Chief Information Officer

Thursday, May 4, 2017
10:00 AM to 12:00 PM
1500 Jefferson Street SE, Rm 2208
Olympia, Washington
See WebEx Instructions Below

Geographic Information Technology (GIT) Committee

AGENDA

Item	Topics	Time	Lead	Action/Follow-up
	Welcome	**10:00 AM** 10 min.	Rob St. John, GIT Co-Chair	
2	**Committee Business:** • GeoPortal Disk Space Expansion – *Decision Item* • Geospatial Interoperability Guideline - *Decision Item* • Metadata Update – Announcement • GeoPortal System Architecture Design Review	**10:10 AM** 60 min.	 Joy Paulus, GIT Co-Chair Joy Paulus, OCIO Joanne Markert, Leon Enviro. Joy Paulus, OCIO	
3	**Briefings & Demonstrations:** • Overview of New WA Statewide Imagery Services • WA Information Sharing Environment (W.I.S.E.) Demonstration	**11:10 AM** 20 min 20 min	 Mike McGuire, Ascent GIS Rick Geittmann, MIL	
4	**Agency Roundtable** **Adjournment** *Next Meeting – September 7, 2017* – Every 4 months	**11: 50 AM** 10 min.	All Participants	

WebEx Connection Information Listed Below

GIT Committee Meeting: WebEx Instructions

Host Key: 978806 (Use this to reclaim host privileges.)

To invite others to join, copy and paste everything below into your invitation.

Meeting information

Topic: GIT Committee Meeting
Date: Thursday, May 4, 2017
Time: 10:00 am, Pacific Daylight Time (San Francisco, GMT-07:00)
Meeting Number: 928 821 496
Meeting Password: GIT-5-4-17

To start or join the online meeting

Go to https://wadismeetings.webex.com/wadismeetings/j.php?MTID=m31814f5959e66f9b55eff21f0844f12d

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Audio conference information

To receive a call back, provide your phone number when you join the meeting, or call the number below and enter the access code.
Call-in toll-free number (US/Canada): 1-877-668-4493
Call-in toll number (US/Canada): 1-650-479-3208

Access code:928 821 496
Global call-in numbers: https://wadismeetings.webex.com/wadismeetings/globalcallin.php?serviceType=MC&ED=519964262&tollFree=1
Toll-free dialing restrictions: https://www.webex.com/pdf/tollfree_restrictions.pdf

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For assistance

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1. Go to https://wadismeetings.webex.com/wadismeetings/mc

GeoPortal Disk Storage

Prepared by Joy Paulus, Office of the Chief Information Officer (OCIO)
joy.paulus@ocio.wa.gov

Issue Statement

The Geospatial Portal imagery and data storage space on the State side (limited access) and Public side are full. There isn't any room to load new data without removing existing data. This includes the loading of the new 2015 high-res statewide imagery (1 ft.) that we will receive the first week of May.

Background

- Imagery data is desired by many people
- Users don't want any existing data removed (needed for change detection)
- The budget for the Geospatial Portal hasn't significantly changed since 2007
- We have 25TB of disk storage on Public side & 2.5 on State side
- We have an undetermined amount (5-10TB) of data arriving the first part of May and no place to put it on the State side. Agencies will need to host this data locally if space isn't found (DNR/DOT/RCO/MIL/OCIO/DFW/ECY) or access it using the streaming service via Valtus
- Cost for adding diskspace 5TB's = $6144/yr and 10 TB's = $12,288/yr
- Specific Imagery service useage can be tracked

Actions/Options for Consideration

The Committee needs to consider and vote to move forward with one of the following options to resolve this issues:

1. Live within the allotted disk space on each server and forgo the installation of any new data (including the new 2015 statewide imagery).
2. Remove lower priority data sets to make room for new imagery on the Public side and State side.
3. Agencies make a one-time, end of bieunnium donation to pay for 1 year of disk space on the state Portal side (at minimum).

Decision Reached and Recorded

The GeoPortal Steering Committee needed to act on and implement Option #

Policy Number 160.01
Geospatial Interoperability Policy

Effective Date: May xx, 2017

See Also:

RCW 43.105.041 details the powers and duties of the Technology Services Board (TSB), including the authority to develop statewide or interagency information services and technical policies, standards, and procedures.

Purpose

This policy is designed to improve geospatial interoperability among agencies by establishing an overarching policy and encourage standards to facilitate the exchange of geospatial data among state agencies, local, tribal, state, and federal users and producers.

Statutory Authority

The provisions of RCW 43.105.041 detail the powers and duties of the Technology Services Board (TSB), including the authority to develop statewide or interagency information services and technical policies, standards, and procedures.

Scope and Exemptions

This policy applies to state of Washington executive branch agencies, agencies headed by separately elected officials, and institutions of higher education referred to as “agencies” throughout this document. Academic and research applications at institutions of higher education are exempt. Exemption requests must be submitted to the Office of the Chief Information Officer (OCIO), Enterprise Geospatial Program Office and will be forwarded to the Technology Services Board or its delegated body of authority for decision.

Policy

Geospatial interoperability depends on the coordination of organizational behavior and implementation of voluntary and consensus-based policy and standards. Washington adopts GIS interoperability policy and standards to support agencies in utilizing geospatial data from a variety of heterogeneous computer information systems. Integrating data from a multitude of data sources is often key for developing applications that support critical business functions within the state.

There are a number of approaches for integrating and exchanging geospatial data including:

- File based approach where geographic data is in a structured file format
    - See also the *Geospatial Data Standard* *161.03*
- Web services approach where geospatial data is accessed and exchanged over networks and between software components using web based protocols
    - See also *Web Mapping Services Publication Standard* *161.06*
- Application programing interface (API) approach where geospatial data is accessed and exchanged between software systems
    - This includes existing industry standards, but not limited to:
        - Web – SOAP, XML, REST, GeoJSON, HTML5, GeoRSS
        - OGC – Geospatial Markup Language (GML), Web Map Service (WMS), Web Feature Service (WFS), Web Coverage Service (WCS) , Web Map Tile Service (WMTS), KML
        - Enterprise Integration – SOAP, XML, EJB, Structured Query Language

Interoperability is the concept of integrating data among many disparate file, web and API approaches. The ability to integrate will be key for efficiently using state resources and sharing geospatial information among state agencies.

References

- *"Interoperability seems to be about the integration of information. What it's really about is the coordination of organizational behavior."* --David Schell, Founder and Chairman of the **OpenGeospatialConsortium**. http://www.opengeospatial.org/domain/gov_and_sdi#modernsdi
- **Environmental Systems Research Institute** (Esri) Interoperability: http://desktop.arcgis.com/en/arcmap/latest/extensions/data-interoperability/what-is-the-data-interoperability-extension-.htm
- **Federal Geographic Data Committee** (FGDC) https://www.fgdc.gov/

Definitions

Federal Geographic Data Committee (FGDC) – is an interagency committee that promotes the coordinated development, use, sharing and dissemination of geospatial data on a national basis.

National Spatial Data Infrastructure (NSDI) – the FGDC nationwide data publishing effort. NSDI is a physical, organizational and virtual network designed to enable the development and sharing of this nation's digital geographic information resources.

Revision History

Date	Version	Editor	Changes
April 2017	0.1	Joy Paulus, OCIO; Joanne Markert, Leon Environmental	2nd draft of geospatial interoperability standard

Contact Information

For questions about this policy, please contact your OCIO GIS Program Office.

Approving Authority

Chief Information Officer Date
Chair, Technology Services Board

GIS System Architecture Design

WA OCIO

Prepared for:

Joy Paulus
Senior Policy & Program Manager
State GIS Coordinator, Geospatial Program Office

Date: April, 2017

Prepared by:
Noah Mayer
Esri

Contents

1 Introduction

Esri is pleased to submit this System Architecture Report to WA OCIO. The report documents Esri's observations, feedback, and recommendations from the System Architecture remote meetings held on March 7th and 8th, 2017.

This document presents a system design that provides for an enterprise, collaborative Geographic Information System, increased levels of service, and reliable, industry-standard performance.

