Web GIS Architecture
Deployment Options

Andrew Sakowicz, asakowicz@esri.com
Ryan Kelly, rkelley@esri.com
Our World Is Evolving

Technology
- Virtualization
- Big Data
- IoT
- Faster Computing
- Distributed Processing
- Smart Devices
- Consumerization
- Cloud

Content
- Lidar
- Field Survey
- Social Media
- Real-Time
- Crowdsourcing
- Sensors
- Scientific Data
- GPS
- Remote Sensing
- UAVs

Applications
- Analytics
- Apps
- Mobile
- 3D
- Visualization
- Real-Time
- Collaborative

Implementation
- Configurable
- Agile
- Open
- Easier
- Ready to Use

Faster Computing
Big Data
Distributed Processing
Cloud
Consumerization
Smart Devices
Virtualization
GIS is Evolving
Opening, Integrating and Simplifying Everything

Integrating Existing Systems . . . Creating a System of Systems
What is Web GIS and ArcGIS Enterprise?
What is GIS?

• A web application
• Digital basemaps
• Operational layers
• Tasks and tools in the web GIS application
• One or more geodatabases
What's included with ArcGIS Enterprise?

- **ArcGIS Server**—the core web services component for making maps and performing analysis.
- **Portal for ArcGIS**—allows you to share maps, applications, and other geographic information with other people in your organization.
- **ArcGIS Data Store**—lets you configure data storage for hosting and federated servers used with your deployment.
- **ArcGIS Web Adaptor**—allows you to integrate your ArcGIS Server and Portal for ArcGIS with your existing web server and your organization's security mechanisms.
Base ArcGIS Enterprise Deployment

- ArcGIS Web Adaptor
- Portal for ArcGIS
- Hosting Server
- ArcGIS Data Store (relational + tile cache)
Federate ArcGIS Server

- Features requiring federation:
  - Automatic item creation in Portal
  - Enterprise Logins (SAML 3.0)
  - Publishing 3D scene layers
  - Publishing from ArcGIS Pro
  - Standard Analysis Tools in Portal
  - Publishing Vector Tiles
  - High Volume Archiving from GeoEvent (Spatiotemporal Data store)
  - Raster Analytics
  - GeoAnalytics
  - Insights for ArcGIS
  - Survey123

Multiple cluster functionality in ArcGIS Server is being deprecated.
Distributed collaboration (Sharing Items from ArcGIS Enterprise to ArcGIS online)
ArcGIS Enterprise Machine and Tier Deployment Options
Singe machine
Multitiered Deployment
Highly Available Deployment
ArcGIS Enterprise
Capabilities
Deployment Options
ArcGIS Server
ArcGIS Image Server
ArcGIS GeoAnalytics Server
ArcGIS Multi-GeoAnalytics Server
ArcGIS GeoEvent Server
ArcGIS Multi-GeoEvent Server
Scaling and Workload Separation
Workload Separation

Initial Deployment

Complete GIS
Server Roles

• Follow best practices on workload separation and assign only one server role per ArcGIS Server site

• If small site and consider combining multiple server roles in a single site:
  - Be careful combining GIS Server role with other server roles
  - Be careful combining Image Server role with other server roles
  - Avoid combining GeoEvent Server role with other server roles
  - Never combine GeoAnalytics Server role with any other server role
Scaling the base ArcGIS Enterprise deployment

- Conduct capacity planning and testing
- Add machine to hosting server as needed, especially when using:
  - Spatial analysis tools
  - Insights for ArcGIS
High Availability Options
Strategies for minimizing downtime and data loss

Backup and Restore
High Availability
Geographic Redundancy
Geographic Redundancy with High Availability

Increasing complexity and required resources
Built-in users, inside firewall
Built-in users with public access to the portal
IWA or LDAP authentication with client access internal
SAML or ADFS authentication with public access to the portal

Secure a publicly accessed portal using load balancers
SAML or ADFS authentication with public access to the portal

Secure a publicly accessed portal using web adaptors
Cloud Architecture Options
On-Premises, Online or hybrid

On-premises  |  Public Cloud  |  Hybrid
Cloud Options

- **Internet Users**
  - **Intranet**
  - **Online**

- **ArcGIS Online**

- **Cloud GIS Server** *(e.g. Amazon)*

- **Esri Managed Cloud Services**

### Options

- **ArcGIS Online**
  - w/ Cloud GIS Server(s)

- **ArcGIS Online**
  - w/ Esri Managed Cloud Svcs
On-Premises, Online or hybrid

- **Online**
  - Fast Start & No Additional Software
  - Likely Lower TCO
  - Some “Metadata” Stored in Cloud
  - Limited Functionality

- **On-premises or hybrid**
  - More Control
  - All Data & Metadata On-Premises
  - More Security Integration Options
  - Additional Software to Manage
  - Architecture Becomes More Complex
ArcGIS Online and Managed Services

- Users:
  - Desktop
  - Web
  - Mobile

- Esri Managed Services:
  - Custom Web Apps
  - GP, Reporting Services
  - Imagery, Large Datasets
  - Dynamic Map Services
  - RDBMS (Oracle, SQL Server)

- ArcGIS Online:
  - Online Basemaps
  - Geocoding, Routing
  - Hosted Feature & Tile Map Services
  - App Templates

ArcGIS Online front-end, Managed Services back-end
Common business drivers…

Outsource Operations
- Don’t have the skills?
- Want to focus your resources elsewhere?
- Does your technology strategy dictate a “cloud first” roadmap?

