Lessons Learned
Migrating from a Custom Solution to COTS Solution

2018 AASHTO GIS for Transportation Symposium

MARYLAND DEPARTMENT OF TRANSPORTATION
STATE HIGHWAY ADMINISTRATION
Agenda

- Brief history of web-based GIS applications at SHA
- COTS solutions SHA is using
- Choosing between custom and COTS
- Transitioning a legacy app to a COTS solution
- Review of lessons learned and way ahead
Web-Based GIS Apps at MDOT SHA

- eGIS Portal
- KPA Dashboards
- Public eGIS
COTS Solutions Used by MDOT SHA

- Esri ArcGIS Online and Web AppBuilder
- Geocortex by Latitude Geographics
### Pros and Cons of Custom Solutions

<table>
<thead>
<tr>
<th>Pros</th>
<th>Cons</th>
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<tbody>
<tr>
<td>Built specifically for user needs</td>
<td>Large investment</td>
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<tr>
<td>Can meet 100% of your requirements</td>
<td>Significant development time</td>
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<tr>
<td>Grows with you--can be modified and expanded</td>
<td>Changes in technology may require solution reengineering</td>
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<tr>
<td>Have control over future of platform</td>
<td>Reliance on solution provider</td>
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Pros and Cons of COTS Solutions

Pros

- Lower cost
- Rapid deployment
- Configurable
- Changes along with technology
- Well suited for in-house development and support
- Access to user communities

Cons

- May not meet all user requirements
- Dependent on vendor for bug fixes, updates, changes, and support
- Lack of control over future of platform
Gap Analysis

- Understand the problem to be solved
- Define functional requirements
- Define architectural requirements
- Identify potential solutions
- Evaluate how well potential solutions meet defined requirements
- Choose a solution and begin planning for the implementation
Transitioning a Legacy App to a COTS Solution

Case Study #1: Bay Restoration Viewer

Purpose of application
- Follows Maryland’s Chesapeake Bay Watershed Implementation Plan in order to meet pollution reduction goals
- Proven strategies and controls to reduce nutrients and sediments that reach local waters and ultimately the Bay
- MDOT SHA implements these projects throughout the eleven most urbanized counties

Features
- Tree Plantings
- Stream Restoration
- Stormwater Control Structures
- Outfall Stabilization
- Pavement Removal

SHA implements various projects and programs to improve water quality across the state:
Transitioning a Legacy App to a COTS Solution

Case Study #1: Bay Restoration Viewer

- Review existing documentation created for custom application (functional requirements, data services)
- Existing custom application created using JavaScript + Ember framework
- Create ArcGIS Online web map (configure feature pop-up to match existing)
- Create ArcGIS Online web application using widgets available via Web AppBuilder (configure to match as closely as possible)
- Enterprise Data → ArcGIS REST services → Map configurations → App configurations
Transitioning a Legacy App to a COTS Solution

Case Study #1: Bay Restoration Viewer

- Theme consistent with other MDOT SHA web applications
- Widgets used
  - Info Summary
  - About (Overview)
  - About (Treatment type definitions)
  - Near Me
  - Legend
  - Layer List
  - Draw
  - Print
  - Share
  - Splash (MDOT data disclaimer)
  - Search (configured for address and feature search)
  - Basemap Gallery (MDOT SHA organizational setting)
Transitioning a Legacy App to a COTS Solution

Case Study #1: Bay Restoration Viewer
Transitioning a Legacy App to a COTS Solution

Case Study #1: Bay Restoration Viewer

Under Maryland’s Chesapeake Bay Watershed Implementation Plan (WIP), MDE has committed to meeting pollution reduction goals to restore the Chesapeake Bay and meet EPA targets by 2025. State agencies, federal and local governments, nonprofits and citizens are joining together to do their part. MDOT SHA uses a series of proven strategies and controls to reduce nutrients and sediments that reach local waters and ultimately the Bay, and is implementing these projects throughout the eleven most urbanized counties in Maryland. Please visit the Chesapeake Bay and Local Watershed Restoration page for more information on SHA’s efforts.