1.1 Project Background

WA OCIO hosts the Washington Geospatial Portal and WAMAS in house, and wishes to evaluate the effectiveness of the existing infrastructure environment with an eye to over/under sizing; performance; and consolidation for cost savings.

1.2 Project Goals

- Look for opportunities to consolidate and re-balance existing resources - analyze resources utilization of current system and evaluate whether there is a way to shift resources to better support WAMAS increasing needs.
    - Capacity analysis is addressed on section 4.
    - Architecture alternatives, based on the capacity analysis, are presented on section 5.
- Look for ways to reduce the production environment into a single environment while still protecting certain REST services and licensed data.
    - Architecture alternatives, including security configuration, are presented on section 5.
- Provide alternative architectures for in-house or cloud hosting.
    - Section 5 contains architectures comparison.

1.3 Methodology

The document is organized into the following sections:

- **Section 1.0 Introduction—**this section includes a review of the document purpose, project background, project goals, document structure, methodology, assumptions, etc.

- **Section 2.0 Architecture Inputs—**this section defines inputs which drive the target (i.e., planned) system architecture design consisting of requirements, constraints, standards, and policies.

- **Section 3.0 Technology Considerations—**this section analyzes the gaps between the architecture related requirements and the current baseline technology architecture. It presents recommended technology components to be considered for the target system architecture based on an assessment of the current baseline technology components along with recommendations for upgrades, additions, or replacement of technology components. Relevant best practices are also provided.

- **Section 4.0 Capacity Analysis—**this section presents the capacity analysis to determine the number of physical resources for the various logical tiers. Traceability is provided to clearly show which architecture requirements have been met and which ones have not been met.

- **Section 5.0 Target Architecture—**this section presents the target or planned system architecture design starting with a logical representation based on all preceding requirements, analysis, and recommendations while simultaneously considering existing constraints.

2 Architecture Requirements and Inputs

This is the requirements sections of the document as they pertain to business architecture, data architecture and application architecture. These include FURPS architecture requirements consisting of Functional (architecturally significant only), Usability, Reliability, Performance, and Supportability. This document section attempts to capture information that contributes to a definition of what is required for this architecture design to be successful. This includes constraints, standards, policies and other pertinent information that is necessary as inputs to the architecture design.

2.1 Business Architecture

2.1.1 Key Business Processes Supported by GIS

The GeoPortal provides customers with the infrastructure needed to store, host and serve shared GIS resources important to conducting state business functions like permitting, licensing, taxation and protecting the public's health and environment in Washington. This includes access to quality state and local GIS resources like:

- Addressing Services: A set of 3 API's that correct and standardize an address, finds its best location on the ground (geocode) and its associated geography (county, legislative district, etc.)

- Data: A place to assemble, host and serve commonly used information like statewide parcels, county and city boundaries, address locations, trails, urban growth areas and much more.
- Imagery: Coordinated access to valuable high resolution county and statewide imagery data that number close to 100 individual imagery services.
- Other Services & API's: Many of the services mentioned above are available in multiple formats making it easy for end users to ingest them into their mainframe, server or desktop applications and the web.

WAMAS is co-hosted with the state's GeoPortal which is another of the Location Based services offered to state and local governmental entities. Some of the WAMAS API's consume the GeoPortal services. By leveraging these shared environments, we're able to provide customers with a cost effective infrastructure to store, host and serve out shared resources important to conducting state business functions like permitting, licensing, taxation and protecting the public's health and environment in Washington.
This includes access to quality state and local data resources like:

- Addressing Services: A set of 3 API's that correct and standardize an address, finds its best location on the ground (geocode) and gives you its associated geography (county, legislative district, etc.)
- Data and Imagery: A place to assemble, host and serve commonly used data and high resolution imagery like statewide parcels, county and city boundaries, address locations, trails, urban growth areas and much more.
- Other Services & API's: Many of the services mentioned above are available in multiple formats making it easy for end users to ingest them into their mainframe, server or desktop applications and web bases service applications like visual address correct & mapping tools.

2.1.2 GIS Sites and Data Centers

Site Name	Applications
GeoPortal	GeoServices & WAMAS
Public Users	GeoPortal Public
27 State Agencies	GeoPortal State
WAMAS Users	WAMAS

2.1.3 Business Level Architecture Requirements

- System Availability
  - Services are guaranteed to be up and running Monday through Friday from 7:00 AM to 6:00 PM

- Maintenance Windows
  - OS Patches twice a month on weekends
  - Data updates during work hours (usually 4pm), users are informed
- High Availability
  - GeoPortal State: Single ArcGIS Server machine, in case of failure restore from VMWare image backup
  - GeoPortal Public: Single ArcGIS Server Site with two machines to handle capacity, not for high availability. In case of failure restore from VMWare image backup
  - WAMAS: One hour recovery time (7am – 6pm) requirement. Single ArcGIS Server Site with two machines, one active and second failover standby for hot swap.
    - WAMAS MSSQL database – DBMS backups. Recovery time is 4-6 hours. The MSSQL database contains only data for the geocoders, so it is being accessed only during rebuilding of the geocoders, thus 4-6 hours recovery time is acceptable.

2.2 Solution Architecture

- Solution Tiers (client, web, services, data, etc.)
  - Load balancer
  - Web adaptor
  - WAMAS app server / ArcGIS Servers
  - Data – File Storage / MSSQL
- Solution Components
  - ArcGIS GIS Server
  - Image Server
- Version:
  - Currently version is 10.4. WA OCIO plans to upgrade the system to version 10.4.1 because they don't want to use the newest version, but might consider to upgrade to 10.5.1 (scheduled for May 2017) when the time comes
- Web Development
  - WA OCIO has developed WAMAS .NET web services, a set of 3 API's that correct and standardize an address, finds its best location on the ground (geocode) and gives you its associated geography (county, legislative district, etc.)
- System integration with other IT systems
  - ArcGIS Services and WAMAS .NET Services are consumed by systems as services.

2.3 Application Architecture

2.3.1 GeoPortal Public

- URL: http://geoservices.des.wa.gov
- Services:
  - Total of 105 services
  - 88 Image Services
  - 10 Map Services, 2 cached
  - 6 Geocode Services
  - 1 Geometry Service
- Usage:
  IIS logs from February 2017 were analyzed to identify peak hour usage. Peak hour on February 2017 for GeoPortal Public ArcGIS Site was found to be on 2/13/2017 at 3pm to 4pm UTC. The below table depicts GeoPortal Public ArcGIS Site usage during that time:

Request Type	Requests/Hour (110%)
Dynamic Image	16,500
Dynamic Map	1,200
Cached Tile	700

- Response Time:
  IIS logs from February 2017 were analyzed to get average response time per request type. The below table depicts GeoPortal Public ArcGIS Site average response times:

Request Type	Average Response Time
Dynamic Image	0.33
Dynamic Map	0.18
Cached Tile	0.04

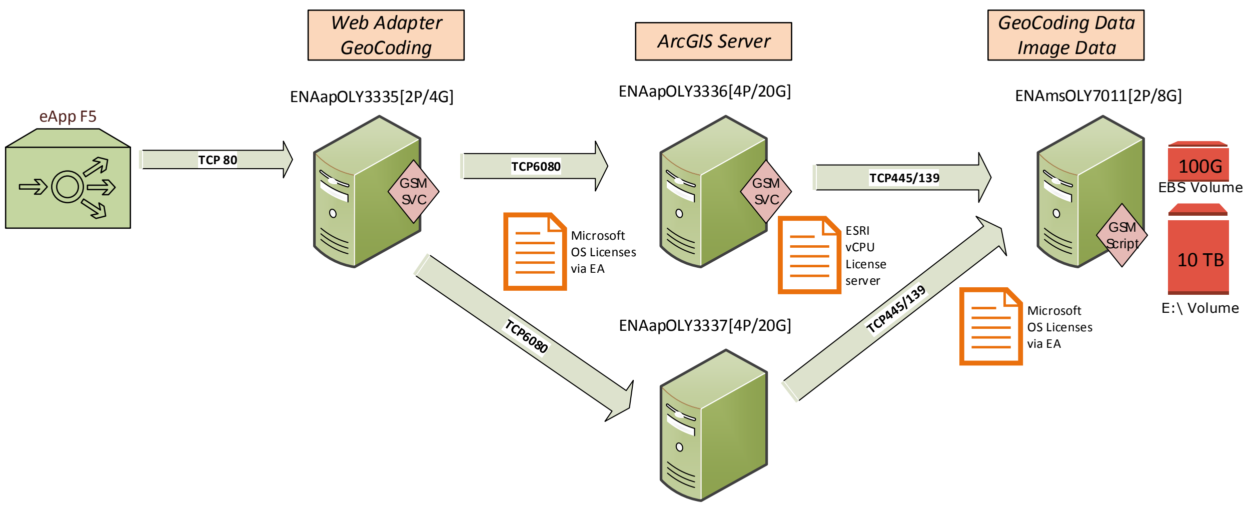
  - Response time is composed of service CPU time + wait time. Services should be monitored on a regular basis to identify opportunities to improve performance by performing service configuration tuning and service performance optimization. On GeoPortal Public, the following services exhibited relatively longer response time:

Service	Req/ Hr	Avg. Res Time
/arcgis/services/ImageServices/Statewide_NAIP_2015_3ft_4band_wsps_83h_img/ImageServer/WMSServer	6138	0.81
/arcgis/services/ImageServices/OlympicPeninsula_2005_18in_color_wsps_83h_img/ImageServer/WMSServer	2668	0.547

/arcgis/rest/services/Parcels/ECY_Washington_State_Parcel_Database_2016/MapServer/0/query	1841	7.44
/arcgis/services/ImageServices/PugetSound_2009_30cm_color_wsps_83h_img/ImageServer/WMSServer	1420	0.967
/arcgis/services/ImageServices/PugetSound_2009_30cm_color_wsps_83h_img/ImageServer	607	0.53
/arcgis/rest/services/ImageServices/Statewide_NAIP_2015_3ft_4band_wsps_83h_img/ImageServer/exportImage	242	0.867
/arcgis/rest/services/Parcels/OCIO_Washington_State_Parcel_Database_2012/MapServer/0/query	173	4.577
/arcgis/rest/services/Parcels/OCIO_Washington_State_Parcel_Database_2012/MapServer/2/query	151	5.832
/arcgis/services/ImageServices/Statewide_NAIP_2006_18in_color_wsps_83h_img/ImageServer/WMSServer	126	1.236
/arcgis/services/ImageServices/KitsapCo_2007_1ft_color_wsps_83h_img/ImageServer/WMSServer	116	1.153
/arcgis/rest/services/MapServices/LocationFinder_GPService/MapServer/find	96	15.507
/ArcGIS/services/ImageServices/OlympicPeninsula_2005_18in_color_wsps_83h_img/ImageServer	91	0.747
/arcgis/rest/services/Parcels/OCIO_Washington_State_Parcel_Database_2012/MapServer/1/query	72	10.329
/arcgis/rest/services/Parcels/DAHP_GLO_Survey_Plat_Maps/MapServer/export	60	3.156
/arcgis/rest/services/ImageServices/Statewide_NAIP_2011_3ft_4band_wsps_83h_img/ImageServer/exportImage	60	0.72
/arcgis/services/ImageServicesDOTCorridors/SR101_Aberdeen_2006_3in_color_wsps_83h_img/ImageServer/WMSServer	35	1.004
/arcgis/rest/services/ImageServices/SouthWest_2003_18in_color_wsps_83h_img/ImageServer/exportImage	31	0.918
/arcgis/rest/services/Parcels/ECY_Washington_State_Parcel_Database_2015/MapServer/0/query	25	13.429
/arcgis/rest/services/ImageServices/Statewide_NAIP_2013_3ft_4band_wsps_83h_img/ImageServer/exportImage	17	1.632
/arcgis/rest/services/ImageServices/Statewide_NAIP_2006_18in_color_wsps_83h_img/ImageServer/exportImage	15	2.535
/arcgis/rest/services/ImageServices/Statewide_NAIP_2009_3ft_4band_wsps_83h_img/ImageServer/exportImage	11	1.277
/arcgis/rest/services/ImageServices/Statewide_1989_2000_1m_bw_wsps_83h_img/ImageServer/exportImage	11	0.981
/arcgis/rest/services/ImageServices/OlympicPeninsula_2005_18in_color_wsps_83h_img/ImageServer/exportImage	4	1.589
/arcgis/services/ImageServicesDOTCorridors/SR167_Extension_2007_6in_color_wsps_83h_img/ImageServer/WMSServer	2	60.017

/ArcGIS/services/ImageServices/Statewide_2009_3ft_color_wsps_83h_img/ImageServer	2	0.851
/arcgis/rest/services/ImageServices/GrantCo_2002_1ft_color_wsps_83h_img/ImageServer	1	0.562

- ArcGIS Server Configuration:
  - Single Site, two active machines
- Architecture:



2.3.2 *GeoPortal State*

- URLs:
  - State:
    - http://state-geoservices.des.wa.gov
    - https://state-geoservices.des.wa.gov
  - WAMAS:
    - http://state-wamas.des.wa.gov
    - https://state-wamas.des.wa.gov
- Services:
  - State:
    - Total of 24 services
    - 15 Image Services
    - 2 Map Services, 1 cached with StreetMap Premium carto data
    - 6 Geocode Services
    - 1 Geometry Service
  - WAMAS
    - Total of 16 services

- 13 Geocode Services, 1 with StreetMap Premium locators data
- 2 Map Services
- 1 Geometry Service

- Usage:
  - State

IIS logs from February 2017 were analyzed to identify peak hour usage. Peak hour on February 2017 for GeoPortal State ArcGIS Site was found to be on 2/13/2017 at 10pm to 11pm UTC. The below table depicts GeoPortal State ArcGIS Site usage during that time:

Request Type	Requests/Hour (110%)
WMS	6,000
Cached Tile	1,100
Dynamic Image	500

  - WAMAS

IIS logs from February 2017 were analyzed to identify peak hour usage. Peak hour on February 2017 for WAMAS ArcGIS Site was found to be on 2/13/2017 at 3am to 4am UTC. The below table depicts WAMAS ArcGIS Site usage during that time:

Request Type	Requests/Hour (110%)
Find Address Candidates	150,000
Dynamic Map	350

In addition, WAMAS is required to support two concurrent batch geocode addresses requests.

- Response Time:
  - State

IIS logs from February 2017 were analyzed to get average response time per request type. The below table depicts GeoPortal State ArcGIS Site average response times:

Request Type	Average Response Time
WMS	0.95
Cached Tile	0.04
Dynamic Image	0.33

- Response time is composed of service CPU time + wait time. Services should be monitored on a regular basis to identify opportunities to improve performance by performing service configuration tuning and service performance optimization. On GeoPortal State, the following services exhibited relatively longer response time:

Service	Req/ Hr	Avg. Res Time
/arcgis/services/ImageServices/KingCo_West_2010_6in_4band_wsps_83h_img/ImageServer/WMSServer	17280	1.253
/arcgis/services/ImageServices/SnohomishCo_2012_1ft_color_wsps_83h_img/ImageServer/WMSServer	14491	0.886
/arcgis/services/ImageServices/ThurstonCo_2012_6in_color_wsps_83h_img/ImageServer/WMSServer	778	0.742

- WAMAS

IIS logs from February 2017 were analyzed to get average response time per request type. The below table depicts WAMAS ArcGIS Site average response times:

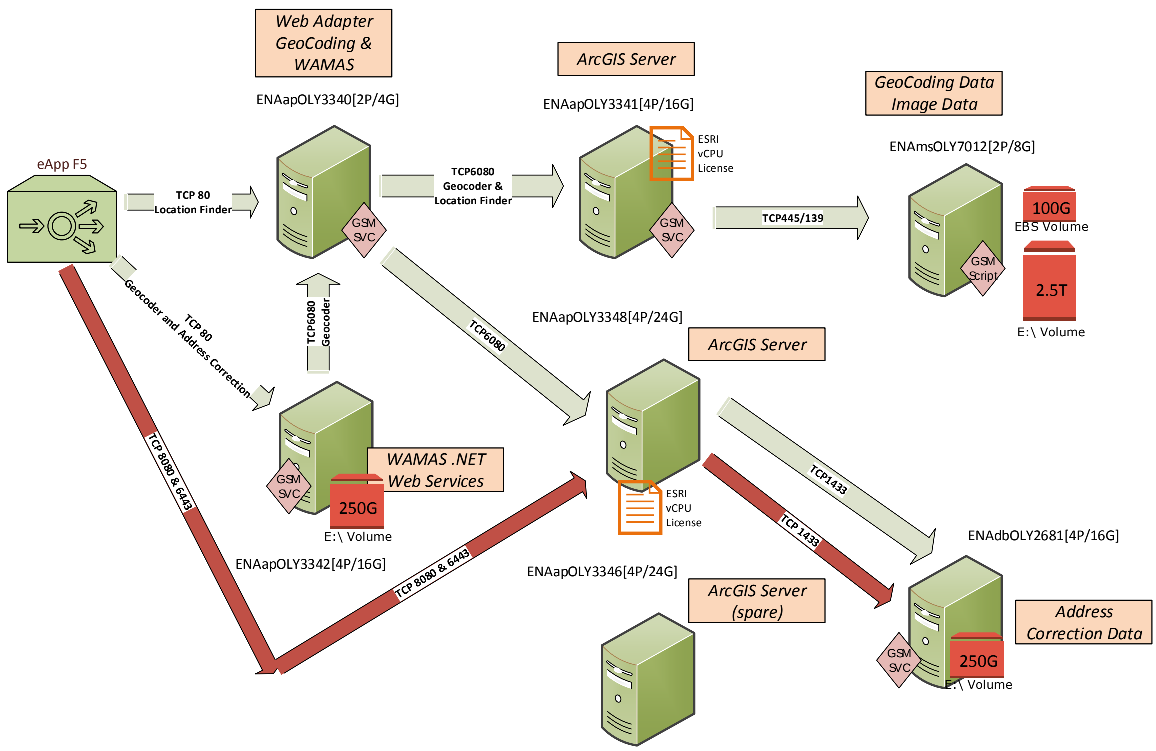
Request Type	Average Response Time
Geocode	0.02
Dynamic Map	0.07

- Response time is composed of service CPU time + wait time. Services should be monitored on a regular basis to identify opportunities to improve performance by performing service configuration tuning and service performance optimization. On WAMAS, the following services exhibited relatively longer response time:

Service	Req/ Hr	Avg. Res Time
/wamas/rest/services/Locators/WAMAS/GeocodeServer/findAddressCandidates	978	1.04

- ArcGIS Server Configuration:
  - State:
    - Single Machine Site
  - WAMAS:
    - Single Site with two machines, one active and second failover standby for hot swap.

- Architecture:



2.4 Data Architecture

Describe how GIS data are managed, the processes involved, and how data are being used with GIS.

WA OCIO leverages FME server to manage data processes (ETL):

- WAMAS FME county data update process
- WAMAS FME address gap process – integration with DOR FME Service (port 443)
- WAMAS FME QA/QC process – integration with DOR FME Service (port 443)

3 System Design Considerations

This section has three purposes. First, it identifies gaps between current requirements and the baseline GIS system architecture. This information is used to derive specific technology needs and design patterns for the target system architecture design (Section 4). Second, it evaluates the baseline architecture from a technology perspective to ensure that the available technology components are appropriate, performant, scalable, and reliable and if not, recommendations are provided for remedy. Further, targeted best practice recommendations are provided based on what is known about the current/planned environments, operations, and configuration.

3.1 Software and Solutions

Software	Quantity	Version
ArcGIS for Server Enterprise Standard Up to Four Cores	4	10.4
ArcGIS for Server Enterprise Standard Up to Four Cores Staging Server	2	10.4
ArcGIS Image Extension for Server Enterprise Standard Up to Four Cores	3	10.4
ArcGIS Image Extension for Server Enterprise Standard Up to Four Cores Staging	1	10.4
StreetMap Premium for ArcGIS for Server Enterprise Map Display + Geocoding USA State HERE Up to Four Cores Term License	2	10.4
ArcGIS for Desktop Advanced Concurrent Use	2	10.4

3.2 Servers

- VMWare Virtual Machines
- Host System: Nutanix NX-3050 16 CPU x 2.6 GHz 262109.7 MB RAM
- Processor: Intel Xeon CPU E5-2643 v3 3.4 GHz
- SPECint2006 Rate[1] per Core: Nutanix did not submit its systems for tests, but other systems with the same processor scored 54 – 56.

3.3 Data Storage

- Storage Systems:
  - File based data is stored on NAS
  - WAMAS address correction vector data is stored on MSSQL 2012 R2 Standard
- Storage Requirements
  - Public Test: 2.5 TB
  - Public Prod: 10 TB
  - State - WAMAS Test: 2.5 TB
  - State - WAMAS Prod: 2.5 TB
  - MSSQL Test: 250 GB
  - MSSQL Prod: 250 GB

[1] https://www.spec.org/cpu2006/results/rint2006.html

3.4 Security

3.4.1 GeoPortal Public

- HTTP (port 80)
  - WA OCIO has started working on enabling HTTPS as well
- Unsecured services with public access

3.4.2 GeoPortal State

- HTTP (port 80) & HTTPS (port 443)
- eApp F5 load balancer has IP white list
- Unsecured services

3.4.3 WAMAS

- HTTP (port 80) & HTTPS (port 443)
- eApp F5 load balancer has IP white list (separate from the GeoPortal State)
- Unsecured services
- WA OCIO wishes to have more control and use ArcGIS Server token-based security for WAMAS services. **Security best practice is to use HTTPS only for token secured services[2].**

4 Capacity Analysis

The following capacity analysis addresses the target architecture for an estimated user loads with the user workflow previously defined. The Esri capacity planning methodology is based on sizing systems for peak active user scenarios to ensure that adequate compute capacity is available with minimal performance degradation during peak utilization periods. Though both user and peak active user totals are estimated, peak active usage numbers drive the capacity analysis.

Capacity analysis is done only for interactive user processes and not for batch processing. As a rule of thumb you should dedicate one core for each concurrent batch process.

[2] http://server.arcgis.com/en/server/latest/administer/windows/best-practices-for-configuring-a-secure-environment.htm#ESRI_SECTION1_363A134471D24B61A1F4D501F41BDBC4

WAMAS is required to support two concurrent batch geocode addresses requests, so two cores have to be added to the calculated cores.

Batch Process	Concurrent Requests	Calculated Cores
Geocode Addresses	2	2

The Esri capacity planning tools consider active user inputs, defined user workflows, along with respective operations to determine expected system loads. The end result is the determination of operations per hour (i.e., throughput), which is the core metric for calculating capacity. This information is coupled with the proposed technology architecture to derive required server counts.

The below table contains capacity summary for the planned user loads and workflows that have a capacity impact. Inputs that drive the capacity analysis are captured either in the form of estimated Active Users or Throughput, as deemed appropriate. Therefore, if Active Users are defined for a given workflow, Throughput is zero, and if a Throughput value is defined, Active Users is zero. Throughput in this case is not calculated throughput, but reflects defined throughput demand for the workflow based on inputs. Capacity For capacity planning definitions, see Appendix A.

Application	Operation	Requests / Hr	Response Time
GeoPortal Public	Dynamic Image	16,500	0.33
	Dynamic Map	1,200	0.18
	Cached Tile	700	0.04
GeoPortal State	WMS	6,000	0.95
	Cached Tile	1,100	0.04
	Dynamic Image	500	0.33
WAMAS	Find Address Candidates	150,000	0.02
	Dynamic Map	350	0.07

The following summary information applies to server capacity analysis. It only addresses those servers for which capacity is relevant. Excluded server types either do not have a capacity impact (e.g., license servers), were not modeled for capacity due to lack of capacity related information, or fall outside of capacity analysis performed by Esri (e.g., non-Esri servers).

4.1 Application Capacity

Application	Operation	Calculated Cores (Op)	Calculated Cores (App)
GeoPortal Public	Dynamic Image	1.45	1.52
	Dynamic Map	0.06	
	Cached Tile	0.01	
GeoPortal State	WMS	1.52	1.57
	Cached Tile	0.01	
	Dynamic Image	0.04	
WAMAS	Find Address Candidates	0.99	3
	Dynamic Map	0.01	
	Geocode Addresses	2	

5 Target Architecture

This section summarizes the planned GIS system architecture intended to support future enterprise GIS operations.

