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INFORMATION SHARING ENVIRONMENT
GEOSPATIAL INTEROPERABILITY REFERENCE ARCHITECTURE (GIRA)

NATIONAL SECURITY THROUGH RESPONSIBLE INFORMATION SHARING

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GEOSPATIAL INTEROPERABILITY REFERENCE ARCHITECTURE (GIRA)

INCREASED INFORMATION SHARINGTHROUGH GEOSPATIAL INTEROPERABILOITY

SPRING 2015

Prepared by the
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Dedicated to the memory of:
Douglas Nebert
1963-2014

The Geospatial Interoperability Reference Architecture (GIRA) is dedicated to the memory of Doug Nebert who was a leader in the Geospatial Industry, consummate professional, and who advanced geospatial interoperability across the industry. Many of the authoritative references upon which the GIRA is based were authored by or contributed to by Doug.

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CONTENTS

LIST OF FIGURES

LIST OF TABLES

EXECUTIVE SUMMARY

An estimated $20 billion of the Federal Government's $80 billion in IT spending is a potential target for migration to cloud computing solutions.[1] The value of the inherent benefits of cloud computing is based upon the cost efficiencies of shared services through interoperable architectures based upon standards. IT investment costs *decrease* as you move from Build to Buy to Leverage/Reuse. A goal of the National Strategy for Information Sharing and Safeguarding is, "*to optimize mission effectiveness* [to] *include shared services, data and network interoperability*."[2]

Interoperability is a term often used or implied but rarely defined. This document defines information interoperability as:

> **INTEROPERABILITY is the ability to transfer and use information in a uniform and efficient manner across multiple organizations and information technology systems.[3, 4] It is the ability of two or more systems or components to exchange information and to use the information that has been exchanged.[5]**

The Geospatial Interoperability Reference Architecture (GIRA) is aligned with current Federal policy, principles, and practices for Enterprise Architecture and further adds to the authoritative body of knowledge of geospatial architecture documentation. It is an unclassified document aimed at an audience consisting of; Executive Leaders, Program Managers, and Solution Architects across Federal, State, Local, Territorial and Tribal governments and private sector stakeholders. It is intended to be a practical roadmap to increase government geospatial information sharing through interoperable capabilities that result in reduced operational costs within and across mission systems. It documents geospatial and architecture policy alignment, references authoritative practices and provides practical guidance including; templates, charters, exchange agreements, baseline requirements matrices, architecture artifacts and tools.

The GIRA is expected to have the following benefits:

- Provide a reference guide for geospatial interoperable architectures to guide solutions to effectively govern, manage, support and achieve information sharing through geospatial system integration, acquisition and/or development.

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[1]   Office of Management and Budget's (OMB's) *Federal Cloud Computing Strategy*, February 8, 2011.

[2]   White House *National Strategy for Information Sharing and Safeguarding*, December 2012.

[3]   Australian Information Interoperability Framework, 2006.

[4]   U.S. Code, Title 44: Public Printing and Documents (2011) U.S.C. Title 44, Chap. 36, § 3601.

[5]   *IEEE Standard Computer Dictionary: A Compilation of IEEE Standard Computer Glossaries* (New York, NY: 1990).

- Provide documented architecture artifacts that can be used to support geospatial program technical oversight and technical assessments for geospatial investments.

The GIRA provides a framework for the management, design and development of new or alignment of existing geospatial system/solution investments. It recommends guidance considerations in the areas of governance, business, data, applications/services, infrastructure, standards and security; and performance measures for validating and reporting results.

1 OVERVIEW

1.1 PURPOSE

The intended purpose of this document is to be a reference guide for geospatial interoperable architecture governance, design and implementation as shared geospatial investments. It supports key stakeholders (e.g., Executive Leadership, Program Managers, and Solution Architects) and their responsibilities associated with geospatial systems implementation, integration and performance to drive interoperability and reduce operational costs as they move toward a shared service environment.

1.2 BACKGROUND

The GIRA is intended to be a compendium of artifacts to assist in the development of geospatial interoperable reference architecture(s) for enterprise investments. It provides a representation of geospatial systems that is expressed in terms of; governance practices, interoperability requirements, standards, and target implementation examples (e.g. artifacts). The GIRA builds upon and advances the foundational work of geospatial and architecture guidance documents and is complimentary to the Program Manager-Information Sharing Environment (PM-ISE)[6] *Information Interoperability Framework* (I^2F).[7] The December 2005 Presidential Memorandum directed building the ISE upon existing Federal Government resources that include standards, systems, and architectures. The Memorandum included requirements to *develop a common framework for the sharing of information* between and among executive Departments and Agencies[8] and state, local, and Tribal (SLT) governments, law enforcement agencies, and the private sector and *define common standards* for how information is acquired, accessed, shared and used within the ISE.[9] The I^2F is intended to drive long-term information sharing requirements that leverage reuse capabilities for improvement and information systems planning, investing, and integration to support the effective conduct of U.S. counterterrorism activities.

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[6] The PM-ISE was established under the authorities of the Intelligence Reform and Terrorism Prevention Act of 2004 (IRTPA), as amended.

[7] Program Manager, Information Sharing Environment *Information Interoperability Framework (I^2F): National Security Through Responsible Information Sharing*, Version 0.5, March, 2014, available at http://ise.gov/ise-information-interoperability-framework.

[8] This document's use of the term "Departments and Agencies" includes Departments, Agencies, Commissions, Bureaus, and Boards and other types of organizations in the Executive Branch of the U.S. Federal Government.

[9] Memorandum for the Heads of Executive Departments and Agencies: *Guidelines and Requirements in Support of the Information Sharing Environment* (White House: Washington, DC, 2005), Section 1, available at http://www.whitehouse.gov/news/releases/2005/12/20051216-10.html

1.3 GOALS AND OBJECTIVES

The GIRA is intended to define a governance and oversight framework with which Executive Leadership will manage program and acquisition decisions and provide references to key geospatial technical architectures established across government. The GIRA is focused upon:

- **Stakeholder community:** Aimed at Executive Leadership, Program Managers and Solution Architects, the GIRA provides actionable guidance to these key stakeholders in a general-to-specific manner, from providing basic management practices and processes to specific technical services and standards that are critical for geospatial data sharing and interoperability.

- **Architecture alignment:** Applying established architecture frameworks and accepted practices from the Federal community to improve communication by using standardized vocabulary and provide technical architecture descriptions that help simplify complex IT environments.

- **Practical implementation:** Providing target implementation examples, templates, checklists and reference artifacts to aide in making program management, technical and acquisition related decisions.

1.4 BENEFITS AND OUTCOMES

Desired outcomes of the GIRA are to; 1) increase government geospatial information sharing of interoperable capabilities, 2) promote reuse of existing information assets, and 3) minimize Department and Agency operational costs. To achieve the desired benefit, geospatial system investments must be leveraged as shared services by providing access to common capabilities (applications/services), and increased system integrations by establishing a technology platform that is services based.

The GIRA is expected to:

- Define governance oversight practices and considerations to ensure collaboration and consensus to meet mission objectives and drive cost efficiencies.

- Serve as a base-line target reference guide and resource to identify the necessary interoperability requirements within each of the key architecture elements (e.g., data, applications/services, infrastructure, security, standards and performance).

- Provide target implementation examples, artifacts, interoperability standards, engineering designs, contract and procurement language, performance measures and procedural guidance.

- Align and conform to the Federal Enterprise Architecture Framework (FEAF) v2, and The Common Approach to Federal Enterprise Architecture, Global Reference Architecture, Unified Architecture Framework, and notional aspects of the Intelligence Community architecture designs.

1 Each Chapter focuses upon those geospatial interoperability elements required for consideration
2 for that portion of the Reference Model. The document does not attempt to provide a complete
3 geospatial architecture reference implementation or duplicate other authoritative reference
4 material. Table 1-1 describes what the GIRA is and is not.

5 <div align="center">Table 1-1. What the GIRA Is and Is Not</div>

GIRA IS:	GIRA IS NOT:
✓ A descriptive, not prescriptive, guide to geospatial interoperability investment considerations	• A "how to" manual for building and maintaining geospatial architectures
✓ A reference for framing a governance structure for geospatial investment coordination and collaboration	• A government-wide all inclusive conceptual or physical geospatial model
✓ A reference for preparing and performing a common baseline assessment (As-Is) of geospatial capabilities and requirements across investments	• A replacement of existing geospatial architecture structures within the agencies
✓ A means to compare geospatial investments among and between agencies in order to exchange, reuse, and share investments	• An endorsement of any referenced document, organization, process, product, service or capability other than those required by government policy
✓ A reference for comparing several target implementation geospatial architectures and artifacts	
✓ A reference for supporting planning and procurement activities for geospatial investments	
✓ A reference supporting Office of Management and Budget (OMB) reporting activities, such as Enterprise Architecture (EA) maturity model and Roadmap	
✓ A snapshot compilation reference guide that builds upon previous authoritative documentation; but intended to be on on-line collaborative resource in the future	

6 1.5 STAKEHOLDER AUDIENCE

7 The GIRA is designed as an instructive guide for the three primary stakeholders; Executive
8 Leadership, Program Managers, and Solution Architects. It provides a practical approach for the
9 responsible governance, assessment, design/development, and implementation of interoperable
10 geospatial investments. These three stakeholders form an interdependent role-based
11 responsibility that *must* be sustained in order to achieve the intended mission benefit:

12 • **Executive Leadership:** is the responsible authority for the Department or Agency's
13 policy, fiscal and human resource requirements for geospatial investments. This
14 stakeholder group will use the GIRA as the framework in which geospatial systems
15 are governed, reviewed, resourced, shared, and collectively managed across an
16 enterprise consisting of other geospatial investments.

17 • **Program Managers:** are responsible for the operational implementation and
18 oversight of geospatial capabilities to ensure they meet the functional mission
19 requirements defined by the intended users. They must communicate to both the
20 Executive Leadership and Solutions Architects to ensure understanding and
21 expectations of the requirements for interoperable geospatial systems investments.

Managers are required to quantify the benefit and resource impacts, both cost and integration savings, to Executive Leadership to ensure continued support, and resource sustainment. The GIRA provides Program Managers with a description of the key capabilities, processes, services, infrastructure, standards, performance measures, and artifacts that are required of an interoperable geospatial architecture solution.

- **Solution Architects:** are responsible for acquisition requirements, design/development and the integration of geospatial solutions in accordance with their respective organization's enterprise architecture technical and management requirements. The Solution Architects will be required to compare and quantify the technical implementation options, alternatives, and cost constraints to the Program Managers. The GIRA provides structured technical guidance and reference artifacts to assist in achieving geospatial system interoperability.

1.6 DOCUMENT APPROACH: HOW TO USE

The GIRA) is designed as an instructive guide and practical approach for the responsible assessment, design/development, and implementation of an interoperable geospatial investment.

The GIRA is organized, in part, to align with the *Federal Enterprise Architecture Framework v2*'s Consolidated Reference Model (CRM). The CRM is the core of the FEAF v2, "…which equips OMB and Federal agencies with a common language and framework to describe and analyze investments." The CRM consists of a set of interrelated "reference models" designed to facilitate cross-agency analysis and collaboration in a common and consistent way. The six reference models in the CRM to be used within the GIRA include: Business, Data, Applications, Infrastructure, Security, and Performance. The GIRA will also include a section on Open Standards to promote interoperability.

By aligning with these FEAF v2's CRM structure, the GIRA provides a framework for cross-community communication, collaboration, requirements collection, resource alignment, and stakeholder buy-in for geospatial investments.

Each reference model Chapter of the GIRA is introduced with a description of the 'What/Why/Who/How,' along with a Stakeholder Performance Guide that frames the requirements, responsibilities, and key questions/issues that each stakeholder must address to achieve an efficient and effective interoperable geospatial investment:

- **Definition/Description (What)** – introduces the intent of the section and the expected results that the stakeholders should derive.

- **Purpose/Function (Why)** – defines the section's content and its consideration within the geospatial system investment.

- **Stakeholder Performance Guide (Who & How)** – provides a practical question, task or action, from the stakeholder perspective (e.g., Executive, Program Manager and/or Solution Architect), that is critical for an effective and efficient system investment.

1.7 AUTHORITATIVE REFERENCING

Over 25 years ago, the Federal Interagency Coordinating Committee on Digital Cartography (the forerunner to the Federal Geographic Data Committee) prepared guidance for evaluating and selecting a Geographic Information System:

> **This document has been prepared to assist Federal managers and technical specialists in evaluating, designing, and procuring geographic information systems (GIS's). Successful GIS implementation and application requires agency personnel to be cognizant of the capabilities and limitations of GIS technology and to carefully evaluate the needs of system users and applications. The variety of possible Federal GIS applications and users make it impractical and inappropriate to provide strict criteria for GIS implementation. However, this document provides general guidance for understanding the technology in a realistic perspective, evaluating the requirements of possible GIS users and applications, identifying applicable standards for information systems technology, selecting desirable software and hardware characteristics, and conducting benchmark tests to identify optimal hardware and software systems.[10]**

The GIRA builds upon this basic premise and advances the foundational work of several subsequent geospatial and architectural guidance initiatives. The GIRA provides geospatial and architectural guidance and directs the reader to other key foundational materials that further geospatial system interoperability.

1.7.1 GEOSPATIAL

- ***A Geospatial Interoperability Reference Model (GIRM)*, Version 1.1**, December 2003. Federal Geographic Data Committee, Geospatial Applications, and Interoperability (GAI) Working Group. (http://www.fgdc.gov/standards/organization/GIRM)

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[10] *A Process for Evaluating Geographic Information Systems*. USGS Open File Report, 1988. 88-105, 1998, http://pubs.usgs.gov/of/1988/0105/report.pdf

Purpose: "This document references standards and specifications needed for interoperability among distributed geospatial services accessible over the Internet."[11]

- ***Geospatial Profile of the Federal Enterprise Architecture (FEA)*, Version 2.0**, March 06, 2009. Architecture and Infrastructure Committee, Federal Chief Information Officers Council *and* Federal Geographic Data Committee. (http://www.fgdc.gov/geospatial-lob)

  Purpose: "The Geospatial Profile is an educational resource for determining how and where geospatial approaches and associated geospatial resources fit into enterprise architectures."[12]

- ***A Segment Architecture Analysis of the Geospatial Platform, Version 1.0***, December 21, 2010. Federal Geographic Data Committee, in support of the Federal Chief Information Officers Council. (http://www.fgdc.gov/geospatial-lob/draft-segment-architecture-review/Segment-Architecture-Analysis-of-the/view)

  Purpose: "The guidance offers strategies for establishing goals, target designs, implementation guidance, and utilization of shared resources and for re-useable, and standards based capabilities."[13]

- ***SDI Cookbook, Global Spatial Data Infrastructure, GSDIWiki***, last modified June 5, 2014. As a part of its role in the Global Spatial Data Infrastructure (GSDI) Association, the FGDC was the principal developer of the first edition of the reference manual on "Developing Spatial Data Infrastructures: The SDI Cookbook in 2000." The second edition was subsequently published in 2004 and the current version is part of an active Wiki site: (http://www.gsdidocs.org/GSDIWiki/index.php/Main_Page)

  Purpose: "…this GSDI Cookbook identifies: existing and emerging standards, open-source and commercial standards-based software solutions, supportive organizational strategies, and policies, and best practices."[14]

- ***Homeland Security Geospatial Concept of Operations (GeoCONOPS)*, Version 6.0**, June 2014. Department of Homeland Security (https://www.geoplatform.gov/geoconops-home)

  Purpose: "The Homeland Security GeoCONOPS is intended to identify and align the geospatial resources that are required to support the National Response Framework, Emergency Support Functions, and supporting federal mission partners all in coordination with Presidential Policy Directive-8 direction."[15]

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[11] *A Geospatial Interoperability Reference Model (GIRM)*, Version 1.1, December 2003.

[12] *Geospatial Profile of the Federal Enterprise Architecture (FEA)*, Version 2.0, March 06, 2009.

[13] *A Segment Architecture Analysis of the Geospatial Platform*, Version 1.0, December 21, 2010.

[14] *SDI Cookbook, Global Spatial Data Infrastructure, GSDIWiki*, last modified June 5, 2014.

[15] Department of Homeland Security, *Geospatial Concept of Operations (GeoCONOPS)*, Version 5.0, June 5, 2013.

GEOSPATIAL INTEROPERABILITY REFERENCE ARCHITECTURE (GIRA)

1.7.2 ARCHITECTURE

- ***The Common Approach to Federal Enterprise Architecture***, May 2, 2012.

  "This [document's] common approach to Federal EA provides principles and standards for how business, information, and technology architectures should be developed across the Federal Government so they can be used consistently at various levels of scope within and between agencies, as well as with external stakeholders."[16]

- ***Federal Information Technology Shared Services Strategy***, May 2, 2012.

  "…. provides organizations [Federal Agencies} with policy guidance on the full range and lifecycle of intra- and inter-agency information technology (IT) shared services … this strategy requires agencies to use a shared approach to IT service delivery."[17]

- ***Digital Government: Building a 21st Century Platform to Better Serve the American People***, May 23, 2012.

  "The [Digital Government] strategy[18] …focusing on the key priority area that requires government-wide action: *innovating with less to deliver better digital services.* It specifically draws upon the overall approach to increase return on IT investments, reduce waste and duplication, and improve the effectiveness of IT solutions defined in the Federal Shared Services Strategy."

- ***Federal Enterprise Architecture Framework*, Version 2.0**, January 29, 2013.

  "The *Federal Enterprise Architecture Framework v2*[19] describes a suite of tools to help government planners implement The Common Approach to Federal Enterprise Architecture." It contains the Collaborative Planning Methodology and is intended to be the next generation replacement for the Federal Segment Architecture Methodology (FSAM). It can be applied as a full planning and implementation lifecycle for use at all levels of scope defined in *The Common Approach to Federal Enterprise Architecture*.

- ***Federal Shared Services Implementation Guide,*** April 16, 2013.

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[16] Office of Management and Budget, *The Common Approach to Federal Enterprise Architecture*, May 12, 2012, available at http://www.whitehouse.gov/sites/default/files/omb/assets/egov_docs/common_approach_to_federal_ea.pdf

[17] Office of Management and Budget, *Federal Information Technology Shared Services Strategy*, May 2, 2012, available at http://www.whitehouse.gov/sites/default/files/omb/assets/egov_docs/shared_services_strategy.pdf

[18] Office of Management and Budget, *Digital Government: Building a 21st Century Platform to Better Serve the American People*, May 23, 2012, available at http://www.whitehouse.gov/sites/default/files/omb/egov/digital-government/digital-government-strategy.pdf

[19] Office of Management and Budget, *Federal Enterprise Architecture Framework,* Version 2, January 29, 2013, available at http://69.89.31.228/~mkerncom/wp-content/uploads/2013/02/Federal-Enterprise-Architecture-Framework-v2-as-of-Jan-29-2013.pdf

"The *Federal Shared Services Guide*[20] provides information and guidance on the provisioning and consumption of shared services in the U.S. Federal Government. The guide provides agencies with a high level process and key considerations for defining, establishing, and implementing interagency shared services to help achieve organizational goals, improve performance, increase return on investment, and promote innovation."

- *ISE Information Interoperability Framework (I2F),* May 2014.

  The ISE I2F describes the components that enable information sharing and interoperability within a given reference implementation. The components of the ISE I2F framework allow for practitioners to organize information that defines the scope of what needs to be considered to achieve interoperability between ISE participants. Through the use of this information, ISE participants are able to identify touch points for sharing and safeguarding information in motion; while encouraging the use of interoperability within the scope of enterprise architecture concepts that are, and driven by, an organization's internal enterprise architecture framework.

1.8 STAKEHOLDER PERFORMANCE GUIDE

The Stakeholder Performance Guide serves as a quick and concise reference table (see Table 1-2) for the three stakeholders (e.g., Executives, Program Managers, and Solution Architects) and identifies the major steps or decision points that are required for each stakeholder to be successful. The Performance Guide is structured to allow each stakeholder to see their specific area of responsibility based upon an identified task/action requiring their input/decision. It provides a recommended approach to accomplishing the identified tasks expected benefits (e.g., cost, infrastructure, shared services, etc.). The Performance Guide table is one mechanism to verify and measure performance of the investment.

Table 1-2. Stakeholder Performance Guide Table Structure

STAKEHOLDER PERFORMANCE GUIDE			
CHAPTER 2 – GOVERNANCE			
Role	Responsibility	Approach	Benefit
Executive Leadership	• Identify specific actions to be taken • Identify the major tasks requiring go/no-go decisions	• Define what step(s) the Exec needs to take/support to accomplish the specified action • Identify dependency of tasks and necessary steps	• Define the benefit in terms of quantifiable measures and expected outcomes (mission and resource impact) • Define the negative impact if not accomplished in terms of mission and resource impact

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[20] Federal CIO Council, *Federal Shared Services Implementation Guide*, April 16, 2013, available at (https://cio.gov/wp-content/uploads/downloads/2013/04/CIOC-Federal-Shared-Services-Implementation-Guide.pdf).

STAKEHOLDER PERFORMANCE GUIDE			
CHAPTER 2 – GOVERNANCE			
Role	**Responsibility**	**Approach**	**Benefit**
Program Manager	• Identify specific actions to be taken • Identify the major tasks requiring go/no-go decisions	• Define what step(s) the PM needs to take/support to accomplish the specified action • Identify how the PM supports the other two stakeholders (Executive and/or Solution Architect) in the approach	• Identify shared benefit/responsibility if cross agency (if applicable)
Solution Architect	• Identify specific actions to be taken • Identify the major tasks requiring go/no-go decisions	• Define what step(s) the SA needs to take/support to accomplish the specified action • Identify how the SA supports the other two stakeholders (Executive and/or Program Manager) in the approach	• Quantify cost avoidance, services shared, and/or technical integration/ consolidation

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2 GOVERNANCE

2.1 INTRODUCTION

Definition/Description (What) – Governance is a strategic decision-making process that grants authority, assigns accountability, defines expectations, and verifies performance. It also determines organizational objectives and monitors performance to ensure those objectives are attained.[21]

Purpose/Function (Why) – Provides a formal collaboration and consensus process for shared responsibilities (e.g., Executive Leadership) that drives economies of scale by identifying, prioritizing, and reusing investments to avoid duplicative costs. This chapter will describe how to:

- Establish collaborative governance and management oversight body for investment planning.
- Establish an Investment Technology Acquisition Review (ITAR) framework and checklist for portfolio management.
- Describe how to align to the Capital Planning Investment Control (CPIC) acquisition process.
- Provide information sharing agreement guidance for Service Level Agreements.

Stakeholder Performance Guide (Who & How) – For Executive Leadership and to a lesser degree Program Managers responsible for policy compliance, resource planning and approval (e.g., fiscal and human), and whom have "signature authority" to commit to program strategic direction and resourcing.

2.2 GOVERNANCE PRINCIPLES

The ability to coordinate across mission areas and collaborate on geospatial investments is a primary responsibility for the Executive Leadership to drive interoperability and cost efficiencies. When a governance structure is executed effectively, it provides procedures for collaboration and consensus-based strategic decision-making, defines accountability, sets obtainable goals and requirements, shares resource investments, validates accomplishments, and provides measurable performance metrics. Effective governance structures will enable agencies to offer and reuse capabilities and services for sharing across the environment, consistent with an interoperable architecture approach.

