County of Los Angeles

Chief Information Office

Preferred Technologies for Geographic Information Systems (GIS)

Version 2 – May 2015

CIO Preferred Technologies for GIS

This document lists the preferred Geographic Information Systems (GIS) technologies for the County of Los Angeles. This document is designed to help GIS and IT personnel identify technologies during proposal and contract development, procurement, and acquisition of new systems to ensure that they are compatible with existing GIS systems within the County. This document supports the Chief Information Office's mission of reducing redundant development platforms and streamlining the development, storage, maintenance, and access to geographic data and GIS application development.

These technologies will be reviewed and updated on an ongoing basis to ensure they are current with new technologies. While the County does not enforce these technologies as standards, it is noted that GIS systems not using these technologies will receive increased scrutiny by the Chief Information Office and the Geographic Information Officer.

Overview

Geographic Information Systems preferred technologies are broadly divided into the following tiers:

- GIS Data Management Tier.
- GIS Data Storage Tier, including database and enabling technologies.
- GIS Data Deployment and Communication Protocol Tier.
- GIS Application Development Tier, including mobile GIS deployment
- Commercial basemaps for areas outside of Los Angeles County.

Technologies listed are organized in the following way:

- Preferred Technology: reviewed and commonly used by the County, and should be the first choice for GIS deployment
- Emerging Technology: newer technologies or systems that have been identified as having potential for moving toward preferred status.
- Not Preferred Technology: Technologies of systems that have been reviewed and identified as having flaws and/or deployment issues, not recommend for deployment.

Revision History

Version	Date
Version 1.0	January 2015
Version 1.1	May 2015 – added Leaflet and geoJSON

CIO Preferred Technologies for GIS

Tier	Preferred Technologies	Source of Standard	Emerging Technologies	Not Preferred
Data Management	ESRI ArcGIS Desktop	De-facto	QGIS, gvSIG, GRASS GIS, Window GIS, MapGuide	MapInfo GeoMedia (Intergraph)
Data Storage	SQLServer Spatial	County Preferred Technologies for Databases	PostgreSQL (PostGIS)	SQL Server with ESRI SDE Oracle with ESRI SDE
	Oracle Spatial			
GIS Data Deployment	ESRI ArcGIS Server, Socrata	De-facto	GeoServer, Boundless, MapServer, TileMill, MapBox,	
GIS Communication	ESRI REST API & JSON	De-facto		SVG
	SOAP XML	W3C		
	WFS (Web Feature Service)	OGC (Open Geospatial Consortium)		
	JSON, geoJSON	W3C, eGIS Commitee		
	WMS (Web Mapping Service)	OGC (Open Geospatial Consortium)		
GIS Application Development	Latitude Geographics	eGIS Committee Identified	MapBox, ArcGIS Online Apps	Orion, OpenLayers
	Leaflet	eGIS Committee Identified		
	ESRI Application Development			
	Custom coding			
Mobile Application Development	Geocortex HTML5 web sites & App	eGIS Mobile sub-committee	AmigoCloud, ESRI ArcGIS Online Collector	
	Leaflet	eGIS Committee Identified		
	Custom coding (iOS & Android)			
Worldwide/ Commercial Maps	Google Maps, Bing Maps	De-facto	OpenStreetMap	

GIS Data Management Tier

ESRI's ArcGIS series of software (ArcGIS Desktop Basic, Standard, and Advanced) is the de-facto standard for the development and maintenance of GIS data, with 98% of the installed desktop GIS software base. GIS professionals also use this software to do advanced geographic analysis, complete mapping tasks, and provide support to County department business operations.

Continuing updates from the software vendor (ESRI) ensures that this software is kept up to date.

Emerging Technologies

Open source desktop GIS software packages are becoming increasingly viable. Quantum GIS (QGIS) is an actively supported open source software that supports local data management, mapping, and analysis, but without some of the advanced analysis and central data management capabilities supported by ESRI's software. QGIS integrates with GRASS GIS, a historical desktop software product. QGIS and other software like it should continue to be evaluated since the open source (free) model may provide cost savings. However, retraining staff to use this tool would be a substantial expense to the County.

Not Preferred

A number of other commercial packages for managing GIS data exist, such as MapInfo. However, they do not have the same robust tools and data structures that are used by the County, and are not recommended.