5.1 Workload Separation

Service delivery is improved when service requests are directed to appropriate compute resources in a way that optimizes hardware and reduces resource contention. Service requests that are known to be central processor unit (CPU) intensive, such as complex analysis tasks, can be directed to GIS server site containing machines with faster processors and directed away from sites/machines that support critical applications. This approach will ensure that GIS server machines are used in the most effective manner and will protect critical tasks from resource contention.

Security is enhanced when workloads and associated GIS server machines are isolated within a site. Separating workloads and GIS server machines by a site ensures that if one machine gets compromised or malfunctions, it cannot affect other machines in the environment. User requests are routed to the appropriate sites through load balancers, and results are securely and transparently delivered to users.

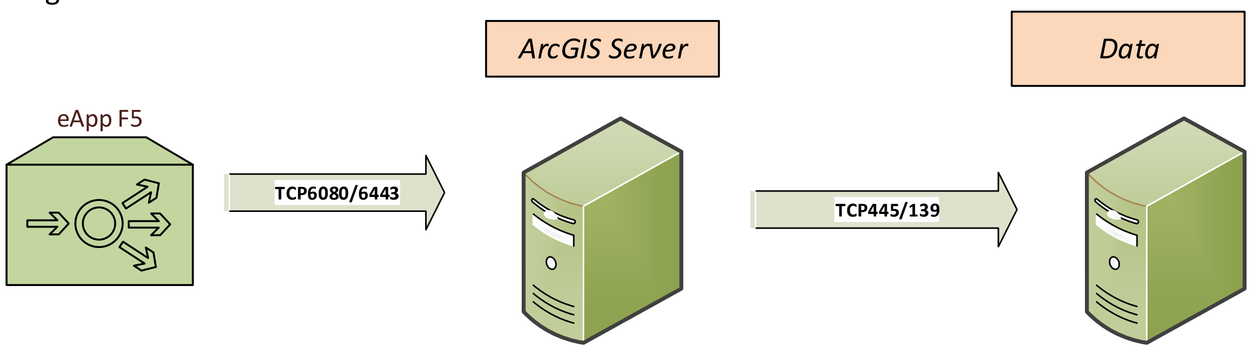
An example of workload separation involves the isolation of analysis tasks from operational awareness and visualization tasks. Back-office analytics are typically CPU intensive, executed sporadically, and maintained by lower Service Level Agreements (SLA). Because analysts use geoprocessing tasks in an ad hoc fashion, the CPU may sit idle for long periods, but then spike when several tasks are executed. On the other hand, operational awareness and visualization activities simply consume map-based information products to drive operational business decisions. They are typically less CPU intensive, executed more consistently, and maintained by higher SLAs. Because the characteristics of these tasks and workflows are so different, it would be appropriate to use workload separation to accommodate each set of activities.

5.2 *Architecture Alternatives*

5.2.1 Alternative A – Business Isolation

GeoPortal Public

Diagram:



Security:

- HTTP (ports 80/6080) and HTTPS (ports 443/6443)
- Unsecured services with public access

Servers:

Server	Cores	Memory (GB)	Storage (GB)	Quantity
ArcGIS Server	4	20		1
NAS			10,000	

ArcGIS Server Capacity:

Allocated Cores	Calculated Cores	CPU Utilization
4	1.52	38%

Software 10.4.x:

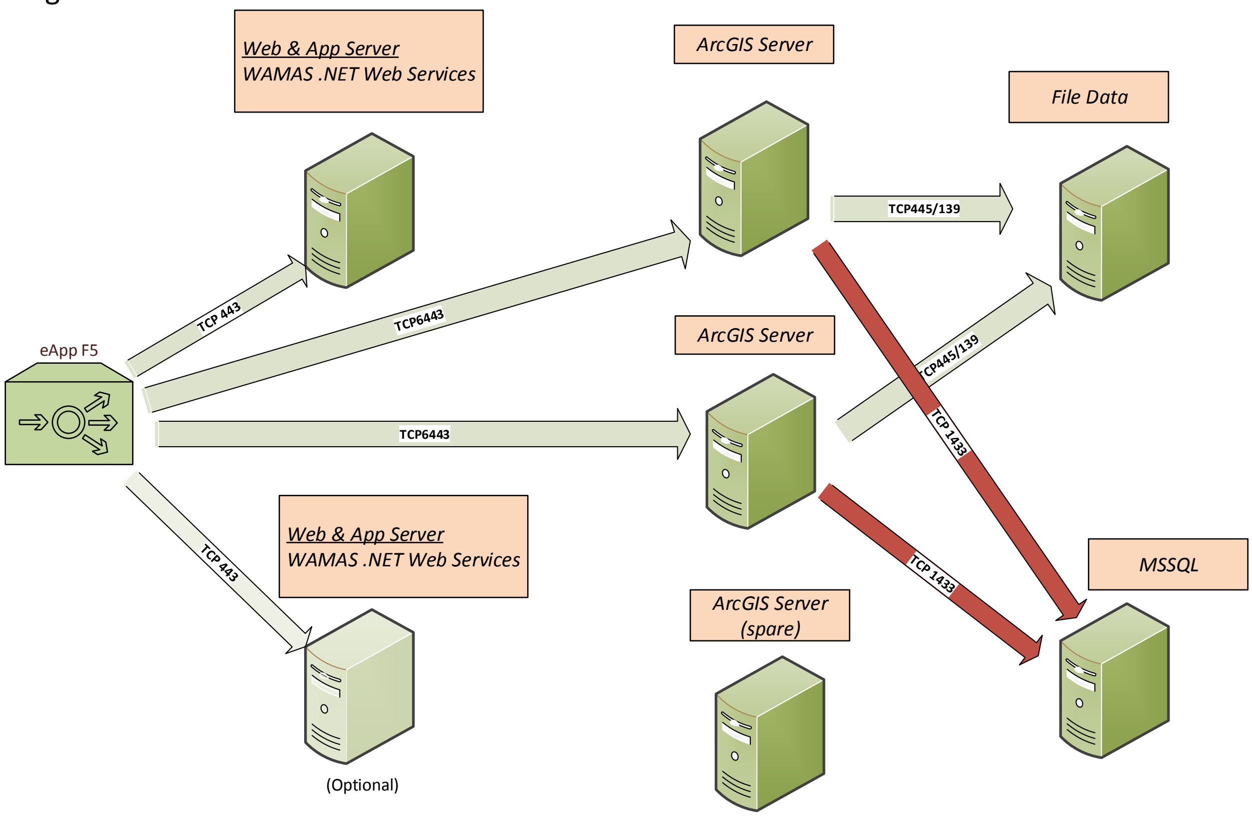
Software	Quantity
ArcGIS for Server Four Cores	1
ArcGIS Image Extension Four Cores	1

Software 10.5.x:

Software	Quantity
ArcGIS GIS Server Four Cores	1
ArcGIS Image Server Four Cores	1

GeoPortal State & WAMAS

Diagram:



Security:

- HTTP (ports 80/6080) and HTTPS (ports 443/6443)
- State services can be secured by eApp F5 load balancer IP white list or ArcGIS Server tokens
- WAMAS services can be secured by eApp F5 load balancer IP white list or ArcGIS Server tokens
- Security best practice is to use HTTPS only for token secured services

Servers:

Server	Cores	Memory (GB)	Storage (GB)	Quantity
Web/App Server	4	16		1/2
ArcGIS Server	4	16		2
ArcGIS Server Failover	4	16		1
NAS			2,500	

ArcGIS Server Capacity:

Allocated Cores	Calculated Cores	CPU Utilization
8	4.57	57%

Software 10.4.x:

Software	Quantity
ArcGIS for Server Four Cores	2
ArcGIS Image Extension Four Cores	2
StreetMap Premium	2
ArcGIS for Server Four Cores Failover	1
ArcGIS Image Extension Four Cores Failover	1
StreetMap Premium Failover	1

