Get a Second Opinion: Enterprise GIS Health Checks

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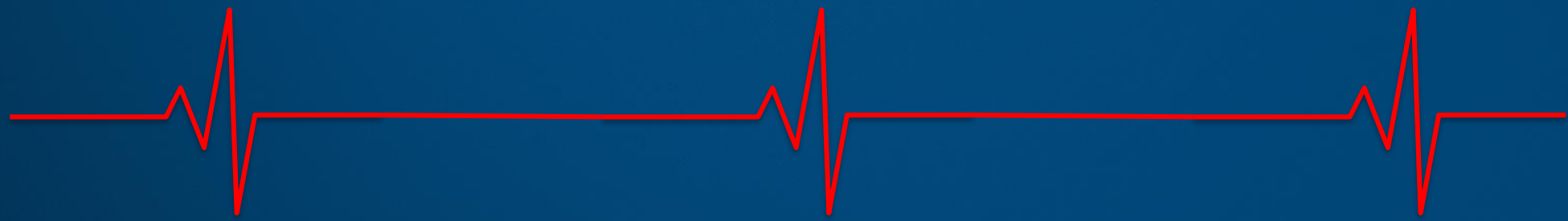
What is an Enterprise GIS Health Check?

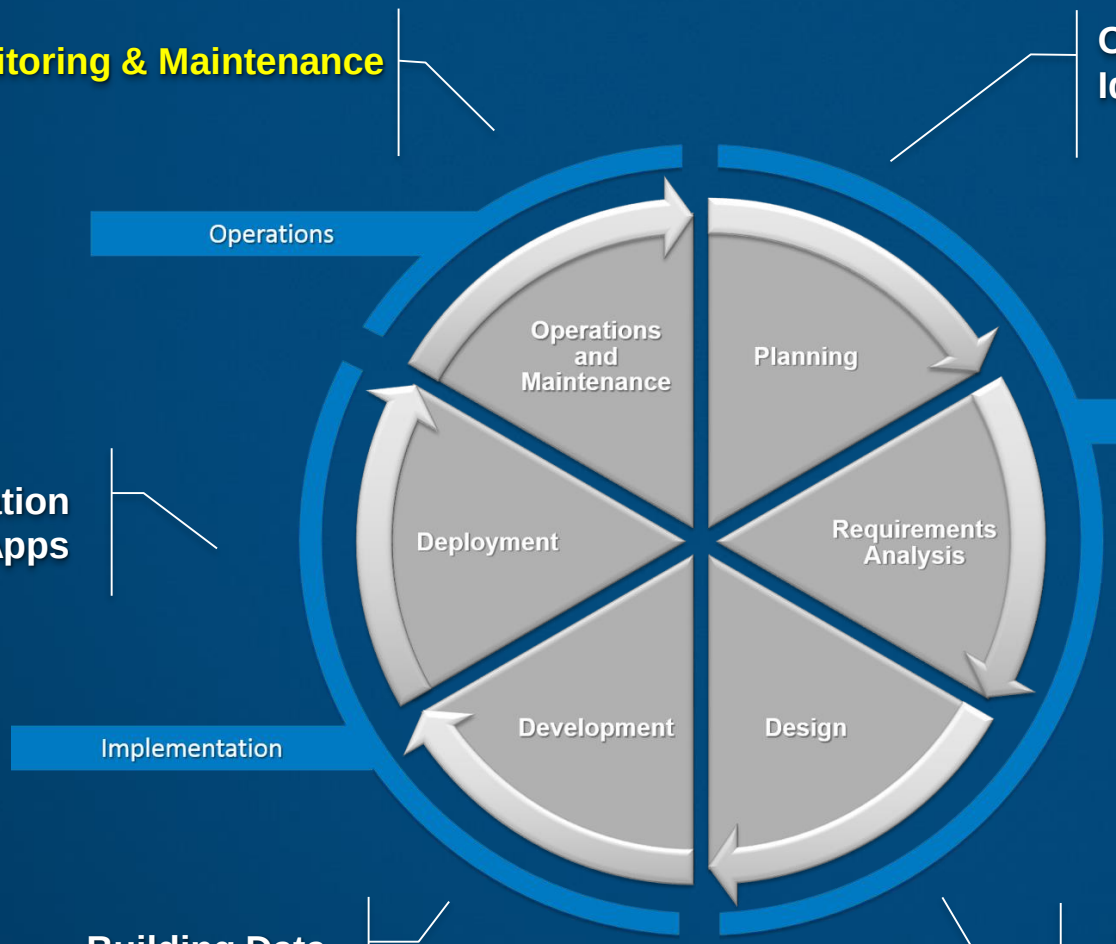
- **A Three Day Onsite Engagement Focusing On:**
  - **Proactively reviewing and assessing current GIS server(s) and web services**
  - **Monitoring, testing and reviewing configuration and operations**
  - **Early detection and evaluation of potential issues**



How System Health and Performance has Changed over Time

- **Traditional GIS performance assessment:**
  - **Desktop -> Enterprise Geodatabase: multi-user editing and viewing, versioning**
  - **Desktop to Server: drawing maps in map services**
  - **Map Document Analysis**
- **Modern Web GIS:**
  - **Hosted feature services**
  - **JSAPI-based web map queries**
  - **GP, geocoding, Portal and Data Store, web app performance, browser considerations**

Why Create an Enterprise Health Check?