GIS Data Storage Tier

Microsoft SQL Server and Oracle database technologies are County Preferred technologies, and support enterprise level access to data, both geographic and non-geographic.

Historically GIS data has been stored in these databases using a proprietary format from ESRI called SDE binary. Recently, ESRI's desktop software is able to leverage the native spatial types that are now part of the two databases (SQL Spatial and Oracle Spatial). This enables applications to leverage database queries directly, potentially increasing performance. It is preferred that data be stored in the native spatial formats rather than the SDE binary format, which will enable County departments to leverage GIS capabilities within their existing infrastructure. The County Enterprise GIS Program is currently transitioning to this technology from the SDE technology.

Emerging Technologies

An open-source database (PostGreSQL) has become a strong spatial database storage technology. With its spatial format enabled, it is called PostGIS, and is supported by ESRI's desktop and server technologies. While this database is not currently a County Preferred Technology, as the

open source model becomes more attractive to the County, this database technology may warrant further investigation as a means of cost savings, since there are no licensing fees. Costs to transition data and staff expertise limit the benefits of the software cost savings.

Not Preferred

ESRI's older SDE spatial storage technology, while still viable, requires separate licensing and upgrade cycles from the database maintenance cycle, and does not enable direct geographic and spatial queries within the database. The County's Enterprise GIS Infrastructure is moving away from this technology, and should be completely away from SDE by the end of FY 2014-2015.

Note, however, that SDE is still a viable technology, and has a longer track record within the County. For departments that do not need to leverage the SQL Spatial capabilities this technology can still be used.

GIS Data Deployment Tier

Along with the Desktop and Storage tiers, ESRI's ArcGIS Server software is the de-facto standard for deploying GIS data for access through applications. ArcGIS Server provides off the shelf capabilities with continuing updates, support, and training, and enables data to be provided to the application tier through the preferred communication protocols and languages listed below, including API capabilities from a number of programming languages (Javascript, Flex, Silverlight).

The County's Open Data Portal (http://data.lacounty.gov) leverages Socrata to enable data viewing, access, and download. It includes publication and an API for developers to leverage this cloud-hosted service.

Emerging Technologies

A number of new data deployment software options have become available, including Map Server and GeoServer, which are open source software tools for publishing data. Boundless (formerly OpenGeo) provides a full stack of software components including PostGIS and GeoServer with support options. Other open source options that are increasingly used are TileMill for generating cached maps as well as MapBox for hosting map services. These emerging technologies are gaining market share in the commercial arena, and will be tracked to determine their viability for use within the County.

GIS Communication Tier

Regardless of the deployment platform, it is critical that the technology enable communication between applications and the GIS data storage tier through API calls which abstract the functions necessary to support GIS capabilities. The County recognizes a number of W3C standards as well as Open Geospatial Consortium (OGC) standards:

- REST (REpresentational State Transfer) – a lightweight communication protocol using JSON (JavaScript Object Notation) to enable data transport
- SOAP (Simple Object Access Protocol) – an earlier technology leveraging XML data structure -
- WFS (Web Feature Service) - which streams raw GIS data to the client for rendering – OGC standard
- WMS (Web Mapping Service) – where the server processes the data into a map and sends the resulting image to the client.

geoJSON has emerged as a method for providing geographic data through geographically tagged JSON (Javascript Object Notation). A geoJSON file can be ready by client APIs and applications natively (leaflet, for example) without needing to have the server do any rendering – which can enable lower server loads and faster deployment.

Emerging Technologies

None at this time.

Not Preferred

Spatial Vector Graphics (SVG) is an older technology that was used for a few applications in the past, but since Adobe stopped support a few years ago, this technology is not preferred.

GIS Application Development Tier

A GIS Application Development Framework enables GIS applications to be developed through a standard configuration tool rather than custom coding.

Deploying such a tool:

- Reduces development costs;
- Increases development speed;
- Reduces application maintenance costs;

- Reduces application upgrade costs;
- Supports code-sharing and re-use;
- "Future-proofs" applications as underlying technologies from ESRI is upgraded,
- Adds new functionality as the framework is upgraded.