If you have feedback regarding the information provided in this application or its accuracy, please Contact Us.

Bay Restoration last updated: 10/11/2017
Transitioning a Legacy App to a COTS Solution

Case Study #1: Bay Restoration Viewer

![Map and pop-up window with information about stormwater control structure point. The pop-up window displays the following information:
- **Treatment Type**: Bio-Swale
- **Watershed**: Patapsco River Mesohaline
- **SHA ID Number**: 130627
- **Location**: Null
- **Runoff Treatment Acres**: 2.14 Acres]
Transitioning a Legacy App to a COTS Solution

Case Study #1: Bay Restoration Viewer

**Treatment Type**

**Stormwater Control Structures**

Stormwater control structures are engineered best management practices (BMPs) that receive stormwater runoff from developed areas and, using a variety of mechanisms, reduce pollutants and slow runoff velocities to minimize impacts when discharged to local waterways. SHA is identifying roadways that currently do not have stormwater control structures and implementing new BMPs that target pollutants in roadway stormwater runoff. The stormwater control structures currently being implemented are:

- **Bio-Swales**: are linear constructed filters that carry stormwater runoff, provide water quality treatment and decrease flow. They collect runoff from roadways, slowly filter the water through layers of vegetated soil, sand, and stone and discharge it through a subdrain that is usually connected to a storm drain inlet, manhole or outfall. They can be seeded or planted with native grass and meadow species.

- **Bio-retention facilities**: are similar to bio-swales, but not linear in form and can be planted with a variety of grasses, herbs, shrubs and small trees. They capture and temporarily store stormwater runoff before passing it through a filter bed mixture of soil, organic matter, sand and stone. Plants provide added pollutant removal through root systems that uptake water and nutrients and form beneficial relationships with soil organisms.

**Treatment Types**

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Case Study #2: Maryland Bridges in Black & White

Purpose of application
- Historic bridge photo collection consists of approximately 2,300 photographs of 367 bridge locations throughout the state
- Maryland State Roads Commission, predecessor of SHA, retained the Baltimore-based Hughes Photography
- Provides a documentary record of construction methods and equipment from the 1920s to the 1940s
- Cultural resource outreach

Features
- Historic Bridge locations
- Associated photographs
- Download photos in multiple resolutions
Transitioning a Legacy App to a COTS Solution

Case Study #2: Maryland Bridges in Black & White

- Review existing documentation created for custom application (functional requirements, data services)
- Existing custom application created using JavaScript + Ember framework
- Application connects to a web service (Oracle database that houses images and attribute info)
- Create ArcGIS Online web map (configure feature pop-up to match existing)
- Create ArcGIS Online web application using widgets available via Web AppBuilder (configure to match as closely as possible) AND custom widgets using Web AppBuilder for ArcGIS (Developer Edition)
- New web application created using ArcGIS API for JavaScript & HTML 5
Transitioning a Legacy App to a COTS Solution

Case Study #2: Maryland Bridges in Black & White

- Theme consistent with other MDOT SHA web applications

- Widgets used
  - Info Summary (Customized)
  - Photo Viewer (Customized) – Photos, Bridge Info, Definitions, MIHP forms
  - Filter
  - About (Overview)
  - Near Me
  - Legend
  - Layer List
  - Draw
  - Print
  - Share
  - Splash (MDOT data disclaimer)
  - Search (configured for address and feature search)
  - Basemap Gallery (MDOT SHA organizational setting)
Transitioning a Legacy App to a COTS Solution

Case Study #2: Maryland Bridges in Black & White
Transitioning a Legacy App to a COTS Solution

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Case Study #2: Maryland Bridges in Black & White

- **Bridge Name**: Alt 40 over Antietam Creek (Funkstown Bridge)
- **Bridge Description**: The Funkstown Stone Arch bridge was constructed in 1822 by James Lloyd as part of the turnpike route between Hagerstown and Boonsboro.
- **Facility Carried**: US 40 ALT
- **Feature Crossed**: Antietam Creek

**Bridge Status**
- **Standing**: This category identifies whether or not a bridge remains standing or in service as part of the State Highway Administration system of roads. “Standing” means a bridge either remains in service or remains standing but is not currently in service. A bridge identified as “demolished” has been removed from service and is no longer standing.