Monitoring & Maintenance

Organizational Vision
Identify Location Value

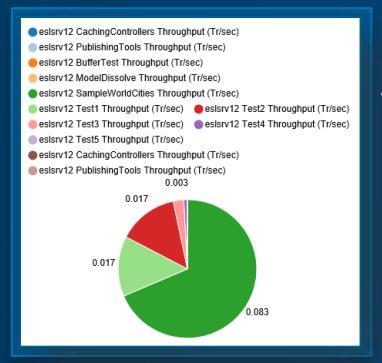
Installation
Configure Maps & Apps

Document Workflows
Determine Core Web Maps

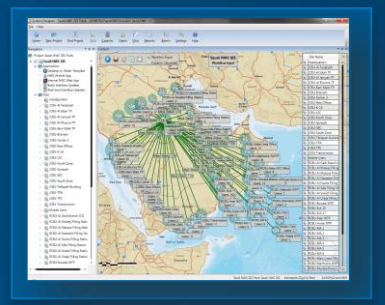
Building Data
Application Prototyping

Geodatabase Design
Capacity & Architecture

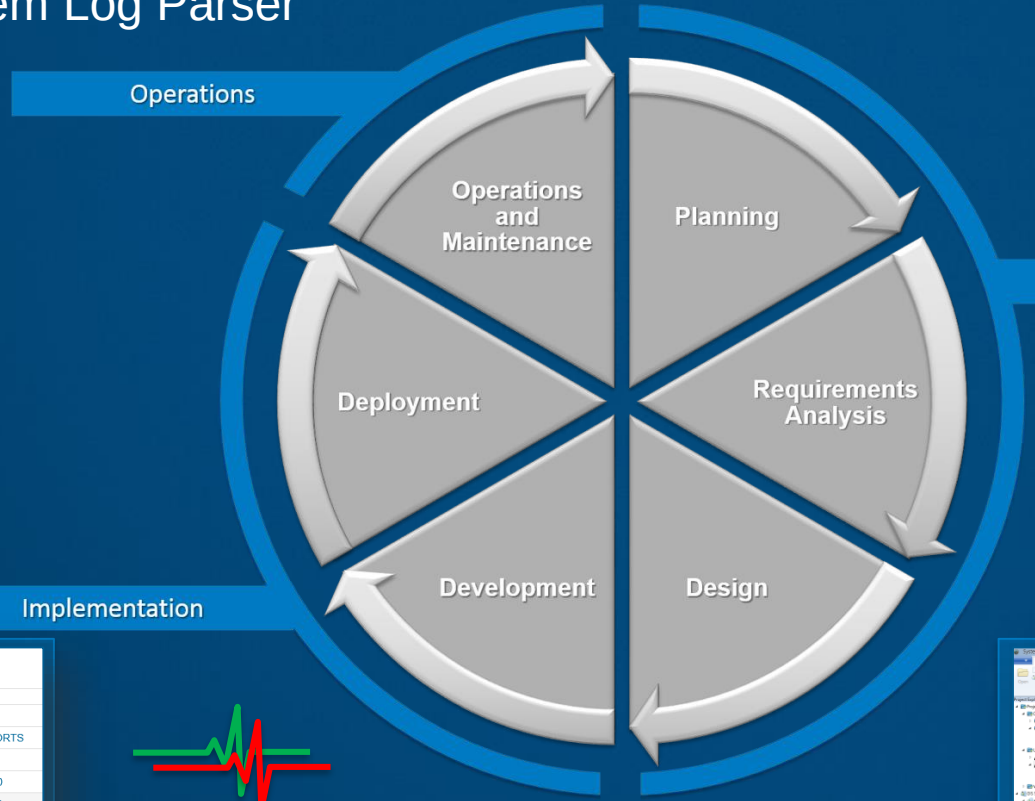
Enterprise Consulting/System Tools For a Science Based Approach