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[21] *Holistic Engineering Education, Systems Integration*, Chapter 5, The MITRE Corporation, February 23, 2011.

Without a consensus-based governance structure, achieving interoperability and the maximum value from enterprise geospatial shared service investments is impossible.

While a "one-size-fits-all" governance model is not practical there are some common principles for successful governance:

- Executive Leadership sponsorship, decision-making authority, commitment, and participation.

- Defined roles and responsibilities with accountability by all members, usually through a Charter.

- Defined goals and objectives with quantifiable performance measures to demonstrate success.

- A systematic and repeatable approach for assessing investments and making decisions.

- Subject matter expertise either resident or available through reach-back.

- Inclusive discussions with consensus-based collaboration from all members.

2.3 GOVERNANCE STRUCTURES

There are numerous governance models that can be applied at varying levels of rigor depending upon an organization's complexity and/or the number and level of geospatial investments that require coordination. The following two examples can be modified or combined to meet the specific needs of the organization and its members. While there is no "one-way" to establish a governance structure; there is "no-way" to succeed without one.

Geospatial programs may exist in multiple forms, and may in some cases be distributed throughout an agency without definable governance. In such cases it will be difficult to provide useful indicators of program performance in any measurement area, especially for customer results.[22]

2.3.1 EXECUTIVE STEERING COMMITTEE

An Executive Steering Committee (ESC) structure should be established within and across an organization's enterprise based upon the needs of the organizations (e.g. Office, Branch, Department, etc.) to be included in the committee. There is policy guidance for cross governmental (e.g., Federal and non-Federal involvement including the public) interaction and

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[22] *Geospatial Profile*, Version 1.1, January 27, 2006. Architecture and Infrastructure Committee, Federal Chief Information Officers Council and Federal Geographic Data Committee. (no longer available)

coordination activities as defined by the Federal Advisory Committee Act (FACA). FACA became law in 1972 and is the legal foundation defining how federal advisory committees operate. The law has special emphasis on open meetings, chartering, public involvement, and reporting.[23] In terms of Federal agency committees, both intra- and inter-agency coordination, committee structures and operating procedures are based upon consensus-based collaboration, usually with express language stating that the results or findings do not interfere with agency or governmental policy or law.

Numerous definitions exist; however, most steering committees are chartered with senior management leadership, are business-oriented and influence/direct resource investment.

> **Merriam-Webster defines a managing or directing committee (e.g., Steering Committee) as "a committee that determines the order in which business will be taken up in a United States legislative body."[24]**

> **BusinessDirectory.com defines an advisory committee: "… usually made up of high level stakeholders and/or experts who provide guidance on key issues such as company policy and objectives, budgetary control, marketing strategy, resource allocation, and decisions involving large expenditures."[25]**

Some organizations may have prescriptive requirements for the establishment of ESCs through their Office of General Council or related policy or legislative affairs offices depending upon the proposed membership of the committee (e.g., internal or external). Once policy guidance is determined, the structuring of the ESC can occur. As the name implies, an ESC is sponsored and lead by a decision-making level body of representatives, (see Section 1.5 Stakeholder Audience, for the definition of Executive Leadership). The sponsoring body, office or board often chairs/co-chairs the committee; however, member roles and responsibilities are defined by a Charter (see Appendix A) as part of the collaborative and consensus-based approach.

2.3.2 INTEGRATED PRODUCT/PROJECT TEAM

In 1995, the Secretary of Defense directed that the Department adopt Integrated Product/Project Teams (IPTs) as the preferred approach for development, review, and oversight of the acquisition process.[26] An IPT process, while generally designed for an engineering approach to a system or "product," it can also be applied to the governance of developing an interoperable geospatial investment either as a standalone approach or as part of the Executive Steering Committee

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[23] http://www.gsa.gov/portal/content/100916

[24] http://www.merriam-webster.com/dictionary/steering%20committee

[25] http://www.businessdictionary.com/definition/steering-committee.html

[26] *Rules of the Road: A Guide for Leading Successful Integrated Product Teams, Revision 1*, October 1999. Department of Defense.

structure described above. Generally, the "P" in IPT stands for *product*; however, it is also appropriate for *project* as defined below:

The Defense University, defines an Integrated Product Team as "a multidisciplinary group of people who are collectively responsible for delivering a defined product or process."[27]

The IT Law Wiki defines an Integrated Project Team as "composed of representatives from all appropriate functional disciplines working together with a Team Leader to build successful and balanced program, identify and resolve issues, and make sound and timely recommendations to facilitate decision-making."[28]

IPTs are used in complex development programs/projects for review and decision making. The emphasis of the IPT is on involvement of all stakeholders in a collaborative forum. IPTs are created most often as part of structured systems engineering methodologies, focusing attention on understanding the needs and desires of each stakeholder. The IPT approach simultaneously takes advantage of all members' expertise and produces an acceptable product the first time.

Several more detailed resources are available for users to assess IPT processes and procedures to determine if the structure can be adopted/adapted for use in their geospatial governance. These documents have detailed operating principles and practices and provide example artifacts for the use to apply to meet their needs.

- *Rules of the Road: A Guide For Leading Successful Integrated Product Teams, Revision 1*, October 1999, Department of Defense[29]

- *Integrated Project Team (IPT) Start-up Guide*, February 2009, MITRE[30]

The following summarizes many of the practices and procedures of the authoritative sources listed above. IPTs, in general, will require operating principles and practices to include:

1. Chartering and Authorizing – requires the overall sponsorship and membership of the governing body within the existing policy and protocol structure of the organization. This may be prescribed by law, statute or other established agency specific policy and guidance. If no authorizing structure exists, the Charter sponsorship and membership agreement must be defined in the Charter which also defines the roles, responsibilities and decision-making process.

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[27] https://acc.dau.mil/CommunityBrowser.aspx?id=24675
[28] http://itlaw.wikia.com/wiki/Integrated_Project_Team#cite_note-0
[29] http://www.navair.navy.mil/nawctsd/Resources/Library/Acgguide/IPT%20Rules%20of%20the%20Road.htm
[30] http://www.mitre.org/publications/technical-papers/integrated-project-team-ipt-startup-guide

2. Goal Alignment – to ensure an agreed upon, mutually beneficial set of objectives that are quantifiable to all members.

3. Open Discussions with No Secrets – is the basis for mutual trust and collaboration. It is also a mechanism to ensure both leadership and individual members do not unduly influence the overall direction of the team.

4. Empowered, Qualified Team Members – ensures the best resources are applied to address the issue. This can also require 'reach-back' to subject matter experts for a limited duration to address a specific issue.

5. Dedicated/Committed Proactive Participation – ensures a collaborative and informed working environment without revisiting issues and unnecessary delays. The level of participation must be understood and agreed to by the member in advance to set expectations.

6. Issues Raised and Resolved Early – pending the structure of the IPT, issues should be resolved with an inclusive approach. If issues cannot be resolved, there needs to be an escalation and resolution process to Executive Leadership for closure and advancement.

IPTs can be very involved requiring defined requirements, process, documentation, measures, and accountability. The need for a disciplined approach includes core tenants:

1. Understanding the requirements – an opportunity is identified that requires IPT resolution or assistance. This could be as broad as developing an interoperable enterprise geospatial capability or as limited as determining which organization within an enterprise will be the steward for an enterprise geospatial capability.

2. Outlining the approach – framing the goal and objectives with roles and responsibilities (and memorialized through a Charter) with clear outcome expectations is defined.

3. Planning the effort – working as an IPT, team members develop a Plan Of Action & Milestones (POA&M) to fully develop detailed tasking and levels of efforts estimates to allow the appropriate allocation of resources.

4. Allocating resources – key stakeholders are identified and the team members are launched by senior leadership to resolve the opportunity at hand. Leveraging financial resources will be determined by the Executive Leadership.

5. Executing and tracking the plan – project management skills are essential along with the subject matter expertise to execute the defined tasks. Reporting based upon the POA&M schedule (scope, schedule, and budget) and the ability to address issues that will arise during the project period. Most issues should be discussed and resolved within the IPT environment. When issues cannot be resolved, problems are escalated to Executive Leadership intervention.

6. Delivery – as issues are resolved and the POA&M executed, the IPT completes and delivers its Chartered outcome requirements.

7. Reevaluation – upon delivery and review with Executive Leadership, the IPT provides necessary feedback to IPT membership and evaluates the need for continuation of the IPT.

8. Finite Duration – if requirements are fulfilled the IPT is disbanded.

The governance of geospatial investments should be crafted based upon the complexity of the organization(s) involved, number and level of investments, and the agreed upon value to the mission/business.

2.4 INVESTMENT GOVERNANCE

Governance of geospatial investments can be viewed as operating at three different levels of an organization: Program, Portfolio and Enterprise. An integrated, multi-tiered governance framework unites disparate processes to eliminate redundant and low-value investments.[31]

- Program – program-level success is defined by meeting the goal of delivering a system that meets specified, contracted-for performance, price, and schedule parameters. Program-level decisions, directions, and actions align with that view of success and influence the expectations of systems engineering provided at that level.

- Portfolio – the focus shifts to making trades among a collection of programs to achieve capability-level outcomes. The tradeoffs balance various criteria, including the importance of capabilities to be delivered and expected delivery schedule within constraints, such as availability of funding and dates operational capabilities are needed. Portfolio-level decisions can result in programs being added and accelerated, cut back and decelerated, deferred, or cancelled.

- Enterprise – result in change of environment or rules in which programs and portfolios operate including their roles and responsibilities to achieve enterprise-wide outcomes, such as joint interoperability or net-centricity. Often, this is achieved through departmental or agency-wide policies and regulations.[32]

As organizations mature from Program to Portfolio to Enterprise levels, greater technical documentation should be developed and maintained to allow each pending new investment to be assessed, aligned, and adopted. The increase in the number of investments makes the complexity

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[31] *Ensuring IT Investments Deliver Their Promised Value, The Importance of Enterprise Governance*, January, 2011, Office of the Chief Information Officer, DHS.

[32] Department of Homeland Security, *Systems Engineering and Acquisition, Best Practices: A Portal Companion*, Version 1.0, September 2012. Developed by the Home Security Systems Engineering and Development Institute.

and challenge greater but also more important. At the individual Program level, the acquisition process may only use the existing Procurement Office procedures required of all investments within an organization. At the Portfolio level, a baseline assessment (e.g., As-Is environment) is essential to allow Senior Leadership the ability to make strategic investment, Program Managers to coordinate and allocate human resource coordination across individual programs, and Solution Architects the ability to design and develop interoperable components at the application and system level. The baseline assessment or As-Is (e.g., GeoBaseline) documentation (see Section 3.4 and Appendices B, C and D) provides the foundation to perform these tasks and the basis upon which to achieve enterprise-wide outcomes.

A mature enterprise may strive to establish and sustain a Technical Reference Model (TRM) or Target Architecture of the desired technical framework to which investments should align. The TRM is a component-driven, technical framework categorizing the standards and technologies to support and enable the delivery of services and capabilities. It provides a foundation to advance the reuse and standardization of technology and Service Components from a government-wide perspective.[33]

Aligning agency capital investments to the TRM leverages a common, standardized vocabulary, allowing intra/interagency discovery, collaboration, and interoperability. Agencies and the federal government will benefit from economies of scale by identifying and reusing the best solutions and technologies to support their business functions, mission, and target architecture. Organized in a hierarchy, the TRM categorizes the standards and technologies that collectively support the secure delivery, exchange, and construction of business and application services and capabilities that may be leveraged in a component-based or service-oriented architecture.

The TRM or Target Architecture would list the types of technology an organization would use and may include categories of use to include:[34]

- Permitted – products and standards that currently reside in the TRM and approved for use.

- Go-To (Target) – products and standards that the *Department/Agency* is migrating towards and considered enterprise-wide solution, and have a compliance date for usage.

- Divest – products and standards which are obsolete and the *Department/Agency* must actively plan for disposal and should not invest further, with a specified divestment date.

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[33] Office of Management and Budget, *FEA Consolidated Reference Model Document*, Version 2.3, October 2007.

[34] Department of Homeland Security, *Information Technology Acquisition Review (ITAR) Quick Essentials Guide*, Version 3.0, January 23, 2013.

- Restricted – products and standards that can only be used by the organization obtaining approval.

- Emerging – products and standards that will be utilized in a very limited capacity during the prototypes or pilot phase of a program development with future decision pending approval.

- Prohibited – products and standards that are not aligned to the *Department/Agency* TRM and may not be procured.

Once a TRM or Target is established, a pending geospatial investment can then be compared against both the As-Is GeoBaseline and TRM and reviewed by the governance body to ensure existing capabilities are reused and new capabilities can be shared across the enterprise.

2.4.1 INFORMATION TECHNOLOGY ACQUISITION REVIEW PROCESS

A primary benefit of governance is the efficient and agreed upon use of geospatial resource investments. As part of the governance structure, an investment review process should be established to ensure the optimal reuse of existing capabilities and the effective development of new shared capabilities across the enterprise. While the geospatial governance body does not [necessarily] have "veto" authority, as each organization will have its own procurement approval procedures and signatory authorities (e.g., CIO or CFO), it does provide the ability to align investments and reduce duplication for maximum interoperability.

The governance body should establish portfolio management guidance to pending investments and help prepare for the Information Technology Acquisition Review (ITAR). Table 2.1 provides portfolio management guidance principles to ensure:[35]

Table 2-1. Portfolio Management Guidance Principles

PORTFOLIO MANAGEMENT GUIDANCE PRINCIPLES
• The program requirements are completely clear in meaning or intention, correct, and complete.
• Acquisition requirements align with established portfolio targets and transition plans.
• New acquisitions support a capability gap existing within a portfolio.
• If the acquisition provides services to other investments within the *Department/Agency*, the performance requirements are defined (e.g., Service Level Agreement (SLA) or Memorandum).
• Any other capability/service in the *Department/Agency* portfolio (existing or planned), as identified in the GeoBaseline or TRM, is identified. Acquisition requirements should not overlap and the investments should determine the most effective solution for the Program and Enterprise.
• Opportunities to consolidate all or part of the acquisition with other existing/planned acquisitions

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[35] Department of Homeland Security, *Information Technology Acquisition Review (ITAR) Quick Essentials Guide*, Version 3.0, January 23, 2013

PORTFOLIO MANAGEMENT GUIDANCE PRINCIPLES
within the Portfolio have been examined and resolved.
• If necessary, contractual or policy language must be developed to mandate portfolio alignment.

The governance body should define the required documentation for an investment review. A pending investment review submission package should include: [36]

- A Standard Acquisition Check list (see Table 2-2).
- Acquisition Documentation (i.e., Statement of Work (SOW), Statement of Objectives (SOO), Performance Work Statement (PWS), Request for Proposal (RFP), or other supporting documents).
- Independent Government Cost Estimate (IGCE) or Bill of Materials (BOM).
- Signed memorandum or other indication of Senior Leadership approval.

A Standard Acquisition Checklist for effective portfolio management should consist of the following:

Table 2-2. Standard Acquisition Checklist[37]

ITAR NAME		ITAR ID #
Questions	Responses	Guidance/Instructions/Comments
Organization Name/POC		Required – Department/Agency office and point-of-contact
Date Submitted		Required – M/D/YYYY
Title		Required – brief title; usually one sentence
Summary		Required – brief summary; usually one clear paragraph
Description (expansion of summary)		Required – expansion of summary, providing a contextual framework of the acquisition, including background
Benefits		Required – explanation of why this procurement is necessary, how Department/Agency benefits, and explanation of potential risks if this acquisition is not complete
Alignment to Geospatial Baseline and/or TRM		Required – explanation of how this procurement is aligned to the GeoBaseline and/or TRM and any new technology needs
Is this a follow-on review?		Required – a "follow-on" review for a continuation of existing procurement with additional capabilities
Previous review ID #		If applicable, provide most recent review number
Have all previous review conditions been resolved?		Ensures that any prior deficiencies on the proposed acquisition have been addressed
Organization approval		Required – ensures senior leadership understanding and commitment
Approval date		Required – M/D/YYYY

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[36] Ibid.

[37] Department of Homeland Security, *Information Technology Acquisition Review (ITAR) Quick Essentials Guide*, Version 3.0, January 23, 2013.

2.4.2 CAPITAL PLANNING INVESTMENT CONTROL PROCESS

The Office of Management and Budget (OMB) provides specific policy, procedural, and analytical guidelines for planning, budgeting, acquisition, and management of major IT capital investments. OMB reviews and evaluates each agency's IT spending, using the guidance on Exhibits 53 and 300, to effectively manage its portfolio of capital assets to ensure scarce public resources are wisely invested.[38] Agencies are required to use a disciplined Capital Planning Investment Control (CPIC) process to acquire, use, maintain, and dispose of IT in alignment with the agency's Enterprise Architecture (EA) planning processes. Exhibit 300 describes the justification, planning, and implementation of an individual capital asset included in the agency IT investment portfolio (as reported in Exhibit 53) and serves as a key artifact of the agency's EA and IT CPIC processes.

Geospatial system investments are often considered a sub-system or supporting technology and may not be clearly identified or listed as the primary technology function of the desired system, making it more difficult to identify many (smaller) geospatial investments across an enterprise. The Program Manager should ensure the geospatial capability of a larger system is identified as a sub-system to allow for identification within the CPIC process.

Capital programming integrates the planning, acquisition, and management of capital assets into the budget decision-making process. It is intended to assist agencies in improving asset management and in complying with the federal IT policy.

The practices, templates and other tools within the GIRA can be directly applied to supporting the development and investment justifications necessary for the OMB CPIC submission process, including:

- **Chapter 2, Governance** – provides the management oversight requirements and coordination mechanisms necessary for investment comparison and sharing.

- **Chapter 3, Business Reference Model** – provides the Geospatial Baseline Assessment Matrix to inventory investments in the areas of data, architecture, technology, applications and services.

- **Chapter 6, Infrastructure Reference Model** – provides the target architecture and artifacts that can be used in the required **Three Alternatives Analysis** for the solution investment.

- **Chapter 9, Performance Reference Model** – provides many of the possible measurable tasks and milestones needed as metrics for investment and stakeholder satisfaction.

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[38] Office of Management and Budget, *Guidance on Exhibits 53 and 300 – Information Technology and E-Government*, available at http://www.whitehouse.gov/sites/default/files/omb/assets/egov_docs/fy14_guidance_on_exhibits_53_and_300.pdf

In the capital planning and investment control process, there are two separate and distinct plans that address IRM and IT planning requirements for the agency. The IRM Strategic Plan (44 U.S.C. 3506 (b)(2)) addresses all information resources management of the agency and ensures IRM decisions are integrated with organizational planning, budget, procurement, financial management and program decisions.[39]

The IT Capital Plan is operational in nature; supports the goals and missions identified in the IRM Strategic Plan, and is a living document that must be updated twice yearly. This IT Capital Plan is the implementation plan for the budget year. The IT Capital Plan must be submitted yearly to OMB with the agency budget submission annually. An example of the required CPIC guidance and how the GIRA tools can be applied to meet this guidance include: [40]

- *Ensure decisions to improve existing information systems or develop new information systems are initiated only when no alternative private sector or governmental source can efficiently meet the need.*
    - ◦ GIRA Chapter 2, Governance: Executive Steering Committee (Section 2.3.1) decision making for existing/new systems, applications and shared investment.

- *Prepare and maintain a portfolio of major information systems that monitors investments and prevents redundancy of existing or shared IT capabilities. The portfolio will provide information demonstrating the impact of alternative IT investment strategies and funding levels, identify opportunities for sharing resources, and consider the agency's inventory of information resources.*
    - ◦ GIRA Chapter 3, Business Reference Model: Geospatial Baseline Assessment Matrix (Section 3.4) provides an inventory of system investments.

- *Ensure improvements to existing information systems and the development of planned information systems do not unnecessarily duplicate IT capabilities within the same agency, from other agencies, or from the private sector.*
    - ◦ GIRA Chapter 6, Infrastructure Reference Model: Geospatial Baseline Assessment Matrix: Infrastructure and Technology (Section 6.3) provides the target To-Be environment and artifacts for system investment comparison and compatibility.

- *Establish oversight mechanisms to evaluate systematically and ensure the continuing security, interoperability, and availability of systems and their data.*
    - ◦ GIRA Chapter 2, Governance: Executive Steering Committee (Section 2.3.1) decision making for existing/new systems, applications, and shared investment.

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[39] OMB Memorandum M-13-13, *Open Data Policy – Managing Information as an Asset* (May 9, 2013), available at http://www.whitehouse.gov/sites/default/files/omb/memoranda/2013/m-13-13.pdf

[40] http://www.whitehouse.gov/omb/fedreg_a130notice

2.4.3 PROCUREMENT POLICY LANGUAGE

At the highest maturity level, an enterprise would have policy in place within the procurement process that requires an Investment Review Board to ensure the proposed procurement aligns with the enterprise TRM or Target Architecture.

An example of geospatial procurement policy language could include:

DEPARTMENT/AGENCY GEOSPATIAL INFORMATION SYSTEM
TERMS AND CONDITIONS

All geospatial implementation including data, information, systems, and services shall comply with the policies and requirements set forth by the Department/Agency Geospatial Governance Board, including but not limited to the following:

- All data created, adopted or acquired, shall be submitted to the government for review and insertion into the Department/Agency Technical Reference Model.
- All software created, adopted or acquired, shall be submitted to the government for review and insertion into the Department/Agency Technical Reference Model.

2.5 INTERAGENCY AGREEMENTS AND SERVICE LEVEL AGREEMENTS: INFORMATION SHARING AGREEMENTS

Information Sharing Agreement (ISA) governance is an essential, yet often overlooked element in the access to and sharing of geospatial data, applications, and services. When an organization has made a decision to share information and services, the provider/consumer need to negotiate, agree, and formally document the services to be provided. If funding will be transferred from one agency to another, then the agreement also needs to contain an authority to transfer funds, the amount being transferred, and a clause describing collection of costs upon cancellation. This information is provided in one of several types of agreements, as shown in Table 2-3: (a) Memorandum of Understanding (MOU); (b) Memorandum of Agreement (MOA); and (c) Interagency Agreement (IAA). Some agencies draw distinctions between different agreement types, while others focus only on the content in the agreement. The Federal Chief Information Officers Council's *Federal Shared Services Implementation Guide*[41], provides clear and comprehensive description and understanding of the types of agreements that could be used as well as funding and pricing model approaches, to establish ISAs across organizations and should be reviewed when moving toward a shared-services environment.

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[41] *Federal Shared Services Implementation Guide*, April 16, 2013. Federal Chief Information Officers Council, available at https://cio.gov/wp-content/uploads/downloads/2013/04/CIOC-Federal-Shared-Services-Implementation-Guide.pdf

1   Table 2-3. Types of Agreements

ACTION	MOU	MOA	IAA
Establish a Non-financial Relationship	X	X	X
Order a Service			X
Terms and Conditions			X
Requirements and Funding Information			X

2   Information Sharing Agreements can include both internal as well as external (government)
3   partners. This write-up does not address ISAs with foreign governments (see Department of
4   State's *Information Sharing Environment Guidance (ISE-G) Checklist of Issues For Negotiating*
5   *Terrorism Information Sharing Agreements and Arrangements*), nor does it directly apply to
6   private sector license agreements although many of the template sections or checklist items could
7   be useful in assessing an offered license agreement from a commercial provider.