**Bridge Type**
- **Arch Bridges**: Arch bridges are one of the earliest recorded advancements in bridge building technology and represent a significant technological improvement over the simple slab crossing. Arch bridges can be built of timber, steel, iron, stone, brick, or concrete. Arches found beneath the deck are called deck arch or spandrel arches. When spandrel walls are filled with material such as concrete, brick or stone they are called closed spandrel arches. A twentieth century advancement in bridge engineering involved using steel beams or shaped reinforced concrete beams to create open space beneath the deck. These are called open spandrel arch bridges. Bridges where the structural arch travel above the road deck are called rainbow or through arch bridges.

- **Dams**: A dam is a barrier that impounds water for purposes of irrigation, navigation, flood management, electric power, industrial use, or consumption. Dams are also constructed to control and stabilize water flow in a method that allows land to be reclaimed for productive use. Dams are constructed on many different types of materials including earth, timber, steel, and concrete.

- **Girder Bridges**: Girder or Beam bridges are a modern application of traditional bridge building technology. The earliest of bridges involved felling two trees, spanning a crossing and connecting the trees with material of some kind. Today, girder bridges are built out of steel or reinforced concrete. Steel girders may be rolled into losa or shaped into plates held together by rivets, bolts or welded joints. Concrete girders may be separate or integrated into the bridge deck.

- **Movable Bridges**: Movable bridges in Maryland are one of two types: bascule bridges, which have one or two leaves or deck sections that lift by mechanical means; or pivot also known as swing spans, which rotate horizontally around a central pier. Both are known as drawbridges. Movable bridges are built at navigable crossings to allow water traffic to pass up and downstream. They are more cost effective to build than larger suspension or cantilever bridges, especially where space is at a premium such as in a small town or where the landscape is primarily flat.

- **Pipes**: Although it is not known when pipes were first used to convey small or infrequently flowing streams beneath roadways, they are now a staple of any highway department. In the early twentieth century, pipes were constructed of materials such as iron, terra cotta, and vitrified clay. Corrugated steel and concrete pipes came into use during the middle of the twentieth century. In the twenty-first century, steel and concrete continue to be used alongside aluminum and high density polyethylene. Depending on the needs of a particular crossing, pipes vary widely in size, shape and number.
Transitioning a Legacy App to a COTS Solution

Case Study #2: Maryland Bridges in Black & White

![Filter Interface]

- **County:** All
- **National Register Eligibility Status:** Eligible, Not Eligible, Not Evaluated
- **Bridge Status:** Demolished, Standing
- **Preservation Priority Status:** Priority, Non-Priority, Eligible, None
- **Bridge Type:** All
- **Bridge Material:** All

![Legend and Filter Options]

- **Legend:**
- **Filter Options:**
  - Bridge Material - Concrete
  - Bridge Material - Metal
  - Bridge Material - Stone
  - Bridge Material - Wood
Lessons Learned

- Considerations when choosing between COTS and custom solutions
- Understanding the “journey of the data” to help in troubleshooting
  - Enterprise Data → ArcGIS REST services → Map configurations → App configurations
- Need for an application developer familiar with ArcGIS API for JavaScript & HTML 5
- Regular outreach with content owners on the “transformation” of their application
- Organizing and making common content accessible through the organization’s ArcGIS Online account
  - Logos, icons, data disclaimers, address locators, etc.
Way Ahead

- Transition away from Flex-based eGIS Portal
  - 62 contents (layers and widgets)
- Continued publication of public-facing applications
- Implementation of data governance plan
- Organize and keep track of map services
Open Data Portal

- Included as part of ArcGIS Online
- Allows users to set up a public-facing website to share open data
- Vector datasets are automatically available for download as CSV, KML, and shapefiles and accessible via the GeoJSON and GeoService APIs
- Can share maps, feature and image services, spreadsheets, web apps, and documents
Q&A

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