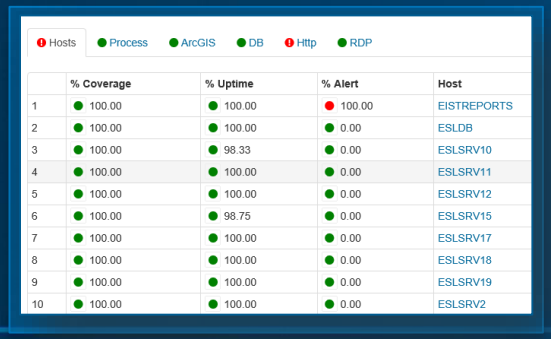


System Log Parser

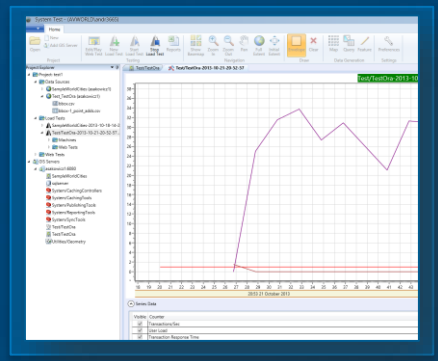


System Designer





System Monitor



System Test

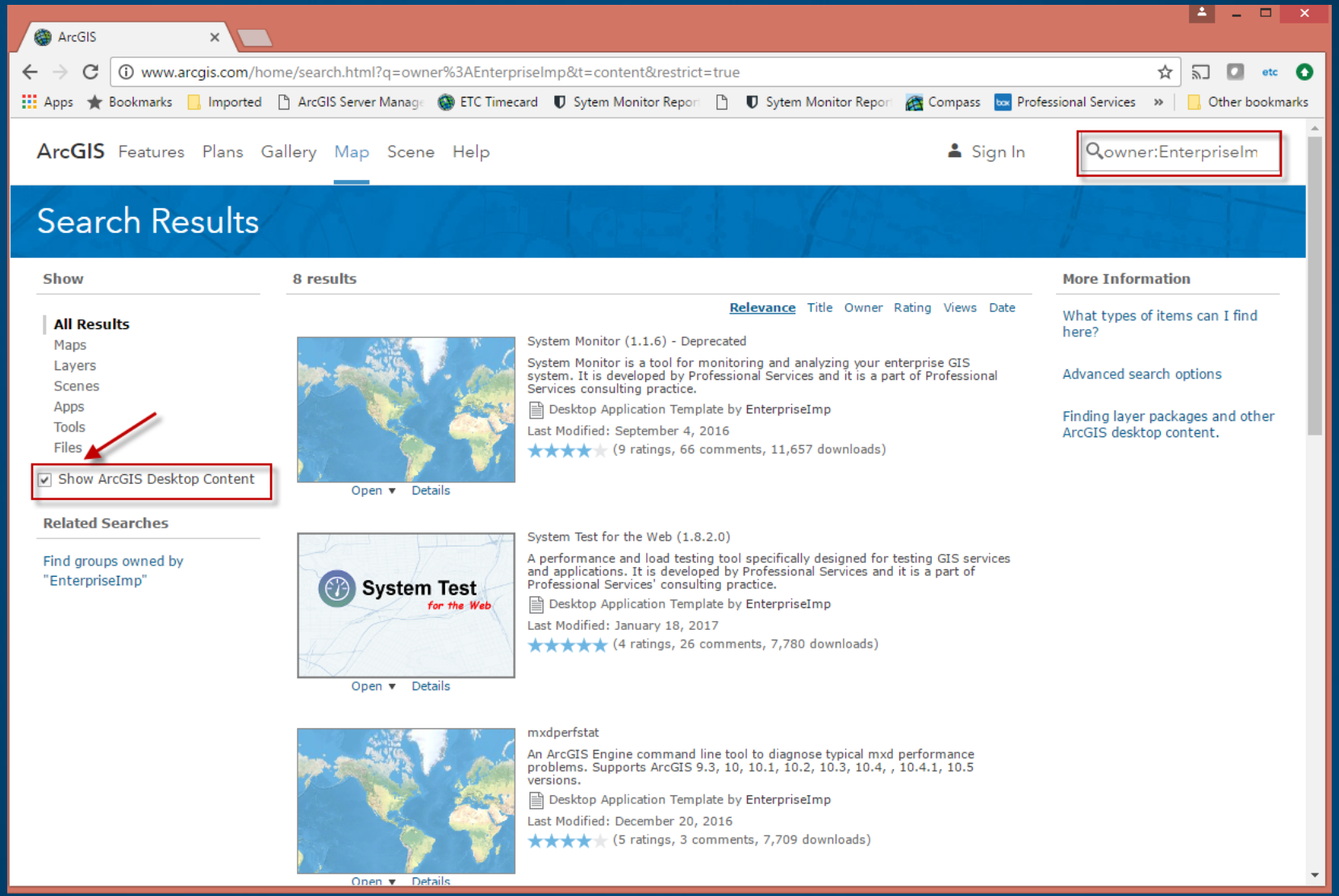
System Log Parser

System Designer

System Monitor

System Test

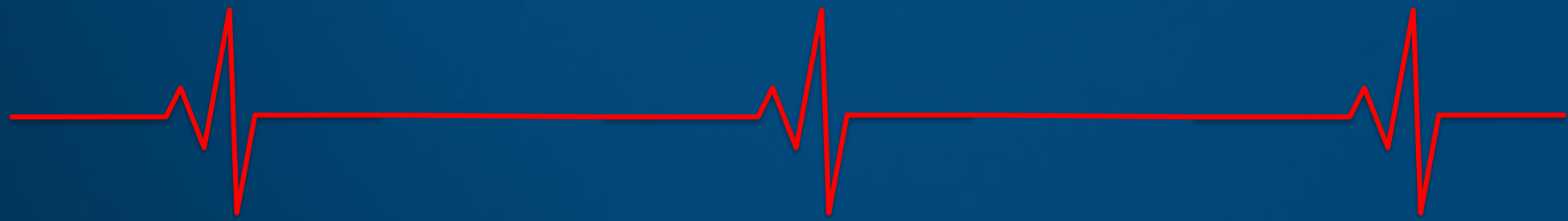
Owner:EnterpriseImp



Two Ways to Get System Monitor

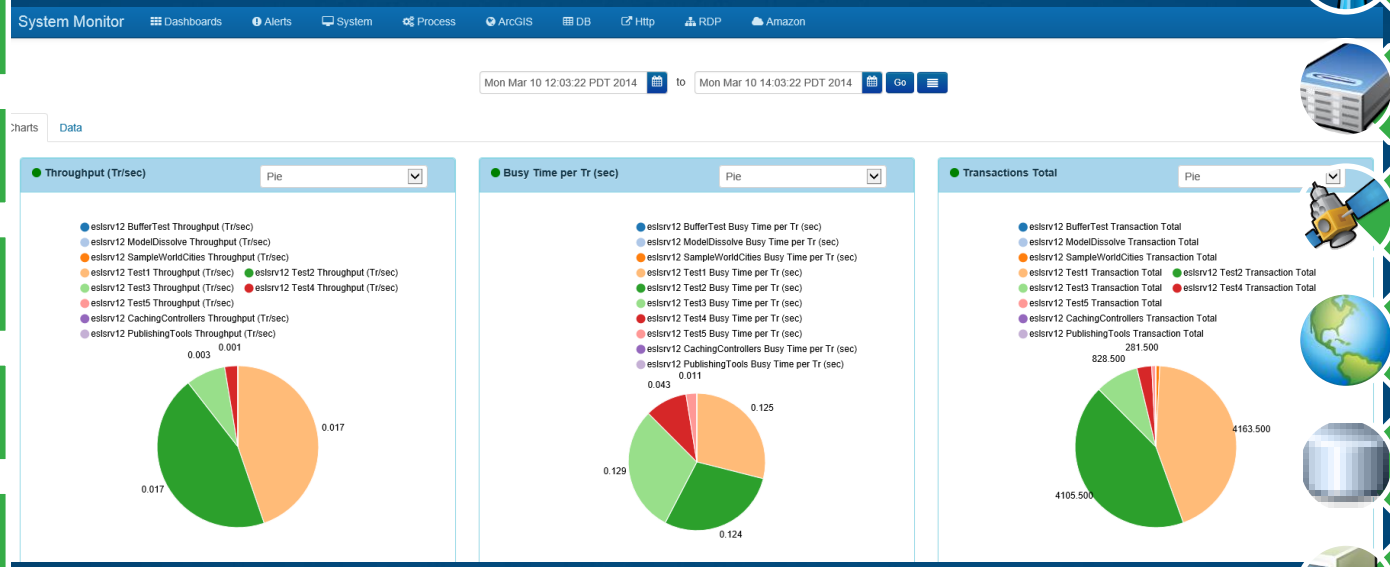
- **Enterprise Health Check:**
  - **System Monitor is set up and configured, with limited time for knowledge transfer on the metrics, really meant for consultant use in performing an enterprise health check**
  - **Customer may keep the tools to continue to monitor operations**

- **System Monitor Workshop:**
  - **System Monitor is set up and configured, with days of knowledge transfer provided**



Monitor and Track Performance…end-to-end

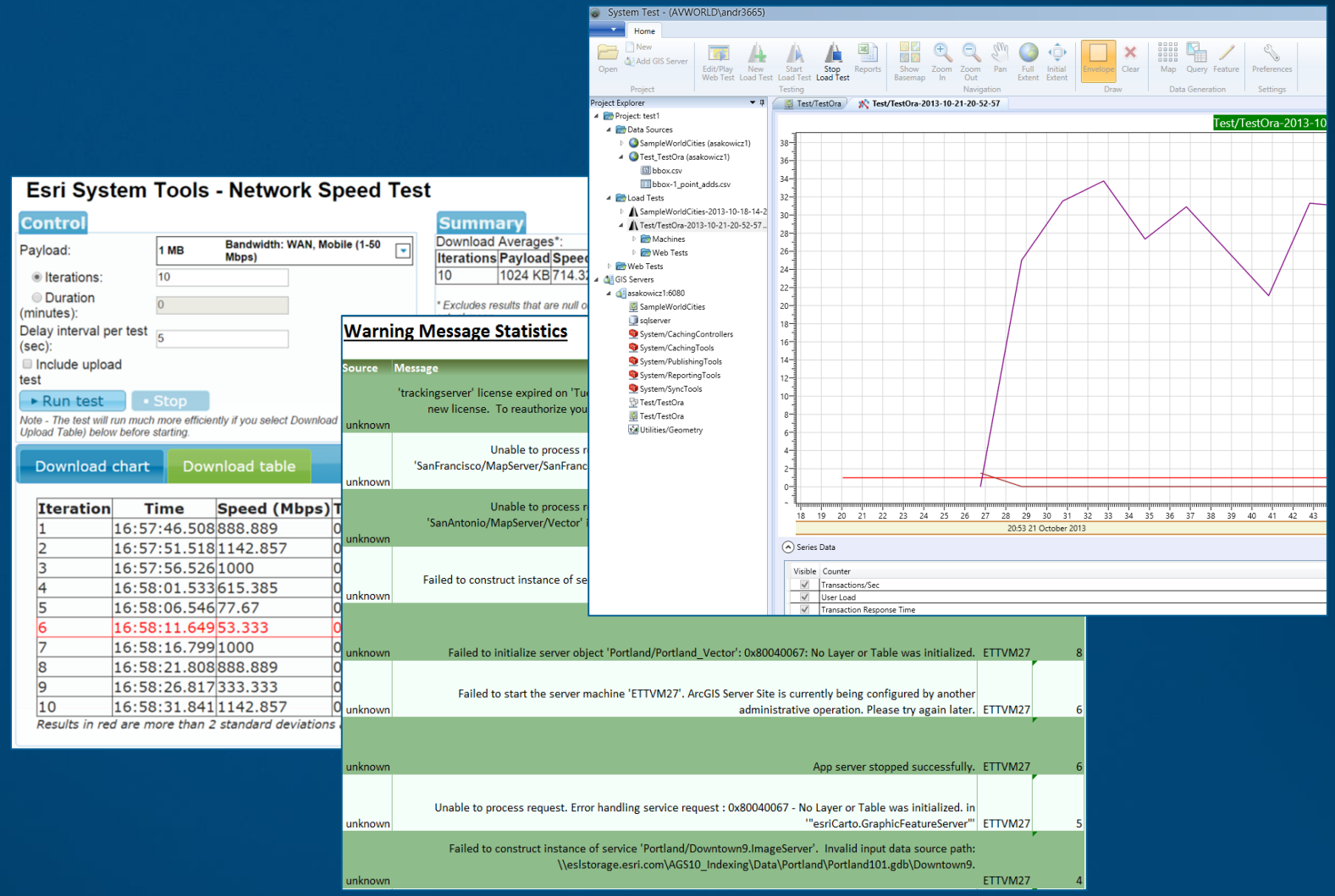
- Configuration
- Resource Utilization
- Usage Trends
- Performance SLA
- Uptime SLA



