

2011 Esri Developer Summit

Palm Springs, CA

Best Practices for Designing Effective Map Services

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Tom Brenneman



Esri Training for ArcGIS Server Developers

<http://www.esri.com/training>



- **Instructor-Led Courses**

- [Introduction to ArcGIS Server](#)
- [Creating Effective Web Applications Using ArcGIS Server](#)
- [System Architecture Design Strategies](#)

- [Online Training Seminars](#)

- Free, one-hour presentation and demos by Esri technical experts
- Live seminar broadcast on a new topic every month

What's in this session

- Map service planning and design
- Ways to serve your maps
 - Cached tiles
 - Dynamic map service
 - Client-side graphics
- Authoring a good Web map
- Performance tips for map services

Please!
Turn **OFF** cell phones
and paging devices

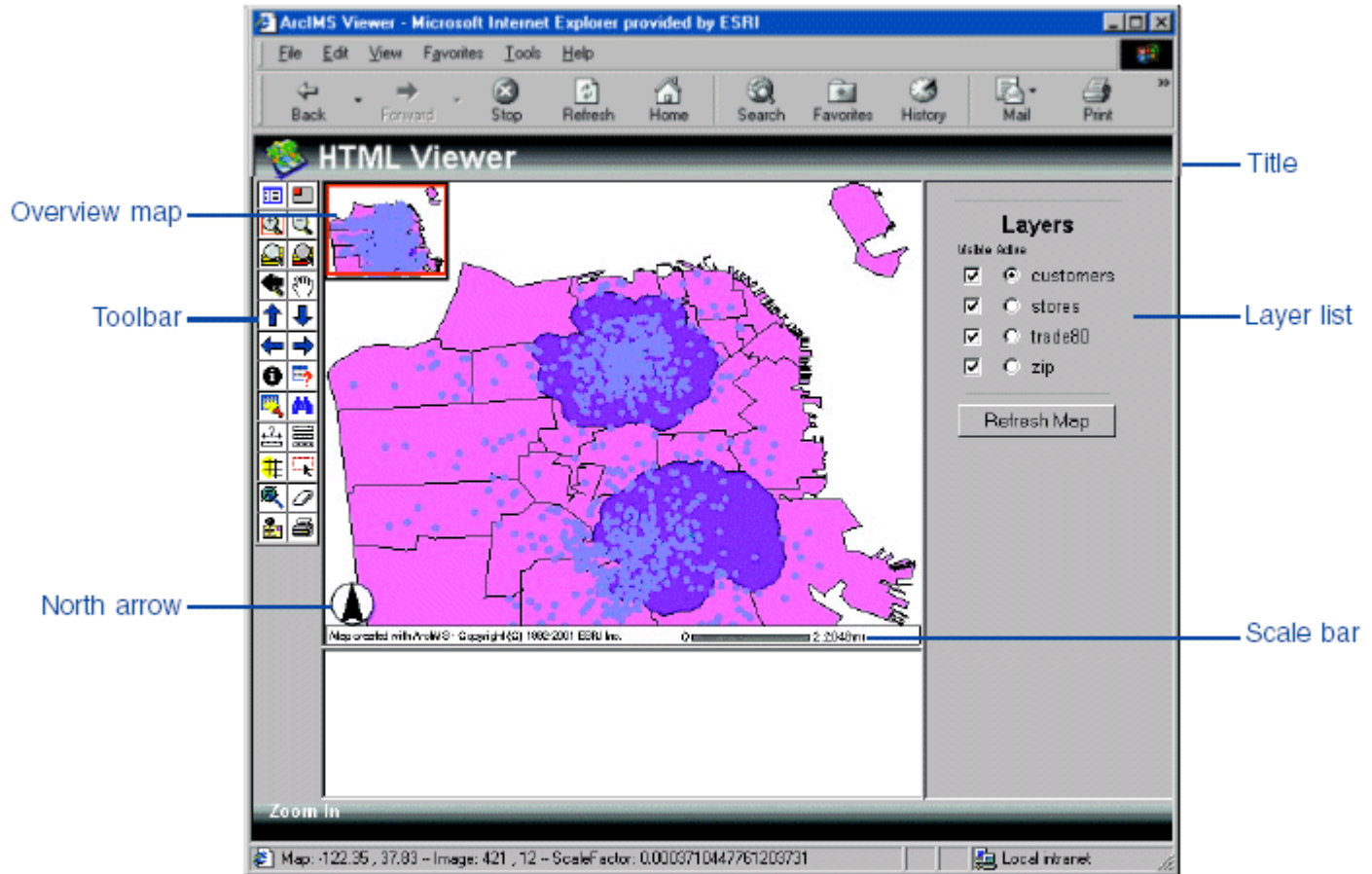




Map service planning and design

```
function onMapReady() {  
  map = new google.maps.Map(  
    document.getElementById('map'),  
    {  
      center: new google.maps.LatLng(37.5, -122.5),  
      zoom: 15,  
      mapTypeId: google.maps.MapTypeId.SATELLITE  
    }  
  );  
  map.addLayer(new google.maps.PolygonsLayer(  
    new google.maps.Polygon(  
      new google.maps.LatLng(37.5, -122.5),  
      new google.maps.LatLng(37.5, -122.5),  
      new google.maps.LatLng(37.5, -122.5)  
    )  
  ));  
}  
  
function getDriverIdFromPolygonsLayer(  
  var features = result.features;  
  for (var f=0, feature; feature = features[f]; f++) {  
    var polygon = feature.geometry;  
    var polysymbol = new google.maps.Symbol({  
      color: 'red',  
      size: 100,  
      type: 'triangle-down'  
    });  
    polysymbol.setMap(polygon);  
  }  
}
```

How Web maps have changed!



