The GeoPlatform:

How service-oriented architecture impacts your organization

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The vision of SOA

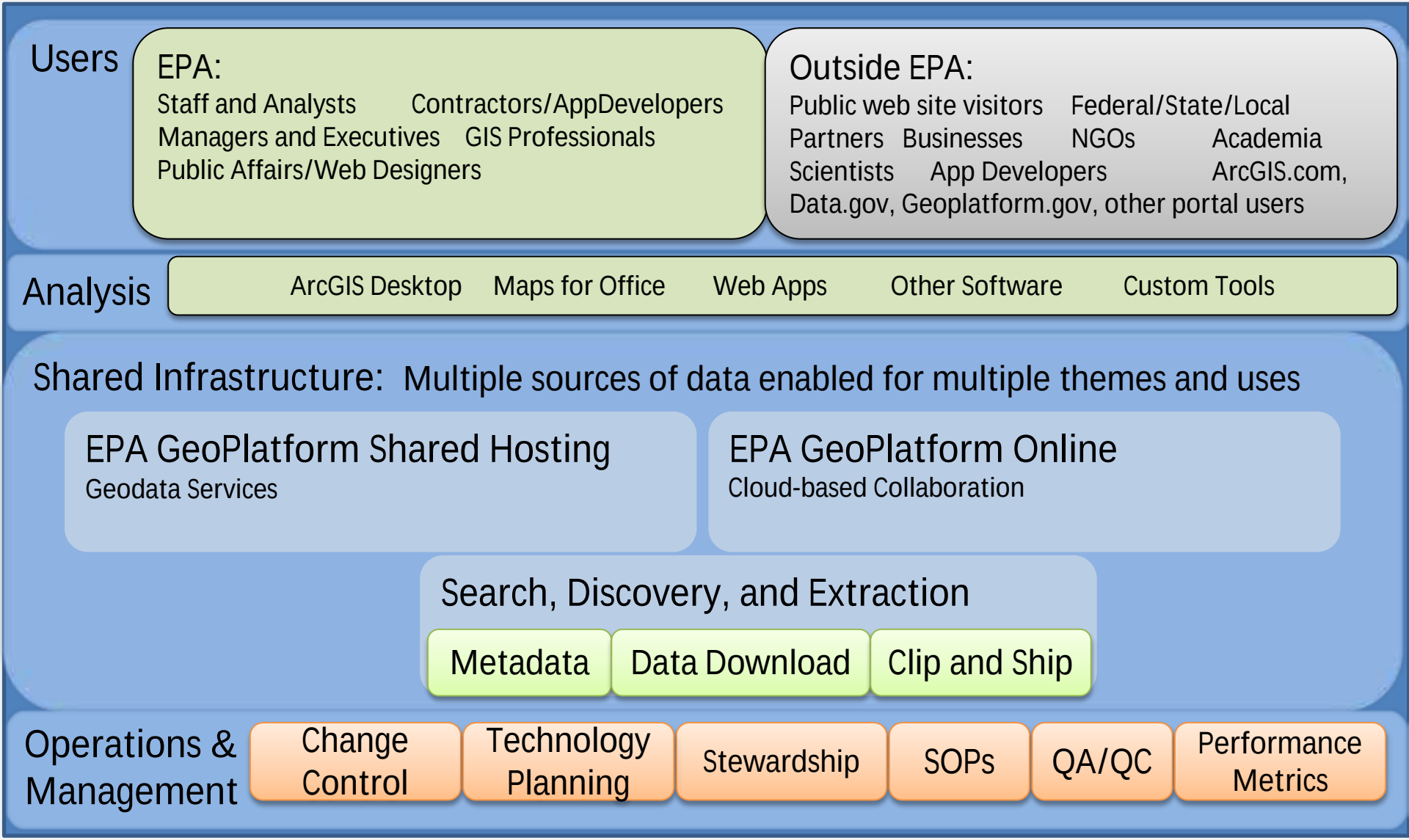
- An ecosystem in which everyone is responsible for managing and publishing their granular, reusable services
- Effort focused on everyone's area of expertise, not obtaining and processing someone else's data
- Decreases redundancy, improves efficiency and lowers costs
- Faster development cycles - ability to adapt to changing requirements
- Lowers barrier to entry – more people authoring more maps
- Transparency and data openness fosters higher quality

Sounds great, but isn't everyone doing this already?