- Network
- Hardware
- Web Server
- ArcGIS Server
- Geodatabase
- RDBMS

Application Testing and Log Analysis

- ArcGIS Services Tests
- Application Testing
- Analyze System Logs



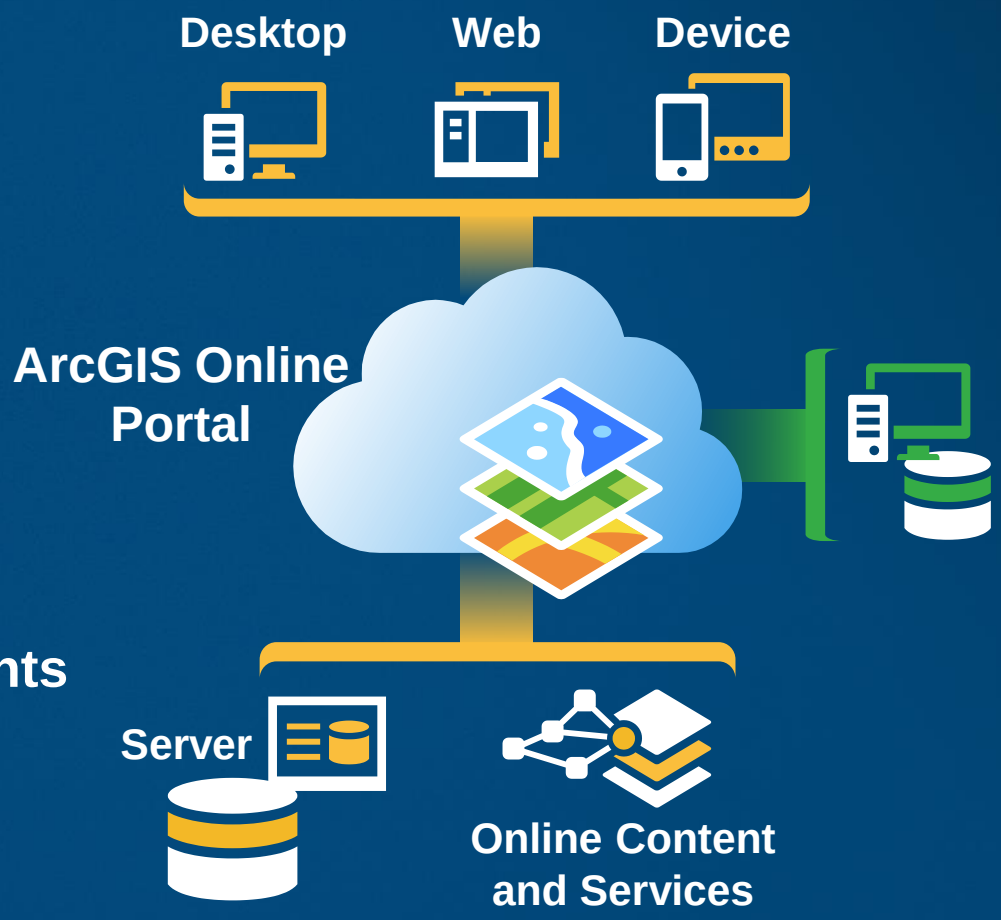
Methodology

- Review of environments and system support roles/activities
- End-to-end monitoring
- ArcGIS Server and Portal log analysis
- Web GIS content analysis
- Web app analysis

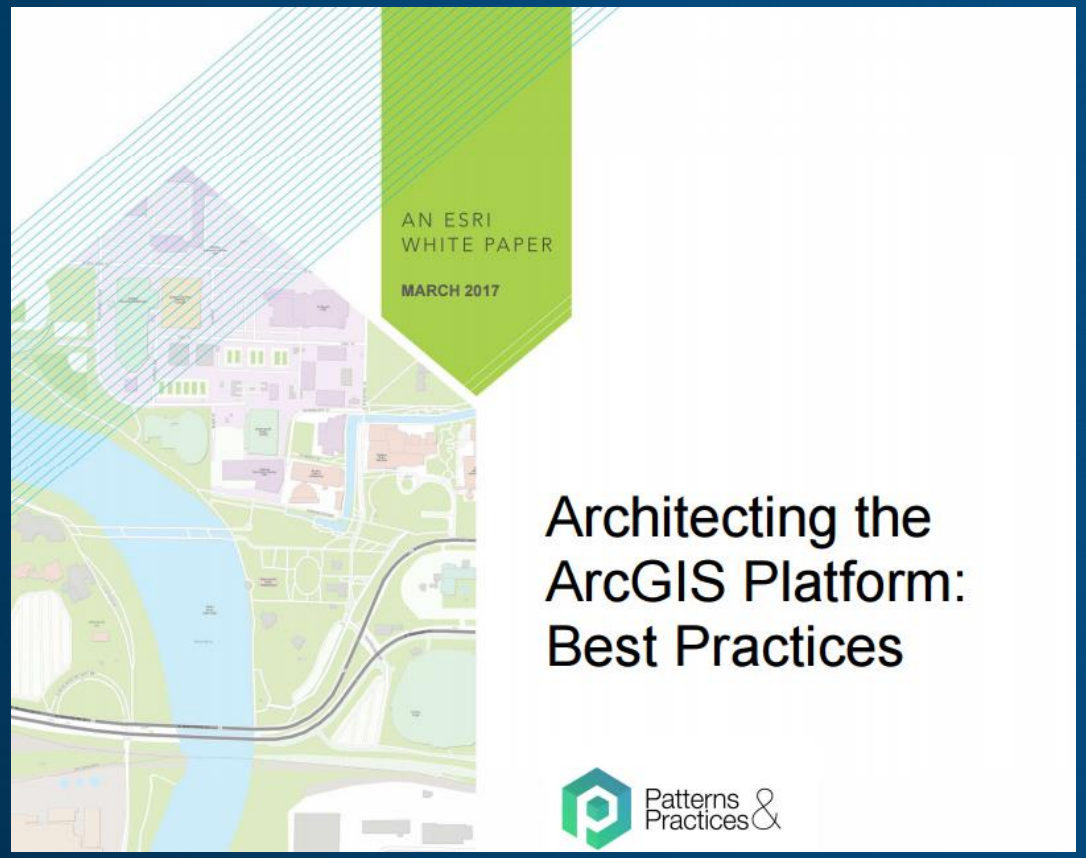
- Of:
  - ArcGIS Platform Implementation
  - System Key Performance Indictors

Review - Implementation

- ArcGIS Server site configuration:
  - Sites
  - Clusters
  - Services
- Infrastructure
- Data Sources
- High Availability and Disaster Requirements
- Security Requirements
- Applications



Review - Implementation



Architecting the ArcGIS Platform – We review and provide recommendations that align with this

Updated at least bi-annually

Environment Isolation (Testing, Development, Staging, Production)

Workload Separation (GeoEvent, Visualization, Geoprocessing)

