MAKING THE "RIGHT" CHOICE

- Place your bets on the best solution for your audience -
let’s start with some definitions
geo geek  *slang.* \jē-ō-gēk\  

- **noun**
  1. a geography professional and enthusiast that specializes in geographic information systems.
  2. a GIS specialist that is interested in emerging technology that allows for the creation of complex maps and analysis using diverse sets of data.

“regular” geek  \'gēk\  

- **noun**
  1. a person often of an intellectual bent.
  2. an enthusiast or expert especially in a technological field or activity.
  3. a carnival performer often billed as a wild man.
WE HAVE TO GO BACK!
Expectations of Mobile Mapping Today

- fast
- accessible off-line
- accessible in occasionally connected environments

Definitions / “Terms we’ll use!”

- **Dynamic map service requests** – requests made to a GIS server when a user pans or zooms

- **Raster / image tiles** – “pre-cached” set of tiled images

- **Vector tiles** - similar to image tiles, but they store a vector representation of the data. Client-side drawing of vector tiles allows for vector tile layers to be customized for the purpose of the map, which drives dynamic, interactive cartography.
mobile mapping timeline

2006
- Google creates “slippy maps”
- “pre-tablet era”
- ArcGIS Mobile released

2007
- Ipad released
- “app” is word of the year

2008
- Ipad released
- “app” is word of the year

2009
- Ipad released
- “app” is word of the year

2010
- Ipad released
- “app” is word of the year

2011
- TG “hybrid experiment”
- Facebook / LinkedIn drop hybrid

2012
- Mapbox announces vector tiles for Streets
- TG builds 50+ native apps

2013
- Mapbox announces vector tiles for Streets

2014
- Esri supports vector tiles in ArcGIS Server, Pro, SDKs

2015
- Esri announces adoption of Mapbox’s vector tile spec

2016
- Esri announces adoption of Mapbox’s vector tile spec
EVOLUTION OF FIELD DATA COLLECTION

PAPER
ACCESS
PRE-TABLET
TABLET
FORM BUILDER
USER FOCUSED!
ACCESS
Collector for ArcGIS - map centric

(Spatial) Form Builder
68% of IT projects fail
WHY DO THESE PROJECT FAIL?
DID YOU SATISFY THE AUDIENCE, THE USERS AND THEIR NEEDS?
HOW DO WE IMPROVE OUR SUCCESS RATE?
Focusing on users and their stories - personas

**The Casual User**

- Google search MDC App
- Search Results
- Navigates to area of interest
- Reads Map, Article, and prints information
- Saves link to web app

**The Business User**

- Received link from MDC email
- Opens app and creates profile
- Enters Search to find area of interest on the map
- Reads Map and drills down to more detail
- Records a report to the area of interest

**The Power User**

- Received link from MDC email, includes credentials
- Opens app and logs in using credentials
- Enter Search to find area of interest on the map
- Reads Map and drills down to more detail
- Edits details through Admin Privileges and then submits a report

**Pete**

Pete is a new resident to Missouri who loves outdoor sports and wants to learn about what he can do in the state. He's a big internet browser but he typically spends most of his time on Facebook, Pandora, and browsing Google.

**Jennifer**

Jennifer has been a resident to Missouri for over five years. She works for a small logging company that has a relationship with Missouri Dept of Conservation. She is not the most experienced internet user and occasionally gets lost when browsing the internet.

**Brad**

Brad is a 12 year experienced forester who works for Missouri Dept of Conservation. He loves his work, details, and applications that do everything at once and show everything at once. He would choose an excel table over a pie chart any day.
**Larry the Land Steward**

**Facts**
- 40-60 year old
- Stable finances
- Mid-Upper class
- Own more than 3 acres
- Not tech gifted
- Educated with land and animal conservation
- Looking to retire
- Male
- Free times

**Behavior**
- Reads National Geo Daily
- Hunter/Outdoorsman
- Active in Agriculture
- Road Trips to National Parks
- Primary use is to keep up with family and friends
- Listens to local AM radio
- Owns dogs

**Needs + Goals**
- See animals on his land
- Give back to nature
- Future of land value/Health (family owns)
- Needs hobby
- More facts + education
- Hunt on property
AS A [USER ROLE], I WANT TO [GOAL] SO I CAN [REASON]
EVOLUTION OF FIELD DATA COLLECTION

- Paper
- Access
- Pre-Tablet
- Tablet
- Form Builder
- User Focused!
OTHER CONSIDERATIONS

