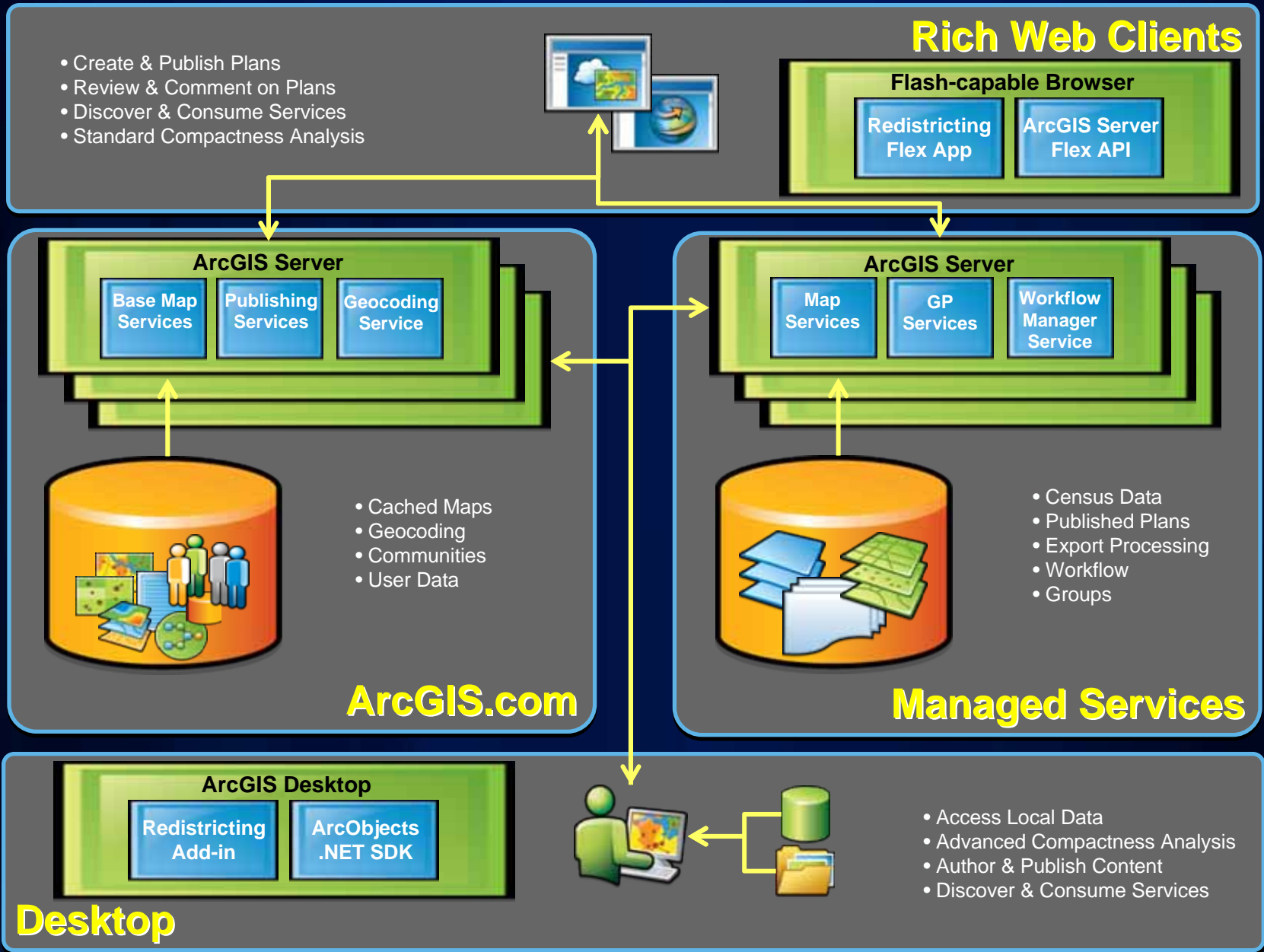
...so what did we do? And how did we do it?