Organize data into logical groupings

Basemaps

Geographic frame of reference

Contain static vector
and raster data

Reusable in multiple applications



Operational Layers

Show a focused item of interest

Support functionality
of the application

Displayed on top of base map



Case study: Google Maps

Web Images Videos **Maps** News Shopping Gmail [more](#) ▼ 🚩 New! | [Help](#) | [Sign in](#)

Google maps [Show search options](#)

Print Send Link

500 mi
500 km

©2011 Google - Map data ©2011 Europa Technologies, INEGI - [Terms of Use](#)

Google Maps base maps

“Map”

- Highways
- Streets
- Ferries
- Railroads
- Transit centers
- Cities
- Parks
- Military reservations
- Municipal boundaries
- Lakes
- Rivers
- Golf courses
- Hospitals
- Shopping centers
- Airports
- Colleges
- Cemeteries
- Amusement parks

“Terrain”

- Shaded relief
- Vegetation
- Highways
- Streets
- Cities
- Parks
- Military reservations
- Municipal boundaries
- Lakes
- Rivers
- Golf courses
- Hospitals
- Shopping centers
- Airports
- Colleges
- Cemeteries
- Amusement parks

“Satellite”

- Imagery
- Source information

Google Maps operational layers

- **Street overlay for imagery**
- **Traffic**
- **Photos**
- **Videos**
- **Wikipedia**
- **StreetView coverage**
- **Web cams**
- **Bicycle routes**

Some ArcGIS Server examples

- [Orange County Property Appraiser Map](#)
- [City of St George](#)
- [North Vancouver Projects](#)
- [Solar Boston](#)
- [City of Greeley Property Information Map](#)

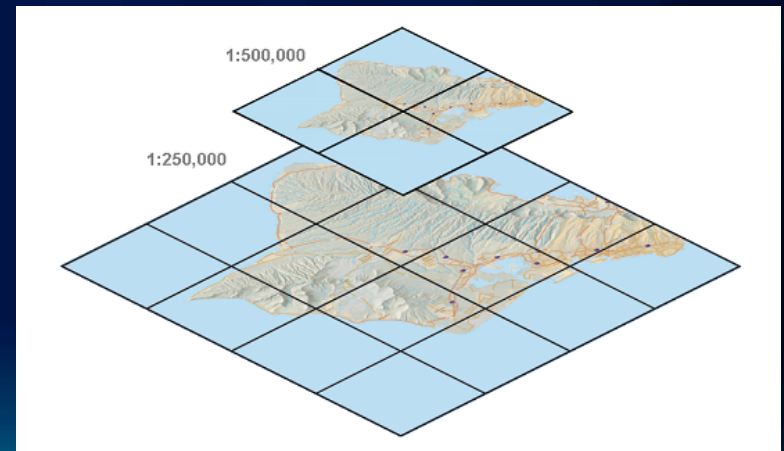


Three options for displaying map services

- **As cached tiles**
- **As a dynamically drawn image**
- **As client-side graphics**

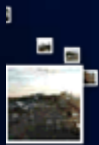
Cached tiles

- **Pre-draw map tiles and serve them to clients**
- **Best performance and scalability**
- **Standard for online maps (Google, Bing, Yahoo, etc)**
- **Requires you to create and maintain cache**



What should you cache?

- **Base maps**
- **Operational layers that satisfy one of the following:**
 - **High volumes of traffic**
 - **Don't change often**
 - **Cover small scales only**



Cache image formats

- **MIXED for most basemaps**
 - High quality (~90) for vectors
 - Lower quality (55 – 75) for imagery
- **PNG for overlay networks (boundaries, roads)**
- **PNG 8 for classified rasters < 256 colors**

Related Session

- **Advanced Map Caching Topics**
 - **Wednesday, 4:30 PM Primrose C/D**



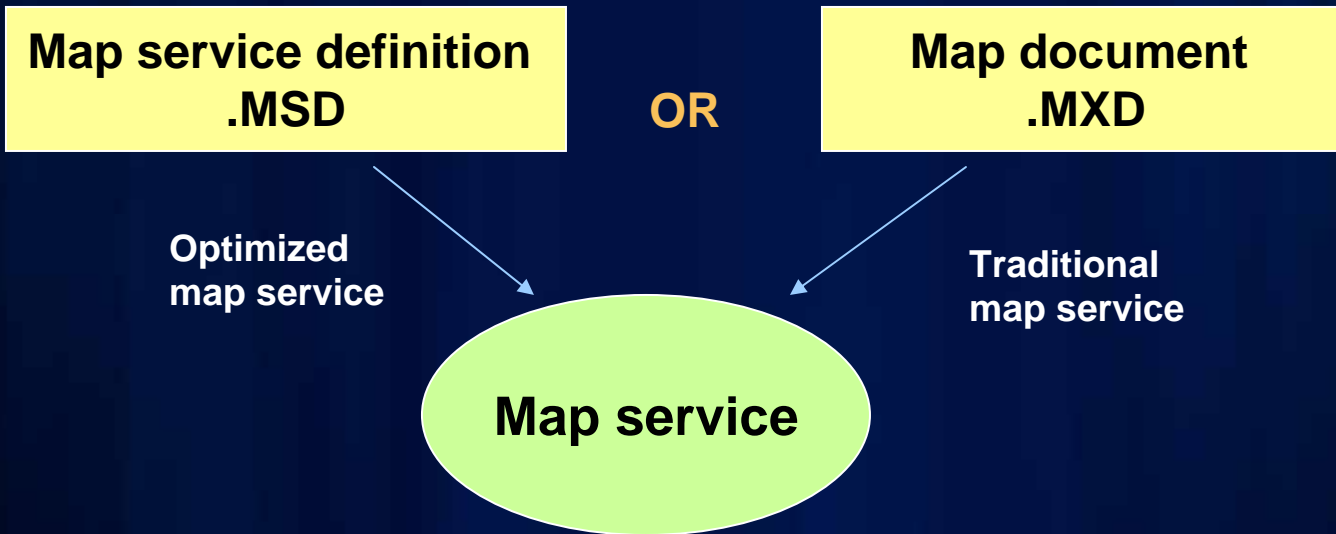
Dynamically drawn map services

- **Server retrieves data, draws an image, sends image to client**
- **Slower than caching, but may be satisfactory using optimized map service**

Data that's OK to draw dynamically

- Real-time data
- Frequently-changing data with large scope
- Internal maps accessed by just a few people

Two types of files can support a map service



Optimized map services

- **Obtained through Map Services Publishing toolbar in ArcMap**
- **Faster dynamic drawing than ArcIMS**
- **Supports the most common layer and symbol types**