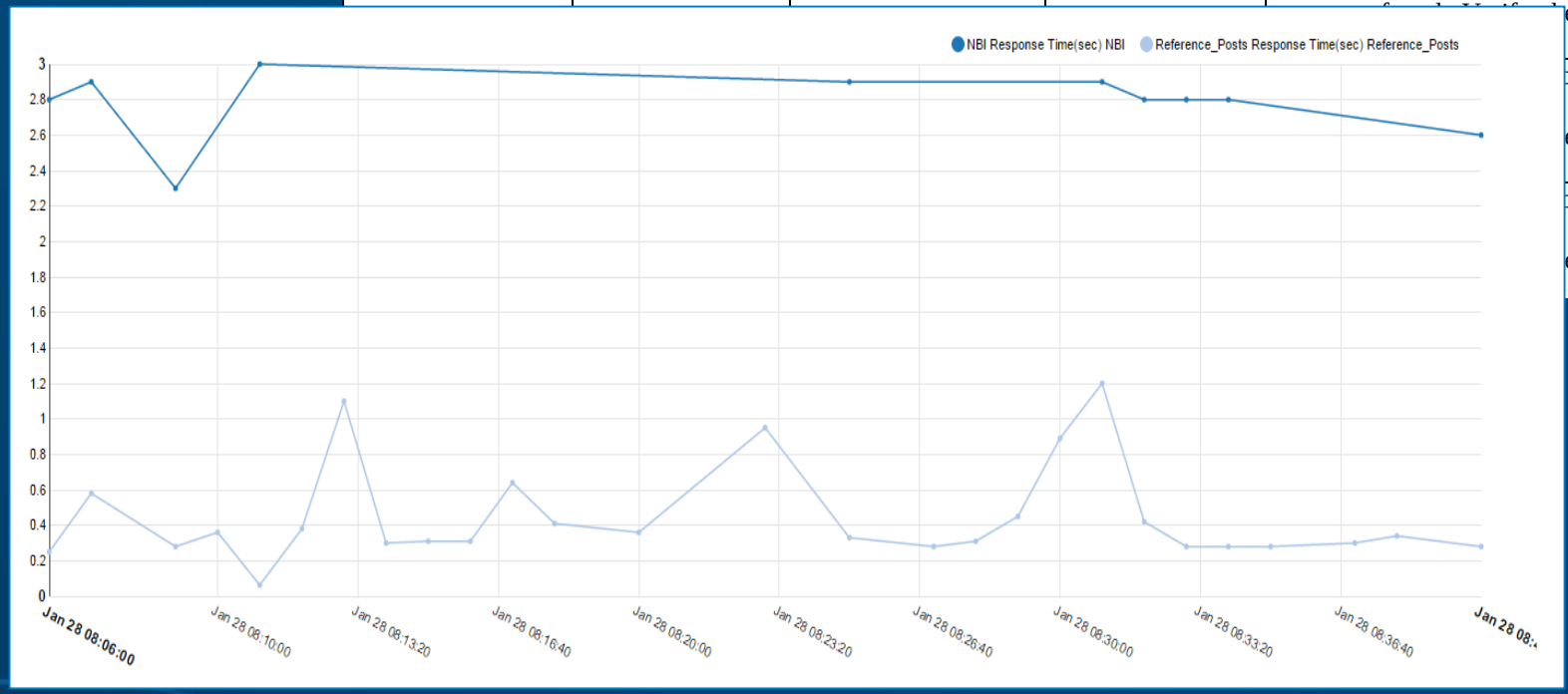
https://www.esri.com/~/media/Files/Pdfs/products/arcgis-platform/architecting-the-arcgis-platform

System Key Performance Indicators

- Uptime
- Performance
- High Utilization
- Low Utilization
- Errors and Alerts

Min(%)	Avg(%)	p95(%)	Uptime(	Samples	Date	Hour	Weekday
0	20.39	100	116.67	70	2016-01-27	0	Wednesday
0	79.56	100	113.33	68	2016-01-27	1	Wednesday
25	40.79	87	31.67	19	2016-01-26	15	Tuesday
0	26.68	85	118.33	71	2016-01-27	5	Wednesday
3	45.16	84	116.67	70	2016-01-26	20	Tuesday
0	48.22	82	120	72	2016-01-26	13	Tuesday

Type	Code	Machine	Count	Message String
SEVERE	9016	AGS3	2907	Error getting service.
SEVERE	9016	AGS4	2250	Error getting service.
SEVERE	9016	AGS5	2159	Error getting service.
SEVERE	9527	AGS3	1339	Error handling request to service 'B/XYZ.MapServer'. The service



System Key Performance Indicators – System Monitor Excel Reporter!

- Uptime
- Performance
- High Utilization
- Low Utilization
- Errors and Alerts

	Report Summary										
2	Category	Type	Name	Source	Time	Uptime	Performa	HighUtili	LowUtili	Alerts	Errors
3	Web Applic	Requests	Response Time(sec)	Url	Timespan		▲			■	
4	Web Applic	Requests	Response Time(sec)	Url	Hourly		▲			■	
5	ArcGIS	Site	Configuraton	AdminAPI	Last						
6	ArcGIS	Cluster	Configuraton	AdminAPI	Last						
7	ArcGIS	Services	Summary	AdminAPI	Last						
8	ArcGIS	Requests	Count	AdminAPI	Timespan				●		
9	ArcGIS	Requests	Requests/sec	AdminAPI	Timespan						
10	ArcGIS	Services	Instances	AdminAPI	Timespan						
11	ArcGIS	Services	Response Time(sec)	AdminAPI	Timespan		▲				
12	ArcGIS	Services	Response Time(sec)	AdminAPI	Hourly		■				
13	System	Summary	Summary	AdminAPI	Last						
14	System	CPU	Utilization(%)	AdminAPI	Timespan			▲	●	■	
15	System	CPU	Utilization(%)	AdminAPI	Hourly			■	●	■	
16	System	Memory Physical	Utilization(%)	AdminAPI	Timespan			■			
17	System	Memory Physical	Utilization(%)	AdminAPI	Hourly			■			
18	System	Memory Virtual	Utilization(%)	AdminAPI	Timespan			■			
19	System	Memory Virtual	Utilization(%)	AdminAPI	Hourly			■			
20	System	Disk Utilization	Utilization(%)	AdminAPI	Timespan			■			
21	System	Disk Utilization	Utilization(%)	AdminAPI	Hourly			■	●		
22	System	Disk Space	Utilization(%)	AdminAPI	Timespan			■	●		
23	System	Network Receive	mbps	AdminAPI	Timespan	■					
24	System	Network Sent	mbps	AdminAPI	Timespan	■					
25	System	Process CPU	Utilization(%)	AdminAPI	Timespan	●		▲			
26	System	Process Memory	Utilization(%)	AdminAPI	Timespan	●		■			
27	System	Process Memory	Utilization(%)	AdminAPI	Timespan	●		■			
28	System	Process Count	Count	AdminAPI	Timespan	●					
29	System	Process Count	Active	AdminAPI	Timespan	●					
30	Database	DB query	DB query	DB query	Timespan						
31	System Mor	Collection Time	Utilization(%)	AdminAPI	Timespan	●		▲	●		
32	System Mor	Collection Time	Utilization(%)	AdminAPI	Hourly			■	●		

Findings and Recommendations

- Executive Summary
- High Level Recommendations
- Detailed Metrics

Contents

5.2 ArcGIS Platform

5.2.1 ArcGIS for Server

[redacted] hosts a single ArcGIS for Server site that supports the needs of internal and external users. The public-facing URL for this server is http://[redacted]/rest/services/ and the internal URL is the same, though it resolves the DMZ servers via internal virtual IPs, not the public-facing [redacted]63.20 DNS entry. The ArcGIS Server configuration currently supports HTTP and HTTPS traffic internally but only supports HTTP traffic through the firewall. Currently the installed ArcGIS for Server software is the 10.3.1 release. A separate Portal for ArcGIS install on AC[redacted]SRV is at version 10.4.

External access to the GIS services is routed through a Cisco ASDM Firewall to two virtual web servers running a single ArcGIS Web Adaptor on each server, all in the[redacted]'s DMZ network. These Web Adaptors forward traffic to ArcGIS Server over port 6080, with port 6443 traffic currently blocked by the firewall or a switch limitation (ongoing work continues on this issue).

Internal access to ArcGIS Server is available via the shared public-facing URLs, via direct access to the GIS Server host over ports 6080 and 6443, or via an internal-facing web adaptor installed on the ArcGIS Server machine in IIS on ports 80 and 443. All access points are secured with built-in ArcGIS Server accounts for publishing purposes. Administrative access is disabled for the public-facing Web Adaptor(s) and endpoints.

5.2.1.1 Site and Clusters

[redacted]s ArcGIS for Server site is composed of one cluster containing one ArcGIS for Server machine.

This primary ArcGIS Server machine hosts (approximately) 2 geocoding services, 8 geoprocessing services and 46 map and/or feature services, with 121 maximum service instances as configured.