Technology Stack

Leveraging the desktop and the web

- **ArcGIS Server 10**
 - Map Services
 - Geoprocessing Services
 - Geometry Services
- **ArcGIS Online**
 - Online Base Maps
 - Geocoding Services
 - Sharing & Discovery
- **ArcGIS Desktop 10**
- **Other Technologies**
 - Adobe Flex
 - Amazon Cloud
 - PostgreSQL RDBMS





Key Considerations & Lessons Learned

- **User Experience:** Flex API provides sufficiently rich user experience for basic redistricting workflows
 - Map Visualization
 - Charting
 - Graphics & Geometry Support
- **Performance:** Use of Query functionality of the Map Service allowed geometries to be delivered once to client application only when needed.
- **Scalability:** Server-side vs. Client-side trade-offs
 - Custom Flex code = lower cost for scalability

Key Considerations & Lessons Learned

- **Map Authoring:** Scale dependencies prevent taxing data requests
 - Block assignments allowed at lower scales, Block Group at higher, etc.
 - Queries faster, payloads smaller
- **Data Security: Hosted vs. On-premise**
 - 'Private' groups provide security for hosted/managed services
 - On-premise deployment allows for physical isolation and data security when required

Summary

- **Sometimes web AND desktop is the right answer**
- **Web provides a platform for delivering a more comprehensive Elections market solution**
 - Election Day Reporting
 - Campaign Management
 - Precinct Management
- **New deployment options = new business models**
 - SaaS
 - Managed services
 - On-premise deployment

Designing the User Experience

The screenshot displays the ArcIMS Image Service - HTML Viewer interface. The main map area shows a city layout with various colored regions and a grid. A scale bar indicates 1 mile. Below the map, a table titled "sd_pointsofinterest" provides data for a specific point of interest.

Map created with ArcIMS - Copyright (C) 1992-2009 ESRI Inc. 0 1mi

Rec	NAME	ESTAB	ADDR	CLASS	#SH.
1	WYNDAM EMERALD PLAZA HOTEL	1990	400 W. BROADWAY	6 HOTEL	[poin

Layers

Visible Active

- sd_pointsofinter
- sd_railstop
- sd_streetlights
- sd_freeways
- sd_railroad
- sd_roads
- sd_convcntr
- sd_park
- sd_zip
- sd_clip

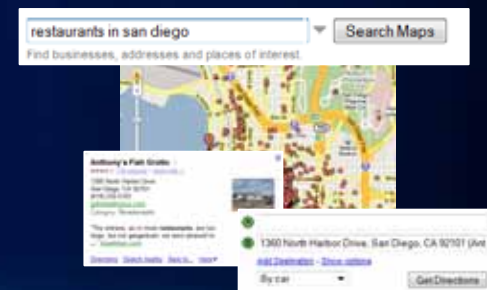
Refresh Map

Identify

Designing the User Experience

Think Usable, Think Fast

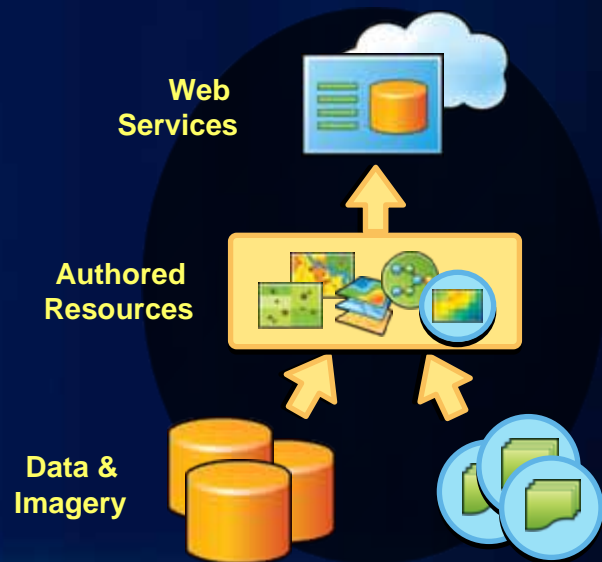
- Today's web user has high expectations
- Don't overcomplicate the interface
 - Design for use cases, not feature function
 - Don't make the user think
- May influence technology choices
 - Flex & Silverlight vs. JavaScript
 - Map services vs. feature services
 - Cached maps vs. optimized maps