The County has selected Latitude Geographics' Geocortex Essentials product suite as its Application Development Framework, and has acquired an Enterprise License for it. Geocortex Essentials has continued to be used as the County's preferred Application Development Framework because it:

- Is a product with regular development cycles rather than un-supported code;
- continues to have tight integration with ESRI's ArcGIS server technology;
- supports new releases of ESRI ArcGIS Server technology;
- includes technical support and training;
- provides the ability to share code between applications;
- receives regular upgrades and addition of new features and functions as part of the product;
- supports for new and emerging platforms including mobile devices;
- supports for new operating systems and standards, including iOS, Android, and HTML5;

For lightweight and mobile applications, Leaflet (http://leafletjs.com/) has distinguished itself as a simple and powerful library for building simple applications, especially on a mobile platform. It can leverage both external basemaps from MapBox, ESRI, and Google, as well as internal map services. A number of commercial sites leverage leaflet, which is a valuable addition to the GIS development space.

Emerging Technologies

MapBox is a hosting company that provides hosting for data, as well as an API (MapboxGL) for application development. The hosted (Software as a Service) model is gaining traction in the GIS world (see ArcGIS Online) and may become a valuable resource for the County.

ESRI has released a set of application development tools centered on its cloud hosted solution, ArcGIS Online. In general, while these capabilities are straightforward to begin development, they are difficult to customize to meet specific business requirements, and any customization is both difficult to implement and will not be supported by future maintenance releases.

The County recognizes that ESRI is investing heavily in the ArcGIS Online platform, and will continue to monitor developments of the platform. Certain applications such as Story Maps and Briefing Books appear to have promise for simple applications that departments can utilize.

Not Preferred

OpenLayers is an open source Javascript API that enables application development. It is used fairly frequently by software vendors delivering COTS solutions for mapping. There is limited support for this product, and it tends to lack critical capabilities that hamper application development.

Other vendors, such as Orion EnPoint, provide very specific solutions, and are not broad enough for the variety of application development that is required in the County.

Mobile Application Development

As the County has moved toward supporting both a mobile workforce and mobile citizenry, the eGIS Committee established the mobile subcommittee to review available options and establish a mobile strategy and preferred technologies for GIS applications. The subcommittee, after reviewing a number of technologies, and reviewing the various mobile development strategies available (read this article for a good summary of the three options), determined the following preferences:

1. Mobile Web Applications – Geocortex HTML5 viewer
2. Hybrid Web Applications – Geocortex HTML5 with their native app to provide access to the native phone features.
3. Native – custom code (Public Works' "The Works" application)

Emerging Technologies

A number of companies are developing mobile application development platforms, including AmigoCloud and ESRI's "Collector for ArcGIS". They were deemed to not meet the variety of deployment requirements of the County at the current time, including support for the various business requirements that are needed to support both internal and public facing applications. The County will continue to review these as they gain a track record.

Not Preferred

None at this time.

Worldwide/Commercial Maps

In some instances County mapping applications require maps to extend beyond the geographic extent of the County. A number of worldwide and commercial map sources exist. The most commonly used are Google Maps and Bing Maps, since these are highly available, updated, and commonly used base maps that provide worldwide coverage, which support user access to maps outside of the boundaries of LA County.

Google maps is a map standard and style recognized by County staff and residents, and is commonly used for stand-alone application development like the County Services Locator (http://maps.lacounty.gov).

A number of departments have found that Bing maps has a better return rate and accuracy for locating addresses, so while in general Bing isn't recommended for mapping applications, for address locating and in instances where the Bing API is required (for example within ESRI-based applications where Google's maps don't integrate as well), if Google cannot be used Bing is acceptable.

Emerging Technologies

A recent addition is OpenStreetMap, which is a crowdsourced map of the world, which is no-cost and provides accurate mapping within the Los Angeles Area. Its free nature has led to its inclusion as a replacement for Bing maps where possible, especially since it can be included in the Latitude Geographic suite of application development tools. As well, many GIS application development platforms such as MapBox and other commercial providers are transitioning from Google to OpenSreetmap due to its lower cost.

Not Preferred

Bing Maps is more commonly supported within the existing ESRI-based ArcGIS Server software, and can be added to the Latitude Geographic suite of application development tools. However, in order to maintain a standard mapping platform, and reduce the number of development methodologies for the County, it is recommended that Google's maps be tried first.