The site's configuration store and directories are stored on the server's local file system and appear to be functioning effectively

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Example 1

- **Case: A state government suspects some practices may be attuned to prior generations of Esri technology.**
  - **Long time Esri customer**
  - **Many legacy systems**
  - **Questions about why certain problems occur**

Value: Validate / update current approaches:

Are the current GIS technologies being used in the best ways?

Is the system design related to specific problems?

How have other organizations approached similar challenges?

Example 2

- **Case: A local government is preparing to launch Portal for ArcGIS.**
  - **Esri is assisting with the Portal implementation.**
  - **ArcGIS Enterprise will get more utilization and visibility**

Value: Identify higher risk implementation practices and "dormant" risks:

Review ArcGIS Server's system design and configuration

Identify risk factors for geographically distributed systems

Look for evidence of capacity bottlenecks or latent problems

Review IT's systems and operating procedures

Proceeded with confidence and awareness of specific risks

Example 3

- **Case: Simple Proactive Review**
  - Implemented an Esri System Design
  - 3rd party, custom application, COTS Solutions
  - Many successes; a few problems

Value: Validate / improve:

IT's approach to provisioning RDBMS

DBA's work to configure/tune the eGDB

3rd party's application follows best practices

Plan for the future

Key Takeaways

- Perform proactive operations and maintenance
- Continually assessing performance
- Review configuration and operations with any change
- Early detection prevents critical issues

Our approach to “Performance” and “Health”

- How do we define these terms?

Stability means that the system is available when you expect it to be, and all the software components run consistently.

When your system is stable, you trust that it’s working well.

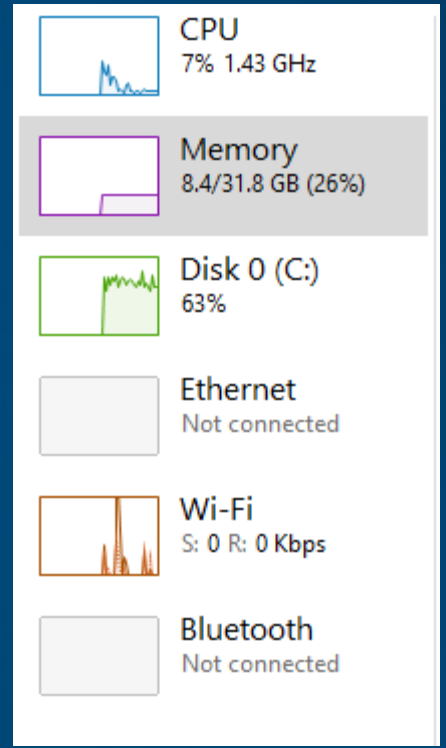
Performance is a relative term, but it means that users of your infrastructure see loading times and performance that they expect.

When your system is performant, you see and feel that it’s working well.

How do you know when your system is stable?

…and how do I keep it that way?

- Understand what a stable system looks like
  - Javaw.exe, ArcGISServer.exe, Memory Usage, etc.
- Monitor CPU and Memory usage from ArcGIS-related processes
- Operate under 75% RAM Utilization
- Maintain CPU utilization below 75% (spikes are OK)
- Stable systems can respond smoothly to increased load
  - Normal or greater than normal



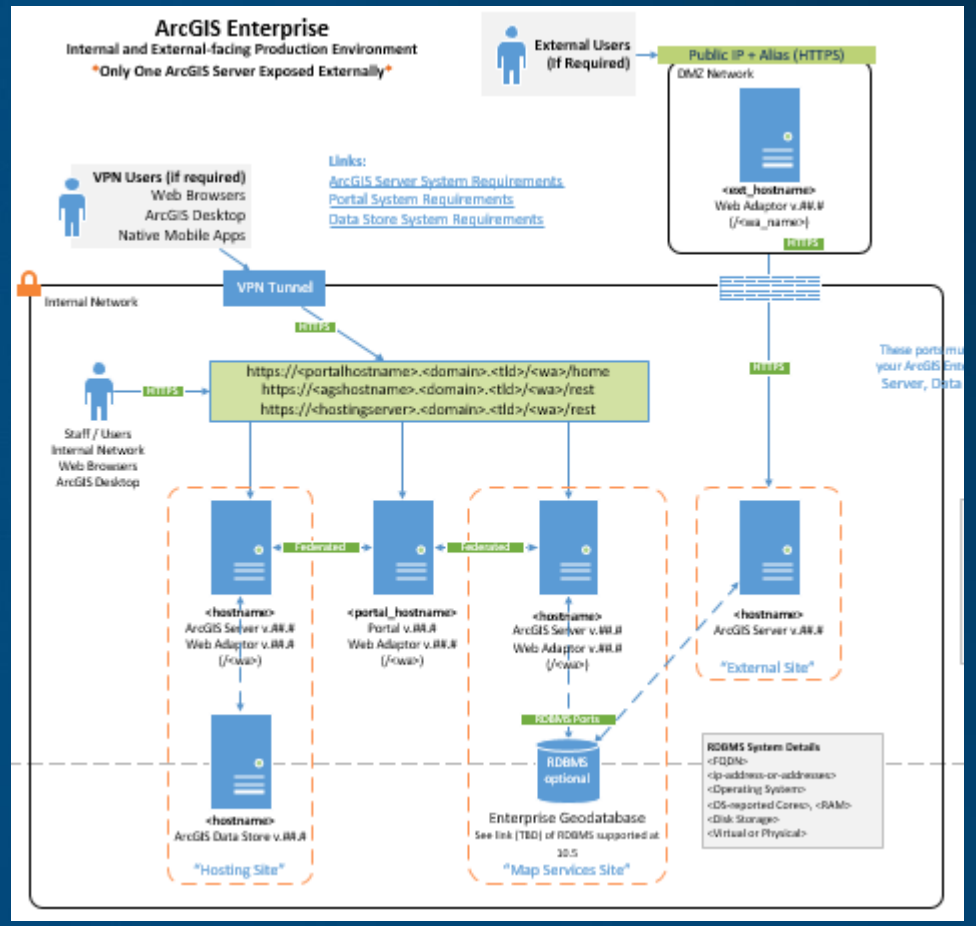
How do you know when your system is FAST (enough)?

…and how do I validate performance?

- Performance is relative
  - How long does it take me to do the thing I want to do
- Performance is complicated
  - Client network speed, web server, GIS Server, database, disk, local network
- Performance metrics can only be generated after a baseline is established
- Performance testing can have multiple strategies
  - What is the maximum load we can sustain?
  - What is the experience of an average user?

How do we define the boundaries of Enterprise GIS?