8   The Department of Homeland Security defines an Information Sharing and Access Agreement as:

9   **An agreement that defines the terms and conditions of information/data**
10   **exchanges between two or more parties. The term encompasses agreements of**
11   **any form, including Memoranda of Understanding, Memoranda of Agreement,**
12   **Letters of Intent, etc.[42]**

13   Information sharing agreements can be complex and time consuming and if not executed
14   properly can introduce cost, redundancies, dependencies, and potential risk into an enterprise.
15   ISAs are not merely a point-to-point discussion between a data owner/steward (e.g., provider)
16   and a data consumer (e.g., requestor). While an agency or a direct point-of-contact within an
17   agency may be the original data developer or custodian, the provisioning of data will require
18   authorities and approvals in the areas of system/network administration, security, policy, privacy,
19   general counsel, and others for the terms and condition of use and reuse or extended sharing to a
20   third party. Third party reuse, in which Agency A (the provider) shares data with Agency B (User
21   1), who then shares the original data with Agency C (User 2), requires permissions/restrictions to
22   be established in the original ISA between Agency 1 and Agency 2 and by extension to any third
23   party requestor.

24   To determine what data or services require an ISA, the Geospatial Executive Steering Committee
25   (Section 2.3.1) should determine all existing ISAs that are in effect (or pending) across the
26   enterprise to ensure a complete understanding of available data sharing resource investments
27   and activities, especially if commercial data provider license or Enterprise License Agreements
28   (ELAs) are required. The Steering Committee as part of its geospatial investment baseline

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[42] Department of Homeland Security, *Information Sharing and Access Agreements Guidebook and Templates*, revision version 2.1,
      October 2010.

assessment (Section 3.3.1 and Appendix C) will be able to determine what data assets are available and which new assets are required. If new data assets are required by multiple components or business units across an organization, the ISA will need to reflect enterprise-wide access and use as well as considerations for Third Party access if applicable.

The following section is extracted and modified from the Department of Homeland Security (DHS) *Information Sharing and Access Agreements Guidebook and Templates*, revision version 2.1, October 2010.[43] The DHS documentation is far more detailed and complete than this abbreviated and highlighted summation.

Prior to the development of a new ISA, an Information Sharing Checklist [44] (see Appendix A.2) can be used to determine whether to accept or reject the request for data. The Checklist, while it is used for both internal and external requests, has primary benefit for internal requests within/across a Department/Agency. The Checklist assists both parties (e.g., Requestor and Provider) in determining the breadth of the requirements and provides the initial framework of understanding necessary to structure either an internal or external sharing agreement or both. Once the initial Checklist has been reviewed, and approved, a Data Access Process Questionnaire (see Appendix A.3) is used to provide the detailed information necessary to establish an ISA. The Requesting Department/Agency completes the Questionnaire with information pertaining to:

1. Points of Contact
2. Data Request
3. Purpose
4. Authorities – Requesting Department/Agency
5. Privacy and Civil Liberties Protections
6. Information Security Controls
7. Adjudication
8. Signatories

The Questionnaire provides the Requestor and Provider a process by which to fully vet the information sharing requirements and challenges. It should be used as a basis for a more in-depth discussion to ensure all aspects of the data and its use/protection are considered prior to an exchange. During the in-depth review, additional requirements can also be discussed, such as; value-added or derived data usage; data accuracy and correction returned to the Provider; updates if the data are not dynamic; metadata and data tagging requirements; disposition; etc.

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[43] Department of Homeland Security, *Information Sharing and Access Agreements Guidebook and Templates*, revision version 2.1, October 2010.

[44] Ibid.

Once the requirements have been fully vetted, the ISA can be established (see Appendix A.4). A basic ISA may include the following sections:

1. Contact information for parties entering into agreement. This includes both the Requestor(s) and Provider(s) information.

2. Statements on the purpose/need for the ISA.

3. Complete citations (including pinpoint cites to particular subsections in the authority) to applicable authorities including laws, regulations, directives, international obligations, and/or policies (including a parenthetical explaining why the authority is relevant to the particular ISA), as well as information regarding compliance with Civil Rights and Civil Liberties (CRCL), privacy, security, and other compliance guidelines.

4. Description of information/data being requested.

5. Statement on how the data will be collected, used, shared, protected, retained, disseminated, and destroyed.

6. Description of how the ISA will be monitored and reviewed.

7. Terms and conditions for ISA enforcement.

2.6 STAKEHOLDER PERFORMANCE GUIDE: GOVERNANCE

At its most basic level, governance comprises a set of formal and informal rules and practices. These rules and practices determine how decisions are made around investments, how decision execution is monitored and the results of these decisions are measured, how empowerment for decision making is exercised, and how those who make the decisions are held accountable.[45]

Stakeholder governance serves to formally recognize/legitimize the collaborative administration of a shared investment and frames the roles, responsibilities and accountability with corresponding performance measures. Some of those performance measures are highlighted below for each of the three stakeholder communities; Executive Leadership, Program Manager, and Solution Architect.

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[45] IT Governance Institute.

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Table 2-4. Stakeholder Performance Guide: Governance

STAKEHOLDER PERFORMANCE GUIDE			
CHAPTER 2 – GOVERNANCE			
Role	Responsibility	Approach	Benefit
Executive Leadership	• Establish and/or Co-Chair the Chartered governance (ESC/IPT) body. • Signatory to establish Investment Technology Acquisition Review (ITAR) framework. • Signatory to ISAs for access or dissemination of data and/or services.	• Work with other Executives to frame Charter goals/objectives and commitment to level-of-effort support/involvement. • Establish review board with CIO/CFO representation and consider policy to ensure participation and commitment. • Establish or follow General Council process and review and maintain repository of Agreements.	• Signatory with defined responsibility and stated measurable results (e.g., ELAs with % cost reduction, shared services with defined Steward, etc.). • Promotes interoperability, reduces redundant investments, and allows for cost share. • Reduce cost for data acquisition and/or document need for establishing an Enterprise License Agreement.
Program Manager	• Coordinate across other internal Department/Agency investment PMs for recommendations to Execs for strategic and tactical objectives. • Staff and perform Working Group tasks as defined within the ESC/IPT Charter. • Develop performance measures and target end-state (To-Be) environment. • Ensure geospatial (sub-system at a minimum) is identified within the CPIC submission process.	• PMs identify and prioritize capability gaps and planned investments to determine To-Be end-state vs. As-Is environment and prepared business plan and value proposition for Execs approval. • Recommend Working Group priority, short-term/high-value tasks, and early delivery results to demonstrate benefits. • Within Charter define Working Group roles/responsibilities and prepare a work plan with Plan of Action & Milestones (POA&M). • Within the annual CPIC submission (e.g., 53/300) process, ensure geospatial capability is identified so that search and identification across system investments can be performed.	• Early adoption/visibility to strengthen long-term commitment from Executive Leadership. • Working Group member awareness of multiple investments across enterprise promotes coordination resulting in leveraged investments. • Results oriented for measurable and quantifiable results demonstrating value of collaboration. • Facilitates the search and identification of geospatial investments (especially for smaller systems) across the entire enterprise to foster participation within the Executive Steering Committee and technical solution teams.
Solution Architect	• SME and reach back for Working Group participation. • Validate technical requirements for work plan.	• Develop baseline assessment and perform capability gap analysis for As-Is and To-Be environments. • Develop technical approach for work plan tasks and POA&M.	• Technical vetting and validation across investments for desired To-Be end-state environment. • Ensure broadest possible technical review, adoption and acceptance.

2

3

3 BUSINESS REFERENCE MODEL

3.1 INTRODUCTION

Definition/Description (What) – the Business Reference Model (BRM) provides planning and evaluation practices to document existing geospatial capabilities and identify requirements for new system investment alignment.

Purpose/Function (Why) – enables individual business investments, through collaborative governance and planning structure, to document and compare capabilities and requirements in the areas of infrastructure, data, applications, and services as a means to share investments and avoid redundant cost. It uses the established governance structure (see Section 2.3) to base-line, align, transition, and mature their geospatial invest across the enterprise. The chapter describes how to:

- Define mission/business needs in terms of geospatial functional/operational requirements.

- Establish a process for geospatial system investment base lining and comparison by analyzing capabilities and functionality, and identifying opportunities for reuse.

Stakeholder Performance Guide (Who & How)

- Executive Leadership and Program Managers responsible for policy setting and compliance, strategic program direction, resource planning and approval (e.g., fiscal and human)

- Solution Architects for validating feasibility of technical approach and establishing target performance metrics

3.2 BUSINESS REFERENCE MODEL(S): APPROACH

The GIRA BRM will focus upon a practical approach to framing the business and functional capabilities and requirements of the geospatial enterprise, based upon the Governance Structure in Section 2.3. The geospatial BRM will leverage *The Common Approach to Federal Enterprise Architecture*[46] and its architecture project planning method, the *Collaborative Planning Methodology*[47] (Section 3.2.2), by highlighting its process for identifying and documenting geospatial investments and requirements across the enterprise. This approach is a prerequisite to allow for system interoperability. Without this understanding and governance structure to

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[46] Office of Management and Budget, *The Common Approach to Federal Enterprise Architecture*, May 2, 2012.

[47] *The Collaborative Planning Methodology*, June 2012, Office of Management and Budget.

facilitate its collection, compilation, and assessment, an enterprise cannot effectively or efficiently leverage or reuse investments.

3.2.1 GEOSPATIAL PROFILES

The *Geospatial Profile of the Federal Enterprise Architecture (FEA)*, Version 2.0[48] (e.g., GeoProfile 2.0) is a resource for determining how and where geospatial capabilities fit into enterprise architectures. The GeoProfile 2.0 provides a methodology for geo-enabling business processes in which a series of steps can be used as a means to identify business areas that could benefit from geospatial capabilities and procure the resources to enable the change. To geo-enable a business process, architects and executives focus on identifying location-based methods for mission functions and analyzing the most cost-effective combination of possible approaches.

> **Geospatial Profile of the *Federal Enterprise Architecture (FEA)*, Version 2.0[49] defines a geo-enabled organization, as "one that deploys the staff and technological infrastructure necessary to provide enterprise geospatial data, services, and technological support to business processes across an organization, while also promoting economies of scale and reuse. This includes supporting agency-wide access to geospatial data and services for multiple business processes and deploying mechanisms for external partners to access the agency geospatial assets."**

Successful geo-enabled organizations have a governance structure in which senior management are engaged in integrating geospatial approaches and practices into the business architecture. A structured and active governance practice at a strategic level enhances optimization of investments by aligning them with mission objectives and business strategy.

3.3 OPERATIONAL REQUIREMENTS DOCUMENTATION

At its core, an architecture framework begins with the understanding that technology investments and development should be planned – and that the mission or business owner, not the technology providers, should determine what is needed (e.g., requirements). The *Collaborative Planning Methodology*, (Step 1: Identify and Validate) and the Enterprise Roadmap (II. Summary of Current Architecture) documents existing and planned capabilities and requirements.

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[48] *Geospatial Profile of the Federal Enterprise Architecture (FEA)*, Version 2.0, March 06, 2009. Available at https://www.fgdc.gov/initiatives/resources/geospatial-profile-of-the-FEA-v2-march-2009.pdf/view

[49] Ibid.

An Operational Requirements Document (ORD) is a method in which to document technology, data and services capabilities, and requirements that provide the input for how investments are leveraged/aligned, purchased or built, and the performance indicators are defined. The capabilities and requirements, as defined by the mission and user community, are documented and prioritized and form the basis of the As-Is baseline and To-Be desired environment. To assist in the identification of new or existing business processes within an organization, which requires or could benefit from geo-enabling, the *Geospatial Profile v2.0*[50] provides a 3-stage process to help identify, assess, and select an investment as well as includes an Appendix (Approaches for Geo-Enabling Lines of Business) that would assist Use Case development to identify geospatial aspects of business/mission activities.

The ORD is a dynamic document, and as new requirements are identified, they are maintained and contribute to future capability development within the CPM lifecycle. An ORD should consider the following:

1. Who should perform the User Requirements Analysis (URA)?

2. Identification and definition of User Levels of capability/need

    a. View

    b. Analysis

    c. Advanced Analysis

3. Definition of required (mission driven) products or services

4. Evaluation of work flow and data inputs/outputs

5. Investment Identification and Comparison

6. Baseline Assessment and Comparison Matrix for technology, data, applications, and services

The *Segment Architecture Analysis of the Geospatial Platform*[51] provides Geospatial Use Cases to help facilitate the identification of geospatial business functions and requirements in a step-wise manner. Each use case describes a series of actions taking place, the actors involved, the data being exchanged, and the systems, applications, technology and standards being leveraged with an As-Is and Target Analysis including Gaps. Use cases include:

- Acquire or Create Geospatial Information.

- Store and Manage Geospatial Assets.

- Use Geospatial Information to Support Business Driven Applications.

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[50] *Geospatial Profile of the Federal Enterprise Architecture (FEA)*, Version 2.0, March 06, 2009.

[51] *Segment Architecture Analysis of the Geospatial Platform*, Version 1.0, December 21, 2010. Federal Geographic Data Committee, in support of the Federal Chief Information Officers Council. Available at http://www.fgdc.gov/geospatial-lob/draft-segment-architecture-review/Segment-Architecture-Analysis-of-the

1 • Process Geospatial Information to Maintain or Update Resources.

2 • Find Geospatial Information or Services.

3 • Publish or Disseminate Geospatial Resources.

4 One of the most important elements of the ORD, as input to the CPM, will be the development of
5 the Baseline Assessment or Asset Inventory. This forms the basis of the investment comparisons
6 and allows a level-set understanding of the capabilities and requirements for the geospatial
7 enterprise.

8 3.4 GEOSPATIAL BASELINE ASSESSMENT MATRIX

9 The Baseline Assessment is more than just an inventory of investments; but serves as a
10 mechanism to normalize and compare investments; a means to demonstrate to Executive
11 Leadership the magnitude of the collective geospatial need across an enterprise; and can be used
12 as input to the OMB CPIC (Section 2.4.2) and annual OMB Roadmap submission for IT Asset
13 Inventory. Performed as a task under the direction of an organization's Geospatial Executive
14 Steering Committee, the Baseline Assessment would include a profile of an enterprise's
15 organizations which have, need or plan to have geospatial capabilities mapped to their Core
16 Stakeholders

1   Table 3-1). The Stakeholders could include communities or sectors such as: federal, state, local,
2   tribal and territory government, public, private and international as well as business/mission
3   areas or "Services for Citizens"[52] such as Defense and National Security, Intelligence, Law
4   Enforcement, Operations, Emergency Management, etc. The OMB Federal Enterprise Architecture
5   Business Reference Model v3[53] provides further subdivisions of the Services for Citizens (e.g., 111
6   Homeland Security: 033: Border and Transpiration Security; 034: Key Asset and Critical
7   Infrastructure Protection; and 035: Catastrophic Defense) that can be used to provide detailed
8   business/mission area delineation.

9

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[52]   http://www.whitehouse.gov/sites/default/files/omb/assets/omb/egov/a-3-2-services.html

[53]   http://www.whitehouse.gov/omb/e-gov/fea/

1   Table 3-1. Geospatial Baseline Assessment: Core Mission Services and Stakeholders

(1) SERVICES FOR CITIZENS	ORG #1	ORG #2	ORG #3	ORG #4	ORG #5	ORG #6
(103) Defense and National Security	Y				Y	Y
(111) Homeland Security	Y	Y	Y	Y	Y	Y
(113) Intelligence Operations	Y				Y	Y
(104) Disaster Management		Y	Y	Y		
(114) International Affairs and Commerce						
(117) Natural Resources						
(107) Energy		Y				
(108) Environmental Management						
(105) Economic Development						
(101) Community and Social Services				Y		
(118) Transportation		Y				
(106) Education						
(119) Workforce Management						
(110) Health						
(112) Income Security						
(115) Law Enforcement	Y				Y	Y
(116) Litigation and Judicial Activities						
(102) Correctional Activities						
(109) General Science and Innovation						
Internal to Agency					Y	
Federal	Y		Y			Y
State		Y	Y	Y		
Local		Y	Y	Y		
Tribal		Y	Y	Y		
Territory		Y	Y	Y		
Public				Y		
Private						
International	Y					

2   These business/mission alignments are directly aligned to the OMB CPIC process (Section 2.4.2)
3   needed for investment planning and justification. Each fiscal year, Federal Agencies are required
4   to submit Exhibit 53s and Exhibit 300s to request funding for new major projects and on-going
5   capital investments and align these projects and investments to the Federal Enterprise
6   Architecture Business Reference Model. This enables OMB to identify projects and investments
7   across the Federal Government that support a common business purpose, which further allows
8   OMB to identify candidate shared services that more agencies can use, thereby reducing the
9   number of redundant services throughout the Federal Government. Through the use of a
10   standard classification scheme, the BRM functional taxonomy, opportunities for shared services

1   and elimination of redundancies may be identified. This high level profile provides a basic
2   awareness of the enterprise organization's stakeholder communities of interest and an early
3   indication of the types of information sharing opportunities or limitations that may exist.

4   The Baseline Assessment Matrix describes an organization through a taxonomy of common
5   (shared) business/mission functional requirements and/or support service capabilities (Table 3-2)
6   instead of through a stove-piped single organizational view.

7

Table 3-2. Geospatial Baseline Assessment: Core Capability

Enterprise Investment	Visualization	Geo-Analysis/ Processing	Reporting	Search & Discovery	Alerts & Notifications	Collaboration	Content Mgmt	Resource Mgmt	Data Mgmt	Asset Mgmt	Decision Support	IT Security	Other
Org #1	C	C	C	P	P	P	P	C	C	P	P	C	
Org #2	C	C	C	C	C		P	C	C	C		C	
Org #3	C	C	C	C	C	C			C		C	C	
Org #4	C	C	C	C	C			C	C			C	
Org #5	C	C	C	C	C	C	C	C	C		C	C	
Org #6	C	C	C	C	C	C	C		P	C		P	
Org #7	P				P							P	
Org #8	C	C				C			C		C	C	
Org #9	C				C	C					C	C	
Commonality Score Percent (%)	9	7	6	6	8	6	4	4	7	3	5	9	0
	100%	78%	67%	67%	89%	67%	44%	44%	78%	33%	56%	100%	0%

Status: C = Current, P = Planned

8   The Baseline Assessment Matrix will allow for a high-level view of an enterprise organization's
9   investments (e.g., C = Current and P = Planned) in the areas of: Visualization, Geospatial Analysis
10   and Processing, Reporting, Search and Discovery, Alerts and Notifications, Collaboration, Content
11   Management, Resource Management, Data Management, Asset Management, Decision Support,
12   IT Security and other categories as defined by the Executive Steering Committee. This profile of
13   Current/Planned investments provides an initial, high-level profile of the general types of needs
14   each organization provides its stakeholders. This profile helps to frame the more detailed Baseline
15   Assessments that will come in the areas of: Data Inputs and Datasets (Chapter 4); Functionality
16   Assessment (Chapter 5); Infrastructure and Technology Assessment (Chapter 6).

17   Once all of the Baseline Assessment Matrices have all been developed, it will provide the
18   framework for the Executive Leaders, Program Managers and Solution Architects to begin to
19   assess opportunities to leverage and maximize shared-service capabilities across the enterprise. It
20   will also provide the basis for an assessment of where possible redundant investments could be
21   reduced; which planned investments could be avoided by agreeing to a steward or service
22   provider (e.g., Org #X or Org #Y) for the use of one of the investments which is most effective. The
23   Matrix will also begin to identify where gaps exist and planned investments can be prioritized and
24   leveraged.

3.5 STAKEHOLDER PERFORMANCE GUIDE: BUSINESS

The Performance Guidance provides a summation of the key decision points necessary to determine the most effective and efficient design, development, and implementation of the geospatial system investment.

Table 3-3. Stakeholder Performance Guide: Business

	STAKEHOLDER PERFORMANCE GUIDE		
	CHAPTER 3 – BUSINESS		
Role	Responsibility	Approach	Benefit
Executive Leadership	• Establish and/or Co-Chair to Chartered governance (ESC/IPT) body. • Signatory to establish Investment Technology Acquisition Review (ITAR) framework. • Signatory to ISAs for access or dissemination of data and/or services.	• Work with other Executives to frame Charter goals/objectives and commitment to level-of-effort support/involvement. • Establish review board with CIO/CFO representation and consider policy to ensure participation and commitment. • Establish or follow General Council process and review and maintain repository of Agreements.	• Signatory with defined responsibility and stated measurable results (e.g., ELAs with % cost reduction, shared services with defined Steward, etc.). • Promotes interoperability, reduces redundant investments, and allows for cost share. • Reduce cost for data acquisition and/or document need for establishing an Enterprise License Agreement.
Program Manager	• Coordinate across other internal Department/Agency investment PMs for recommendations to Execs for strategic and tactical objectives. • Staff and perform Working Group tasks as defined within the ESC/IPT Charter. • Develop performance measures and target end-state (To-Be) environment.	• PMs identify and prioritize capability gaps and planned investments to determine To-Be end-state vs. As-Is environment and prepared business plan and value proposition for Execs approval. • Recommend Working Group priority, short-term/high-value tasks and deliver early results to demonstrate benefits. • Within Charter define Working Group roles/responsibilities and prepare a work plan with Plan of Action & Milestones (POA&M).	• Early adoption/visibility to strengthen long-term commitment from Executive Leadership. • Working Group member awareness of multiple investments across enterprise promotes coordination resulting in leveraged investments. • Results oriented for measurable and quantifiable results demonstrating value of collaboration.
Solution Architect	• SME and reach back for Working Group participation. • Validate technical requirements for work plan.	• Develop baseline assessment and perform capability gap analysis for As-Is and To-Be environments. • Develop technical approach for work plan tasks and POA&M.	• Technical vetting and validation across investments for desired To-Be end-state environment. • Ensure broadest possible technical review, adoption, and acceptance.

4 DATA REFERENCE MODEL

4.1 INTRODUCTION

Definition/Description (What) – defines the primary considerations for describing, discovering, delivering, and sharing common data using open standards and the promotion of uniform data management practices to sustain data as a national asset.

Purpose/Function (Why) – to promote the common identification, tagging, sharing, and reuse of appropriate geospatial data/information resources across communities. It contributes to the mission/business Operational Requirements Documentation (Section 3.3) to determine what data inputs and assets are required to meet the functional needs of the stakeholder. The chapter describes how to:

- Establish a process for base lining and documenting geospatial data inputs and datasets.
- Provide guidance for preparing data description, context, and sharing methods.
- Provide [limited] references to common operating data and other sources.

Stakeholder Performance Guide (Who & How) – driven by mission/business requirements and the associated functional capabilities identified in the Operational Requirement Document, data resource investment must be a shared responsibility agreed to by the Executive Leadership and managed as an enterprise/corporate resource and service administered by a steward (e.g., Program Manager) and implemented by the Solution Architects.

> **Geospatial data are the biggest cost to an enterprise geospatial solution, and remains the primary need, challenge and barrier to the geospatial community.**

4.2 DATA REFERENCE MODEL APPROACH

Geospatial data identification, search, discovery, and access continues to be the primary challenge for the geospatial professional/user, but is now compounded by the fact that geospatial technology has become 'commoditized' to a level where the general public have come to expect it to be just another query tool on their web browser. This is the same expectation that the geospatial Program Manager and Solution Architect face when providing geo-data and services to the mission/business owner within their organizations who are not geospatial professionals.