Designing Access to Content

Web Services, not Direct Data Access

- **Web applications → Web services → Data**
 - No longer have direct access database
 - Requires deliberate & thoughtful authoring
 - Different security model
- **Content based web services:**
 - Map services
 - Feature services
 - Image services
 - Geoprocessing services



Designing Access to Content

Web Services, not Direct Data Access

- **Map Services**
 - Organize into ...
 - **Basemaps**
 - Consider using Esri or Microsoft Bing
 - Consider full or partial caching
 - Requires time to build
 - **Operational Layers**
 - Use optimized maps (MSD) where possible
 - Use best practices for web authoring
 - Use map service publishing toolbar



Designing Access to Content

Web Services, not Direct Data Access

- **Feature Services**
 - Returns features instead of map images
 - Especially useful when:
 - Content must be highly interactive (hover tips, etc)
 - Data must be editable through web interface
 - Application has small operational datasets (performance)
- **Image Services**
 - Consider when managing your own image library
 - Available at 9.3.1, but improved at 10
 - New mosaic dataset used by both Desktop and Server
 - Simplifies and streamlines publishing process

Designing Geospatial Business Logic

Consider Trade-offs Between Options

- **Consider where your business logic should live to maximize:**
 - Ease of development
 - Reusability by other applications
 - Portability to other technologies
- **Consider:**
 - Client-side Modules
 - Geoprocessing Models / Services
 - Server Object Extensions (SOE)



Planning the Development

Consider Skills Required for Modern Web Development

- **Today's web APIs are easier to use**
 - Less experience required
 - Barrier of entry is lower
 - More available out-of-the-box
- **Requires new skills:**
 - User experience
 - Information integration
 - Creative thinking



```
var layer = new esri.layers.ArcGISTiledMapServiceLayer("http://server.arcgisonline.com/ArcGIS/rest/services/World_Street_Map/MapServer");
map.addLayer(layer);

var southCarolinaCounties = new esri.layers.FeatureLayer("http://sampleserver1.arcgisonline.com/ArcGIS/rest/services/USA/FeatureServer/0", {
  mode: esri.layers.FeatureLayer.MODE_SNAPSHOT,
  outFields: ["NAME", "POP2000", "POP2007", "POP00_SQMI", "POP07_SQMI"]
});
southCarolinaCounties.setDefinitionExpression("STATE_NAME = 'South Carolina'");

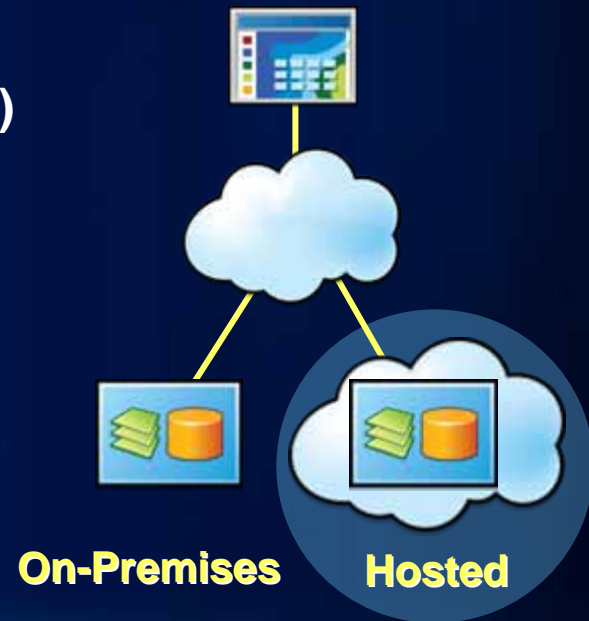
var symbol = new esri.symbol.SimpleFillSymbol(esri.symbol.SimpleFillSymbol.STYLE_SOLID, {color: "#f00000"});
southCarolinaCounties.setRenderer(new esri.renderer.SimpleRenderer(symbol));
```