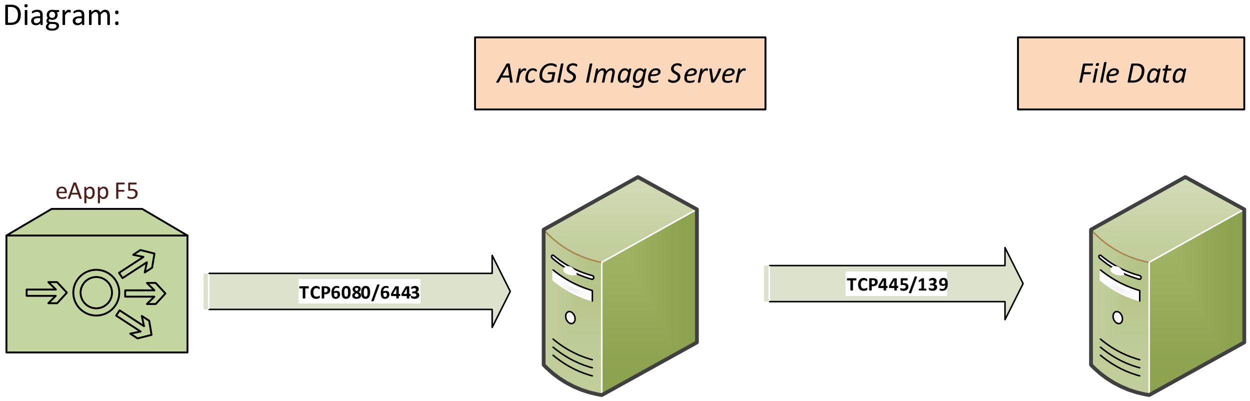
Software 10.5.x:

Software	Quantity
ArcGIS GIS Server Four Cores	2
ArcGIS Image Server Four Cores	2
StreetMap Premium	2
ArcGIS for Server Four Cores Failover	1
ArcGIS Image Extension Four Cores Failover	1
StreetMap Premium Failover	1

5.2.2 Alternative B – Server Role Isolation

<u>ArcGIS Image Server</u>

Diagram:



Security:

- HTTP (ports 80/6080) and HTTPS (ports 443/6443)
- Public services are not secured with public access
- State services can be secured by eApp F5 load balancer IP white list or ArcGIS Server tokens
- Security best practice is to use HTTPS only for token secured services

Servers:

Server	Cores	Memory (GB)	Storage (GB)	Quantity
ArcGIS Server	4	24		1
NAS			10,000	

ArcGIS Server Capacity:

Allocated Cores	Calculated Cores	
4	3.01	75%

Software 10.4.x:

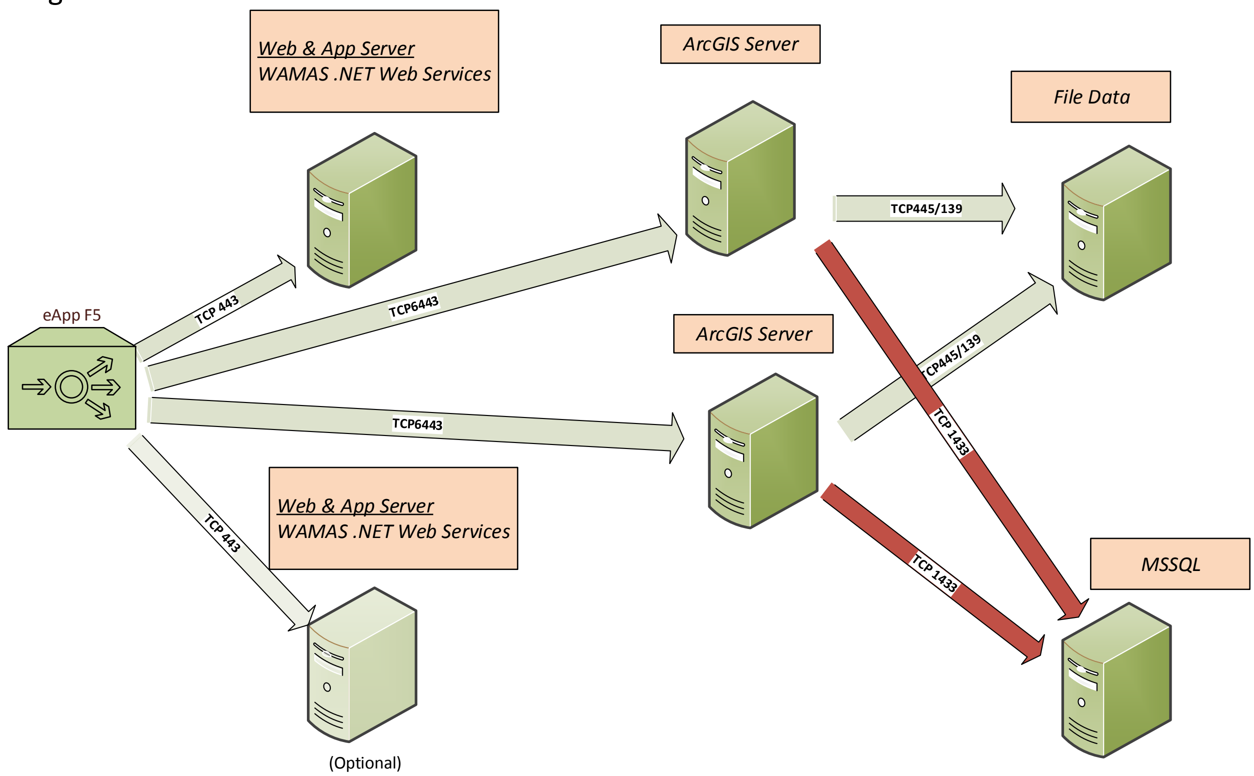
Software	Quantity
ArcGIS for Server Four Cores	1
ArcGIS Image Extension Four Cores	1

Software 10.5.x:

Software	Quantity
ArcGIS Image Server Four Cores	1

ArcGIS GIS Server

Diagram:



Security:

- HTTP (ports 80/6080) and HTTPS (ports 443/6443)
- Public services are not secured with public access
- State services can be secured by eApp F5 load balancer IP white list or ArcGIS Server tokens
- WAMAS services can be secured by eApp F5 load balancer IP white list or ArcGIS Server tokens
- Security best practice is to use HTTPS only for token secured services

Servers:

Server	Cores	Memory (GB)	Storage (GB)	Quantity
Web/App Server	4	16		1/2
ArcGIS Server	4	16		2
NAS			2,500	

ArcGIS Server Capacity:

Allocated Cores	Calculated Cores	CPU Utilization N+1 (2 Servers)	
8	3.08	38.5%	77%

Software 10.4.x:

Software	Quantity
ArcGIS for Server Four Cores	2
StreetMap Premium	2

Software 10.5.x:

Software	Quantity
ArcGIS GIS Server Four Cores	2
StreetMap Premium	2

5.3 Architectures Comparison

5.3.1 Servers

Server	Current	Alternative A	Alternative B
Web/App Server	3	1/2	1/2
ArcGIS Server	3	3	3
ArcGIS Server Failover	1	1	0
NAS	2	2	2

5.3.2 Licenses

Software 10.4.x:

Software	Current	Alternative A	Alternative B
ArcGIS for Server Four Cores	3	3	3
ArcGIS Image Extension Four Cores	3	3	1
StreetMap Premium	2	2	2
ArcGIS for Server Four Cores Failover	1	1	0
ArcGIS Image Extension Four Cores Failover	1	1	0
StreetMap Premium Failover	1	1	0

Software 10.5.x:

Software	Current	Alternative A	Alternative B
ArcGIS GIS Server Four Cores	3	3	2
ArcGIS Image Server Four Cores	3	3	1
StreetMap Premium	2	2	2
ArcGIS for Server Four Cores Failover	1	1	0
ArcGIS Image Extension Four Cores Failover	1	1	0
StreetMap Premium Failover	1	1	0

5.3.3 ArcGIS Server Capacity

Architecture	Application	Allocated Cores	Calculated Cores	CPU Utilization N+1 (2 Servers)	CPU Utilization N (1 Server)
Current	Public	8	1.52	19%	38%
	State	4	1.57	N/A	39.25%
	WAMAS	4	3	N/A*	75%
Alternative A	Public	4	1.52	N/A	38%
	State & WAMAS	8	4.57	N/A*	57%
Alternative B	Image Server	4	3.01	N/A	75%
	GIS Server	8	3.08	38.5%	77%

* Standby ArcGIS Machine

5.4 System Monitor

Performance bottlenecks can occur at any tier of a GIS deployment making component monitoring tools limited in value for evaluating a GIS deployment. To evaluate a complex deployment, the performance analyst will need to account and correlate for all the latencies in every tier. This is not always effective or possible using separate, disjoined component level monitoring and using multiple management tools. Here are typical reasons:

1. ArcGIS administrator does not have access to all these tools
2. Data collected in a reactive fashion: on demand and for limited time
3. Correlation of data with different timestamp is difficult
4. It is challenging to quickly identify the root cause and take appropriate measures. For example, when users report performance degradation and administrators observes the server runs at high CPU or memory, should administrator add more resources? The answer might be yes, if this is a result of additional user load. On the other hand, this could be related to newly published service that requires tuning.