- Balancing efficiency gains in the field with cost
- Existing business processes and flexibility to modify
- Audience
- Inventory vs. Inspection
- Mapping (Including offline)
- Integration with other systems
- Time (Schedule)
- Ability to get feedback from users
No one size fits all approach
Mobile Mapping Application Use Cases

Public - High Visibility / MDC promoted
Needs:
- Market / Promote MDC's resources
- Excellent User Experience
- Performance similar to other apps in App Store
- Work in occasionally connected scenarios
- Mapping experience similar to Google Maps, etc.
- Support 1000's of users (need scalability)
- Data to be updated infrequently (quarterly or annually)
- Read-only mapping data

Examples
- MO Fishing
- MO Areas
- MO Hunting
  (no mapping currently)

Public - Targeted Use Cases
Needs:
- Crowd source data for a specific project
- Display a mobile map for a specific project
- Share data for a specific initiative
- Quick time to release / go-live
- Less emphasis on user experience / performance

Examples
- Crowd Sourced Data Collection
  ex - Animal Sightings
- ArcGIS App Studio
- ArcGIS Web App Builder
- ArcGIS for Collector
- Survey 123 for ArcGIS

Internal MDC - Inventory / Seasonal Data Collection
Needs:
- Collecting locational data for an asset inventory or survey
- Seasonal or one-time data collection
- Submit data back to EGIS
- Quick time to release / go-live
- Less emphasis on user experience / performance
- Limited user base
- Real-time data updates desired

Examples
- MO Inspect
  (no mapping currently)
- MO FITS
  (no mapping currently)

Internal MDC - Daily Inspection / Data Collection
Needs:
- Daily data collection
- Users use the app in the field every day as part of their job responsibilities
- Potential need to submit data back to EGIS
- Excellent user experience
- Customized workflows to achieve maximum productivity by inspectors
- Map cache creation would support a limited user base
- Real-time data updates desired
- Offline data access needed often

Examples
- Custom Apps / Cached maps (if offline) and / or Esri Feature Services
Give me some examples!!
Bull Shoals Lake

INFO

Prospects
Largemouth Bass (Good)

Water
Level: high
Temperature: 85
Quality: dingy

Weekly Report
largemouth bass good on topwater lures.

PROSPECTS

Prospects
White Bass (Fair), Walleye (Fair), Crappie (Fair), Black Bass (Good)

Water
Level: high
Temperature: 84

REPORTS

JUL 6, 2016

Largemouth Bass

Family
Centrarchidae (sunfishes) in the order Perciformes (perch-like fishes)

Description
Upper parts are greenish; the lower sides and belly are white without dark spots or with spots that are irregularly arranged. Midside has a broad, dark continuous stripe. Large, elongated fish with a very large mouth. Upper jaw reaches far beyond the rear margin of the eye, except in small young. Smooth tongue. Dorsal fins not well connected. Cheek scales same size as rest of body scales.

Size
Total length: 10 to 20 inches; weight: 0.5 to 4.5 pounds; maximum about 24 inches and 15 pounds.
Nongame Fish - Bow Fishing, Impounded Waters

**Hours**
Sunrise to midnight from February 1 to March 31.

**Limits**
- Daily limit: 20
- Possession limit: 40, except on the Mississippi River which has a daily and possession limit of 100.

The daily limit is the combined total of all nongame species taken by bow, crossbow, gig, attali, snagging, grabbling, snaring, or underwater spear.

On the Current River from Cedar Grove downstream to the Arkansas line, only 5 bowfishers may be included in a daily limit.

Goldfish, bighead carp, common carp, grass carp, and silver carp may be possessed in any number and do not count in the daily or possession limit.

Bighead carp, common carp, grass carp, and silver carp that jump from the water into a boat or onto land may also be taken and possessed in any number.

Bowfish must remain whole and intact while on state waters or adjacent banks.

**Notes**
Applies to bowfishing in impounded waters.

**Fish**
- Longear Sunfish, Bluegill, Bowfin, Longnose Gar, Northern Hogsucker, River Carp, Rainbow, Brook, Brown, Rainbow, Brook, and Brown Trout.

Tree Survey

Tree ID:
As shown in tree tag if available

Tree location:
GPS coordinates can only be collected when outside.