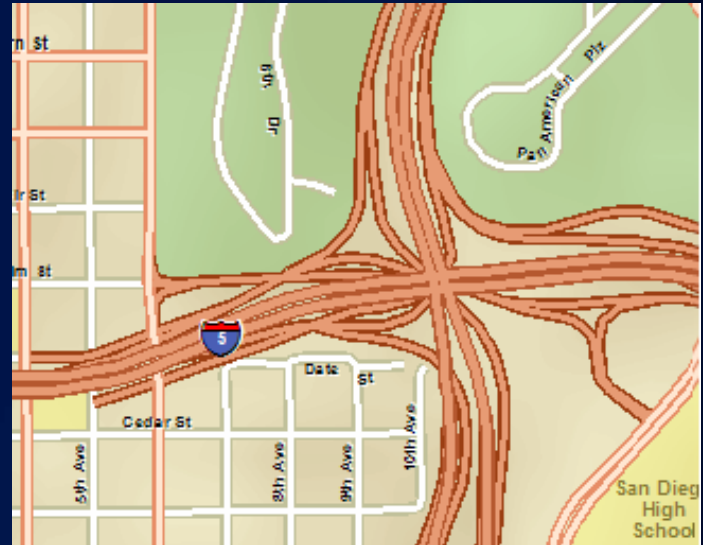


Demo

Publishing an optimized map service

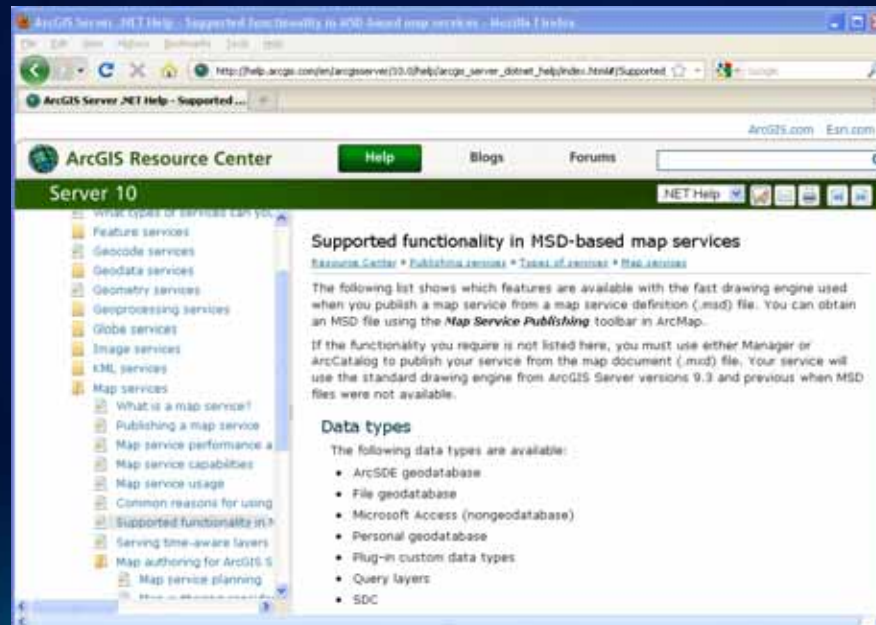
Antialiasing with optimized map services

- Improves visual quality
- Slight performance cost
 - Use Preview button to see effect on performance



What's available through optimized services?

- Most data and layer types
 - You'll get an Error in analyzer if not supported
- New at 10.0: Maplex and cartographic representations
 - Recommended for caching only

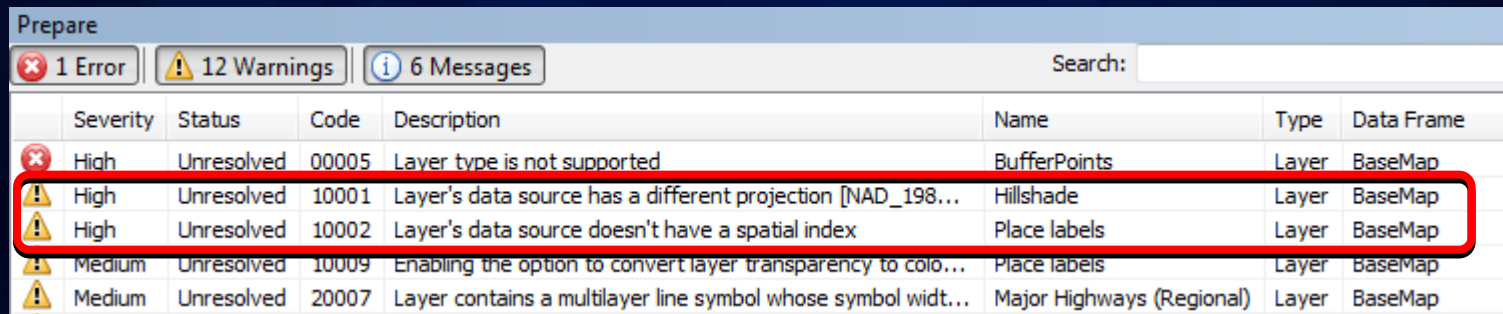


Can you use fine-grained ArcObjects with optimized map services?

- **Cannot** use ArcObjects directly related to map document
 - IMap, ILayer, etc.
- **Can** use coarse-grained ArcObjects that work with MapServer
 - MapServer, IMapLayerInfos, IMapDescription
- **Can** get to underlying data via IMapServerDataAccess
 - Gives you IFeatureClass, ITable, IRaster

If you have to use an MXD-based service...

- Move whatever layers you can into a separate optimized map service
- Use ESRI_Optimized style for drawing
- Still use the Analyze button to catch performance warnings



Prepare

1 Error | 12 Warnings | 6 Messages

Search:

	Severity	Status	Code	Description	Name	Type	Data Frame
✖	High	Unresolved	00005	Layer type is not supported	BufferPoints	Layer	BaseMap
⚠	High	Unresolved	10001	Layer's data source has a different projection [NAD_198...	Hillshade	Layer	BaseMap
⚠	High	Unresolved	10002	Layer's data source doesn't have a spatial index	Place labels	Layer	BaseMap
⚠	Medium	Unresolved	10009	Enabling the option to convert layer transparency to colo...	Place labels	Layer	BaseMap
⚠	Medium	Unresolved	20007	Layer contains a multilayer line symbol whose symbol widt...	Major Highways (Regional)	Layer	BaseMap

Client-side graphics

- “Data on demand” pattern treats map service as a feature server
 - Queries from map services
 - Feature services
- Server sends geometries and attributes to client
- Features drawn in browser



What should you draw with client-side graphics?