The GIRA's Data Reference Model will focus upon a practical approach to documenting the geospatial data requirements within and across an organization to meet mission/business requirements as well as provide guidance for data description, context, and sharing. The GIRA Data Reference Model is not:

- A data management "how to" manual for building and maintaining data architectures.

- A government-wide conceptual data model or fully attributed logical data model.

- A set of XML schemas.

- A replacement of existing data structures within an organization's geospatial enterprise.

4.3 GEOSPATIAL BASELINE ASSESSMENT MATRIX: DATA INPUTS AND DATASETS

Once established, an organization's Executive Steering Committee's should have the authority and ability to initiate an enterprise-wide Geospatial Baseline Assessment (Section 3.4). The baseline would include data requirements based upon mission/business functional needs taken from the Operational Requirements Document. Agencies should perform a business analysis that generates the geospatial data requirements including data model, geospatial and temporal coverage, accuracy, and quality. The potential sources for that geospatial information, ranging from self-production, to usage of another agency's data product, to direct acquisition from commercial sources should be considered. This should yield a data architecture that defines information types and data requirements in terms of business needs.

The Baseline Assessment for Data can serve multiple benefits and reporting requirements. The Data Assessment is essentially an inventory and catalog of current data holdings as well as planned needs based upon functional requirements. However, the Matrix is a tool to help foster discussion with the stakeholder community to better understand the mission/business requirements.

> **"The creation of duplicative data and redundant capabilities often results from consumers' inability to locate, access, understand, or trust that existing data assets meet their needs."[54]**

The Data Assessment Matrix is not exhaustive and there are many themes of data within each category listed in the

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[54] DoD 8320.02-G, *Guidance for Implementing Net-Centric Data Sharing*, April 2006, available at
http://dodcio.defense.gov/Portals/0/documents/832002g.pdf

1   Table 4-1 (see also Appendices C.1 and C.2) that would require further discussion to identify the
2   best available dataset to meet the business need. Agencies should use the Data Reference Model
3   from the Federal Enterprise Architecture to help create and maintain their inventory. The
4   inventory would facilitate the identification of "authoritative"[55] and/or desired datasets; identifies
5   redundant data assets for decommissioning; identifies opportunities to reuse or extend a data
6   asset rather than creating a new one; and the opportunity to avoid redundancy costs based upon
7   the establishment of enterprise licensing agreements.

8   The GeoCONOPS[56] defines authoritative data owned and/or produced by the federal entities
9   supporting the National Response Framework as:

10   • **Rational Authority:** Government agencies are by default the "authoritative" sources for
11   data or services that they produce, or have a statutory responsibility.

12   • **Expert Authority:** Scientifically authoritative data is defined in the realm of the various
13   professions under which the standards and methodology for data are created.

14   These classifications provide clarity beyond the frequent notion that an authoritative data source
15   is simply the entity trusted because of a subjective belief that it is the "best" or "most accurate"
16   source for a specific data theme. The owner or authoritative source of any geospatial data is
17   responsible for defining the business rules for the access and sharing of that information across
18   the stakeholder community.

19   The Baseline Assessment would also serve to meet OMB's *Open Data Policy*[57] responsibility to
20   "Create and maintain an enterprise data inventory… that accounts for datasets used in the
21   agency's information systems."

22   The Baseline Assessment discussion would begin with a Data Inputs (

23

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[55] Department of Homeland Security, *Geospatial Concept of Operation (GeoCONOPS)*, Version 5.0, June 2013, available at

    See also https://www.geoplatform.gov/geoconops-home

[56] Ibid.

[57] OMB Memorandum M-13-13, *Open Data Policy – Managing Information as an Asset* (May 9, 2013), available at http://www.whitehouse.gov/sites/default/files/omb/memoranda/2013/m-13-13.pdf

1   Table 4-1 and Appendix C.1) of general types of data required to meet the mission/business

2   functional capabilities of the organizations stakeholders as identified in the Operational

3   Requirements Document. This can generally be performed by the geospatial investment Program

4   Manager and Solution Architects initiating discussions with both geospatial investment 'owners'

5   as well as business owners that may need geospatial functionality/services but do not intend to

6   have a system investment. A follow-on assessment with a more detailed (inventory) would be

7   performed to fully identify the existing datasets either currently existing or planned for

8   acquisition. Table 4-2 provides an extract of the 6-page Baseline Dataset Assessment Matrix that

9   is contained in Appendix C.2.

10

11

1

Table 4-1. Geospatial Baseline Assessment Matrix: Data Inputs

Geospatial Baseline Assessment: Data Inputs

Data Inputs	Org #1	Org #2	Org #3	Org #4	Org #5	Org #6	Common Score	Pct %
Email	P	P	C	C	C	C	6	100%
SMS / Text Messages	P	C	C	P	C	C	6	100%
Internet Media	P		C	P	C	C	5	83%
Critical Infrastructure	C	C	C	C	C	C	6	100%
Suspicious Activity Reports	P	P	C		C	P	5	83%
Weather Service Forecasts / Warnings	P	C	C	C	C	C	6	100%
Natural Hazards	P	C	C	C	C	C	6	100%
Base Maps (see GIRA Appendix F-2)	P	C	C	C	C	C	6	100%
Business Directories	P	P	C	C	C		5	83%
Personnel / Blue Force Tracking	P	C	C				3	50%
Asset / Vessel Tracking	P	C	C	C			4	67%
Elevation & Terrain	P	C	C	C			4	67%
Navigation & Reference Grids	P	C	C				3	50%
Population / Demographics	C	C	C			C	4	67%
Travel Conditions	P	C	C	C		C	5	83%
Political Jurisdictions	P	C	C	C			4	67%
Tax Parcels		P	C				2	33%
Law Enforcement	P		C				2	33%
Emergency Services	P		C			P	3	50%
Health & Disease Outbreaks	P	P	C			C	4	67%
Aerial Photography	C	C	C	C	C	C	6	100%
Satellite Imagery	C	C	C	C	C	C	6	100%
Traffic Camera / Feeds	P	C	C	C	C	C	6	100%
Camera Feeds / live video	P	C	C	C	C	C	6	100%
Business Partners Operating Status		P				P	2	33%
Personal Identifiable Information (PII)		P				P	2	33%
Classified / FOUO sensitivie data		P				P	2	33%
Others							2	33%
Status C - Current P - Planned								0%

2

3

Table 4-2. Geospatial Baseline Assessment Matrix: Datasets (Extract)

Geospatial Baseline Assessment: Datasets

Datasets[1]	Org #1	Org #2	Org #3	Org #4	Org #5	Org #6	Common Score	Pct %
Agriculture/Food								
Animal Health Surveillance	C	P					2	33%
Mobile Food			P	P	C	C	4	67%
Processing / Packaging / Production					C		1	17%
Product Distribution		P	P		C		3	50%
Product Storage					C		1	17%
Product Transportation					C		1	17%
Supply					C		1	17%
Support Facilities					C		1	17%
Other					C		1	17%
Banking / Finance								
Banking and Credit					C		1	17%
Securities / Commodities / Financial Investments					C		1	17%
Other								0%
Chemical and Hazardous Materials								
Manufacturing Facilities				C			1	17%
Release		C					1	17%
Storage	C						1	17%
Superfund Sites	C	P				C	3	50%
Transportation Routes	C					C	2	33%
Other	C					C	2	33%
Commercial Assets								
Industry	C	P	C	C		C	5	83%
Lodging	C					C	2	33%
Manufacturing	C					C	2	33%
Mining	C					C	2	33%
Public Venues	C					C	2	33%
Retail Facilities	C					C	2	33%

4

4.4 DATA REFERENCE MODEL ALIGNMENT

The Data Reference Model's (DRM) primary purpose is to promote the common identification, use, and appropriate sharing of data/information across the federal government. The DRM is a flexible and standards-based framework to enable information sharing and reuse via the standard description and discovery of common data and the promotion of uniform data management practices.[58] The DRM focus upon two core questions: What information is available for sharing and re-use, and what are the information gaps needing correction?[59] The DRM provides a standard means by which data may be described, categorized, and shared while respecting security, privacy, and appropriate use of that information. It consists of three standardization areas:[60]

- **Data Description:** Provides a way to uniformly describe data to convey meaning, thereby supporting its discovery and sharing.

- **Data Context:** Facilitates discovery of data through an approach to the categorization of data according to taxonomies. Additionally, enables the definition of authoritative data assets within a common operating environment.

- **Data Sharing:** Supports the access and exchange of data where access consists of ad-hoc requests (such as a query of a data asset), and exchange consists of fixed, reoccurring transactions between parties. This is enabled by capabilities provided by both the Data Context and Data Description standardization areas.

This standardized Data Reference model structure is depicted in Figure 4-1.[61]
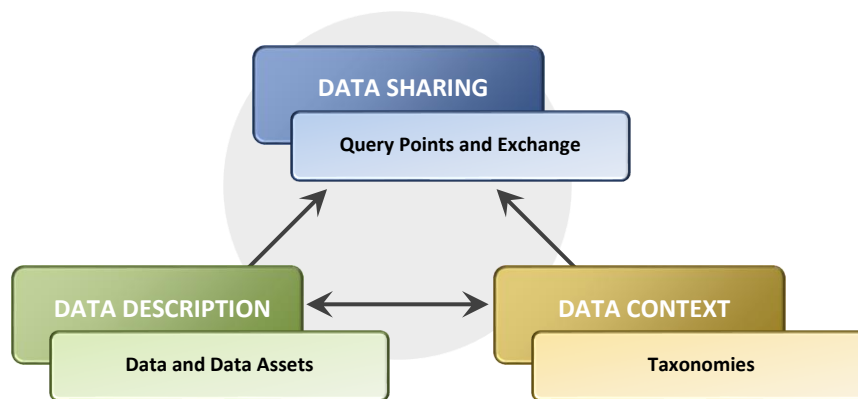
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[58] Office of Management and Budget, *Federal Enterprise Architecture Framework*, Version 2, January 29, 2013, available at http://69.89.31.228/~mkerncom/wp-content/uploads/2013/02/Federal-Enterprise-Architecture-Framework-v2-as-of-Jan-29-2013.pdf

[59] Office of Management and Budget, *A Common Approach to Federal Enterprise Architecture*, May 2, 2012, available at http://www.whitehouse.gov/sites/default/files/omb/assets/egov_docs/common_approach_to_federal_ea.pdf

[60] Ibid.

[61] Office of Management and Budget, *Consolidated Reference Model*, Version 2.3, October 2007, available at http://www.whitehouse.gov/sites/default/files/omb/assets/fea_docs/FEA_CRM_v23_Final_Oct_2007_Revised.pdf.

Figure 4-1. Data Reference Model Structure

4.4.1 DATA DESCRIPTION

Data Description provides a means to uniformly describe data, thereby supporting its discovery and sharing. Traditionally, data description was solely focused on organizing and describing structured data [geographic base data layers]. With unstructured data [mission/business data that may contain a geographic element] as the largest focus of agencies' data management challenges, the Federal Enterprise Architecture Framework's DRM Description component has been revised to focus on the larger topic of metadata, which includes both traditional structured data and unstructured data description.[62]

Metadata is structured information that describes, explains, locates, or otherwise makes it easier to retrieve, use, or manage an information resource (NISO 2004, ISBN: 1-880124-62-9).[63] The challenge is to define and name standard metadata fields so that a data consumer has sufficient information to process and understand the described data. The more information that can be conveyed in a standardized regular format, the more valuable data becomes. Metadata can range from basic to advanced, from allowing one to discover the mere fact that a certain data asset exists and is about a general subject all the way to providing detailed information documenting the structure, processing history, quality, relationships, and other properties of a dataset that enable a potential user to determine its fitness of use for their purposes.

The International Standards Organization (ISO) 19115-1:2014: Geographic Information – Metadata, Part 1: Fundamentals, available at http://www.iso.org/iso/home/store/catalogue_tc/catalogue_detail.htm?csnumber=53798, defines the schema required for describing geographic information and services. It provides information about the identification, extent, quality, spatial and temporal schema, spatial reference, and distribution of digital geographic data.[64] The Metadata Standard is applicable to:

- Cataloguing of datasets, clearinghouse activities, and the full description of datasets.
- Geographic datasets, dataset series, and individual geographic features and feature properties.

The ISO Metadata Standard also defines:

- Mandatory and conditional metadata sections, and metadata elements.

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[62] Office of Management and Budget, *Federal Enterprise Architecture Framework*, Version 2.0, January 29, 2013.

[63] http://project-open-data.github.io/schema/

[64] International Standards Organization, ISO 19115:2003 Geographic Information – Metadata, available at http://www.iso.org/iso/iso_catalogue/catalogue_tc/catalogue_detail.htm?csnumber=26020

- Minimum set of metadata required to serve the full range of metadata applications (e.g., data discovery, determining data fitness for use, data access, data transfer, and use of digital data).

- Optional metadata elements—to allow for a more extensive standard description of geographic data.

- Method for extending metadata to fit specialized needs.

What is commonly understood as metadata comprises:[65]

- **Identification information**, i.e., information to uniquely identify the resource such as:

    ◦ Title, abstract, reference dates, version, purpose, responsible parties, …

    ◦ Data extent,

    ◦ Browse graphics (overview, thumbnail, …), and

    ◦ Possible usage.

- **Content Description**, i.e., information identifying the feature catalogue(s) used and/or information about the coverage content.

- **Distribution information**, i.e., information about the distributor of, and options for obtaining the resource.

- **Legal and security constraints**; i.e., restrictions placed on the data and metadata in the context of delivering, accessing, and using.

- **Portrayal information**, i.e., information identifying the portrayal catalogue used.

- **Reference system information**, i.e., identification of the spatial and temporal system(s) used in the resource data.

- **Spatial Representation**, i.e., information concerning the mechanisms used to spatially represent the resource data.

- **Quality and validity information**, i.e., a general assessment of the quality of the resource data including:

    ◦ Quality measures related to the geometric, temporal and semantic accuracy, the completeness or the logical consistency of the data,

    ◦ Lineage information including the description of the sources and processes applied to the sources, and

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[65] Defense Geospatial Information Working Group (DGIWG), DGIWG Metadata Vision – 906, September 30, 2013, available at https://www.dgiwg.org/dgiwg/htm/documents/committee_enterprise_documents.htm

◦ Validity information related to the range of space and time pertinent to the data; to whether the data has been checked to a measurement or performance standard or to what extent the data is fit for purpose.

- **Maintenance information**, i.e., information about the scope and frequency of updating of the resource data.

- **Information about metadata**, i.e., identifier for the metadata itself, information about the language and character set of the metadata, metadata date stamp, metadata point of contact, name, and version of the metadata standard.

All nationally significant and other federally stewarded geospatial data should be documented with descriptive metadata to enable discovery, assessment of fitness-of-use, and sharing of geospatial data resources.[66] Geospatial metadata should be organized by a common schema to be applied across the federal sector that:

- Is organized in accordance with ISO metadata specifications (ISO 19115-1:2014 and ISO 19139 - Geographic Metadata XML schema implementation), documenting key properties of geospatial data resources including but not limited to the following:

    ◦ Identification information (e.g., context/topic, search keywords, dataset title),

    ◦ Data quality information (e.g., positional accuracy and precision, adherence to data accuracy standards, completeness),

    ◦ Spatial representation and reference system information (e.g., geometric properties, coordinate systems, projections, datum),

    ◦ Other relevant information [e.g., maintenance frequency, data steward (POC) information, content description, distribution protocol and constraints], and

    ◦ Explicitly defines distribution rights and restrictions to enable role-based access implemented through federal e-authentication initiatives.

The Office of Management and Budget's *Open Government Directive*[67] requires agencies to expand access to information by making it available online in open formats. Specifically, this Memorandum requires agencies to collect or create information in a way that supports downstream information processing and dissemination activities. This includes using common core and extensible metadata for all new information creation and collection efforts.

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[66] *Geospatial Profile of the Federal Enterprise Architecture (FEA)*, Version 2.0, March 06, 2009, available at http://www.fgdc.gov/geospatial-lob

[67] OMB Memorandum M-1 0-06, *Open Government Directive*, December 8, 2009, available at http://www.whitehouse.gov/sites/default/files/omb/assets/memoranda_2010/m10-06.pdf

Federally sponsored Metadata Working Groups promote the advancement, adoption and use of geospatial metadata and provide considerable expertise, documentation, training, and information for users including:

- Geospatial Intelligence Standards Working Group's (GWG) Metadata Focus Group (MFG), available at http://www.gwg.nga.mil/mfg.php,

- Federal Geographic Data Committee (FGDC), Metadata Working Group, available at http://www.fgdc.gov/participation/working-groups-subcommittees/mwg/index_htm , and

- Defense Geospatial Information Working Group (DGIWG), available at https://www.dgiwg.org/dgiwg/htm/documents/committee_enterprise_documents.htm.

4.4.2 DATA CONTEXT

Data Context is any information that provides additional meaning to data and an understanding to the purposes for which it was created. The Data Context method can also be called "categorization" or "classification."[68] OMB's *Open Data Policy* responsibility to "Create and maintain an enterprise data inventory … that accounts for datasets used in the agency's information systems,"[69] provides input for the categorization. The Baseline Assessment (Section 4.3 and Appendix C.2) allows organizations the ability to begin to agree upon data taxonomies, definitions and authoritative sources. Once data assets are inventoried, categorized, and then shared in data registries, these catalogs become source for discovering data and assessed based upon metadata that determine utility to the user. The catalog and its taxonomy are not meant to be fixed and unchanging, but flexible and scalable so that new Subjects and Topics can be added as the business model for the organization changes as needed, for their respective business processes.

The Federal Enterprise Architecture Framework V2.0 describes Data Categorization Methods[70] and provides best practices examples (Table 4-3) used to describe the common data assets.

Table 4-3. Federal Enterprise Architecture Framework V2.0: Data Categorization Methods

METHOD	DESCRIPTION	AUTHORITATIVE REFERENCE
Data Asset Catalog	A data asset catalog reduces time and cost to implement change by reducing the time to locate needed data, identifies redundant data assets for decommissioning, and identifies opportunities to	Data Management Book of Knowledge (DMBOK) DAMA, April 2009.

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[68] Office of Management and Budget, *Federal Enterprise Architecture Framework*, Version 2.0, January 29, 2013.

[69] OMB Memorandum M-13-13, *Open Data Policy – Managing Information as an Asset*, May 9, 2013, available at http://www.whitehouse.gov/sites/default/files/omb/memoranda/2013/m-13-13.pdf

[70] Office of Management and Budget, *Federal Enterprise Architecture Framework*, Version 2.0, January 29, 2013. Appendix C: Data Reference Model.

METHOD	DESCRIPTION	AUTHORITATIVE REFERENCE
	reuse or extend a data asset rather than creating a new data asset.	DoD 8320.02-G, Guidance for Implementing Net-Centric Data Sharing, April 2006
	Using the Data Taxonomy, agencies should inventory their data assets, associate or map the data assets to the Data Taxonomy and create a data catalog consisting of the Taxonomy Subject, Taxonomy Topic, Entity Name (table, class, file name), Attribute Name (column, attribute, field, tag), and Data Asset Population (a rule to limit scope of an association). The data asset catalog is populated through a "bottom up" process that associates the data contents of a data asset documented in the data asset's data model to the Data Taxonomy.	An agency can create a data catalog with the following steps: 1) Inventory data assets and collect the data model or structure for each asset, 2) Map the asset characteristics to the Data Taxonomy, 3) Present the results in a data catalog. The data asset catalog provides the foundation of an enterprise data inventory, which lists and describes all agency data sets used in the agency's information systems and is required by OMB's Policy on *Managing Government Information as an Asset*.

1 In summary, an organization can create a geospatial data catalog with the following steps:

2   1. Inventory data assets and collect the data model or structure for each asset.

3   2. Map the asset characteristics to the DRM Taxonomy.

4   3. Preserve the results in a data catalog that is exposed for Search and Discovery.

5 There are numerous geospatial data cataloging initiatives and websites available for search,
6 discovery, posting and retrieval (Section 4.6). Each catalog capability however uses its own
7 taxonomy for the inventory and includes variations such as: Community Categories, Types,
8 Groups, Tags, Layers, Name, Keyword, etc.

9   **The geospatial community does not maintain a standardized, consensus driven**
10   **or commonly applied taxonomy to catalog geospatial data assets.**

11 Taxonomies describing nationally significant and other federally stewarded geospatial data should
12 be documented using eXtensible Markup Language (XML) Topic Maps, Web Ontology Language
13 (OWL), Resource Definition Format (RDF) hierarchies, or ISO 11179 classification schemes.[71]
14 Taxonomies describing geospatial data can then be made accessible via services to facilitate
15 efficient search, discovery, and data translation capabilities and to facilitate development of more
16 detailed data schemas and logical data models.

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[71] *Geospatial Profile of the Federal Enterprise Architecture (FEA)*, Version 2.0, March 06, 2009, available at
http://www.fgdc.gov/geospatial-lob

4.4.2.1 DATA SEARCH AND DISCOVERY

Mapping each geospatial data asset in an agency's data asset catalog to the agency's data categorization taxonomy, enables users to identify the data assets that satisfy the search criteria of the user.[72] There are three primary search and discovery methods as described in Table 4-4.

Table 4-4. Standards-based Content Search Methods

STANDARD SEARCH METHOD	DESCRIPTION
Federated Search	A real-time, simultaneous search of multiple resource collections that may reside on many separate domains. Federated Search utilizes a broker to accept a query request, broadcast it out to a number of providers, and aggregates the results into a combined set for the consumers.
Centralized Search	Operates by creating a central index of content obtained by crawling web sites and following web feeds. Search queries are then executed against the index.
Enterprise Metadata Catalog	A central catalog of discovery metadata organized into collections. The Enterprise Metadata Catalog searching mechanism supports precise criteria such as geospatial and temporal parameters as well as full-text search. The Defense Discoverable Metadata Specification (DDMS)[73] is an example of an appropriate metadata tagging standard for the contents of an Enterprise Metadata Catalog.

Regardless of the search method applied, each requires the effective use of Data Description and Data Context in order to identify the requested data.

4.4.3 DATA SHARING

Geospatial data sharing (e.g., identification of and access to requested data) is often the greatest need and obstacle for the user community. Office of Management and Budget's (OMB) *Open Government Directive* requires agencies to expand access to information by making it, "online in an open format that can be retrieved, downloaded, indexed, and searched by commonly used web search applications."[74] Specifically, this Memorandum requires agencies to collect or create information in a way that supports downstream information processing and dissemination activities. This includes using machine readable and open formats, data standards, and common core and extensible metadata for all new information creation and collection efforts.

> **CHALLENGE: "Federal, state, local, and tribal organizations typically use different definitions in the storage and exchange of like data across a community of interest."[75]**

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[72] Office of Management and Budget, *Federal Enterprise Architecture Framework*, Version 2.0, January 29, 2013.

[73] http://metadata.ces.mil/dse/irs/DDMS/

[74] OMB Memorandum M-1 0-06, *Open Government Directive*, December 8, 2009, available at http://www.whitehouse.gov/open/documents/open-government-directive

[75] Office of Management and Budget, *Federal Enterprise Architecture Framework*, Version 2.0, January 29, 2013.