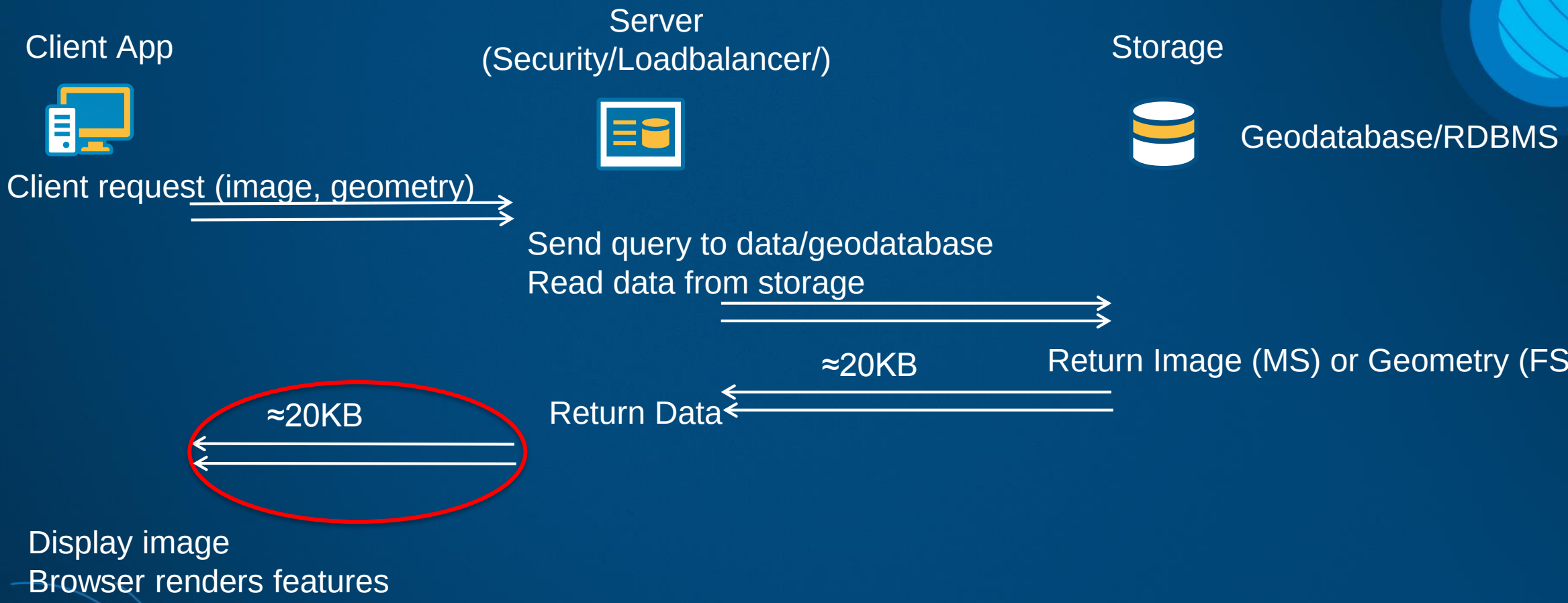
- **Based on what impacts performance and stability:**
  - VM Infrastructure
  - Network Architecture
  - Database Configuration
  - Client Environment/Location
  - Storage Performance
  - Esri Software
  - Operating System software
  - 3rd Party Components
  - User workflows



Everything that affects your system is relevant to System Health

Dynamic Map Service Data Flow

…and how do I validate performance?

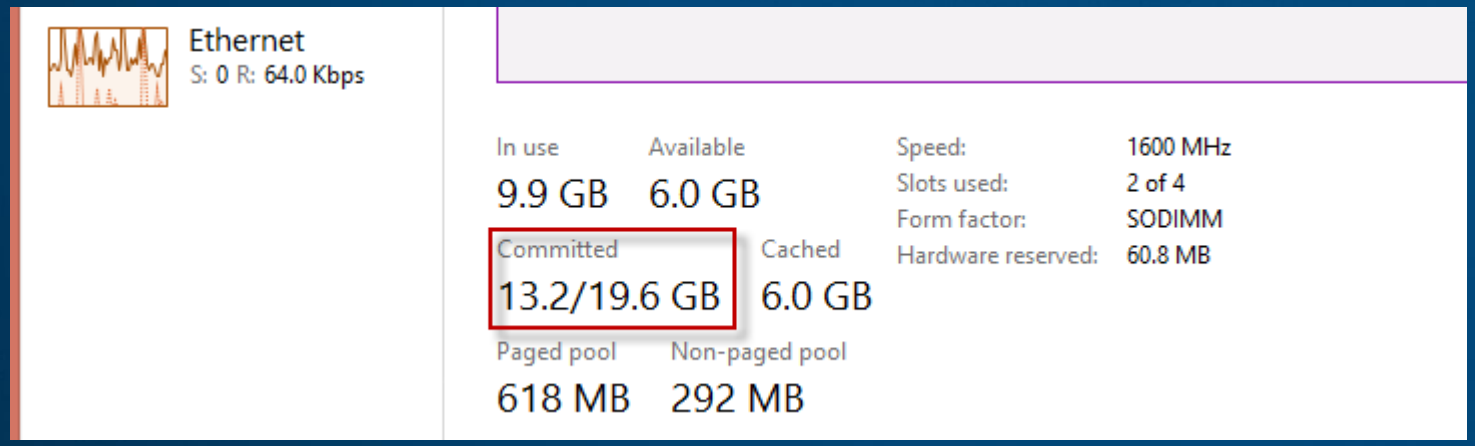


Common Issues and Themes found during Enterprise Health Checks

- Not using ArcGIS Server instance settings properly
  - Too many max SOCs, not enough, too many min SOCs, improper use of pooling, min 1
- Clustering and Single Cluster Mode
- Pagefile and Memory usage (Commit Ratio)
- Competing workflows running on a single machine (Geoprocessing + Maps etc.)
- VM over-allocation
- Disk performance
- Access to remote file shares and databases
- Indexing on frequently-updated or replaced data
- Data center organization

Common Issues – Commit Ratio

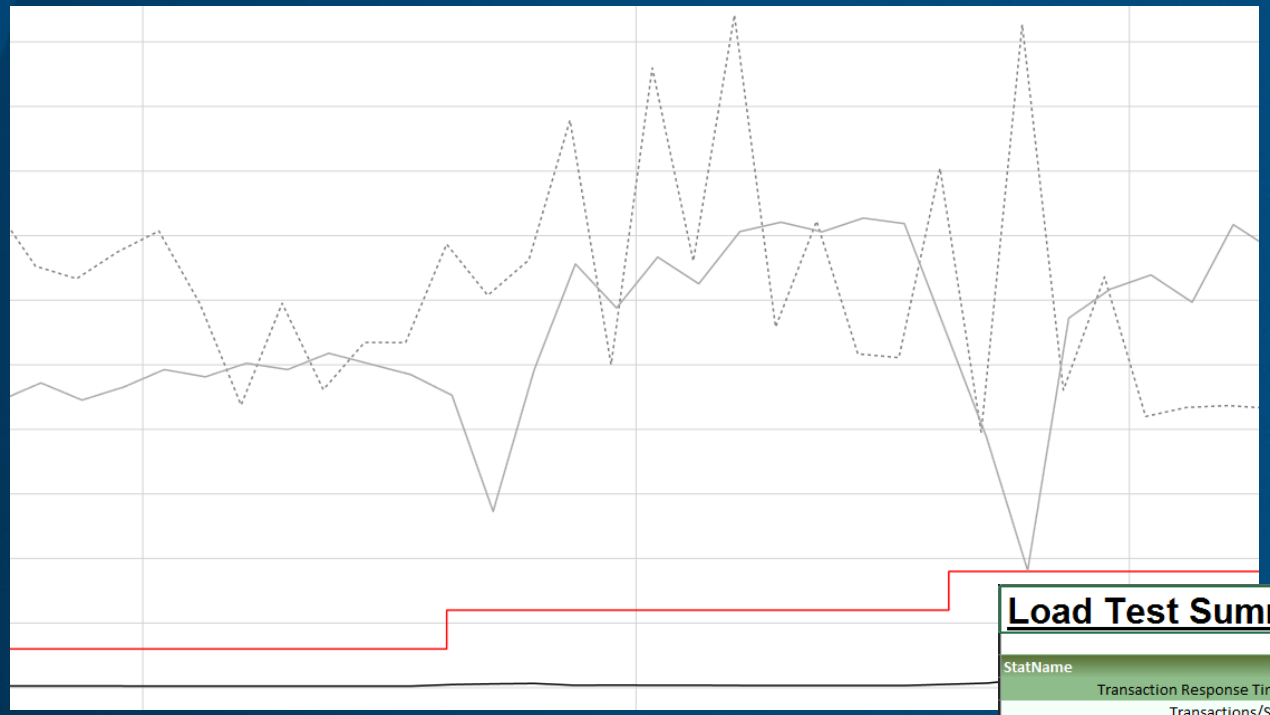
- **The system could start running up against the system-wide commit limit even though it does not run out of the physical memory**
- **Commit Limit = physical memory + page file – you can reach this limit before physical memory is exhausted**
- **Check the Commit Ratio – is it close to 1?**



TIP - page file size can be increased to 1.5 times the physical RAM on each of the disk drives (unless you are running out of HDD space).