- Interactive operational layers for mashups
- Layers that need to be thematically symbolized on the fly
- Query or geoprocessing results
- Web editing: Feature Services

- Example: [Social Media Template](#)
- Example: [Election Results Viewer Template](#)

Feature service symbology

- Rendered in the client
- Symbols can be Simple (Marker, Line, Fill) or Picture (Marker, Fill)
 - Complex symbols are converted to picture (PNG)
 - Most point symbols reproduced well – test
 - Avoid gradient fills

ArcMap

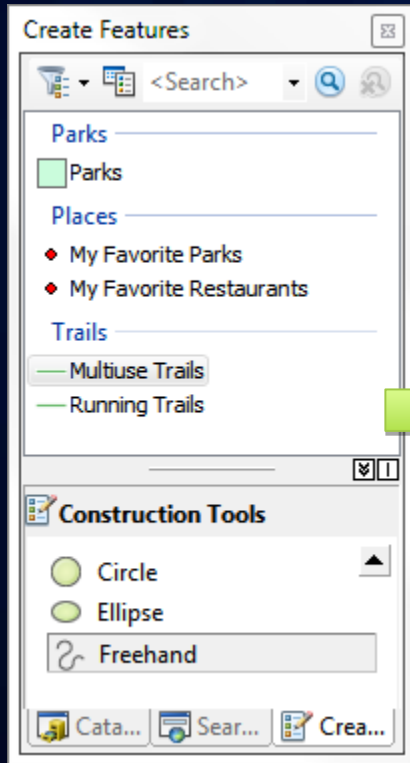


WebMap



Feature Service feature templates

ArcMap Feature Templates

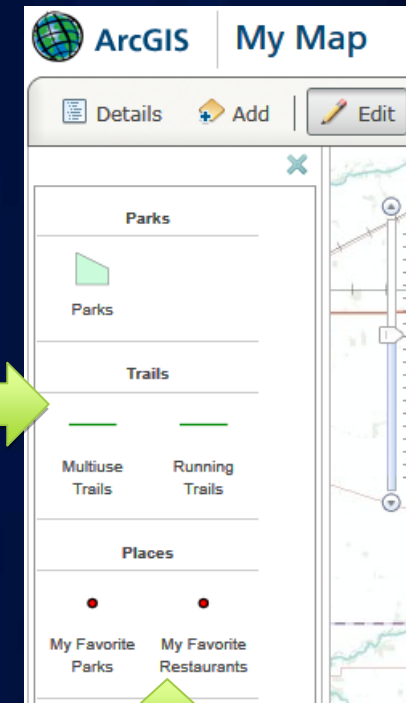


REST

Templates:

Name: Multiuse Trails
Description: Multiuse
Drawing Tool: esriFeatureEditToolFreehand
Prototype:
Attributes:
Name: Running Trails
Description: Running
Drawing Tool: esriFeatureEditToolFreehand
Prototype:
Attributes:

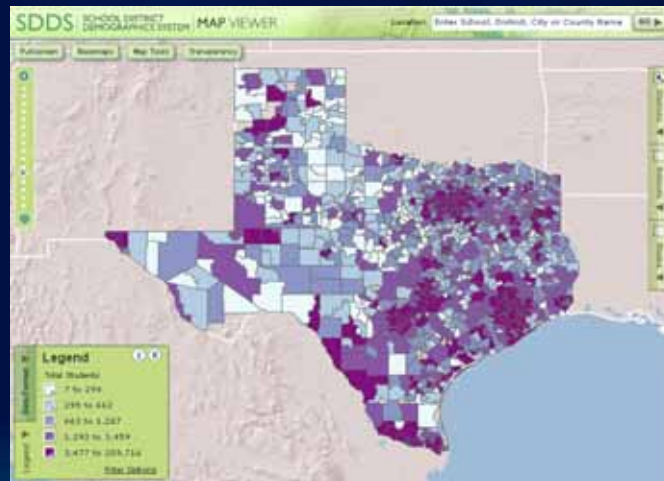
Web Map



Single symbol
in the TOC

Graphics performance considerations

- **Generalize geometries**
- **Be careful not to request too many features**
 - Scale dependencies with Feature Services
- **Beware of server limits on number of features that can be returned**
 - Default 1000
- **Beware “1=1” firewall filters**



Where can I learn more about these techniques?

- Implementation differs depending on the web API being used
- See the Web API Sessions (Javascript, Flex, Silverlight) in the agenda.
- Online examples at the [ArcGIS Resource Center](#)

Demo

Authoring a map service with feature access

Authoring mobile maps

Specific cartography for mobility

- **Design for purpose**
 - Remove unnecessary layers of information
 - Set scale dependency (walk, drive, etc)
 - Render editable layers to define feature types
- **Design for the environment**
 - Establish contrast, choose meaningful symbology



Authoring mobile maps continued

Specific cartography for mobility

- **Design for device form factor**
 - Set scale dependency based on device resolution
 - Set symbol width based upon device resolution

- **Architect and Deploy Map Data**
 - Build Compressed Base Map Datasets
 - Build Operational Mobile Caches



1280x1024
BIG



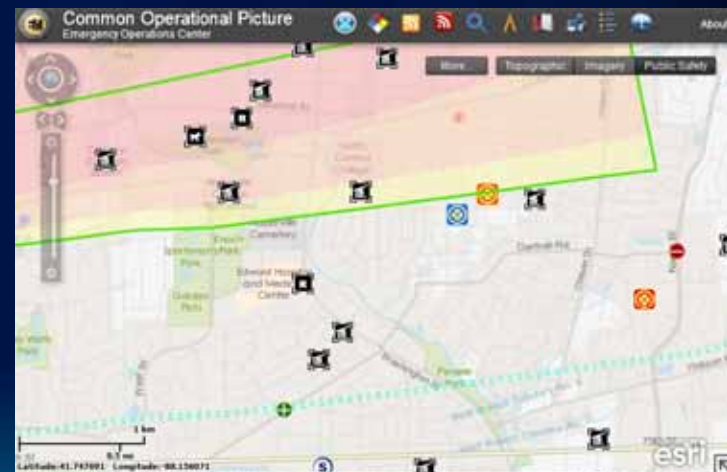
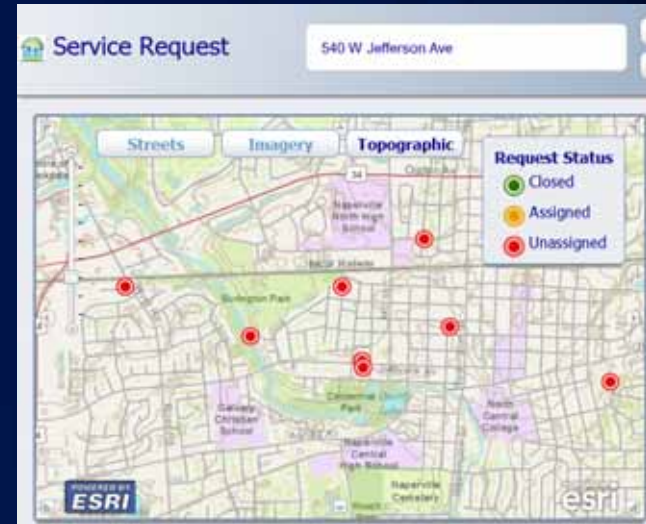
320x240
Small

Choosing an API

- What are your developers comfortable with?
- Which IDE will you use?
- Will you require a plug-in?
- Will it be deployed to mobile?