Creating a standardized information exchange with agreed upon data descriptions, or Content Model, enables each participating organization to create the necessary interface to receive or provide data only once. Content models refer to community agreements on the elements, relationships between elements, semantics and so forth for a specific data set in a given domain. Further, content models are implementation independent and vendor neutral. In order to automate and make the exchange of domain specific geospatial data seamless, consensus needs to be built among the community participants on:

- A shared data model for data exchange, in terms of a common understanding and agreement for how different systems "understand" each other;

- Common definitions of the different data entities and their properties; and

- Common controlled vocabularies and taxonomies.

Creating a standardized information exchange with agreed upon data descriptions enables each participating organization to create the necessary interface to receive or provide data only once. Existing exchange partners can use a new participant's data without having to write any interface or transformation. Also, it improves the quality of information exchange by ensuring that the source and target mapping is accurate, by utilizing the exchange model and standardized data definitions.

For example, the DRM abstract model can be implemented using different combinations of technical standards. As one example, the Exchange Package concept in the Data Sharing standardization area may be represented via different messaging standards (e.g., eXtensible Markup Language (XML) schema, Electronic Data Interchange (EDI) transaction set) in a system architecture for purposes of information sharing.[76]

The *Geospatial Profile of the Federal Enterprise Architecture*[77] describes geospatial data sharing in the following context. Geospatial data schemas define how geospatial data are organized, how geospatial objects relate to each other, and list the attributes associated with each object. For maximum interoperability, these schemas must be based on standards for logical (abstract/database design) and physical (encoding/exchange) applications. The National Information Exchange Model (NIEM)[78] is an example of a federally developed data schema which incorporates geospatial content. Community collaboration and harmonization of semantics and exchange schema is used to provide common approaches and resolve discrepancies.

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[76] Office of Management and Budget, *Consolidated Reference Model*, Version 2.3, October 2007.

[77] *Geospatial Profile of the Federal Enterprise Architecture (FEA)*, Version 2.0, March 06, 2009, available at http://www.fgdc.gov/geospatial-lob

[78] National Information Exchange Model (NIEM). https://www.niem.gov/Pages/default.aspx

The FEA DRM provides an architectural pattern for sharing and exchanging data through a services-oriented strategy. Geospatial data should be encoded using appropriate interface standards and specifications to enable data exchange (fixed recurring transactions between data suppliers and consumers) and less structured requests for data access.

Geospatial architectures should leverage metadata catalogs as exposure mechanisms to enable consumers to discover availability and fitness-of-use of relevant geospatial data while also providing an effective means to connect consumers with authoritative geospatial data through service-oriented discovery, brokering, and access. To facilitate data sharing geospatial standards should:

- Be open and vendor-neutral to enable exploitation by a broad range of technology solutions.

- Be based on consensus (ISO/ANSI/FGDC/OGC) or community standards.

- Promote encoding of full geographic information (i.e., raster and vector spatial data and their attributes) in support of multiple mission requirements.

4.5 DATA ACCESS AND POLICY

The goal of a data architecture is to facilitate accurate (timely and precise information), trusted (data authorities and security), and common (agreed upon information source) data across the geospatial investments. Data access is key to understanding the 'who and why' of data management. Access is a leveraged capability involving policy considerations. This consists of identity and role based access that relies upon standards defined through the Federal Identify and Access Management (FICAM) roadmap.[79] Additionally, Information Sharing Agreements (ISA) and Memorandums of Agreement/Understanding (Section 2.5) must be structured and adaptive among mission partners to gain access to data sets to be used in the respective agency geospatial systems.

One of the five goals of the 2012 *National Strategy for Information Sharing and Safeguarding*,[80] (NSISS) is to improve information discovery and access through common standards. Goal 2 of the strategy states:

> **"Secure discovery and access relies on identity, authentication and authorization controls, data tagging, enterprise-wide data correlation, common information sharing standards, and a rigorous process to certify and validate their use."**
>
> *– National Strategy for Information Sharing and Safeguarding*

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[79] http://www.idmanagement.gov/identity-credential-access-management

[80] *National Strategy For Information Sharing and Safeguarding*, December 2012, available at http://www.whitehouse.gov/the-press-office/2012/12/19/national-strategy-information-sharing-and-safeguarding

1   The NSISS Goal 2.1 goes on to state:

2   **"Discovery and access are distinct concepts: the first addresses a user's ability**
3   **to identify the existence of information, and the second relates to a user's ability**
4   **to retrieve it. Our national security demands relevant information is made**
5   **discoverable, in accordance with existing laws and policies, to appropriate**
6   **personnel. Discovery and access require clear and consistent policy and**
7   **standards, as well as technical guidance for implementing interoperable process**
8   **and technology."**

9   *– National Strategy for Information Sharing and Safeguarding*

10   Data handled by various governmental authorities is subject to differing concerns regarding
11   operational security, as well as the privacy, civil rights, and civil liberties of individuals and
12   organizations described by the data or having access privileges to the data. As such, organizations
13   will likely caveat source data with various access restrictions, and any operations on the source
14   data will need to appropriately propagate those access controls through data access policies and
15   reflected in the metadata at varying degrees of granularity. Figure 4-2 graphically depicts the data
16   access and policy element "wrappers" necessary for sharing.

17
18   Figure 4-2. Data Access and Policy Wrapper

19   The granularity of the metadata applied to each data object is critical for enabling repeatable fine-
20   grain access control. This allows for maximizing information integration while minimizing risks
21   associated with over-sharing. Each organization and associated data stewards are ultimately
22   responsible for defining the security policies that govern how data is acted upon. These policies
23   should be machine executable to dynamically provide a grant/deny decision to each data object
24   at run-time.

4.6 DATA RESOURCES

The number of geospatial data resource catalogs are too numerous to attempt to list, as many of the geospatial community (federal, state, local, private, international, and academia) have on-going initiatives to provide a variety of these data resources. The following examples are offered as examples of (primarily) government geospatial data resources available to users.

4.6.1 GEOSPATIAL PLATFORM

"The Geospatial Platform (GeoPlatform) is a managed portfolio of common geospatial data, services, and applications contributed and administered by trusted sources and hosted on a shared infrastructure, for use by governmental agencies and partners to meet their mission requirements and the broader needs of the Nation."[81] The GeoPlatform.gov was developed by the member agencies of the Federal Geographic Data Committee (FGDC), in coordination with the Federal CIO Council, as an interagency Federal initiative and OMB shared service and is hosted by the U.S. Department of Interior, as the Managing Partner for the Geospatial Platform.[82]

The GeoPlatform provides open standards compliant catalog web services supporting the GeoPlatform and Data.gov[83] (e.g., official U.S. government site providing increased public access to federal government datasets). The shared catalog provides access via the Catalog Service for the Web (CSW) standard for both first-order and all metadata (including members of large collections) for harvested data, services, and applications. The Catalog Service for the Web is an Open Geospatial Consortium (OGC)[84] standard that defines common interfaces to discover, browse, and query metadata for data and services. The catalog enables both data and services searching via several methods (e.g., Categories, Types, Groups, Tags, Name, Keyword, etc.) and provides the metadata on that specific dataset or tool. Some datasets are downloadable, while others are extraction tool or widgets. The user must also be aware of and acceptable to the data policy use conditions for the requested dataset.

Many of the Federal datasets available on the GeoPlatform are part of the National Geospatial Data Asset (NGDA) portfolio management approach prescribed by OMB *Circular A-16 Supplemental Guidance.*[85] To ensure quality and usability, the data must be:

- **Discoverable** – published and available.

- **Reliable** – coordinated by a recognized national steward.

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[81] Geospatial Platform. https://www.geoplatform.gov/overview-page

[82] Federal Geographic Data Committee, Steering Committee meeting minutes, April 19, 2012.
http://www.fgdc.gov/participation/steering-committee/meeting-minutes/april-2012/meeting-minutes-public-sc-20120419.pdf

[83] Data.gov. https://www.data.gov/

[84] http://www.opengeospatial.org/

[85] OMB Memorandum M-11-03, *Issuance of OMB Circular A-16 Supplemental Guidance*, November 10, 2010, available at http://www.whitehouse.gov/sites/default/files/omb/memoranda/2011/m11-03.pdf

1 • **Consistent** – supported by defined schema, standards and understood content
2 definitions to ensure their integrity (including conformance with FGDC Standards as
3 applicable).

4 • **Current and applicable** – maintained regularly and adaptable to current needs.

5 • **Resourced** – established and recognized as an enterprise investment.

6 The GeoPlatform provides a Datasets Published per Month for the previous 12-month period and
7 the most recent summary at the time of this writing is displayed in

8 Table 4-5.

9

10 Table 4-5. GeoPlatform Datasets Published per Month[86]

AGENCY NAME	NUMBER OF DATASETS PUBLISHED BY MONTH												TOTAL IN THE PAST 12 MONTHS
	May '13	Jun '13	Jul '13	Aug '13	Sep '13	Oct '13	Nov '13	Dec '13	Jan '14	Feb '14	Mar '14	Apr '14	
Department of Agriculture	–	–	–	–	–	–	48	–	–	3	5	–	56
Department of Commerce	25217	–	–	317	3422	64	236	41	61	22	76	116	29572
Department of Homeland Security	–	–	–	1	–	–	–	–	–	–	–	–	1
Department of the Interior	–	–	–	388	461	2	41	275	9	9	5	–	1190
Department of Transportation	–	–	–	–	–	–	–	–	–	49	–	–	49
Total	25217	–	–	706	3883	66	325	316	70	83	86	116	30868
Data as of 04/03/2014 1:08 AM.													

11 At the time of this writing, the GeoPlatform listed 80,603 datasets found with the dataset type of
12 "geospatial."

13 4.6.2 GEOSPATIAL CONCEPT OF OPERATIONS

14 The Homeland Security Geospatial Concept of Operations (GeoCONOPS)[87] is a multiyear effort
15 focused on the geospatial communities supporting the Department of Homeland Security (DHS)
16 and the Federal Emergency Management Agency activities under the National Response
17 Framework (NRF) and in coordination with Presidential Policy Directive 8: National Preparedness
18 (PPD-8), which describes the Nation's approach to preparing for the threats and hazards that pose
19 the greatest risk to the security of the United States. The GeoCONOPS, in its sixth year, is a
20 multiyear product to document the current geospatial practices and serves as a guide to federal
21 departments and agencies providing support under the NRF, PPD-8, and Stafford Act activities.

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[86] Geospatial Platform. Available at https://www.geoplatform.gov/node/509

[87] *Geospatial Concept of Operations (GeoCONOPS)*, Version 6.0, June 2014, available at
https://www.geoplatform.gov/geoconops-home

The GeoCONOPS is an interagency collaboration with strategic direction provided by a federal interagency Geospatial Interagency Oversight Team (GIOT). The participants and intended audience of the GeoCONOPS include the GIOT Members, 15 Emergency Support Functions (ESF), both primary and support, and other federal mission partners. The GeoCONOPS is updated on a yearly basis to ensure it meets the needs of all mission partners.

The intended audiences for this document are the geospatial communities supporting homeland security and emergency management activities from the Joint Field Offices and operations centers to NRF headquarter entities. The GeoCONOPS outlines federal geospatial capabilities in support of state, local, and tribal authorities during homeland security and emergency management operations across the entire emergency management life cycle. The GeoCONOPS website[88] is a resource that provides:

- Geospatial mission blueprint of the resources and capabilities available for support in the Homeland Security Enterprise.
- Identifies points of coordination and collaboration.
- Documents authoritative geospatial data sources.
- Describes best practices.
- Identifies technical capabilities.

Table 4-6 is an extract from the GeoCONOPS Appendix: Authoritative Data Matrix, which lists over 1,200 data themes (datasets) by subcategory (Appendix C-2). These datasets are the desired resources, although many of those assets may not be available or have a URL link to their source availability. Users can search the on-line catalog for data listing content through the GeoCONOPS taxonomy using attributes, including; Type, Keywords, Category/Subcategory, etc.

Table 4-6. GeoCONOPS Authoritative Data Matrix (Extract)

	SUB CATEGORY	THEME	TYPE	POC	RESTRICTIONS	SOURCE	URL	ESF#	PPD-8 MISSION
HOMELAND SECURITY GEOSPATIAL CONCEPT OF OPERATIONS (GeoCONOPS)									
Team Members		Egg Production Farms	Polygon	USDA	n/a		http:www.ers.usda.gov/topics/animal-products/poultry-eggs.aspx#.UbcWJpxyaYk	5, 11	Protection, Response
		Sheep/Goat Farms	Polygon	USDA	n/a		http://www.ers.usda.gov/topics/animal-products/sheep,-lamb-mutton.aspx#.UbcWYpxyaYk	5, 11	Response
	Support Facilities	Agriculture Chemical Manufacture	Point	USDA	n/a		unavailable	5, 10, 11	Protection, Response
		State Fairgrounds	Point	NGA-PMHP	No	HSIP Gold	https://gii.dhs.gov/arcrest/services	5, 8, 11	Protection, Mitigation, Response
		U.S. Agriculture	Point	USDA	n/a		unavailable	5, 11	

[88] https://www.geoplatform.gov/geoconops-home

GeoCONOPS		Census							
		Veterinary Pharmaceutical Manufacture	Point	USDA	n/a		unavailable	5, 10, 11	Protection, Response
		Veterinary Services	Point	Dun & Bradstreet (D&B)	n/a	HSIP Gold	https://gii.dhs.gov/arcrest/services	1 thru 13	Prevention, Protection, Mitigation, Response, Recovery
		BANKING/FINANCE							
Requirements & Capabilities	**Banking and Credit**	Automated Check Clearing Houses	Point	Federal Reserve	n/a		unavailable	5, 13	Protection, Response
		Banking Institutions– National Credit Union Administration (NCUA)	Point	NCUA	n/a		http://www.ncua.gov/Legal/GuidesEtc/Pages/CUDirectory.aspx	5, 13	Protection, Response
PPD-8 Mission Areas		Branches/Agencies of Foreign Banks	Point	FDIC	Yes	HSIP Gold	https://gii.dhs.gov/arcrest/services	5, 13	Protection
		Credit Unions HQ	Point	NCUA	Yes	HSIP Gold	https://gii.dhs.gov/arcrest/services	5, 13	Protection
		Farm Credit Administration (FCA) Financial Institutions	Point	FCA	n/a		unavailable	5, 13	Protection

1

4.6.3 NATIONAL STATES GEOGRAPHIC INFORMATION COUNCIL GIS INVENTORY

The GIS Inventory[89] of the National States Geographic Information Council (NSGIC) is a tool for states and their partners. Its primary purpose is to track data availability and the status of Geographic Information System (GIS) implementation in state and local governments to aid the planning and building of Spatial Data Infrastructures. The random access metadata for online nationwide assessments (RAMONA) database is a critical component of the GIS Inventory. RAMONA moves its FGDC-compliant metadata for each data layer to a web folder and a Catalog Service for the Web (CSW) that can be harvested by Federal programs (e.g., GeoPlatform.gov) and others. This provides far greater opportunities for discovery of user information. The GIS Inventory allows the user to search by keywords including Theme or Place Names, Layer Category, Layer Name, Production Date, and Production Status. The GIS Inventory is maintained by individual users that document their own organizational information and data holdings.

At the time of this writing, the NSGIC GIS Inventory listed 23,012 results under its "Browse Data Layers" tab.

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[89] National State Geographic Information Council (NSGIC), available at http://www.gisinventory.net/

4.7 STAKEHOLDER PERFORMANCE GUIDANCE: DATA

The Performance Guidance provides a summation of the key decision points necessary to determine the most effective and efficient design, development, and implementation of the geospatial system investment.

Table 4-7. Stakeholder Performance Guide: Data

STAKEHOLDER PERFORMANCE GUIDE			
CHAPTER 4 – DATA			
Role	Responsibility	Approach	Benefit
Executive Leadership	• Authorize a Business Needs Analysis to identify geospatial data requirements using the Baseline Assessment Matrix: Data. • Agreed upon data authorized source to reduce redundancy and determine Enterprise License Agreement (ELA) opportunity with data provider/vendor. • Require any/all funded data creation or enhancement initiatives (e.g., contract award, cost-share, grant, etc.) include metadata standard compliance.	• Work with other Executives to acknowledge the need to reduce data costs by leveraging investment and performing the Baseline Assessment based upon mission/business needs. • Based upon business/mission need during Data Matrix assessment, may require Service Level Agreement and cost share for availability and Enterprise License Agreement (ELA) with vendor/provider. • Working with Exec Leadership approach Chief Procurement Officer to require contract language for the inclusion for all financial obligations.	• Signatory with defined responsibility and stated measurable results (e.g., IT Asset Inventory for OMB Open Data Policy reporting and a quantifiable data resource inventory). • The inventory would facilitate the identification of desired datasets; identifies redundant data assets for decommissioning; identifies opportunities to reuse or extend a data asset rather than creating a new one; and the opportunity to reduce redundancy costs based upon the establishment of enterprise licensing agreements and allows for cost share for economies of scale. • Provides a way to uniformly describe data, thereby supporting its discovery and sharing resulting in cost avoidance. Compliance with government *Open Data Policy*.

STAKEHOLDER PERFORMANCE GUIDE			
CHAPTER 4 – DATA			
Role	**Responsibility**	**Approach**	**Benefit**
Program Manager	• Coordinate across organization's geo investment PMs for completion of Data Matrix and document business/mission functional requirements that drive data needs. • Determine which dataset will be used enterprise-wide based upon data content, currency, and availability. • Work with PMs across enterprise to perform review of internally produced data includes metadata with a common taxonomy and cataloged for discovery. • Post datasets in open standards to appropriate catalogs for discovery.	• PMs prepare Data Matrix and schedule survey and follow-on interviews to clarify Data findings with business owners to understand functional needs. • Detailed assessment of datasets and how they meet the mission/business functional requirements. May require ELA with broader use terms and additional attributes requiring cost-share. • Review procurement vehicles to ensure metadata standard compliance language. Develop a common taxonomy for cataloging the metadata enhanced data resources. • Ensure enterprise data are exposed or 'harvestable' to appropriate web catalog services.	• Awareness and understanding of enterprise data requirements and business/mission owner functional needs that drive data. • Reduced contracting for vendor provided data, ELA discounts for volume-based pricing, data Steward responsibility as opposed to multiple posting/storage of datasets. • Ability to identify, search, discover and share datasets across the enterprise. • Facilitates the search and identification of geospatial data sharing. Compliance with government *Open Data Policy*.
Solution Architect	• Data Assessment Matrix design and development. • Ensure data are cataloged and available in open standards and posted to web catalog service.	• Assist the data matrix interview with mission/business owner to determine functional requirements that drive data and application needs. • Develop technical approach for ensuring enterprise data resources are available, vetted, and provided in compliance with open data requirements.	• Technical vetting and validation across investments for desired To-Be end-state environment. Understand functional requirements to optimize application development and data resource acquisition. • Facilitates the search and identification of geospatial data sharing. Compliance with government Open Data Policy.

1

2

5 APPLICATION/SERVICE REFERENCE MODEL

5.1 INTRODUCTION

Definition/Description (What) – is a mission/business driven functional framework that provides guidance and evaluation practices used to identify, document, classify, discover, deliver, and share geospatial application and service (App/Svc) capabilities. It provides the basis for categorizing IT App/Svc investments across an organization's enterprise geospatial architecture.

Purpose/Function (Why) – as an organization documents and catalogs their current and planned App/Svc investments, gaps and redundancies will become evident, which will aid in identifying opportunities for sharing, reuse, consolidation, redesign, renegotiating or developing new sources. Organizations and enterprise architectures will benefit from economies of scale by identifying and reusing the best solutions and technologies for applications that are developed, provided or subscribed to support their mission, business functions and target geospatial architecture.[90] This chapter provides a process to document and leverage IT investment assets from a shared services perspective by:

- Establish a process for base lining and documenting geospatial applications and services.

- Providing an understanding of design principles for shared services.

- Provide guidance for complying with Federal shared services policy.

- Provide [limited] references to resources for shared applications and services.

Stakeholder Performance Guide (Who & How) – Executive Leadership and Program Managers responsible for policy setting and compliance, strategic program direction, resource planning and approval (e.g., fiscal and human), and Solution Architects for identifying, documenting, and sharing technical solutions for applications and services. This model helps managers or architects understand the geospatial services delivered by their organization, and others; and assess whether there is an opportunity to group like services and create opportunities for reuse or shared services.

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[90] *Segment Architecture Analysis of the Geospatial Platform*, Version 1.0, December 21, 2010. Federal Geographic Data Committee, in support of the Federal Chief Information Officers Council. Available at http://www.fgdc.gov/geospatial-lob/draft-segment-architecture-review/Segment-Architecture-Analysis-of-the

5.2 APPLICATION/SERVICE REFERENCE MODEL(S): APPROACH

Federal Agencies are expected to implement the *Federal Information Technology Shared Services Strategy*[91] and make "Shared-First" the default approach to IT service planning and delivery. Geospatial Apps/Svcs are becoming "commoditized" to a level where users, including the general public, have come to expect these services to be readily available to them anytime, anywhere, on any device, at no/low cost. These expectations are impacting the way in which Apps/Svcs are designed, developed, and delivered. Federal Agencies must also eliminate wasteful spending that result from implementing duplicative solutions for mission, support, and commodity IT functions. A review of over 7,000 Federal Agency IT investments reported to OMB for Budget Year 2013 revealed many redundancies and billions of dollars in potential savings that could be achieved through consolidation and a shared approach to IT service delivery within and between agencies.[92] Along the same lines, in 2011 the U.S. Government Accountability Office (GAO) identified thirty-four (34) areas where Federal Agencies provide similar services to the same customer groups within and outside of government, with billions of dollars in potential savings if these services were reconciled, consolidated, and moved to a shared delivery model.

The App/Svc Reference Model will focus upon a practical approach to documenting the geospatial App/Svc requirements and capabilities within and across an organization to meet mission/business requirements as well as provide guidance for description, cataloging, sharing and Federal policy compliance. The App/Svc Reference Model is not:

- A "how to" manual for building and maintaining applications and services.
- A taxonomy for cataloging applications and services.
- A definitive list of available applications and services.

5.3 GEOSPATIAL SERVICES TAXONOMY STRUCTURES[93]

There are differences of opinion across the geospatial community whether geospatial is a mission specific capability, or an enterprise-wise service offering, and now many expect it to simply be another commodity service offering. The cross-cutting nature of Geospatial Information Systems makes it difficult to neatly categorize the technology other that the widely held opinion that it needs to be a shared service.

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[91] *Federal Information Technology Shared Services Strategy*, OMB, May 2, 2012, http://www.whitehouse.gov/sites/default/files/omb/assets/egov_docs/shared_services_strategy.pdf

[92] *Federal Information Technology Shared Services Strategy*, OMB, May 2, 2012.

[93] Much of the information in this section is taken directly from the *Federal Enterprise Architecture Framework, V2.0*; the *Federal Information Technology Shared Services Strategy*; and the *Federal Shared Services Implementation Guide*.