Tips for Common Issues and Misconfigurations

- Monitor system performance over time
  - get to know what “normal” looks like, so you can identify variances
- A few consolidated, well-tuned services run more efficiently than many small, poorly configured services
- Keep your software up to date – security and bug fixes but also performance improvements
- Keep your VMs fresh – re-create instances with updated OS versions periodically
- Get to know your database and how to monitor it



Demonstration: System Test

Load Test Summary

StatName	CategoryName	Overall Average Value
Transaction Response Time	Transactions	0.219
Transactions/Sec	Transactions	27.393
Request Response Time	Requests	0.219
Requests/Sec	Requests	27.415
Passed Requests	Requests	4959
Failed Requests	Requests	0
% Failed Requests	Requests	0.00
HTTP 5xx Requests	Requests	0
HTTP 4xx Requests	Requests	0
HTTP 3xx Requests	Requests	0
HTTP 200 Requests	Requests	4959
Avg. Content Length	Requests	892.000

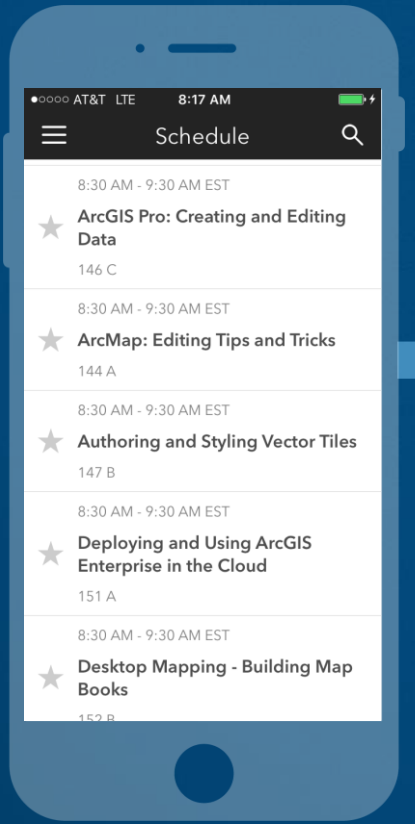
How to plan for the near future

- If your system is stable and performs within your expected baseline:
  - That’s great, but it’s not enough
- Modern Web GIS grows consistently, more services, apps, web maps, users, etc.
- Have a hardware and IT plan for how you will update your environment in the next 1-3 years
- Plan for the growth in usage you hope to see

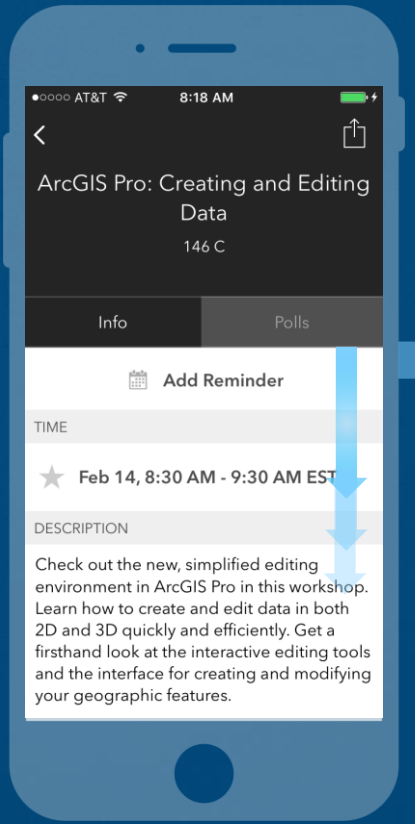
Please Take Our Survey on the **Esri Events App!**

Download the Esri Events app and find your event

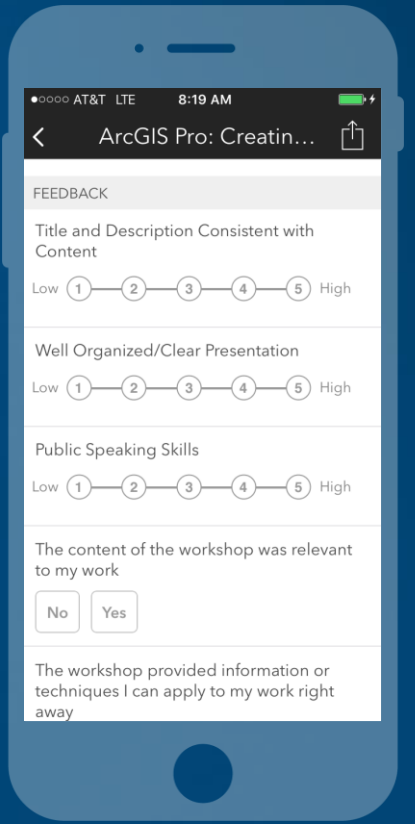
Select the session you attended



Scroll down to find the survey



Complete Answers and Select “Submit”



Thanks!

Feel free to contact:

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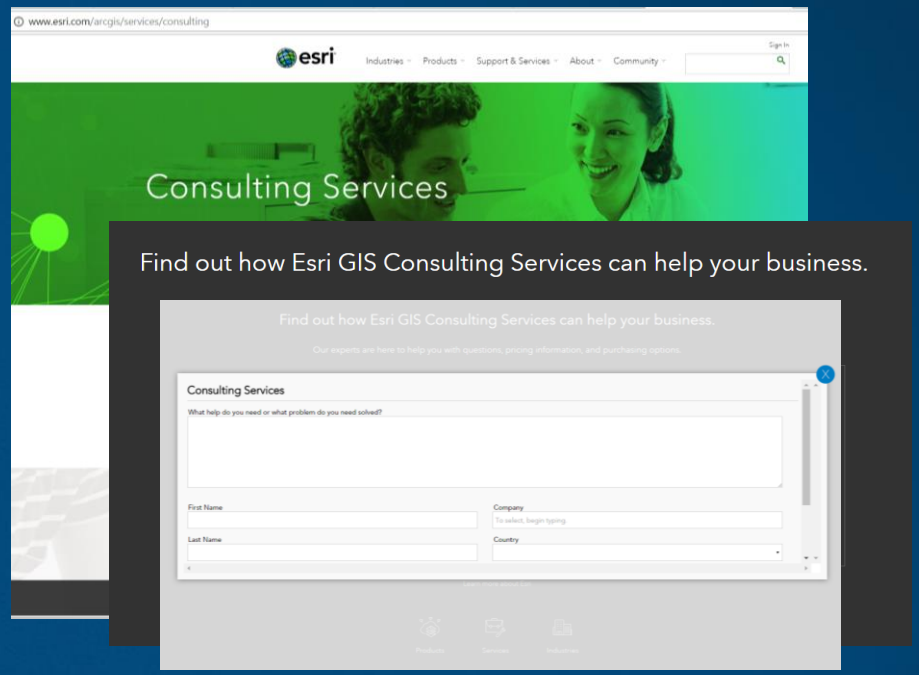


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