34° 5' N 117° 11' W

Health:
- Good
- Poor
- Dead

Action required?
- Yes
- No
Potential Mobile Mapping Options

Option 1: Use Esri dynamic map services

This option would allow the mobile app to make dynamic map export requests utilizing REST endpoints exposed by an Esri ArcGIS Server instance hosted by MDC and available externally.

<table>
<thead>
<tr>
<th>Pros</th>
<th>Cons</th>
</tr>
</thead>
<tbody>
<tr>
<td>No caching needed</td>
<td>Dependency on MDC's external ArcGIS Server because it is being drawn dynamically</td>
</tr>
<tr>
<td>Data can be updated quickly and available to mobile users quickly</td>
<td>Slow performance during multiple request load</td>
</tr>
<tr>
<td></td>
<td>Mobile users expect cached map performance</td>
</tr>
<tr>
<td></td>
<td>Data is not available off-line</td>
</tr>
<tr>
<td></td>
<td>Performance is poor / unacceptable in occasionally connected or in areas of poor internet connection</td>
</tr>
</tbody>
</table>
MDC Update Process for Option 1

Update Fish Attractors Data in SDE

Refresh Map Service
Potential Mobile Mapping Options

Option 2: MDC provide hosted tile cache layer

A tile layer would be created up front or on demand for the mapping layers. TG could create the tile cache and deliver it, help set it up at MDC, or assist in training if needed.

<table>
<thead>
<tr>
<th>PROS</th>
<th>CONS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Data is cached and performant</td>
<td>Requires MDC to re-generate raster tiles (or cache on-demand) when a data update is desired</td>
</tr>
<tr>
<td>Standard industry best practice for serving and consuming mobile maps</td>
<td>MDC needs to expose hosted tile cache layer on an external server</td>
</tr>
<tr>
<td></td>
<td>Symbology can not be modified without recreating the cache</td>
</tr>
</tbody>
</table>
MDC Update Process for Option 2

1. Update Fish Attractors Data in SDE
2. Update Map Document as Desired (Symbology, Scales, etc.)
3. Generate Tile Package (using ArcMap or ArcGIS Pro) *
4. Update Tile Cache on Production Server
<table>
<thead>
<tr>
<th>Conservation</th>
<th>Mixedgrass Prairie</th>
<th>Gerald Droste</th>
<th>CZ006</th>
</tr>
</thead>
<tbody>
<tr>
<td>Assigning ONLY 4 Evals Sand Sagebrush Prairie</td>
<td>Alley Ranches, Inc.</td>
<td>CZ031</td>
<td></td>
</tr>
<tr>
<td>Lots of Mgmt and Eval Unit Mixedgrass Prairie</td>
<td>Hashknife</td>
<td>CZ087</td>
<td></td>
</tr>
</tbody>
</table>

**Monitoring**

**Plant Height**

<table>
<thead>
<tr>
<th>Plant Height</th>
<th>75'</th>
<th>85'</th>
<th>95'</th>
<th>105'</th>
<th>115'</th>
<th>125'</th>
<th>135'</th>
<th>145'</th>
</tr>
</thead>
<tbody>
<tr>
<td>Plant Phenology</td>
<td>None</td>
<td>None</td>
<td>None</td>
<td>None</td>
<td>None</td>
<td>None</td>
<td>None</td>
<td>None</td>
</tr>
<tr>
<td>Line Point Intercept</td>
<td>None</td>
<td>None</td>
<td>None</td>
<td>None</td>
<td>None</td>
<td>None</td>
<td>None</td>
<td>None</td>
</tr>
</tbody>
</table>

Measure tallest living or dead plant, including seed heads, intersecting a 12" diameter vertical cylinder next to and north of the tape, at the mark. Record heights to the nearest inch for plants < 3', to the nearest foot for plants between 3' and 10', and to the nearest 5' for plants > 10'.
### Evaluation Unit #3

<table>
<thead>
<tr>
<th>This Year Location</th>
<th>37.5110807322776° N</th>
<th>77.528471341117° W</th>
</tr>
</thead>
<tbody>
<tr>
<td>Last Year Location</td>
<td>37.5803627440274° N</td>
<td>99.9183889940291° W</td>
</tr>
</tbody>
</table>

#### Tree Cover %
- 0 %
- < 1 %
- < 5 %
- ≥ 5 %

[Map Image with delineated areas and site numbers]
### Potential Mobile Mapping Options

**Option 3: Provide vector tile service**

This option would allow the mobile app to consume a vector tile, thereby reducing demand on the server and allowing for faster load times, faster cache creation, and map style changes.