5.3.1 FEDERAL ENTERPRISE ARCHITECTURE FRAMEWORK, VERSION 2.0

An IT shared service is defined as: "An information technology function that is provided for consumption by multiple organizations within or between Federal Agencies."[94] There are three general categories of IT shared services: commodity, support, and mission; which are delivered through cloud-based or legacy infrastructures, as is shown in Figure 5-1. Note that Geospatial is highlighted within the Mission IT Category as a Service Type.
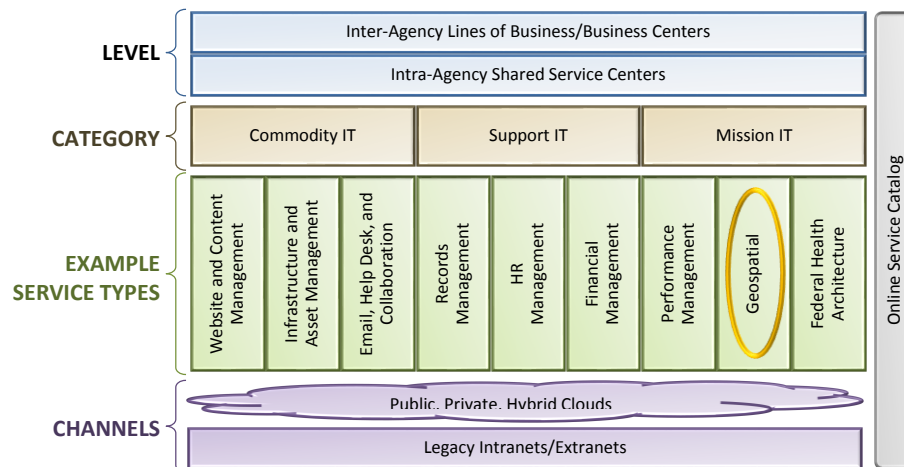
Figure 5-1. IT Shared Services Concept Overview

However; when the three general categories of IT shared services are defined, the *Shared Services Strategy* also places Geographic Information Systems as an IT Support Service:

- Commodity IT Services: A category of back-office IT services whose functionality applies to most, if not all, agencies (e.g., infrastructure and asset management, email, hardware and software acquisition, and help desks).

- Mission IT Services: A category of enabling IT that support agency core business functions.

- Support IT Services: A category of back-office IT services whose functionality applies to multiple agencies and is business focused (e.g., **Geospatial Information Systems**).

The purpose of the *Federal Enterprise Architecture Framework's* Application Reference Model (ARM) is to provide the basis for categorizing applications and their components. It is expected that as agencies map their current and planned Information Systems to the ARM categories (as required by the OMB IT asset inventory annual reporting guidance), gaps and redundancies will

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[94] Office of Management and Budget, *Federal Enterprise Architecture Framework*, Version 2.0, January 13, 2013.

1 become evident, which will aid in identifying opportunities for sharing, reuse, and consolidation
2 or renegotiation of licenses.

3 As seen in Figure 5-2, the ARM consists of three levels: Systems, Application Components, and
4 Interfaces. Note that Geospatial is highlighted within the Application Components category as
5 opposed to a [Mission IT] support System.

Systems	
Acquisition Management	Legal
Customer Service	Human Resources Management
Emergency Management	Physical Safety
Financial Management	Property and Asset Management
Grants Management	Security Management
Workforce Management	Systems Management

Application Components	
	Middleware
Analysis, Reporting, and Statistics	Process Automation and Management
Data Management	Productivity
Development Environment and Tools	Security Controls
Document and Content Management	Unified Communication and Collaboration
Geospatial Information	Visualization
Knowledge Discovery and Management	Web Access

Interfaces
Application Interface

6
7 Figure 5-2. Federal Enterprise Architecture Framework (FEAF): Application Reference Model

8 The three levels: Systems, Application Components, and Interfaces are defined as:

9 • **Systems** – are discrete sets of information technology, data, and related resources,
10   organized for the collection, processing, maintenance, use, sharing, dissemination
11   or disposition of information in support of a specific business process. The ARM
12   Systems category does not include mission-specific systems.

13 • **Application Components** – are self-contained software that can be aggregated or
14   configured to support, or contribute to achieving, many different business
15   objectives, processes, and multiple IT Systems.

16 • **Interfaces** – are protocols used to transfer information from system to system.

17 When the Geospatial Information Application Component is further expanded as shown in Figure
18 5-3, the granular level of detail is limited to five categories.
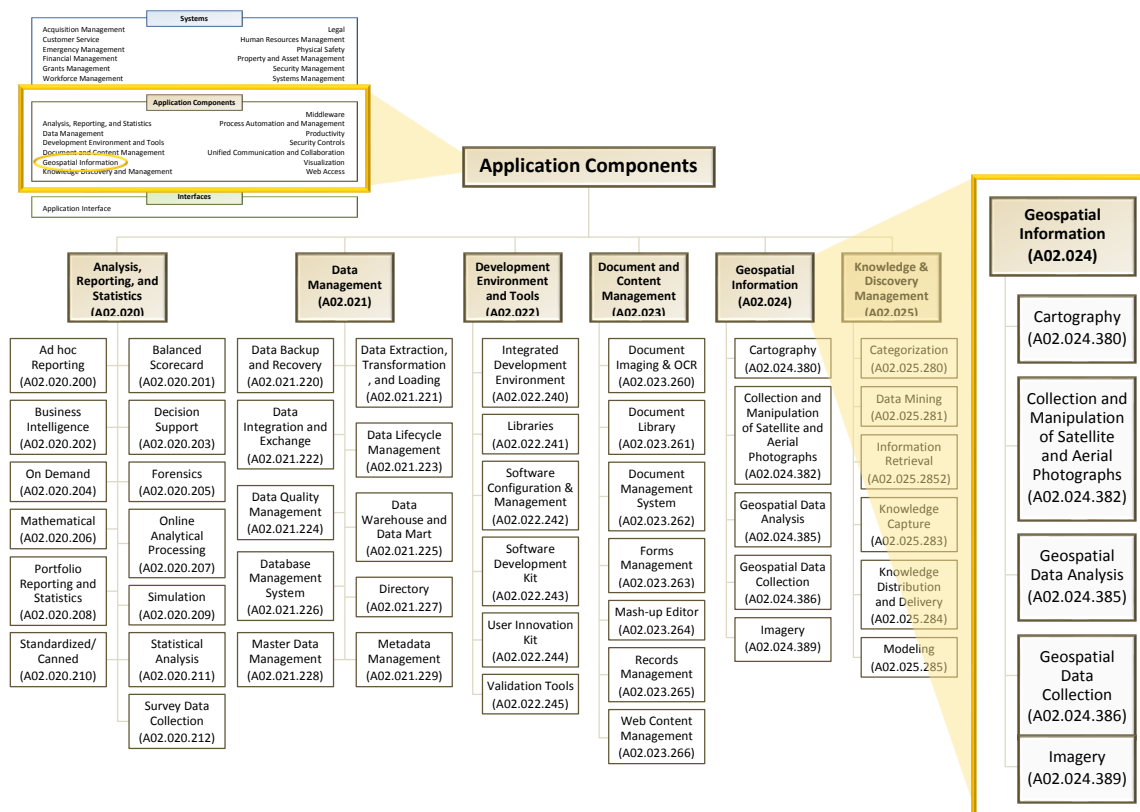
Figure 5-3. FEAF Application Reference Model: Geospatial Information

5.3.2 GEOSPATIAL PROFILE OF THE FEDERAL ENTERPRISE ARCHITECTURE FRAMEWORK, VERSION 2.0[95]

The Geospatial Profile of the Federal Enterprise Architecture provides an Appendix that lists a set of some 68 geospatial service components that might apply within an agency's services architecture. It is a business-driven, functional framework that describes how geospatial services can support mission/business and performance objectives. This list provides Program Managers and Solution Architects with a view of how geospatial fits within an organization operational requirements and can be used to educate mission/business owners about how geospatial can support their needs (Section 3.3). Table 5-1 is an extract from the *Geospatial Profile's* Appendix C: Geospatial Service Components that describes the business-driven geospatial services.

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[95] Geospatial Profile of the *Federal Enterprise Architecture (FEA)*, Version 2.0, March 06, 2009.

1   Table 5-1. Geospatial Profile V2.0: Geospatial Service Components (Extract)

FEA SERVICE DOMAIN	FEA SERVICE TYPE	FEA SERVICE COMPONENT	FEA SERVICE COMPONENT DESCRIPTION	GEOSPATIAL SERVICE COMPONENT (* = Multiple Entries)	GEOSPATIAL SERVICE COMPONENT DESCRIPTION
Back Office Services Domain	Assets/ Materials Management	Facilities Management	Defines the set of capabilities that support the construction, management, and maintenance of facilities for an organization.	Facilities Management System	A GIS-based Facilities Management System
Back Office Services Domain	Assets/ Materials Management	Property/ Asset Management	Defines the set of capabilities that support the identification, planning, and allocation of an organization's physical capital and resources.	Property/Asset Management System	A GIS-based Property – Asset Management System
Back Office Services Domain	Data Management	Data Exchange	Support the interchange of information between multiple systems or applications; includes verification that transmitted data was received unaltered.	Geospatial Data Exchange and Translation Services	The ability to import/export, manipulate, and convert geospatial data through standard data exchange and trans-formation services. Services to transform geospatial data schemas between disparate systems.

5.3.3 SEGMENT ARCHITECTURE ANALYSIS OF THE GEOSPATIAL PLATFORM, VERSION 1.0

The *Segment Architecture Analysis of the Geospatial Platform*[96] noted that a complex business component system such as a GIS does not fit neatly under the Federal Enterprise Architecture taxonomy. Geospatial cuts across many, if not all service types defined within the FEAF. To address this complexity, the Geospatial Platform analysis recognized the variation in taxonomies and provided an expanded categorization adaptation from several the geospatial service components to reflect the roles of geospatial across an enterprise. Figure 5-4 depicts the seven higher-level service categories or "Types" that are grouped into the areas of; access, analysis,

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[96] *Segment Architecture Analysis of the Geospatial Platform*, Version 1.0, December 21, 2010. Federal Geographic Data Committee, in support of the Federal Chief Information Officers Council. Available at http://www.fgdc.gov/geospatial-lob/draft-segment-architecture-review/Segment-Architecture-Analysis-of-the

1 services, and systems. Within these 7 types are the 23 dependent service "Components." The
2 figure represents two main layers of the Geospatial Services Framework:

3 • Service Type – Provides a seven-layer categorization that defines the context of a
4 specific set of service components.

5 • Service Component – A self-contained business process or service with
6 predetermined and well-defined functionality that may be exposed through a
7 business or technology interface.

MAPPING SERVICES
- Geographical Information System
- GIS Server
- Map(ping) Client
- Topology Service

IMAGERY ACCESS
- Web Map Service
- Map Publication Service

GEOGRAPHICAL FEATURE DATA ACCESS
- Native Geospatial DBMS Server
- Geospatial Data Exchange and Translation Services
- Web Feature Service
- Geospatial Information Broker

METADATA AND CATALOG SERVICES
- Geospatial Resource Metadata (Catalog) Update Service
- Geospatial Service Metadata (Catalog) Update Service
- Registry Service

GEO-CODING AND GAZETTEER SERVICES
- Gazetteer Update Service
- Geocoder/Reverse Geocoder Service
- Coordinate Transformation Service

GEOGRAPHICAL ANALYSIS
- Sensor Planning Service
- Geoparser Service
- Geolocate Service
- Navigation Service
- Model Service

IMAGE PROCESSING SYSTEM
- Geospatial Imagery Processing Server
- Terrain Simulator

8
9 Figure 5-4. Geospatial Services Framework[97]

10 The seven services "Types" are described as:[98]

[97] Service types taken from the *Enterprise Architecture Segment Report* (Draft Interim Instruction Guide for Quarter 4 FY2009). Service components taken from the *Geospatial Profile of the Federal Enterprise Architecture*, Version 2.0.

[98] *Segment Architecture Analysis of the Geospatial Platform*, Version 1.0, December 21, 2010. Federal Geographic Data Committee, in support of the Federal Chief Information Officers Council.

- Mapping Services Descriptions – access vector and raster data and render them in the form of a map for display (combines access and portrayal). Independent of whether the underlying data are features (point, line, and polygon) or coverages (such as gridded digital terrain models or images), the mapping service produces data that can be directly viewed in a Web browser. Data are labeled as one or more "layers," each of which is available in one or more "styles."

- Imagery Access Descriptions – provides an image of a requested layer(s) in either the specified or default rendering style(s). Typical output formats include Portable Network Graphics (PNG) format, Graphics Interchange Format (GIF), Joint Photographic Expert Group (JPEG) format, and Tagged Image File Format (TIFF).

- Geographic Feature Data Access Descriptions – for selecting, browsing, extracting, transforming, and updating of a geographic feature database.

- Metadata and Catalog Services Descriptions – for browsing, entering, transforming, integrating, and updating metadata for geospatial resources, and optionally, updating of associated geospatial resource records. A geospatial catalog supports search against geographic feature and imagery data through metadata.

- Geo-Coding and Gazetteer Services Descriptions – provides the ability to determine the geospatial coordinates for a place, given an address, place name, or identifier. This function accesses a database of geographic features and returns the location and other descriptive information.

- Geographical Analysis Services Descriptions – is a Web service that computes a geographic function for a specified geographic input, including computational overlay functions of a GIS.

- Image Processing System Services Descriptions – is an integrated system for collecting, storing, accessing, sharing, disseminating, integrating, manipulating, visualizing, analyzing, and otherwise exploiting geospatial imagery.

The 23 Service Components within the 7 Types are each defined within the *Segment Architecture Analysis of the Geospatial Platform*.

5.3.4 OPEN GEOSPATIAL CONSORTIUM: OPENGIS SERVICE ARCHITECTURE

The Open Geospatial Consortium[99] (OGC®) notes that, "There exist multiple possible taxonomies for services, based on various classification dimensions … the purpose of defining a taxonomy … is to have one way of identifying geographic extensions to various existing service types. [This] is not intended to be the only taxonomy to be used in the context of geographic services."

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[99] Open Geospatial Consortium. http://www.opengeospatial.org/

The OGC® Service Architecture Abstract Specification[100] applied the International Standards Organization (ISO) 19101[101] to define six classes of information technology services as the basis to categorize geographic services. ISO 19101 defines the Extended Open Systems Environment (EOSE) model for geographic information. The EOSE defines classes of services based on the semantic type of computation that they provide. EOSE provides the functional decomposition of the services for the geographic domain by extending the more general Open System Environment model [ISO/IEC TR 14252]. The IT Services use to categorize geographic services included:

- Human interaction services – for management of user interfaces, graphics, multimedia, and for presentation of compound documents.

- Model/Information management services – for management of the development, manipulation, and storage of metadata, conceptual schemas, and datasets.

- Workflow/Task services – for support of specific tasks or work-related activities conducted by humans. These services support use of resources and development of products involving a sequence of activities or steps that may be conducted by different persons.

- Processing services – perform large-scale computations involving substantial amounts of data. Examples include services for providing the time of day, spelling checkers, and services that perform coordinate transformations (e.g., that accept a set of coordinates expressed using one reference system and converting them to a set of coordinates in a different reference system). A processing service does not include capabilities for providing persistent storage of data or transfer of data over networks.

- Communication services – for encoding and transfer of data across communications networks.

- System management services – for the management of system components, applications, and networks. These services also include management of user accounts and user access privileges.

The resulting Geographic Services Taxonomy, depicted in Table 5-2, uses the IT services and expands the processing services to include; spatial, thematic, temporal, and metadata.

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[100] OpenGIS Abstract Specification, Topic 12 "System Architecture," OpenGIS Consortium, Version 4.2, October 2001. Available at http://www.opengis.org/techno/abstract.htm Volume 12 is equivalent to ISO/DIS 19119, Geographic information – Services (2002). ISO 19119 was subsequently published in 2005. As of the date of this document, ISO 19119 is under revision.

[101] International Standards Organization (ISO), ISO 19101:2002 Geographic information – Reference Model. INCITS subsequently approved ISO 19101:2002 as INCITS/ISO 19101-2002 (R2012), available for purchase at http://webstore.ansi.org/RecordDetail.aspx?sku=INCITS%2fISO+19101-2002+(R2012). ISO 19101-1 rev. Geographic information - Reference model - Part 1: Fundamentals (Revision of ISO 19101:2002) is pending publication as of the date of this document.

1   Table 5-2. Geographic Services Taxonomy[102]

GEOGRAPHIC SERVICES TAXONOMY
• Geographic human interaction services
• Geographic model/information management services
• Geographic workflow/task management services

• Geographic processing services
   ◦ Geographic processing services – spatial
   ◦ Geographic processing services – thematic
   ◦ Geographic processing services – temporal
   ◦ Geographic processing services – metadata

• Geographic communication services
• Geographic system management services

2   The OGC® Service Architecture Abstract Specification goes on to map its Geospatial Services
3   Taxonomy to that of the ISO 19100 series standards as displayed in **Error! Reference source not**
4   **found.**.

5   Table 5-3. OGC® Geospatial Services Taxonomy to ISO 19100 Series Standards

EXTENDED OSE SERVICE CATEGORY	RELEVANT ISO 19100 SERIES STANDARD
Geographic human interaction services	19117 Geographic information – Portrayal
	19128* Geographic information – Web Map Server interface
Geographic model/information management services	19107# Geographic information – Spatial schema (See note)
	19110 Geographic information – Methodology for feature cataloguing
	19111+ Geographic information – Spatial referencing by coordinates
	19112 Geographic information – Spatial referencing by geographic identifiers
	19115# Geographic information – Metadata
	19123 Geographic information – Schema for coverage geometry and functions
	19125-1* Geographic information – Simple feature access – Part 1: Common architecture
	19128* Geographic information – Web Map server interface
	19136* Geographic information – Geography Markup Language
	19142* Geographic Information - Web Feature Service Interface
	19143* Geographic Information – Filter Encoding Interface
	19156:2011* Geographic information -- Observations and measurements
Geographic workflow/task management services	(no relevant ISO 19100 series standards)
Geographic processing service	19107# Geographic information – Spatial schema

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[102] Based on OpenGIS Abstract Specification, Topic 12 "System Architecture," OpenGIS Consortium, Version 4.3, October 2002, Available at http://www.opengeospatial.org/standards/as.

EXTENDED OSE SERVICE CATEGORY	RELEVANT ISO 19100 SERIES STANDARD
	19108 Geographic information – Temporal schema
	19109 Geographic information – Rules for application schema
	19111+ Geographic information – Spatial referencing by coordinates
	19116 Geographic information – Positioning services
	19123 Geographic information – Schema for coverage geometry and functions
	19118 Geographic information – Encoding
Geographic communication services	19149* Geographic information -- Rights expression language for geographic information -- GeoREL
Geographic system management services	(no relevant ISO 19100 series standards)

1
2   "*" An OGC standard that was submitted to ISO.
3   "#" An ISO standard approved as a topic volume of the OGC Abstract Specification
4   "+" Jointly developed OGC and ISO standard

5

5.3.5 SPATIAL DATA INFRASTRUCTURE: COOKBOOK[103]

7   The *SDI Cookbook* identifies existing and emerging standards, open-source and commercial
8   standards-based software solutions, supportive organizational strategies and policies, and best
9   practices. "The SDI Cookbook wiki is intended as a 'living document' which provides information
10   on standards and best practices for implementing a Spatial Data Infrastructure."

11   The *SDI Cookbook* defines services as:

12   **"… self-contained, self-describing, modular applications consisting of collections**
13   **of operations, accessible through interfaces, which allow clients to evoke**
14   **behaviors of value to the user. Clients can invoke services from across a network**
15   **using standardized protocols independently of platform, language, or object**
16   **model on which the services or the client were deployed."**

17   The OGC Service Framework groups geospatial services into five categories corresponding to the
18   OGC services taxonomy top-level domains described in OGC's Service Architecture Abstract
19   Specification (also ISO 19119[104]). The *SDI Cookbook* provides a summary of these categories
20   (below), and when available, includes implementation specifications for these services:

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[103] The information in this section is taken directly from SDI Cookbook, Global Spatial Data Infrastructure, GSDIWiki, last updated 5 June 2014. Available at http://www.gsdidocs.org/GSDIWiki/index.php/Main_Page

[104] ISO 19119:2005 Geographic information – Services. "ISO 19119:2005 identifies and defines the architecture patterns for service interfaces used for geographic information, defines its relationship to the Open Systems Environment model, presents a geographic services taxonomy and a list of example geographic services placed in the services taxonomy. It also prescribes how to create a platform-neutral service specification, how to derive conformant platform-specific service specifications, and provides guidelines for

- Catalogue Services – respond to requests for metadata in a Catalogue that comply with certain browse or search criteria. Geospatial data that are stored for use in local databases can often be used in external applications once they are published. In this chapter, the concepts and implementation of geospatial data catalogues are presented as a means to publish descriptions of your geospatial data holdings in a standard way to permit search across multiple servers.

  ◦ Note: A Catalogue is a single collection of metadata entries that are managed together.

- Geospatial Data Services - provide access to a wide range of collections of geospatial data stored in distributed repositories and databases. Examples of data services include:

  ◦ Feature Access Services: provide access and management of feature stores. *Applicable implementation specification: OGC Web Feature Service (WFS; http://www.opengeospatial.org/standards/wfs http://www.opengis.org/docs/02-058.pdf)*

  ◦ Coverage Access Services: provide access and management of coverage stores. *Applicable implementation specification: OGC Web Coverage Service (WCS; http://www.opengeospatial.org/standards/wcs)*

  ◦ Sensor Collection Services: provide access, manipulation and collection of sensor observations. *Applicable implementation specification: OGC Sensor Collection Service (SCS; http://www.opengis.org/docs/02-028.pdf)*

  ◦ Image Archive Services: provide access and management of large sets of digital images and related metadata

- Data services also provide access to location-based data in the form of the following services *(Applicable implementation specification: OGC Location Services OLS; http://www.opengeospatial.org/standards/ols)*:

  ◦ Directory Services: provide access to online directories to find the locations of specific or nearest places, products or services

  ◦ Geocoding Services: transform a description of a location (place name or street address) into a normalized description of the location

  ◦ Navigation Services: determine travel routes and navigation between two points

  ◦ Gateway Services: fetch the position of a known mobile terminal from the network

- Portrayal services – provide visualization of geospatial information. Given one or more inputs, portrayal services produce rendered outputs (maps, perspective views of terrain, annotated images, etc.). They can be tightly or loosely coupled with other services such as the Data and Processing services, and can transform, combine, or create portrayed outputs. Examples of such services include:

  ◦ Map Portrayal Services

  ◦ Coverage Portrayal Services: *Applicable implementation specification: OGC Coverage Portrayal Service (CPS; http://www.opengis.org/docs/02-019r1.pdf*)

  ◦ Mobile Presentation Services

- Processing services – unlike data services, are not associated with specific datasets. Instead, they provide operations for processing or transforming data in a manner determined by user specified parameters. Processing services can be tightly or loosely coupled with other services such as the Data and Processing Services. The most common examples of processing services are:

  ◦ Coordinate Transformation Services: convert geospatial coordinates from one reference system to another. *Applicable implementation specification: Coordinate Transformation Services (CTS; http://www.opengeospatial.org/standards/ct*)

  ◦ Image Processing Services, detailed in OGC's Abstract Specification Topic 15 *http://www.opengeospatial.org/standards/as*, include:

- Image Manipulation Services - manipulate images (resizing, changing color and contrast values, applying various filters, manipulating image resolution, etc.) and are used for conducting mathematical analyses of image characteristics (computing image histograms, convolutions, etc.).