Start with a template

- Fully functional apps, maps and data
 - Esri: [Resources.arcgis.com](https://resources.arcgis.com)
 - User Communities
 - Community: www.arcgis.com > Gallery
 - Look for “Configurable”
 - Download and point at your own data

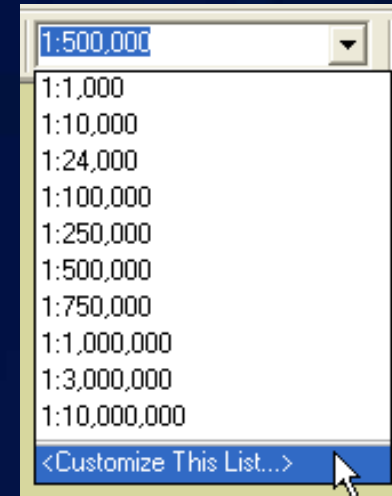


Demo

Building a basemap from a template

Authoring a basemap from scratch

- Only a good option if there are no templates
- Design map for cache scales
 - Add your tiling scheme scales to the ArcMap dropdown list
- Group layers by scale level
 - Only have to set the scale range at the group layer level
 - Copy layers between groups



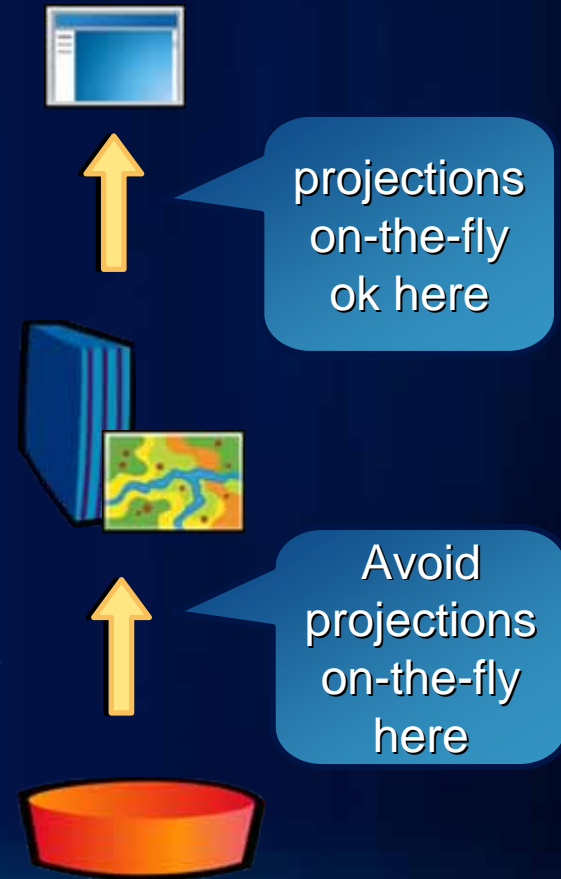
Pre-compute when possible

- **Annotation**
- **Query or tool results**
- **Projection**
 - **Tip: You can re-project geodatabase features during replication**
- **Cache**



Projections on the fly

- **Best: No projections on the fly**
 - Data can be projected through replication
- **Good: Projections on-the-fly in the map service**
- **Bad: Projection on-the-fly in the map document**
- **Really, really, really bad: a web service projected on-the-fly in a map document**



Data access tips

- **ArcSDE geodatabase tips**
 - **Tune ArcSDE**
 - **Use direct connect**
- **Avoid UNC paths for file-based data**

Indexes matter

- **Spatial indexes**
 - Keep up to date
 - Correct size relative to map extent
- **Attribute indexes**
 - Use for joins and common queries

Review

- **Organize map services in logical groups**
 - **Base maps**
 - **Operational layers**
- **Use a high-performance blend of display techniques**
 - **Cached tiles**
 - **Dynamically drawn services**
 - **Client-side graphics**
- **Follow performance tips, pre-computing when possible**

Additional Resources

- **ESRI Showcase – Hall C**
- **Meet ESRI Development staff**
- **Other sessions**
 - **Advanced Map Caching Topics**
 - **Javascript, Flex, Silverlight web API sessions**
 - **Many other ArcGIS Server sessions**
- **Resource centers: resources.esri.com**



Questions

Please fill out the survey for this session



Title Safe Area — Please Read

This area is the **title safe area** (10% in from each slide edge). All text and graphics should be contained within this area to prevent loss during transmission and reproduction.

Any information outside the title safe area runs the risk of being cropped off when captured to video.

Please note the adjusted title and body template styles adhering to the title safe area. Presenters will need to adjust their slides accordingly as needed to reposition text and graphics.

Right-click and select **Grid and Guides**
Check "Display drawing guides on screen"

Successful Presentation Guidelines

- Know your target audience
- Use slides to **lead** not read
 - Use a key phrase or a few words
 - Avoid more than two levels of bullet points
- Use title slides for each section
 - Make it clear where you are going
- Avoid too much animation—Keep it simple!

Additional ESRI presentation resources available on ArcZone
<http://arczone/resources/presentations.cfm>

Migrating to the New Template

This template was rebuilt from scratch and fixes problems found in previous versions.

- **Download the instructions and support files from <http://arczone/resources/presentations.cfm>**

Color Guidelines

Color Swatches

Use **Esri 2011** as theme colors
(see presenter's notes for the instruction of how to add the Esri theme and theme colors)



Projector Color Guidelines

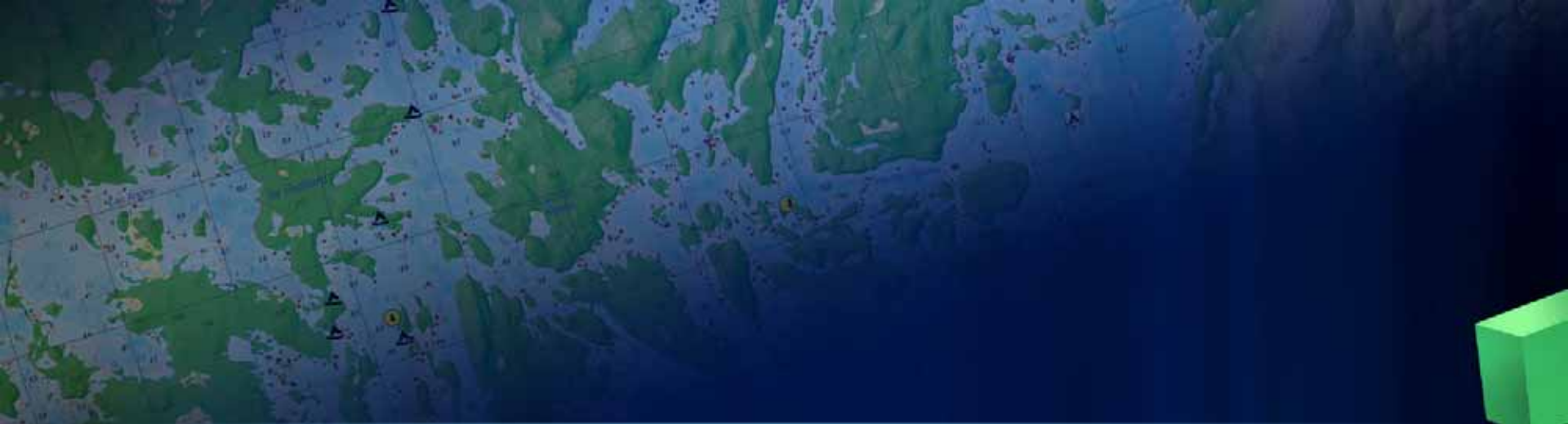
Use the **sRGB** video mode on the projector.
Most projectors have this setting.