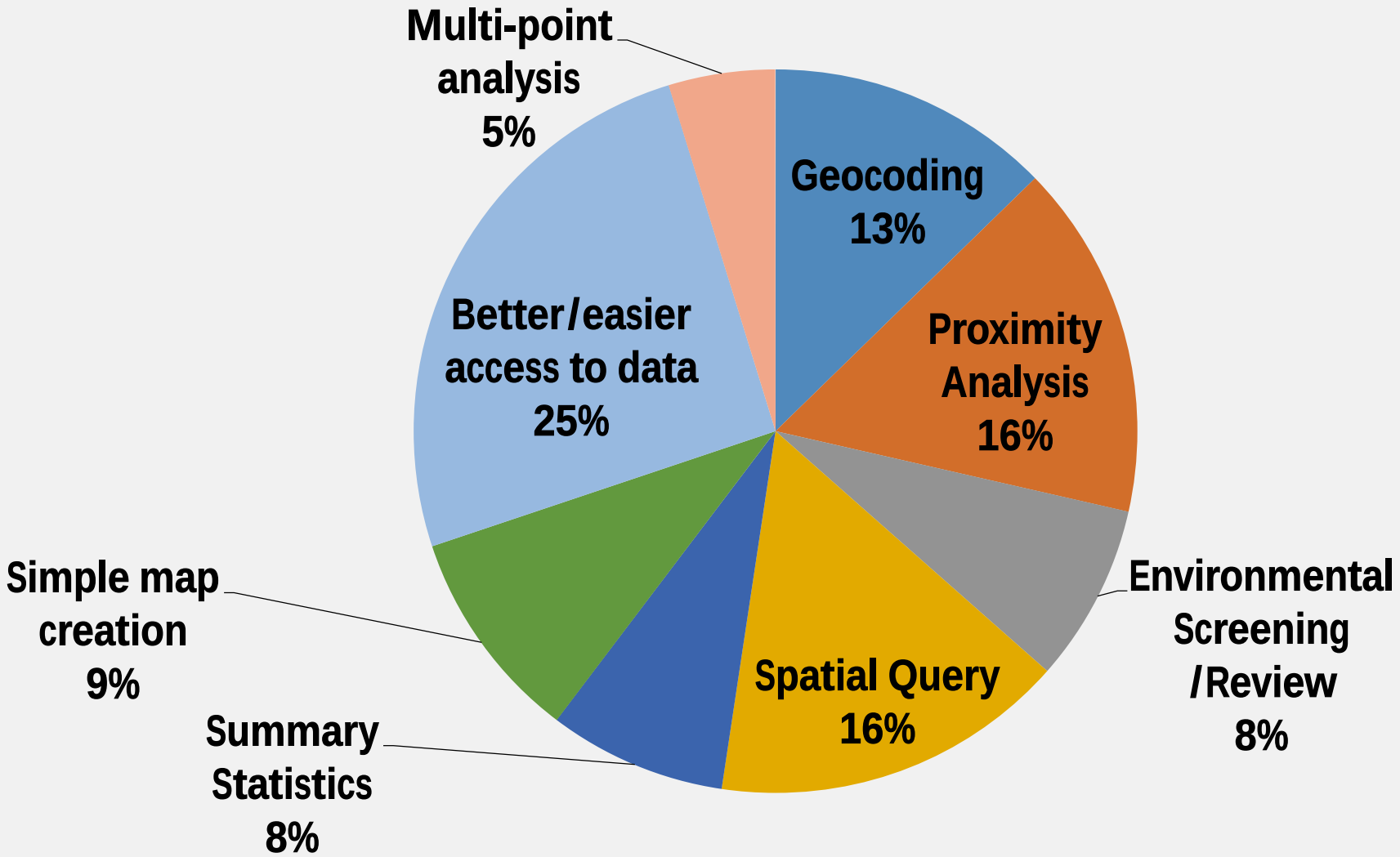
- Service Oriented Architecture as a technology isn't new
- Adoption has been spotty, or isolated, or stovepiped
- What are the barriers to publishing services?
  - No requirements, less control, less credit/more criticism, costs
- What are the barriers to consuming services?
  - Discovery, fit, documentation, reliability, change control
- SOA isn't something you can buy, it requires organizational change
  - Roles, responsibilities, expectations, workflows, trust
- We have a success story to share, but thorny challenges remain