- Image Exploitation Services - support the photogrammetric analysis of remotely sensed and scanned imagery and the generation of reports and other products based on the results of the analysis.

- Image Synthesis Services - create or transform images using computer-based spatial models, perspective transformations, and manipulations of image characteristics to improve visibility, sharpen resolution, and/or reduce the effects of cloud cover or haze.

- Geospatial Analysis Services: exploit information available in a Feature or Feature Collection to derive application-oriented quantitative results that are not available from the raw data itself.

- Gazetteers: provide access to geospatial data indexed by place name rather than by coordinate locations. *Applicable Gazetteer Service – Application profile of the Web Feature Service Best Practice 1.0 (*http://www.opengeospatial.org/standards/bp*)*

- Service Chaining – can be considered as a special case of processing services, enabling the combination or pipelining of results from different services in response to clients' requests. Efficient service chaining is critical to the ability to leverage and combine multiple information sources hosted by various service providers. Service chaining is required when a task needed by a client cannot be provided by a single service, but rather by combining or pipelining results from several complementary services. Most GIS applications will require the chaining of multiple geospatial and non-geospatial services.

5.3.6 GEOSPATIAL TAXONOMY CONSIDERATIONS

The successful adoption and use of the geospatial Application/Service Reference Model will depend upon achieving consensus on a consistent, well-known and well-understood set of names and definitions for geospatial service components. Aligning agency capital investments to an agreed upon Apps/Svcs Reference Model leverages a common, standardized vocabulary, allowing interagency discovery, collaboration, and interoperability. Agencies and the Federal Government will benefit from economies of scale by identifying and reusing the best solutions and technologies for applications that are developed/provided or subscribed to support their business functions, mission, and target architecture.[105]

Several initiatives described above have attempted to refine a view of geospatial applications/services taxonomies. These examples will be useful to the geospatial stakeholders (e.g., Program Managers and Solution Architects) developing the geospatial services and how they expose them as shared services in places like Repositories and App Stores. However, there is no commonly agreed to, consensus-driven or policy-based geospatial applications and services taxonomy to uniformly categorize capabilities across the geospatial community. No one categorization [currently] will meet the user communities' requirements in terms of mission/business function(s), understanding and ease of use.

> **When developing an organization's IT Asset Inventory and corresponding Apps/Svcs categorization, the geospatial investment owners responsible for delivering the mission/business functionality across the enterprise must agree upon the name, definition of the service types and their components.**

5.4 GEOSPATIAL BASELINE ASSESSMENT MATRIX: APPLICATIONS AND SERVICES

As part of the Executive Steering Committee's authority to initiate the enterprise-wide Geospatial Baseline Assessment (Section 3.4), application and service requirements based upon

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[105] Office of Management and Budget, *The Common Approach to Federal Enterprise Architecture*, May 12, 2012.

1 mission/business functional needs from the Operational Requirements Document must also be
2 identified. This business analysis should include a categorization of the general types of Apps/Svcs
3 necessary to meet the functional needs of the organizations. Regardless of the final categorization
4 used in defining the Apps/Svcs (Section 5.3), the Baseline Assessment will require a discussion
5 with the user community to define requirements, especially mission/business owners not
6 intending to create a geospatial capability of their own. One of the challenges with defining the
7 geospatial application/services functional requirements with non-geospatial centric
8 mission/business owners is that geospatial functionality is often merely one type of capability that
9 is needed by the user or system. Often, geospatial is a secondary service capability that may be
10 used to contribute to or integrate with other primary service requirements. An example of this is
11 the requirement for a Common Operating Picture (COP), while having a geospatial visualization
12 component, it is primarily a decision support system requiring such functionality as; document
13 management, incident management tracking, reporting, alerts and notifications, email triage with
14 automated ingest, request for information, and archival capabilities.

15 Table 5-4 and Appendix D.1 provides an example of the general functional categories of
16 applications and services that do not necessarily correspond directly with the taxonomies in
17 Section 5.3, but provide a starting point for which to develop more detailed or drill-down
18 Apps/Svcs assessment.

19 Table 5-4. Geospatial Baseline Assessment Matrix: Functionality Categories

Geospatial Baseline Assessment: Functionality

Category	Org #1	Org #2	Org #3	Org #4	Org #5	Org #5	Common Score	Pct %
Geospatial: Visualization	C	C	P	C	C	C	6	100%
Geospatial: Analysis / Processing	C	C		C	C	C	5	83%
Reporting	C	C		P	C	C	5	83%
Search & Discovery	P	C		C		C	4	67%
Alerts & Notifications	P	C	P	P	C	C	6	100%
Collaboration	P	C			C	C	4	22%
Content Management	P	C			C	C	4	22%
Resource Management	C				C	C	3	50%
Data Management	C	P		C	C	C	5	83%
Modeling	C	P	P	P	P	C	6	100%
Analytics	C	C	P	C	C	C	6	100%
IT Security	C	P	P	C	C	C	6	100%
Other								0%
Status c - Current P - Planned								

20

21 This initial categorization is expanded in Table 5-5 which provides a basis to perform an inventory
22 of specific Apps/Svcs either currently existing, planned for development or acquisition. Table 5-5

1 provides an extract of the two-page Baseline Apps/Svcs Assessment Matrix that is contained in
2 Appendix D.2.

3 Table 5-5. Geospatial Baseline Assessment Matrix: Applications and Services (Extract)

Geospatial Baseline Assessment: Functionality of Applications and Services

Functionality	Category	Org #1	Org #2	Org #3	Org #4	Org #5	Org #6	Common Score	Pct (%)
GIS Visualization	Geospatial	C	C	C	C	C	C	6	100%
ANSI 415 Map Symbology	Geospatial	C		C		P	P	4	67%
Mil 2525B Map Symbology	Geospatial						P	1	17%
Geocode Address / Place	Geospatial	C	C	C	C	C	C	6	100%
Reverse Geocode	Geospatial	C	P	C		C	P	5	83%
Batch Geocode	Geospatial	P	P	C		C	C	5	83%
Gazeteer	Geospatial	P	C	C		C	C	5	83%
Translate Coordinate Systems / Grids	Geospatial	P	C	C			C	4	67%
Decimal Degrees	Geospatial	P	C	C	C	C	C	6	100%
Decimal Minutes Seconds	Geospatial	P	C	C		C	C	5	83%
Other Coordinate Systems / Projections	Geospatial			C		C		2	33%
US National Grid	Geospatial	P	C	C			C	4	67%
Military Reference Grid	Geospatial	P		C	C			3	50%
Add Custom GIS data	Geospatial	P	P	C		C	C	5	83%
Export Data Layers	Geospatial	P	P	C		C	C	5	83%
Print Map	Geospatial	C	P	C	C	C	C	6	100%
Export Map	Geospatial	P	P	C	C	C	C	6	100%
GIS analysis / processing	Geospatial	C	C				C	3	50%
Imagery Visualization	Digital Photography / Streaming Video	C	P	C	C		C	5	83%
Streaming Video	Digital Photography / Streaming Video	P	P	C	C		C	5	83%
Live Camera Feeds	Digital Photography / Streaming Video	P	P	C	C		C	5	83%
Reporting	Reporting	C	P	C	C	C	C	6	100%
Reporting Templates	Reporting	C	P	C	C	C	C	6	100%
Standard Form Generation	Reporting	P	P	C	C	C	C	6	100%
Export Reports / Output	Reporting	C	P	C	C	C	C	6	100%
Search Tools	Search & Discovery	P	C	C	C	C	C	6	100%
Auto-ingest / Harvesting	Search & Discovery	P	C	C	C	C	C	6	100%
Unstructured Text / Document Search	Search & Discovery	P	P	C	C	C	C	6	100%
Cataloging	Search & Discovery	P		C		C	C	4	67%

5 Table 5-4 and Table 5-5 (Appendix D.1 and D.2) are not intended to be a definitive list of
6 geospatial Application/Services functional capabilities, but serve as a basis for the Executive
7 Steering Committee to task the development of a comprehensive and mutually agreed upon
8 taxonomy of Apps/Svcs among the organization's geospatial practitioners (e.g., Program
9 Managers and Solution Architects) and mission/business owners. This will in turn foster the
10 discussion to determine operation requirements and the opportunity to share geospatial services
11 across the enterprise. The inventory of these Applications/Services across the enterprise will also
12 serve to meet the OMB reporting requirement of the *Federal IT Shared Services Strategy*[106] to
13 submit an "Enterprise Roadmap" that includes a list of IT assets agency-wide to include all IT
14 systems and services that support mission, administrative, and commodity IT programs, using [or
15 aligned to] the Federal Enterprise Architecture Reference Model taxonomies provided in the
16 Common Approach.

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[106] Office of Management and Budget, *Federal IT Shared Services Strategy*, May 2, 2012.

5.5 GEOSPATIAL APPLICATIONS/SERVICES CATALOGS

Currently, Federal Agencies have limited information regarding the full spectrum of inter-agency IT shared service options that are available.[107] The OMB, working with the Federal CIO Council's Shared Services Subcommittee established an online IT Services Catalog[108] to provide Federal Agencies with a list of available services and contract vehicles. The Federal Shared Services Catalog – Uncle Sam's List (Figure 5-5) is intended to be a "prices paid portal," that identifies candidate shared services in the areas of: Commodity IT, Support Services and Mission IT, which included Geospatial listed under Mission IT in Section 5.3.1; however, it does not, nor is it intended to, provide geospatial applications/services as described in this chapter.

Figure 5-5. Uncle Sam's List

Although the OMB Enterprise Roadmap[109] will include an inventory of all of the agency's IT applications, systems, and services, there are limited resources for geospatial applications/services catalogs available to the user community. The Segment Architecture Analysis of the Geospatial Platform,[110] as part of its Target Analysis states that in the [desired or To-Be] target state; "metadata is produced for both geospatial data and services, adheres to a common standard, is governed by coordinated agency policies, and supports catalogs dynamically." The document further, highlights the 'Enable Discovery' portion of the Process Flow section with three prescribed tasks:

1. An agency stands up a catalog to enable metadata storage and discovery. Catalogs are deployed in the context of goals, objectives, and technical specifications to ensure they are open, flexible, and accessible to a broad audience. Catalogs are only implemented if no suitable existing catalog (internal or federal) exists to fit the agency's goals.

2. The agency implements harvesting or update services that automatically populate catalogs with new metadata on a set schedule. The catalogs to be updated as well as the schedule are set forth in agency policy.

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[107] Office of Management and Budget, *Federal IT Shared Services Strategy*, May 2, 2012.

[108] *Uncle Sam's List*, April 2013. Available to Federal employees through the OMB MAX at https://login.max.gov/cas/login?service=https%3A%2F%2Funclesamslist.max.gov%2F
Public site available at http://unclesamslist.us/

[109] Office of Management and Budget, *The Common Approach to Federal Enterprise Architecture*, May 12, 2012.

[110] *Segment Architecture Analysis of the Geospatial Platform*, Version 1.0, December 21, 2010. Federal Geographic Data Committee, in support of the Federal Chief Information Officers Council.

3. The agency implements alternate discovery mechanisms/service as planned. Once deployed, the agency publishes use of the new mechanisms/service.

The following provides brief examples of Federal Applications/Services Catalogs and is intended to highlight the differences in approaches for the establishments of catalogs for the identification and delivery of services.

5.5.1 GEOSPATIAL PLATFORM

"The Geospatial Platform enables the sharing of data, services, and applications across the government on a shared cloud infrastructure. This aligns with the government-wide shared services strategy, which is intended to improve return on investments, close productivity gaps, and increase communications with stakeholders."[111] While predominantly regarded a data catalog service site, it also has additional services offerings. The Geospatial Platform offering is considered to be "the suite of geospatial assets delivered to customers, including geospatial data, services, applications, and infrastructure,"[112] as defined as:

- Data: includes individual datasets, integrated data (such as base maps), or other products derived from multiple datasets. These assets include foundational geospatial data that can be trusted, used reliably and shared across organizations. Governments at all levels or, in some instances nongovernmental organizations, can provide data to the Geospatial Platform.

- Services: provide a consistent, easily accessible way to access geospatial capabilities (e.g., access to data, geocoding, geoprocessing services, metadata management, etc.). The Geospatial Platform will offer access to services that can used by multiple agencies as stand-alone capabilities or as building blocks to develop applications.

- Applications: consist of a set of tools or capabilities that enable a user to exploit geospatial information through visualization, query, reporting, and spatial analysis to achieve their results. Applications may leverage one or more different services to conduct analysis and return results to the user. The Geospatial Platform will offer access to applications that can be downloaded, customized, and used to meet customer business needs.

- Infrastructure: includes both physical and logical technology components that can be leveraged by multiple customers.

- Geospatial Platform Marketplace: provides the "Marketplace" as a public facing listing of datasets that are planned for acquisition by one or more Federal agencies. Utilizing metadata records registered with the shared Data.gov/Geospatial Platform

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[111] http://www.geoplatform.gov/sites/default/files/document_library/2012-09-12-geospatial-platform-business-plan-redacted-final.pdf

[112] Ibid.

data catalog, and tagged as both "geospatial" and "planned", Federal agencies and non-federal partners use this listing to identify potential partnering opportunities for data purchase.

The Geospatial Platform is generally considered a dataset catalog and maintains a shared catalog between Data.gov[113] through an open standards compliant Catalog Service for the Web (CSW) specification that defines common interfaces to discover, browse, and query metadata about data, services, and other potential resources.[114] The catalog provides access for both first-order and all metadata (including members of large collections) for harvested data, services, and applications. The first-order CSW endpoint provides collection level filtering of all metadata records. The all metadata CSW endpoint provides all levels of metadata at varying levels of granularity. Any client supporting CSW (desktop, GIS, web application, client library, etc.) can integrate the Geoplatform.gov/Data.gov CSW endpoints.

The Geospatial Platform provides a Tutorial and Training resource with a link[115] to a "Data.gov CSW How To" that allows any client supporting CSW (desktop, GIS, web application, client library, etc.) the ability to integrate the Data.gov CSW endpoints.

In terms of the Applications/Services offered by the Geospatial Platform, the site provides a Featured Applications page (https://www.geoplatform.gov/applications) that has several user generated examples. The link to the "Maps and Apps" (https://www.geoplatform.gov/labs-add-your-app) results in a page for "Add Your Application" (Figure 5-6) where future functionality is expected.

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[113] https://www.data.gov/

[114] https://gist.github.com/kalxas/5ab6237b4163b0fdc930

[115] Ibid.
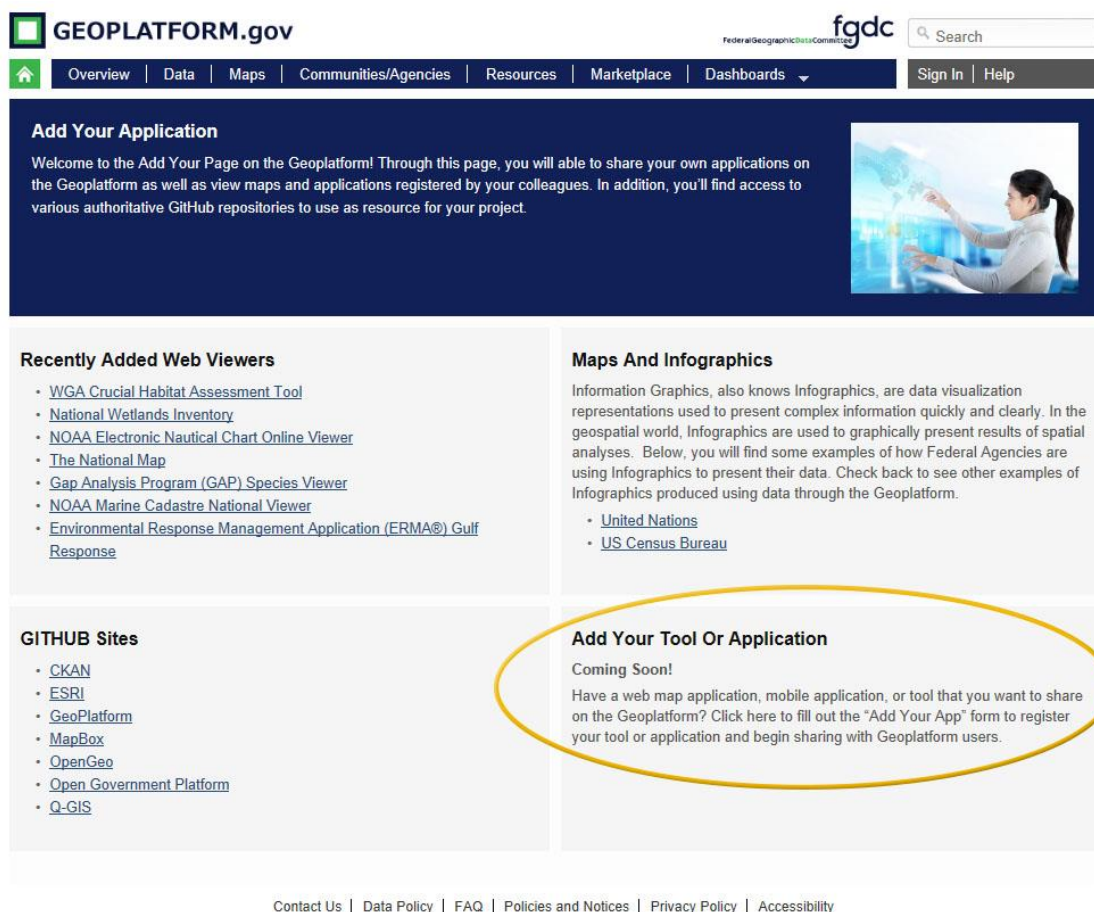
1
2 Figure 5-6. Geospatial Platform: Add Your Tool or Application

5.5.2 GEOINT APP STORE

4 "The GEOINT App Store is an online platform that provides useful apps, widgets, and web services
5 for members of the IC. These powerful yet intuitive software tools are simple to find and use for
6 completing specific GEOINT tasks."[116] The GEOINT App Store accepts contributions from across
7 the Intelligence Community to include; apps, widgets, or web services through a submission,
8 review, and approval process.

9 The GEOINT App Store[117] has a number of web applications and unclassified applications (more
10 than 270 in late 2013[118]) for handheld devices. The GEOINT Applications Storefront assists
11 Android and iOS users find National Geospatial Intelligence Agency and partner applications from
12 their devices. Patterned off of commercial storefronts, it provides downloadable apps for
13 smartphones and tablets in the three security domains—unclassified, secret, and top secret.

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[116] National Geospatial-Intelligence Agency (NGA). GEOINT App Store. https://apps.nga.mil/about
[117] https://www1.nga.mil/DATAAPPS/Pages/AccessDataAppStore.aspx
[118] http://defensesystems.com/articles/2013/10/22/geoint-app-store.aspx

GEOINT App Store allows authorized users to search by keyword or category to download the application they need directly. Most apps are designed around simply bringing information to handheld devices, such as reports and maps, although some apps will allow users to create reports as well. Though not every application works on every device, the services are cross indexed by category, type as well as a smaller grouping by community as depicted in Table 5-6. While the Apps are grouped in multiple locations, the cross-indexing allows the intended user communities to more rapidly search for services.

Table 5-6. GEOINT App Store Index

GEOINT APP STORE					
CATEGORIES	#	TYPES	#	COMMUNITIES	#
Communication/Collaboration	4	Algorithm	0	First Responder Apps	4
Mapping	19	Android	7	Mariner Apps	3
Navigation	4	Desktop	2	Aviator Apps	2
Reference	2	Idea	8	Wildfire Apps	10
Situational Awareness	19	iOS	4	Tropical Weather Apps	10
		Mobile Web	4		
		Web	14		
		Web Service	8		
		Widget	1		

5.5.3 ENTERPRISE REGISTRY AND REPOSITORY[119]

The overarching goal of the Office of the Director of National Intelligence (DNI) is to ensure that the elements of the Intelligence Community (IC) and Department of Defense (DoD) are working collaboratively to provide useful, timely, and accurate intelligence to support those who make and implement U.S. National Security policy, defend our Nation, and enforce our laws. A mission objective is to provide the intelligence community the ability to publish, manage, discover, retrieve, access and govern information about mission, business, and enterprise information technology (IT) resources throughout their lifecycle resulting in the effective management, sharing and integration of IT across the entire IC enterprise.

In response to increasing threats to national security and a growing need for better information sharing between IC elements, the DNI embarked on making significant enhancements across the community by creating a "Single Information Environment (SIE)" for the community and the establishment of a Common Software Repository and Service Registry. This service registry (Enterprise Registry and Repository (ER2) was first established on the Joint Worldwide Intelligence Communications System (JWICS) to support software and services reuse within the IC. The ER2

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[119] The information in this section is taken directly from the (Unclassified) Enterprise Registry and Repository entry from Intellipedia as redirected from http://www.intelink.gov/wiki/ER2

1   also has an instance on the Secret Internet Protocol Router Network (SIPRNet). The goals of ER2

2   are:

3   •   Support the DNI and community's efforts in achieving an efficient IT environment.

4   •   Enable information sharing for IC business and IT data.

5   •   Adapt IT rapidly to changes in IC mission and business needs.

6   •   Enable IT discovery, retrieval, access, and reuse.

7   •   Lower the lifecycle costs of IT through sharing and reuse.

8   •   Help reduce unwarranted duplication of IT resources.

9   ER2 is part of the IC enterprise service delivery infrastructure featuring:

10   •   Publishing and Managing – Easy to populate and update data (supports bulk loads).

11   •   Discovery and Reuse – Search for and take advantage of available capabilities.

12   •   Enhanced Portfolio Management – Provides for better informed decision making,
13   automated reporting, improved management and the leveraging of IT investments.

14   •   Governance and Oversight – Supports publishing, tracking, decision points, and
15   lifecycle milestones.

16   The ER2 solution is based upon community-developed requirements and is aligned with existing
17   IC element technical solutions including controlled vocabularies and taxonomies from commonly
18   agreed to architecture reference models. ER2 allows IC elements to transition their internal
19   software repositories into the service to enable discovery and sharing of available assets. IC
20   elements have published thousands of shared assets such as widgets, services, Enterprise
21   Standards Baseline and many other asset types. ER2 manages a variety of asset types, including
22   services, software and applications. The different types of community IT assets include:

23   •   Web services

24   •   Applications

25   •   Software

26   •   Web Service Definition Language (WSDLs) and Schemas

27   •   Endpoints and Bindings

28   •   Providers and Points of Contact

29   •   IC Standard Citations

30   •   IC Profiles

31   •   Widgets

An important benefit to the IC is the ability to discover the relationships between the IC-wide shared IT assets and make a better informed decision on utilization, maintenance, and management of these assets. Organizations are employing the ER2 as a primary asset registry and repository and require the register and search of the ER2 for existing assets that can be reused or consumed. If an asset already exists that performs the functions required by the program, full development may be avoided, thus reducing the program's overall costs while decreasing time-to-field.

The IC user community has benefited from the identification and collection of the applications and services registered within the ER2 in many areas, including:

- Developers – find already-built components for the mission solution they are supporting.

- Analysts – find tools and data sources that have information about the problem they are working.

- Architects – find pre-built profiles that show standards and reference architecture to design a community-compatible information sharing capability.