Additional ESRI presentation resources
available on ArcZone
<http://arczone/resources/presentations.cfm>

2011 Esri Developer Summit

Palm Springs, CA

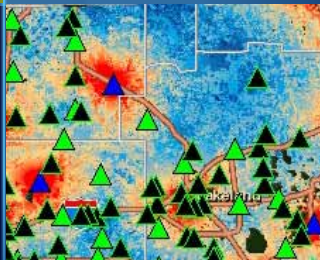




```
function onMapReady() {  
  map = new google.maps.Map(  
    document.getElementById('map'),  
    {  
      center: new google.maps.LatLng(30.2672, -92.0849),  
      zoom: 15  
    });  
  map.addLayer(new google.maps.PolygonsLayer(  
    new google.maps.Polygon(  
      {  
        vertices: [new google.maps.LatLng(30.2672, -92.0849),  
                  new google.maps.LatLng(30.2672, -92.0849),  
                  new google.maps.LatLng(30.2672, -92.0849)]  
      }  
    ));  
}  
  
function getDriverIdFromLatLng( lat, lng ) {  
  var features = results;  
  for ( var f=0, features; f<features.length; f++ ) {  
    var feature = features[f];  
    if ( feature.geometry.type === 'Point' ) {  
      var polySymbol = new google.maps.PolygonsLayer(  
        new google.maps.Polygon(  
          {  
            vertices: [ new google.maps.LatLng( lat, lng ),  
                      new google.maps.LatLng( lat, lng ),  
                      new google.maps.LatLng( lat, lng ) ]  
          }  
        ));  
        do {  
          Symbol = new google.maps.Symbol({  
            color: 'red',  
            size: 100,  
            text: 'Driver ID: ' + feature.properties.driver_id  
          });  
          feature.setSymbol( Symbol );  
          polySymbol.addLayer( feature );  
        } while ( true );  
      }  
    }  
  }  
}
```

DeKalb County Board

Fulton County Dept. of Health and Wellness/District 3, Unit 2, Office



DeKalb County Board

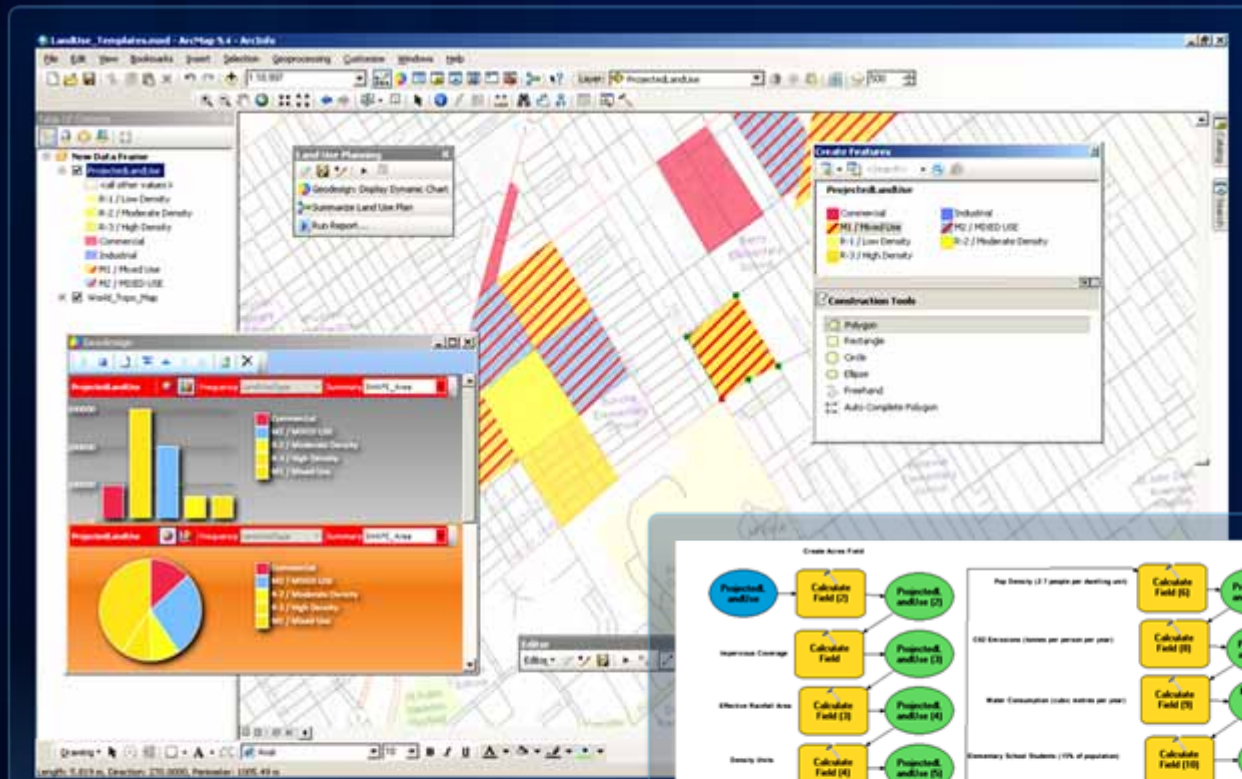
Fulton County Dept. of Health and Wellness/District 3, Unit 2, G