Evaluate Capabilities
- Want to evaluate either the capabilities of the cloud technology or software?
One or multiple portals

One Portal

Many Portals?
Portal Architecture Options

Department A Users

Department B Users

Department C Users
Portal Architecture Options

Department A Users

Department B Users

Department C Users

Shared Services
Portal Architecture Options

Enterprise or Public Users

Department A Users

Department B Users

Department C Users

Shared Services
High Availability

3rd party load balancer
ArcGIS Server
Architecture
Options
Silos, Sites & Clusters

Silo
- Configuration Stores
- LB

Site recommended
- Configuration Store (shared)
- LB

Cluster To be deprecated
- Configuration Store (shared)
- LB

Use silos or small sites
Site design consideration
Multi-node, high number of services

• Ensure require infrastructure resources
  - Network stability
  - NAS stability for ArcGIS Server and Portal config stores
  - RAM
  - CPU

• Avoid during the working hrs:
  - Publishing high number services
  - Adding/removing nodes

• Distribute recycle times
Site management consideration

- Identify unused services and reduce min (to 0 if possible)
- Tune slow services
- Provide best practices to the publishers
- Monitor resources:
  - RAM and committed memory
  - CPU
  - Network latency

All available as part of System Monitor, https://systemmonitoring-emcs.esri.com/Portal
Data Architecture Options
Data management strategy

Centralized

- Single data center = lower cost
- Performance depends on network: good bandwidth and low latency
Data management strategy
Distributed

- Good performance - local application and data
- Might require complex replication and synchronization process
- Multiple datacenters = higher costs
Data management strategy

- Geodatabase export / import
- RDBMS export / import
- RDBMS replication
- ETL Tools (e.g. FME, Informatica)
- Geodatabase replication
### Performance Factors

Network transport time

- **Impact of service and return type on network transport time**
  - Compression
  - Content, e.g., Vector vs. Raster
  - Return type, e.g., JPEG vs. PNG

<table>
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<th>Application Type</th>
<th>Service/Op</th>
<th>Content</th>
<th>Return Type</th>
<th>Mb/Tr</th>
<th>56 kbps</th>
<th>1.54 Mbps</th>
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</tr>
</tbody>
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Data management strategy
Production and Publication (external access)

• Pros:
  - Better security
  - Improved performance
  - Additional capacity

• Cons:
  - Requires replication
  - Additional hardware
Publication Strategies
The Role of Portal & Web Layers

Portal
- Active Wells
- Proposed Wells
- Wells by Status

GeoServices
- Wells

Geodata
- Wells
Hosting server

- Scalable solution - can publish thousands of services
Deployment best practices
Best Practices for Deployment

Plan Ahead

• Workload Separation
• DNS Aliases
• Follow Deployment Patterns
• Reduce Complexity
• Document Configurations
• Prototype
• Monitor Health
DNS Aliases

It is best when planning to provision DNS aliases in anticipation of adding additional servers or load balancers to the configuration.

DNS aliases decouples machine names and fully qualified domain names (FQDN) from the URL’s and web entry points to the system.
Provide sufficient hardware resources

Most systems are CPU bound

GIS Systems are bound by:

1. CPU - typically
2. Memory – when large number of services
3. Disk – Image Service, Synchronization
4. Network – low bandwidth deployment
5. Poorly configured virtualization can result in 30% or higher performance degradation

Most well-configured and tuned GIS systems are CPU bound.
CPU capacity

1. User load: Concurrent users or throughput
2. Operation CPU service time (model)—performance
3. CPU SpecRate

\[
\# CPU_t = \frac{ST_b \times TH_t \times 100}{3600 \times \%CPU_t} \times \frac{SpecRatePerCPU_b}{SpecRatePerCPU_t}
\]

subscript \ t = target
subscript \ b = benchmark
ST = CPU service time
TH = throughput
\%CPU = percent CPU
Network capacity

Network transport time

- Required bandwidth
  - Response size
  - Number of transactions

- Network transport time
  - Response size
  - Effective bandwidth

\[ Mbp s = \frac{TH \times Mbits / req}{3600} \]

\[ Transport(\text{sec}) = \frac{Mbits / req}{Mbp s - Mbp s_{\text{used}}} \]
Monitor
Full stack monitoring

http://go.esri.com/monitor
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Planning an Enterprise Geodatabase