EPA GeoPlatform Concept

EPA GeoPlatform Architecture



EPA GeoPlatform Business Case



Publishing Barriers – No requirements

- Fundamental premise of SOA is that not every use case can be foreseen - services will be discovered and recombined freely
- How do you publish with no clear requirements?
- We authored a checklist of best practices to guide authorship of generic, reusable services
- Publish the same data in multiple open formats
- Design services to be modular and flexible
  - Include only semantically similar layers
  - Separate labels, enable dynamic rendering

Publishing Barriers – Access Control

- Data owners often feel possessive about their data
- Addressing at the organizational and federal level via mandates:
  - Data required to be published openly by default unless a valid justification is given for restricting access
- Continuous outreach documenting success stories built on open services ensures data owners continue to receive credit
- Reassure data owners that transparency may air dirty laundry but will get it cleaner faster – avoid organizational blame
- Data misers do not win friends in an organization
- Services and data portals do support access controls

Publishing Barriers – Message Control

- Data owners often believe that their data is unique and complex and therefore they need to guide users carefully through it
- Result is often overweight, kitchen-sink style maps that imitate desktop functionality but still lack a message and overwhelm users
- Solution: New application development model:
  - Tightly focused maps/apps – simple UI, specific message
  - Agile development – flexible, lightweight, adaptable
  - Works best with flexible, modular, reusable services!
- High quality data with thorough metadata will ensure that services will be used appropriately

Publishing Barriers – Bureaucratic and Financial

- Historically the bureaucratic burden to publishing a map service or application was significant
- GIS Applications can be complex, involve many IT groups, and many reviews for content and technology alignment
- EPA has internal hosting cost recovery mechanism, GIS complexity also drives up those costs
- Result: only the very largest, best funded applications survived, which means no ecosystem of services
- Solution: communal “GeoPlatform” hosting environment with no direct cost and streamlined review process, limits on application size and complexity to control costs