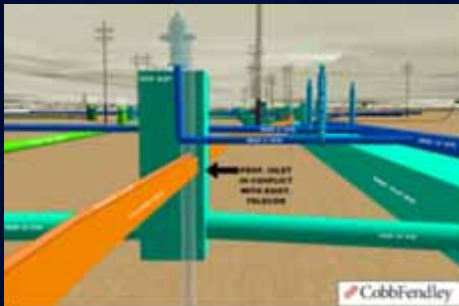
esri

Sample Screenshots Layout (preferred)



Sample Screenshots Layout

Underground Utilities



Texas

Utility Network



Germany

University



Pennsylvania

Building/Room



Panama

Railroads



Switzerland

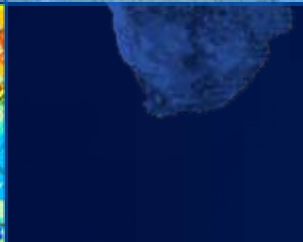
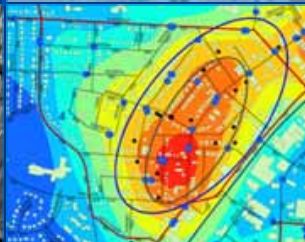
Oil Platform



Norway

Grids for Images/Screenshots (may ask designer for assistance)

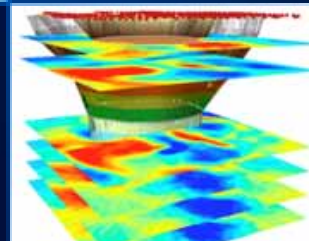
environmental
conservation



disaster
resoponse



demographic
analysis

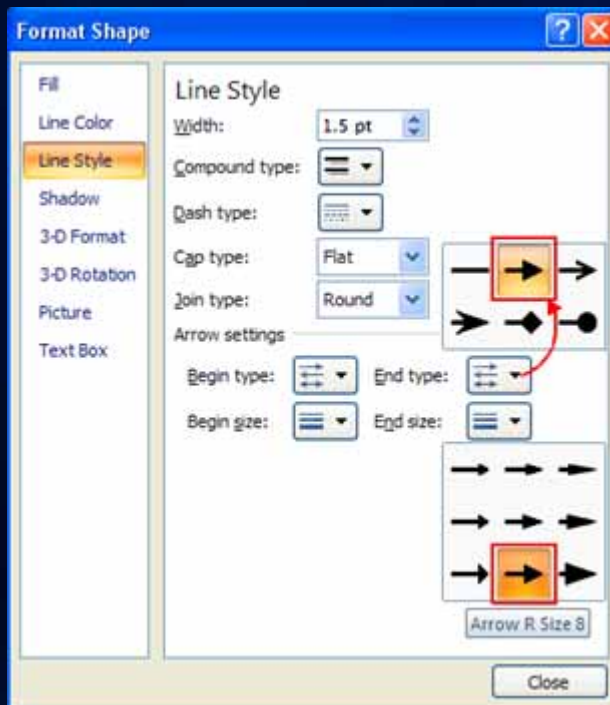




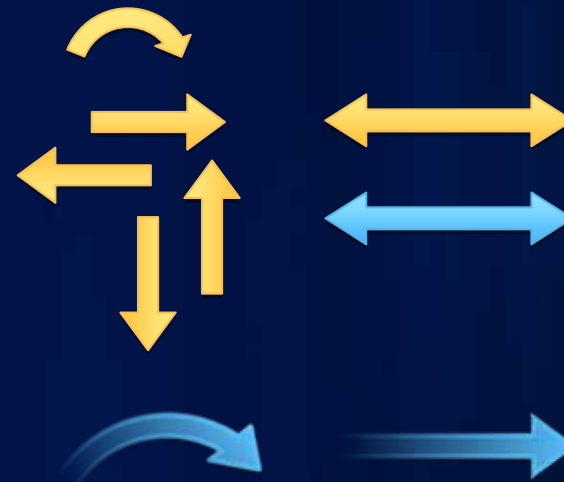
Diagrams/Icons

Arrows

Arrows for Connecting Items

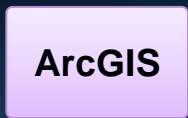
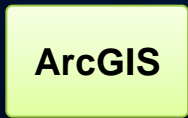


Arrows for Connecting Large Concepts

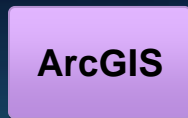


Shapes for Diagrams

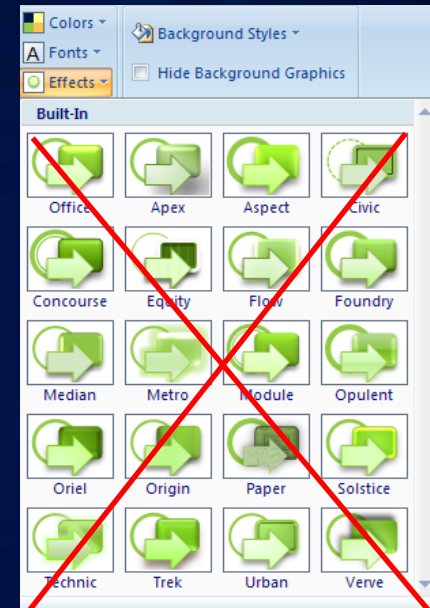
Quick Style:
Subtle Effect



Quick Style:
Moderate Effect



DON'T APPLY EFFECTS
from the Design tab



Shapes for Diagrams *(continued)*



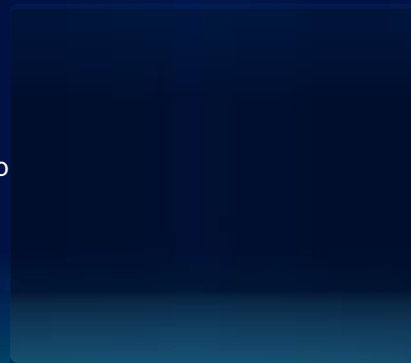
Cloud optimized for use behind diagrams



Cloud for general diagram



Circle behind a group of objects



Content box for each tier
(see sample diagrams)