Esri recommends to use System Monitor. System Monitor supports end-to-end monitoring for complex N-tier GIS applications. It was developed by Professional Services and it is a part of Professional Services consulting practice. System Monitor 3 requires a dedicated machine with 4 CPU, 8 GB RAM, and 50 GB disk space.

Appendix A – Capacity Planning Definitions

The following definitions of terms are used in Esri's capacity planning methodology.

Active Users
The target number of concurrent users associated with a workflow, which is typically a subset of the potential Total Users.

Batch Process
A batch process is a unit of work that has a long duration and zero think time. Once a service time of 15 seconds or greater is defined for an operation, the operation is no longer treated as an interactive user process and any queuing time is excluded from response time calculations for the operation. This causes the response time to be equal to the service time of the operation. Generally, a batch process will consume a processor core.

Operation
An Operation is a unit of work as seen from the system perspective. With ArcGIS Server, typical Operations are ExportMap, Find, Geocode, etc. In this case, it is common to name Operations for the REST API methods that they consume. With ArcGIS Desktop, typical Operations are DrawMap, Complex Edit, Identify, Geocode, etc. In this case, there is not a canonical list of software-specific methods to use for Operation naming.

There is a 1:N relationship between transactions and operations. A transaction can be composed of a single operation. Or, a transaction can be composed of multiple operations. With server-based applications, it is quite common for a single transaction to be composed of multiple operations. For example, an operation that buffers a feature may create the buffer (one operation) and cause the map to redraw (a second operation) to show the buffer. The composition of transactions depends upon the design of the application.

Operations per Hour (Op/hr Calc)
This is a calculation of the number of Operations that occur in the peak planning hour. It is built upon the Workflows per Hour calculation and includes the Occurrences of the Operation, as well as its calculated Response Time.

Pacing
Pacing, sometimes referred to as "Idle time", is the time between workflow cycles or iterations. If a user completes all of the transactions in a workflow and immediately moves on to the next piece of work (i.e. the last transaction is immediately followed by a new first transaction), then the pacing is zero. On the other hand, if a user completes all of the transactions in a workflow and waits for the next unit of work (like at a public counter) or perform other tasks (e.g. putting

documents away, attending to email, etc.) then the pacing time between cycles will be greater than zero. Pacing is expressed in seconds.

Response Time

Ultimately, performance is measured by the difference between the start and end of a transaction from the user's perspective. This is "Response Time". Response time is composed of service time and queue time.

In Esri's benchmark models, the response times of interest are the response time of the system with a single user request and the response time of the system at maximum throughput.

Operations have an "RTMax" attribute. This is the maximum response time that the user community will tolerate for a given kind of operation. "RTMax Calc" is the calculated Response Time at the Maximum Throughput of the system. It is based upon the Service Time and the Queue Time.

Service Time

The service time is the amount of time the processor spends working on a request. In Esri's benchmark models, the service time of interest is the service time at the maximum throughput of the system. This value is calculated from the maximum throughput and the processor activity at the maximum throughput.

Site

In System Designer, a Site is meant to represent a physical or logical location where server infrastructure and/or user workflows exist. An organization's actual facilities (data center, regional office, etc.) are examples of physical locations. Logical locations are things such ArcGIS Online, Amazon Web Services, Internet Users, or Field Users.

SPECintRate Benchmark

The SPECintRate is a processor benchmark rating which can be used to compare the processing capacity of different hardware systems. Currently, Esri uses the 2006 SPEC Integer Rate benchmark data for comparing systems (SPECintRate2006). The baseline value is the specific SPEC data value that is used by System Designer. Information about the benchmark is available from the Standard Performance Evaluation Corporation website (www.spec.org).

Think Time

User's requests (transactions) are composed of response time and think time durations. You can think of response time as the time that the system is busy and think time as the time that the user is busy. They could be actually busy thinking. But, they might also be busy doing something else like responding to an email. Think time is modeled on a per-operation basis.

Transport Time
Transport Time may appear as “Transport” in System Designer. It is the calculated value for “transport latency” for an Operation. It is based upon the payload size of the Operation (Mb/tr) and the smallest network bandwidth in the network pathways for the Operation.

Workflow
A Workflow is a collection of Operations that are used to complete a given task. For example, a Workflow could be “View Election Results”. And, it could be composed of 10 “Draw Map” Operations, a “Geocode” Operation, and 4 “Identify” Operations. The quantities of each Operation represent an average of how the typical Workflow is carried out. Individual instances may be greater or lesser in their counts of Operation Occurrences.

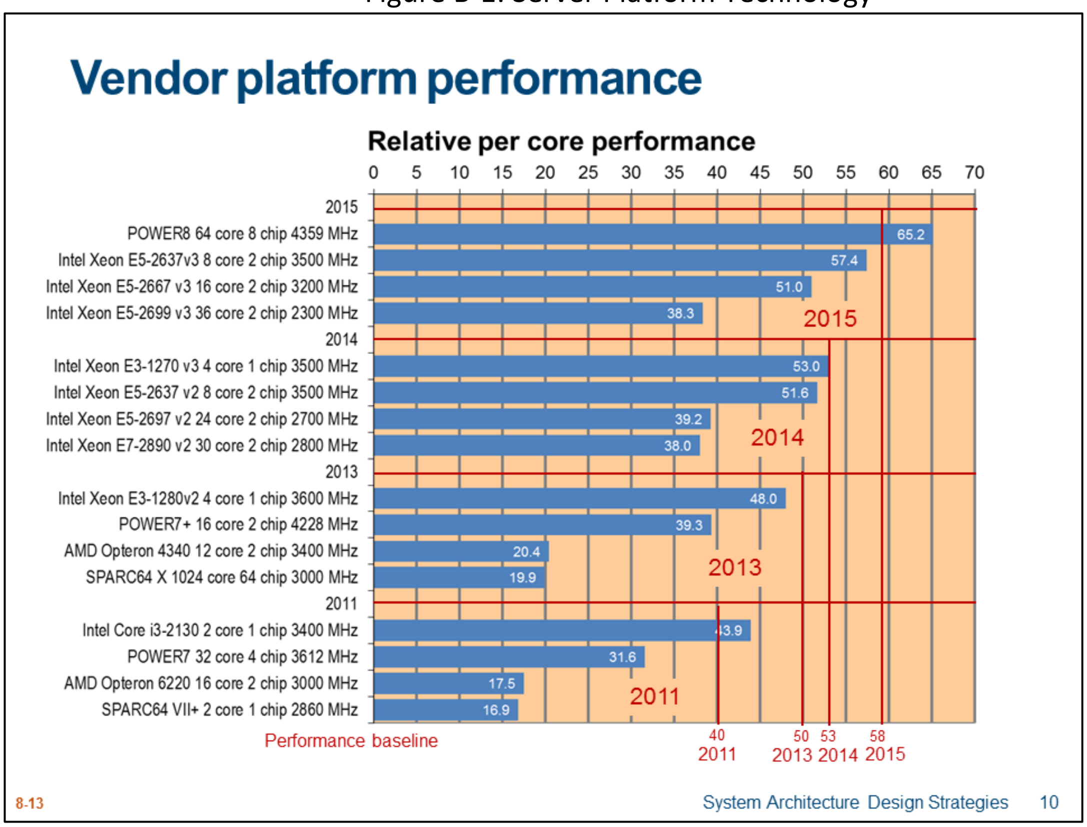
Appendix B – Server System Technology Selection

The guidelines presented below can be used to determine server system technology selection.