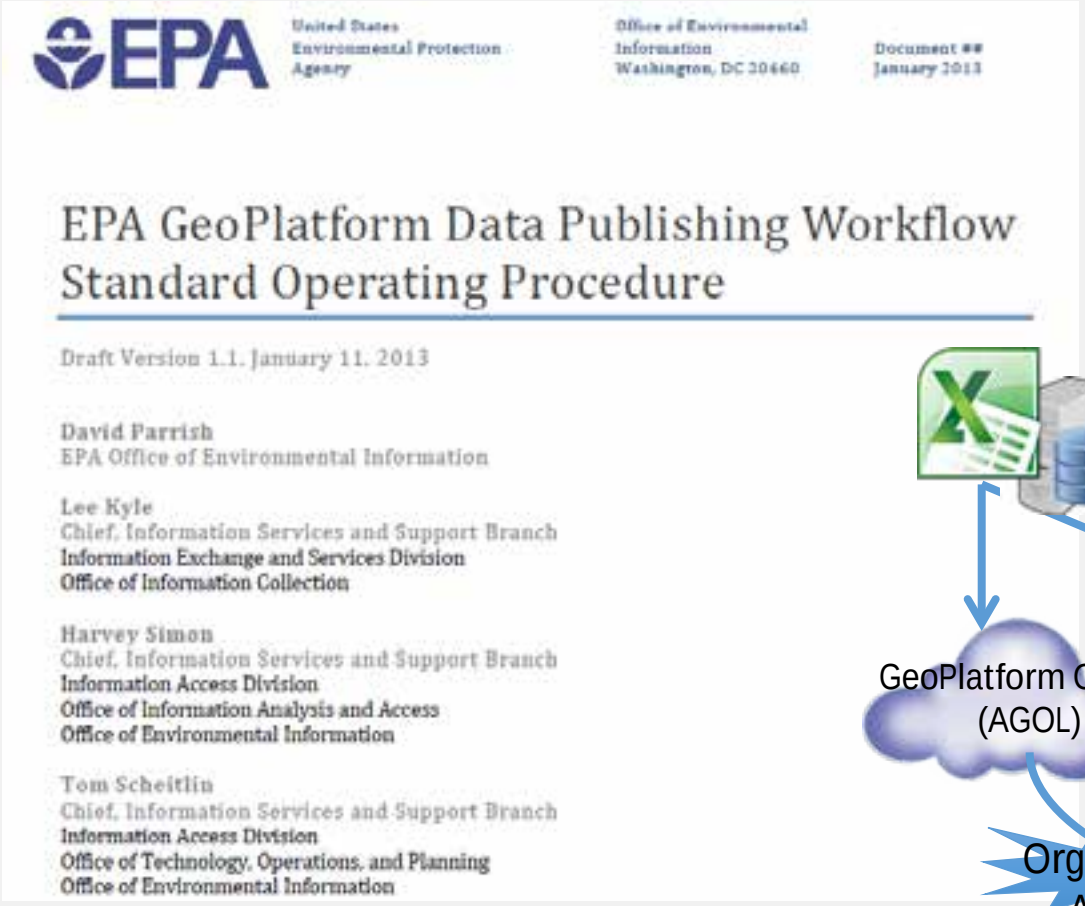
Bureaucratic and Financial Gaps

- Federal authority to operate (ATO) in ArcGIS Online cloud
  - EPA still operating in provisional mode
  - FISMA low certification recently approved for USDA
- Feature service hosting still outstanding, as well as FISMA moderate
- Federal security requirements mean cloud solutions rarely cheaper, usually much more expensive than on-premises solutions

Publishing Barriers – Technical Knowledge

- Publishing geospatial data requires significant expertise: subject matter, cartography, metadata, as well as databases, application servers, web programming and cloud services
- ESRI is really helping by providing simple, easy to use tools and templates:
  - Esri Maps for Office
  - ArcGIS.com viewer, FlexBuilder and new JavaScript app builder
  - Story Map templates and other application templates
- We can't eliminate all the complexity, some business cases and data are simply rich and complex
- We have developed SOP documents, best practices checklists and are conducting ongoing training and outreach
- We also rely on traditional GIS staff (analysts, managers, and developers) to educate new users and review products

Process for publishing maps and data



EPA

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Document ##
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EPA GeoPlatform Data Publishing Workflow Standard Operating Procedure

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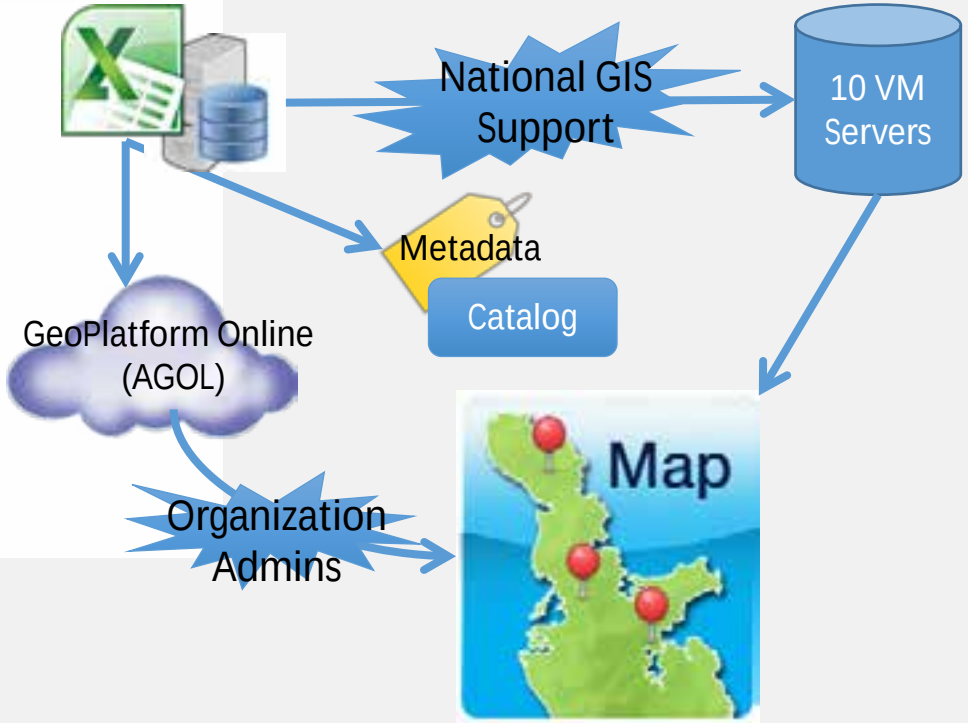