<table>
<thead>
<tr>
<th>PROS</th>
<th>CONS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Data is cached and performant</td>
<td>Requires ArcGIS Pro 1.2 to create tiles (and therefore an ArcGIS Online account as well)</td>
</tr>
<tr>
<td>Styles of vector tiles can be modified when requested</td>
<td>Requires either ArcGIS 10.4 for Server (license) or ArcGIS Online to serve vector tiles</td>
</tr>
<tr>
<td>Vector tiles are much smaller and faster to create and request than raster / image tiles</td>
<td>Tools used to create vector tiles and serve them are relatively new (1/2016)</td>
</tr>
<tr>
<td>Open specification used by mapping vendors</td>
<td></td>
</tr>
</tbody>
</table>
MDC Update Process for Option 3

1. Update Fish Attractors Data in SDE
2. Create Vector Tile Package Using ArcGIS Pro
3. Share (Publish) Vector Tile Package (to ArcGIS Online, ArcGIS Server, or Web Service)
<table>
<thead>
<tr>
<th></th>
<th>MAP TILE PACKAGE</th>
<th>VECTOR TILE PACKAGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Scale</td>
<td>20 levels of Google/Bing tiling scheme</td>
<td>Min Scale: 1:591657528</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Max Scale: 1:1128</td>
</tr>
<tr>
<td>Package Size (MB)</td>
<td>119 / 4382 (including aerial)</td>
<td>6.5</td>
</tr>
<tr>
<td>Time (mins)</td>
<td>17 / 40 (including aerial)</td>
<td>1</td>
</tr>
</tbody>
</table>
Potential Mobile Mapping Options

Option 4: Upload data to MapBox and consume cached maps

A third party mapping platform that enables users to upload data to it and create maps and serve them out as vector tiles.

<table>
<thead>
<tr>
<th>PROS</th>
<th>CONS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Data is cached and performant</td>
<td>Need to upload data to Mapbox in order to update mobile app(s)</td>
</tr>
<tr>
<td>Mapbox automatically caches the data</td>
<td>Mapbox subscription required (either TG account or an MDC account) if more than 50,000 mobile users per day (would require free subscription sign-up)</td>
</tr>
<tr>
<td>No effort needed by MDC to create the cache (just upload the desired data)</td>
<td></td>
</tr>
<tr>
<td>Supports both raster and vector tile caching</td>
<td></td>
</tr>
</tbody>
</table>
MDC Update Process for Option 4

1. Update Fish Attractors Data in SDE
2. Export Fish Attractor Data to Shapefile
3. Upload Shapefile to MapBox
Potential Mobile Mapping Options

Option 5: Upload data to ArcGIS Online and consume data as a published tile layer or a published vector tile layer

A third party mapping platform that enables users to upload data to it and create maps and serve them out as raster or vector tiles.

<table>
<thead>
<tr>
<th>PROS</th>
<th>CONS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Data is cached and performant</td>
<td>ArcGIS Online subscription required</td>
</tr>
<tr>
<td>Data can be updated at MDC and uploaded to update the mobile app</td>
<td>Vector caches still need to be created outside ArcGIS Online</td>
</tr>
</tbody>
</table>
MDC Update Process for Option 5

1. Update Fish Attractors Data in SDE
2. Create Vector Tile Package Using ArcGIS Pro OR Generate Tile Package (using ArcMap or ArcGIS Pro) *
3. Share (Publish) Tile Package to ArcGIS Online
## COLLECTOR (or other) VS. CUSTOM

<table>
<thead>
<tr>
<th>FEATURE</th>
<th>COLLECTOR</th>
<th>CUSTOM</th>
</tr>
</thead>
<tbody>
<tr>
<td>CONFIGURATION</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>TIME TO MARKET</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>USER WORKFLOW DRIVEN</td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>DISCOVERABILITY</td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>COMPLEX FORMS</td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>MINIMAL DEVELOPMENT COSTS</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>INTEGRATION WITH OTHER SYSTEMS</td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>MAINTENANCE</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>OFF-LINE FORMS AND MAPPING</td>
<td>X (INCL)</td>
<td></td>
</tr>
<tr>
<td>ARCGIS ONLINE ORGANIZATIONAL ACCOUNT REQ’D</td>
<td>X</td>
<td></td>
</tr>
</tbody>
</table>
QUESTIONS?

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