... and add a designer to the team

Planning the Deployment

Consider Trade-offs Between Options

- On-Premise vs. Hosted vs. Hybrid
- Considerations:
 - Your IT operations (maintainability)
 - Scalability requirements
 - Availability requirements
 - Security requirements
 - Operational costs
 - License models



Redesigning Desktop Applications for the Web

Prerequisites

- Learn about web technology options
- Understand the potential user base
- Establish vision & business drivers
- Compile use cases
- Map functional (business) requirements to use cases
- Map non-functional (IT) requirements to use cases

*Look Beyond Current Users & Application ...
... Consider Who Could Be Using Application, and How*

Redesigning Desktop Applications for the Web

Design Process

1. **Review and evaluate use cases**
 - **Map appropriate technologies to each use case**
 - **Can the technology support functional requirements?**
 - **Can the technology support non-functional requirements?**
 - **Performance**
 - **Scalability (number of users)**
 - **Interactivity (richness)**
 - **Determine what level of customization is required**

Redesigning Desktop Applications for the Web

Design Process

2. Design Solution

- **Identify ...**
 - **Application(s) to support use cases**
 - **Data stores** (*features, related attributes, imagery, etc.*)
 - **Web services** (*maps, models, mosaics, etc*)
- **Develop a solution architecture**
- **Design key aspects of the system**
 - **The user experience**
 - **Access to content via web services**
 - **Geospatial business logic**
- **Prototype early to mitigate risk**
- **Plan for the development and deployment**



Summary

```
function onMapClick (e) {  
    const map = new maplibre.Map({  
        style: 'https://raw.githubusercontent.com/Mapbox/Mapbox-styles/master/style.json',  
        center: [0, 0],  
        zoom: 0  
    });  
    map.addLayer({ type: 'symbol', layout: { 'text': 'Clicked' } });  
    map.flyTo(e.lngLat, 15, { easing: 'ease-exponential', duration: 1000 });  
}
```

```
function getDriverIdFromCoordinates (lat, lng) {  
    var features = results.features;  
    for (var f=0, feature = features[f]; f < features.length; f++) {  
        if (feature.geometry.type === 'Point') {  
            return feature.properties.driverId;  
        }  
    }  
}
```

```
do {  
    Symbol.prototype.$color = 0, 0, 0;  
    features.forEach(function (feature) {  
        feature.$color = 5;  
        var polygon;   
        if (feature.type === 'Polygon') {  
            polygon = feature.geometry.coordinates;   
            do {  
                polygon[0][0] = polygon[0][0] + 1;  
                polygon[0][1] = polygon[0][1] + 1;  
                polygon[0][2] = polygon[0][2] + 1;  
            } while (true);  
        }  
    });  
} while (true);
```

```
new dojo.Color(0, 0, 0).setAlpha(0.5);  
var polySymbol = new dojo.Color(0, 0, 0).setAlpha(0.5);  
var feature = results.features[0];  
feature.$color = polySymbol;
```

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dojo.Color(0, 0, 0).setAlpha(0.5);  
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```

Redesigning Desktop Applications for the Web

Carefully Consider the Options and Trade-offs

- **The Web is a powerful platform**
 - Different from desktop
 - Often not an either-or situation
- **Design a solution that takes into consideration ...**
 - Your needs and skills
 - Today's web environment
 - Today's web user
 - ArcGIS best practices and patterns

*Design Deliberately for the Web ...
... and Don't Wing It !*



Q & A

```
function onMapReady() {  
  map = new google.maps.Map(document.getElementById("map"), {  
    center: new google.maps.LatLng(41.88, -87.63),  
    zoom: 15,  
    mapTypeId: google.maps.MapTypeId.SATELLITE  
  });  
  map.addLayer(new google.maps.StreetView pegman);  
}
```

```
function getDriverIdFromPolygons(  
  var features = results;  
  for (var f=0, feature;  
  var feature = features[  
  f; f++) {  
    var polygon =  
    feature.geometry;  
    polySymbol =  
    do o.Color(0, 0, 0, 0.5)  
    feature.symbol =  
    polySymbol;  
  }  
  feature.symbol =  
  do o.Color(0, 0, 0, 0.5)  
  feature.symbol =  
  polySymbol;  
}
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polySymbol =  
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