Optional: Use as a frame
around showcased
screenshots



ArcGIS Implementations

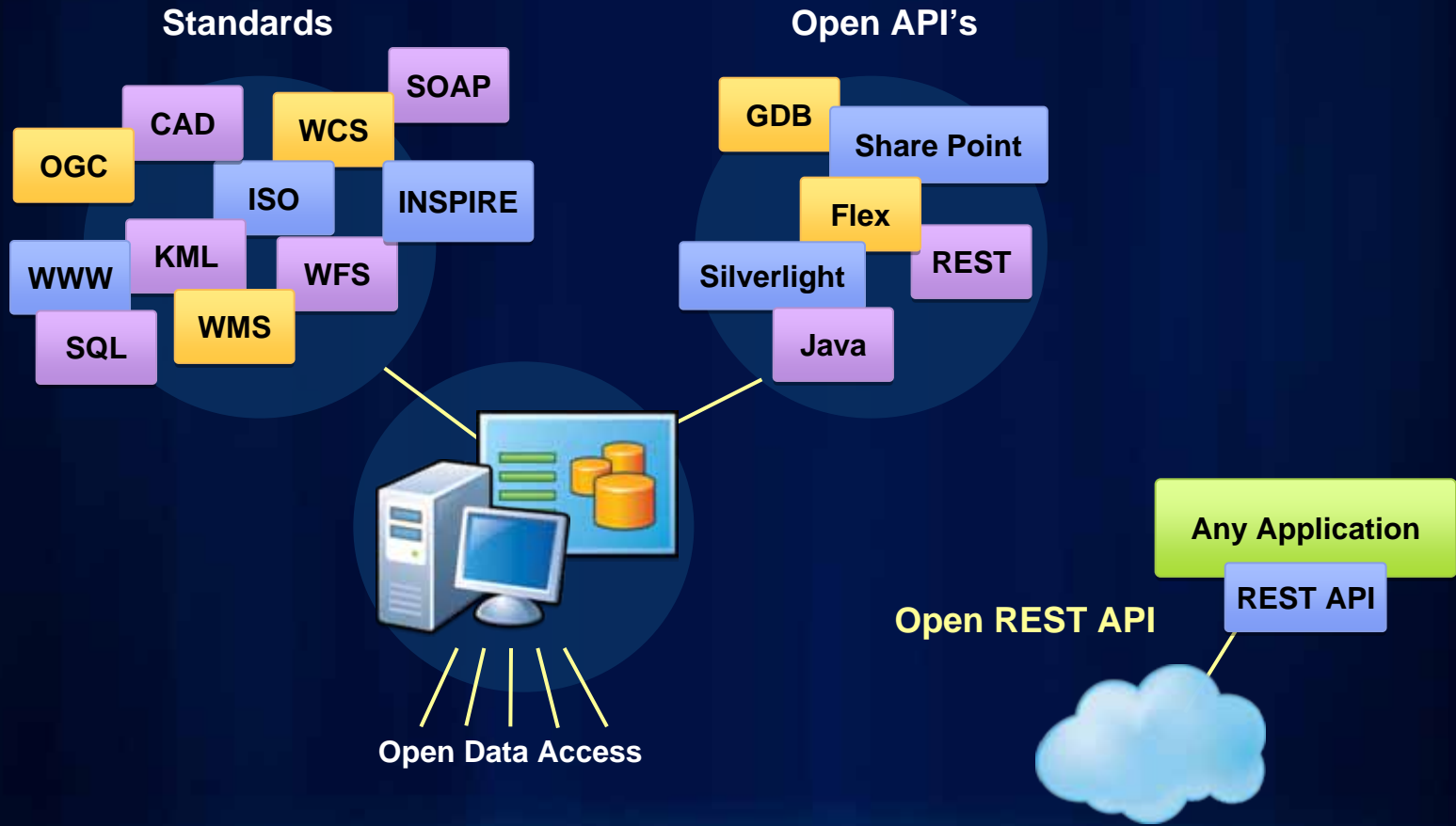


ArcGIS 10 — A Complete System

Easier
More Powerful
and Everywhere



Quick Style — Moderate Effect



Esri is Publishing Our REST Interface as an Open Standard

Access the Entire Icon Library

Over 160 items added in 2010

- 430 total icons available for Esri use
- Browse and search from any Microsoft Office application
- Accessible when you're connected to the Esri Network
- Also available offline as directories of PNG files
- See the presenter notes below for details



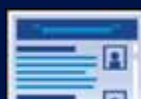
A Selection of Frequently Used Icons



ArcGIS Desktop



ArcGIS Online



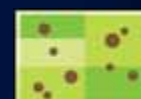
Web Blog



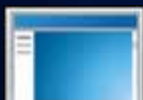
Web Blog



Mashups



Mashups



Browser



Open Standards



ArcGIS Desktop
Authors



Web Map



Web Map



Map



Web Map



Map



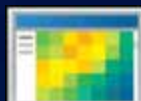
Web Map



Map



Raster Files



Raster Files



Web Map



Map



Web Map



Map



Web Map



Map



Web Map



Map



Web Map



Map



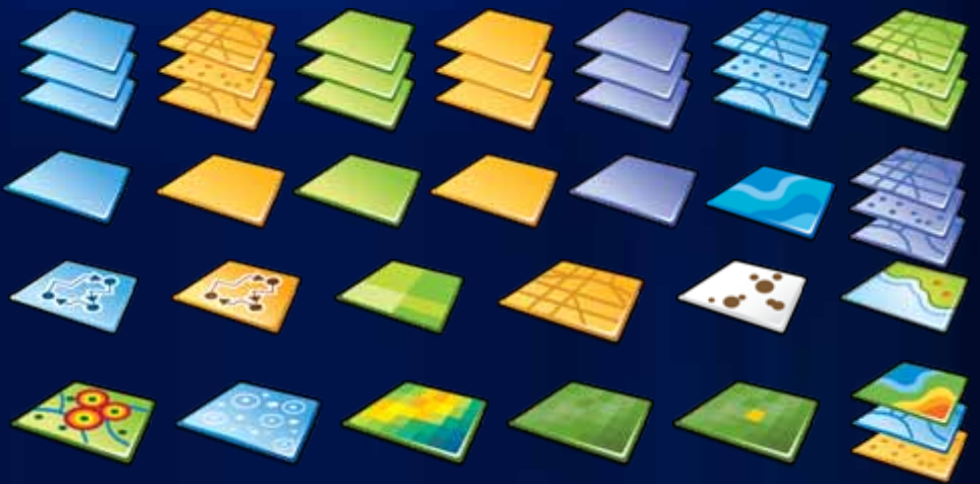
Explorer



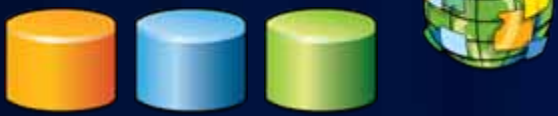
Web Map



Globes



Layers



Databases



Files



Table



Files



CD/DVD

Internet/Cloud



Legend



Network



Models



Designing & Planning



Situational Awareness



Professional Services



Professional Services



Education



Education



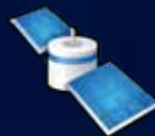
Business Partner



Mobile GIS User



GIS User





Data Server



Data Appliance



GIS Users



Geodatabase



Web GIS



Mashups