Service Publishing Checklist Sampler

- Performance really matters – test, tune, optimize, test
  - Use local data in Web Mercator projection with indices
- Services are multiscale – set appropriate visibility, generalization
- Services don't do relational data well – flatten, reorganize
- Include all/only appropriate attributes and aliases
- Enable all practical endpoints and formats
- Publish source data in parallel
- Produce thorough and complete metadata
- Register service, crosslink metadata

Usage Barriers – Resource Discovery

- Finding resources can be a big challenge:
  - Many services and downloads aren't indexed by Google
  - Many services aren't registered in ArcGIS Online or other portals
  - Often best resources are buried in clutter of ArcGIS Online or other portals
- Carrot and stick approach with metadata:
  - EPA Metadata Editor and Metadata Styleguides make authorship easy
  - Registration of complete metadata a requirement for hosting
- System of federated metadata harvesting from producers through Environmental Dataset Gateway up to Data.gov
- Active partner in federal *project open data* initiative to make datasets more accessible and machine-readable

Usage Barriers - Gaps in Resource Discovery

- We are still struggling with tagging within the ArcGIS Online Environment:
  - Need to simultaneously promote and standardize keyword usage
  - Need to better match tagging with used search terms
  - Need to find better mechanisms for weighting search results to emphasize preferred datasets
- Creation of service metadata is still detached from dataset metadata
  - Need better, more seamless synchronization
- Metadata standards and guidance are still misaligned
- Goal is federated stewardship, still a clear need for a catalog librarian

Usage Barriers – Resource Fit

- All too often, even after discovering a service, users will say “that’s great, but…”
  - “I don’t like the cartographic choices”, “I wish it had certain additional attributes”, etc.
- Publish the same data in multiple open formats – service, download, and web-accessible file (csv, kml, GeoRSS, GeoJSON)
- Design services to be modular and flexible
  - Include only semantically similar layers
  - Separate labels, enable dynamic rendering
- Provide feedback to service owner – engage in constructive dialog

Usage Barriers - Documentation

- A service can look perfect, but still be unusable without accompanying metadata, data dictionary, other documentation
- Even if it is perfectly usable, many users won't trust it without documentation
- EPA Metadata Editor makes authorship easy – success story for FGDC CSDGM metadata, in beta for ISO and Data.gov Common Core
- EPA Metadata Styleguides provide templates, boilerplate language, and map between MXD, REST, ArcGIS Online, and XML elements.
- Service layer metadata often doesn't belong in metadata catalogs, but should be referenced in service layer descriptions
- Cross-linking between REST pages, ArcGIS Online registration and full FGDC metadata is crucial

Usage Barriers – Reliability and Change Control

- Common concerns about services include excessive downtime, poor performance, or unanticipated changes
- Internal solutions
  - Migrated hosting infrastructure to load-balanced Linux cluster – high performance and stability, can perform maintenance without interruptions
  - Service performance often about map authorship – developed best practices checklist based on Esri recommendations and internal findings
  - Developed some change control communication protocols, but also requested enhancements to ArcGIS Server and ArcGIS Online to better facilitate communications between service owners and service consumers
- External solutions
  - Active engagement with external organizations, sharing of best practices and feedback, development of communities of interest

Summary - Organizational Change

- Democratization of map authorship using modular services and lightweight datasets
  - Everyone should know first aid, but we still need doctors
  - Everyone should be able to make a map, but we still need GIS Specialists
- GIS community needs to educate this new user base and review their work
- Data owners need to focus on data quality, multiple publication channels, and documentation
- Application developers need to move away from kitchen sinks, towards lightweight applications that tell a clear and coherent story
- A successful SOA ecosystem requires full participation, engagement, and communication from all parties
- Build organizational governance and success metrics around these goals

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