- Platform Performance Baseline
  http://www.wiki.gis.com/wiki/index.php/Platform_Performance#Platform_Performance_Baseline

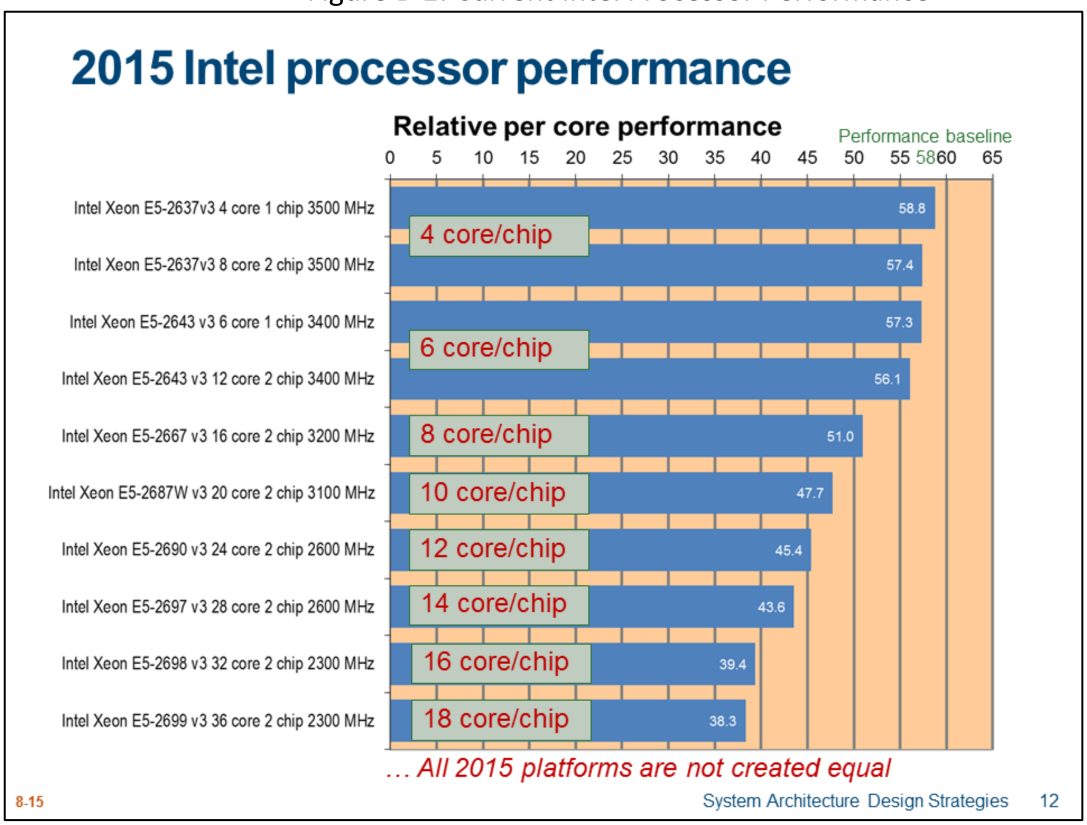
The relative capability in terms of both performance and scalability of server technology establishes the importance of maintaining server hardware refreshes. For example, the Intel Xeon E5-2637 v3 processor available today offers a significant performance boost relative to many previous generation processors. This is based on comparing per-core SPEC rates (i.e., performance benchmarks) which translates into how fast a particular request or application can be serviced, which in the end translates into user productivity. Scalability has also increased tremendously with the advent of multi-core processors coupled with realized performance gains. For 2015, the target performance baseline is a SPEC score of 58 therefore new systems being deployed should strive to achieve a performance level approaching that benchmark level. Figure B-1 depicts evolving performance of server platform technology.

Figure B-1: Server Platform Technology



Keeping up with the latest processor technology is important, but just as important is selecting the appropriate processor within the next-generation release of processors as per-core performance can vary significantly. Figure B-2 demonstrates the importance of proper processor technology selection related to selecting the proper next generation processor. For example, many servers today are virtualized and rely on large physical host servers. From an IT perspective, it is attractive to deploy large servers with a high core count. However, from a performance perspective, there is often a trade-off as higher density processors typically offer lower per-core performance. For example, if choosing between a two-chip, six-core E5-2643 v3 and a two-chip, twelve-core E5-2697 v3, it is clear that the E5-2643 v31 is the better choice compared from a performance perspective as if offers approximately 28% faster performance at the core level (SPEC 56.1 vs. 43.6). This may lead to more server hosts to manage which presents a trade-off between server management costs and performance.

Figure B-2: Current Intel Processor Performance



Geographic Information Technology (GIT) Committee Meeting

May 4, 2017

1500 Jefferson St SE, Room 2208

Rob St. John & Joy Paulus, Co-Chairs

WA • Office of the Chief Information Officer

Decision Item: Geospatial Portal Disk Storage

Issue Statement
The Geospatial Portal imagery and data storage space on the State side (limited access) and Public side are full. There isn't any room to load new data without removing existing data. This includes the loading of the new 2015 high-res statewide imagery (1 ft.) that we will receive the first week of May.

Actions/Options for Consideration
The Committee needs to consider and vote to move forward with one of the following options to resolve this issues:
1. Live within the allotted disk space on each server and forgo the installation of any new data (including the new 2015 statewide imagery).
2. Remove lower priority data sets to make room for new imagery on the Public side and State side.
3. Agencies make a one-time, end of biennium donation to pay for 1 year of disk space on the state Portal side (at minimum).

Decision Reached and Recorded
The GeoPortal Steering Committee needed to act on and implement Option #

Chief Information Officer

Geospatial Interoperability Policy

- Policy initially drafted in 2014 and dusted off
- Circulated to OCIO Forum participants in April 2017
- Requested by OCIO Policy lead to pull this submittal to the TSB
  - Rational: Sue Langen will be delving closer into a state policy on interoperability and is forming a group to work on it
- In the interim, verified that Interoperability is covered in the *Geospatial Data Management Policy*

- Proposal: Move interoperability forward as a Geospatial Guideline with the GIT's approval.

Chief Information Officer

Call for Agency 2017 Geospatial Metadata Update

Box - Web Accessible Folder (WAF)

- State agencies
- Office of the Chief Information Officer (OCIO)

Washington State Geospatial Clearinghouse

- UW
- Harvests XML files from agency WAFs

National States Geographic Information Council

- Consolidation of national metadata
- Provide access to standardized, searchable ISO metadata

Geospatial One Stop

- Final destination for XML files
- Process minimizes duplication and provides most up-to-date versions available

Chief Information Officer

Geospatial Portal Infrastructure
GIS System Architecture Design Review

Project Background

WA OCIO hosts the Washington Geospatial Portal and WAMAS in house, and wishes to evaluate the effectiveness of the existing infrastructure environment with an eye to over/under sizing; performance; and consolidation for cost savings.

Project Goals

Look for opportunities to consolidate and re-balance existing resources - analyze resources utilization of current system and evaluate whether there is a way to shift resources to better support WAMAS increasing needs.

- Capacity analysis is addressed
- Architecture alternatives, based on the capacity analysis
- Look for ways to reduce the production environment into a single environment while still protecting certain REST services and licensed data.
- Architecture alternatives, including security configuration
- Provide alternative architectures for in-house or cloud hosting and contains architectures comparison.

Chief Information Officer

Other business items?

Briefing & Demonstration

- Overview of the WA Statewide Imagery Services (Contract #17-088)
  - Mike McGuire, Ascent GIS

- Demonstration of W.I.S.E
  - Rick Geittmann, MIL

Next Meeting

September 7, 2017
1500 Jefferson St SE, Olympia WA
Room 2208

Have fun !

Chief Information Officer