- Community Providers – find and edit metadata, add artifacts, and update the lifecycle of a community asset and advertise the availability of the services to the community for reuse.

- Program Managers – reduce development costs and shorten delivery cycles by reusing existing community components.

5.6 GEOSPATIAL SHARED SERVICES STRATEGY[120]

The *Federal IT Shared Services Strategy* requires agencies to default to a shared solution when opportunities for consolidation exist. Cloud-First and Shared-First concepts and policies are intended to work in tandem to continue to advance the Federal Government's move toward cloud-based IT solutions that will serve as a catalyst for the broader adoption of IT shared services.

The *Federal Shared Services Implementation Guide* provides information and guidance on the provisioning and consumption of shared services in the U.S. Federal Government. The guide provides agencies with a high level process and key considerations for defining, establishing, and implementing interagency shared services to help achieve organizational goals, improve performance, increase return on investment, and promote innovation. It includes specific steps

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[120] The information in this section is taken directly from the CIO Council's Federal Shared Services Implementation Guide, April 16, 2013. Available at https://cio.gov/wp-content/uploads/downloads/2013/04/CIOC-Federal-Shared-Services-Implementation-Guide.pdf

1   that should be considered for identifying shared services candidates, making the business case,
2   examining potential funding models, using agency agreements, and discusses some of the key
3   challenges that should be expected along the way.

4 5.6.1 SHARED SERVICES IMPLEMENTATION STEP-WISE
5   PROCESS

6   The *Federal Shared Services Implementation Guide* provides a step-by-step assessment indicating
7   tasks and activities, best practices, and risk areas with mitigations to consider and prepare for
8   when implementing shared services.

9   The decision to move agency or department functions to a shared service is best served by a
10   methodical approach that helps to ensure achievement of the desired outcomes and benefits (see
11   Figure 5-7).
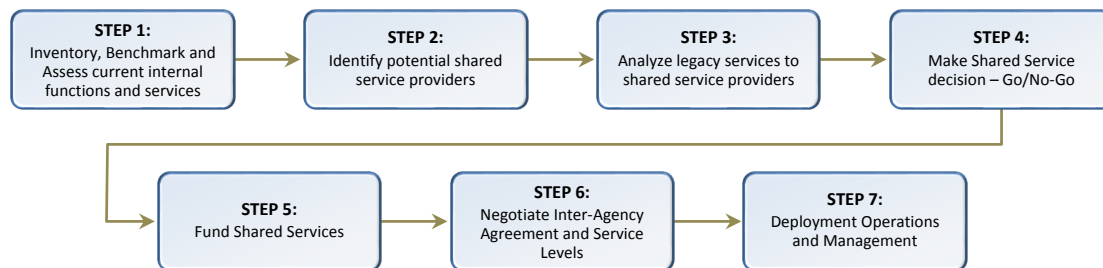
12
13   Figure 5-7. Shared Service Implementation Decision

14   This approach can be applied to evaluate the transition costs and demonstrate future savings. It is
15   also needed to understand the capabilities that can be supported and changes in business
16   processes that may be required to fit into an existing shared service. The Implementation Guide
17   provides high-level guidance on the Steps and Tasks needed to determine whether to pursue
18   implementation of a shared service.

19 5.7 STAKEHOLDER PERFORMANCE GUIDANCE

20   The Performance Guidance provides a summation of the key decision points necessary to
21   determine the most effective and efficient design, development, and implementation of the
22   geospatial system investment.

23   When developing their organization's annual strategic plans and performance goals, Senior
24   Leadership and Program Managers must evaluate the prior performance of their organization.
25   This presents an opportunity to question and assess the following:[121]

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[121] Ibid.

1   • What is the performance of existing processes and services?

2   • What existing capabilities can be improved?

3   • What is the cost structure of current capabilities?

4   • How efficient is service delivery?

5   • What new capabilities are needed and funded by the organization?

6   When considering each of these questions, the leadership team should consider the availability of
7   existing capabilities that may potentially be provided by a shared service provider and to leverage
8   these capabilities prior to buying or building a new capability.

9

1

Table 5-7. Stakeholder Performance Guide: Applications/Services

STAKEHOLDER PERFORMANCE GUIDE			
CHAPTER 5 – APPLICATIONS/SERVICES			
Role	Responsibility	Approach	Benefit
Executive Leadership	• Authorize the Application and Service inventory using the Baseline Assessment and catalog App/Svc capabilities across the enterprise using a common taxonomy. • As part of the Investment Technology Acquisition Review (ITAR) framework, require all new applications and services be compared against the App/Svc Catalog to determine shared first requirement. • Apply the Shared Services Implementation Step-wise Process to geospatial investment.	• Work with other Executives to acknowledge the need to reduce data costs by leveraging investment and performing the Baseline Assessment based upon mission/business needs. • Establish review board with CIO/CFO representation and consider policy to ensure participation and commitment. • During annual budget review/planning cycle or with proposed new investments review against process.	• Signatory with defined responsibility and stated measurable results (e.g., IT Asset Inventory for OMB Open Data Policy reporting and a quantifiable App/Svc resource inventory). • Promotes interoperability, reduces redundant investments, and allows for cost share. • Reduce cost for App/Svc development/acquisition alignment to Share-First policy.
Program Manager	• Coordinate across other internal Department/Agency investment PMs to establish Geospatial Taxonomy Working Group and Geospatial App/Svc Catalog. • Staff and perform inventory and of existing/proposed App/Svc investment. • Staff and perform Shared Services Implementation Step-wise Process to assess geospatial investments.	• Initiate the Taxonomy development and perform App/Svc inventory for documenting App/Svc and creating a catalog. • Perform Baseline Assessment: Apps/Svcs across enterprise and populate catalog. • Develop repetitive process for evaluating investment to share services.	• Shared awareness of investment and value of geospatial capabilities across the organization. Basis for shared service capabilities. • Provides baseline for shared service investment and leveraged capability • Catalog meets Share First policy and forms basis for reduced investment.
Solution Architect	• SME and reach back for Taxonomy Working Group participation. • Perform technical evaluation of App/Svc investments to determine commonality and alignment.	• Develop baseline assessment and perform inventory of App/Svcs. • Technical review of services for alignment to TRM and Infrastructure compatibility (Section 6.3).	• Cross enterprise collaboration for technical exchange and comparison. • Ensure broadest possible technical review, adoption and acceptance.

2

3

6 INFRASTRUCTURE REFERENCE MODEL

6.1 INTRODUCTION

Definition/Description (What) – the Infrastructure Reference Model (IRM) establishes a roadmap to achieve an organization's mission/function through optimizing its information technology environment. The IRM will provide an architectural "blueprint" for effectively defining an organization's current (Baseline/"As-Is") and/or desired (Target/"To-Be") geospatial system environments.

Purpose/Function (Why) – the IRM is used to inform, guide and constrain the geospatial investment decisions for the enterprise/organization. Geospatial reference architecture should serve as a primary authoritative resource for organizational planning, a baseline from which to insert new technologies and capabilities into the infrastructure of the enterprise, and a documentation source for investment justification. The IRM provides a roadmap from the "As-Is" environment to the "To-Be," target environment using documentation tools and artifacts. It contributes to the investment governance structure (see Section 2.4) to baseline, align, transition, and mature their geospatial invest across the enterprise. It describes how to:

- Establishes a process for base lining and categorizing geospatial technology and functionality.

- Defines a 3-Tier geospatial architecture as the To-Be target.

- Provides reference artifacts for the 3-Tier architecture.

Stakeholder Performance Guide (Who & How) – Solution Architects serve as the primary developer and user of the Infrastructure Reference Model documentation, planning tools, and system artifacts necessary for the design and subsequent leverage/buy/build investment strategy. Program Managers must facilitate the cross organizational collaboration necessary to document the technology investments and negotiate implementation options that support both mission and enterprise needs. Executive Leadership must assess the justification for approving/denying a proposed geospatial investment.

<p align="center">Design for the Mission … Develop for the Enterprise.</p>

6.2 ALIGNMENT TO THE ENTERPRISE ARCHITECTURE INVESTMENT PLANNING PROCESS

The Infrastructure Reference Model will focus upon a practical approach to documenting the technical and functional capabilities and requirements of the geospatial enterprise. The IRM

supports architectural analysis and reporting within an organization's overall Enterprise Architecture.[122] The IRM also unifies existing agency infrastructure portfolios and guidance by providing a foundation to advance the reuse and standardization of technology and service components. Aligning agency capital investments to the IRM leverages a common, standardized vocabulary, allowing intra/interagency discovery, collaboration, and interoperability. Organizations and enterprise architectures will benefit from economies of scale by identifying and reusing the best solutions and technologies for applications that are developed/provided or subscribed to support their business functions, mission, and target architecture.

Agencies must document and submit their Enterprise Architecture (EA) documentation to OMB.[123] The EA provides the explicit description and documentation of the current and desired relationships among business and management processes and information technology. It describes the "current architecture" and "target architecture" as well as providing a strategy that will enable the agency to support its current state and also act as the roadmap for transition to its target environment. These transition processes will include an agency's capital planning and investment control (CPIC) processes (Section 2.4.2). The EA should inform the CPIC process by defining the technologies and information critical to operating an agency's business, and by creating a roadmap which enables the agency to transition from its current to its targeted state. The EA helps the agency respond to changing business needs, and ensures that potential solutions support the agency's targeted state. A proposed IT solution that does not comply with the EA should not be considered as a possible investment, and should not enter the CPIC process. The CPIC process helps Executive Leadership select, control, and evaluate investments that conform to the EA. For example, during the select stage of capital planning an agency identifies and investigates different potential solutions for an investment. An agency then selects the option with the best business case. If any of these alternatives does not conform to the EA, the agency should drop it from consideration.

6.3 GEOSPATIAL BASELINE ASSESSMENT MATRIX: INFRASTRUCTURE AND TECHNOLOGY

Each agency must support the Enterprise Architecture with a complete inventory of agency information resources, including personnel, equipment, and funds devoted to information resources management and information technology, at an appropriate level of detail.[124] Agencies must implement the EA consistent with the following [amongst others] principles:

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[122] Office of Management and Budget, *The Common Approach to Federal Enterprise Architecture*, May 2, 2012.

[123] http://www.whitehouse.gov/omb/fedreg_a130notice

[124] Ibid.

1. Develop information systems that facilitate interoperability, application portability, and scalability of electronic applications across networks of heterogeneous hardware, software, and telecommunications platforms.

2. Meet information technology needs through cost effective intra-agency and interagency sharing, before acquiring new information technology resources.

To accomplish this requirement, the organization's Executive Steering Committee (Section 2.3.1) should authorize the development of the Baseline Assessment Matrix (Section 3.4) that begins to document the existing and planned geospatial infrastructure and technology investments across the organization's enterprise. The Baseline Assessment provides a framework to begin to profile the geospatial system infrastructure environment. The Solution Architects from across the organization's geospatial investments should develop the Infrastructure Assessment Matrix (Appendix E.1) to include the entire infrastructure core capabilities involved in or impacted by their geospatial system capability.

Table 6-1. Geospatial Baseline Assessment: Infrastructure

Geospatial Baseline Assessment: Infrastructure

Infrastrcuture	Core Capability	Org #1	Org #2	Org #3	Org #4	Org #5	Org #6	Score	Pct
Initial Operating Capability	System Maturity Level	C				C		2	33%
Full Operating Capability	System Maturity Level			C	C		C	3	50%
Prototype	System Maturity Level		C					1	17%
Other	System Maturity Level							0	0%
COTS Solution	Software Components	C	C	C	C	C	C	6	100%
GOTS Solution	Software Components	C					C	2	33%
Open Source Solution	Software Components						C	1	17%
Custom Solution	Software Components	C	C			C		3	50%
Internal Hosting	Hosting Capability		C	C				2	33%
External Hosting	Hosting Capability					C	C	2	33%
Datacenter	Hosting Capability	P					C	2	33%
Disaster Recovery / Failover Capability	Hosting Capability	P	P	C	P	C		5	83%
Certification & Accreditation Complete	IT Security	P	P	C	C	C	P	6	100%
Authority to Operate	IT Security	P	C	C	C	C	P	6	100%
Section 508 Compliance	User Accessibility	C				C		2	33%
NIEM Compliant	Information Exchange	P					C	2	33%
Unclassified	System Designation		C	C	C		C	4	67%
Sensitive But Unclassified	System Designation	P				C	P	3	50%
Classified	System Designation						P	3	50%
Public	System Designation		C				P	2	33%
Network #1	Operating Environment	P					C	2	33%
Network #2	Operating Environment							0	0%
Network #3	Operating Environment							0	0%
Other Network	Operating Environment					C	C	2	33%
Data Exchange Agreements	System Overview		P		C			2	33%
Service Level Agreements	System Overview				P			1	17%
< 1,000 Current Users	System Capacity	C	C	C		C	C	5	83%
1,000-5,000 Current Users	System Capacity	P						1	17%
>10,000 Current Users	System Capacity							0	0%
> 5,000 Surge Users	System Capacity		C					1	17%
5,000-10,000 Surge Users	System Capacity							0	0%
> 10,000 Surge Users	System Capacity	P						1	17%
Mobile Version	Interoperability	P	P	C	P	C		5	83%

Status: C = Current   P = Planned

Additionally, the Solution Architects will need to prepare the Technology core capability matrix for the Baseline Assessment. Table 6-2 is an extract of the three-page Technology Assessment Matrix (Appendix E.2) and combined with the Infrastructure Matrix will provide the foundation for investment comparison, both existing and planned to determine the optimal technology infrastructure and how it should align to the Enterprise Architecture. It will also provide the content necessary to respond to the OMB *Common Approach to Federal Enterprise Architecture* and submit an Enterprise Roadmap[125] which includes a summary of current architecture, including infrastructure.

Table 6-2. Geospatial Baseline Assessment: Technology (Extract)

Geospatial Baseline Assessment: Technology							
Technology	Core Capability	Org #1	Org #2	Org #3	Org #4	Score	Pct
Internet Explorer	Web Browser	C	C	C	C	4	100%
Chrome	Web Browser			C		1	25%
Firefox	Web Browser	C	C	C		3	75%
Opera	Web Browser					0	0%
Safari	Web Browser					0	0%
Other Web Browsers	Web Browser					0	0%
Windows OS	Operating System	C	C	C	C	4	100%
Linux OS	Operating System			C	C	2	50%
UNIX	Operating System					0	0%
Other OS	Operating System					0	0%
Anakam	IT Security	P				1	25%
Open SSO	IT Security	P				1	25%
Active Directory	IT Security		C			1	25%
Other IT Security	IT Security	C				1	25%
.Net Framework	Programming Framework	C			C	2	50%
Flash	Programming Framework		C			1	25%
JAVA	Programming Framework		C		C	2	50%
Other Frameworks	Programming Framework			C		1	25%
AJAX	API				C	1	25%
FLEX	API			C		1	25%
Silverlight	API	C		C		2	50%
Rest	API		C			1	25%
Other APIs	API			C		1	25%

6.4 DIGITAL GOVERNMENT STRATEGY ALIGNMENT

The Digital Government Strategy[126] is intended to be disruptive, realizing the need to do more with less.

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[125] Office of Management and Budget, *The Common Approach to Federal Enterprise Architecture*, April 30, 2012.

[126] *Digital Government: Building a 21st Century Platform to Better Serve the American People*, May 23, 2012.

"[The Digital Strategy] gives the federal workforce the tools needed to carry out their mission of delivering services to all citizens—whether to a warfighter in the field retrieving geospatial imagery information ... or a rural farmer accessing real-time forecast of seasonal precipitation. It provides a platform to fundamentally shift how government connects with, and provides services to, the American people."[127]

To drive this transformation, the strategy is built upon four overarching principles:

- An "**Information-Centric**" approach – focuses on ensuring data and content are accurate, available and secure. Transforming unstructured content into structured data – then ensure all structured data are associated with valid metadata and providing this information through web Application Programming Interfaces (APIs) helps to architect for interoperability using open standards. This approach also supports device-agnostic security and privacy controls, as attributes can be applied directly to the data and monitored through metadata, enabling agencies to focus on securing the data and not the device.

- A "**Shared Platform**" approach – requires the reuse of resources and to "innovate with less", accelerates the adoption of new technologies, lowers costs and reduces duplication. A shared platform approach to developing and delivering digital services and managing data needs to leverage existing services, build for multiple use cases at once, apply common standards and architectures, produce shared government-wide solutions to ensure consistency in how information is created and delivered.

- A "**Customer-Centric**" approach – means quality information is accessible, current and accurate at any time. It requires an understanding of stakeholder business/mission requirements (Section 3.3) and makes content more broadly available and accessible in a device-agnostic way.

- A platform of "**Security and Privacy**" – requires the transformation to happen in a way that ensures the safe and secure delivery and use of digital services to protect information and privacy. Architecting for openness and adopting new technologies have the potential to make devices and data vulnerable to malicious or accidental breaches of security and privacy. Architectures must adopt solutions in areas such as continuous monitoring, identity, authentication, and credential management, and cryptography (Chapter 7: Security Reference Model) that support the shift from securing devices to securing the data itself and ensure that data is only shared with authorized users.

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[127] http://www.whitehouse.gov/sites/default/files/omb/egov/digital-government/digital-government.html

1 The development of any Federal geospatial infrastructure must align with the Digital Government
2 Strategy principles.

6.5 GEOSPATIAL 3-TIER TARGET ARCHITECTURE

4 The Digital Government Strategy[128] establishes a conceptual model that acknowledges three
5 "layers" of digital services. Three-tier architecture is a client-server architecture in which the
6 functional process logic, data access, computer data storage, and user interface are developed
7 and maintained as independent modules on separate platforms.[129] Three-tier architecture allows
8 any one of the three tiers to be upgraded or replaced independently. The user interface is
9 generally implemented on the client-side environment either at the desktop or web browser uses
10 a standard graphical user interface with different modules running on the platform layer that
11 hosts the application server(s). The data layer includes a relational database management system
12 that contains the computer data storage logic (e.g., schemas, metadata, topology, and
13 ontologies). This 3-Tier architecture model includes: the Presentation Layer, the Platform or
14 Application Layer, and the Information of Database Layer.
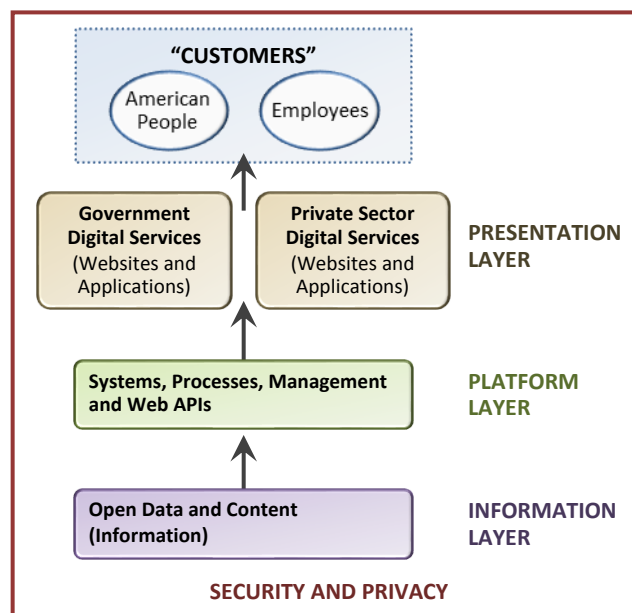
15
16 Figure 6-1. Three-Layers/Tiers of Digital Services

17 The three layers or 3-Tier model separates information creation from information presentation—
18 allowing organizations to create content and data once, and then use it in different ways through
19 hosted applications or publication services operating on the shared platform.

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[128] *Digital Government: Building a 21st Century Platform to Better Serve the American People*, May 23, 2012.

[129] Technopedia.com 3-Tier Architecture definition. http://www.techopedia.com/definition/24649/three-tier-architecture

6.5.1 PRESENTATION LAYER

The Presentation Layer defines the manner in which information is organized and provided to customers. It displays information related to services available on a platform. This tier communicates with other tiers by sending results between the user applications and interfaces and other tiers in the network and represents the way information delivery occurs (e.g., data or content), whether through desktop clients, websites, mobile applications or other modes of delivery. The presentation layer must support open interface standards and allow application programmers, software developers, web service publishers and device manufacturers' extensibility in presentation of information resources. The Infrastructure Assessment Matrix (Appendix E.1) illustrates some of the common technical elements to consider in the implementation process such as web browser support, application programmer interfaces and methods. The Infrastructure Assessment Matrix also includes the core infrastructure capabilities involved in or impacted by the target geospatial system capability.

6.5.2 PLATFORM/APPLICATION LAYER

The Platform or Application Layer, also known as the logic or business logic tier, is where it controls application functionality includes all the systems and processes used to manage the information. Examples include systems for content management, processes such as web API and application development, services that support mission critical IT functions such as mapping and situational awareness, as well as the hardware used to access information (e.g., mobile devices). Solution Architects should use the Infrastructure Assessment Matrix (Appendix E.1) as a blueprint to address common technical elements to consider for assessing infrastructure serviced through an on premise data center or off premise cloud service offering. These considerations include operating systems, user and system access controls, support for commercial or government off-the-shelf software, distributed processing capability, and search and indexing software.

6.5.3 INFORMATION/DATABASE LAYER

The Information or Database Layer houses the database servers where information is stored and retrieved. Data in this tier is kept independent of application servers or business logic and contains the digital information. It includes structured information (e.g., the most common concept of "data") such as geospatial data layers and metadata, plus unstructured information (e.g., content), such as fact sheets, guidance documentation geospatial search indexes, or geocoding / geo-tagging dictionaries. The Infrastructure Assessment Matrix (Appendix E.1) provides Solution Architects a frame of reference for technical considerations such as database software, support for federated search and queries using structured query language (SQL), ability to provide geospatial search and indexing capabilities, access control at the data layer and role level.

6.6 GEOSPATIAL TARGET ARCHITECTURE ARTIFACTS

The goal of the Geospatial Interoperability Reference Architecture is to make geospatial information and technology more broadly accessible, geospatial investments more effective, and geospatial practitioners and business systems more productive. The GIRA provides a blueprint for architectural analysis and reporting within an Agency's Enterprise Architecture. The reference implementations of the GIRA are intended to provide Solution Architects with go-to Target Architectures for the sensitive-but-unclassified and public domains that so Government Program Managers can reuse and/or emulate. These reference implementations provide best practices for geospatial interoperability and information sharing to drive:

- Discoverability – Discoverable by appropriate users, systems, and communities of interest.

- Accessibility – Available in a usable form that is easily understood.

- Understandability – Able to be used intelligently using commonly defined terms and intuitive interfaces and tools.

- Interoperability – Readily consumed and combined with other geospatial capabilities (software, data, services, or systems) using open-standards or best practices for geospatial information and services exchange.

- Reliability – Capabilities are consistently delivered over time.

- Trust – Accuracy, currency, completeness, and source of capabilities (software, data, services, and systems) are available to users.

6.6.1 UNCLASSIFIED/PUBLIC DOMAIN: GEOSPATIAL PLATFORM

The Federal Geospatial Platform[130] is a FY 2011 budget initiative and Presidential call for action. Through the Federal Geographic Data Committee (FGDC), federal departments and agencies are developing the Geospatial Platform to more effectively share place-based products and services to the public. The Geospatial Platform will be a managed portfolio of common geospatial data, services, and applications contributed and administered by authoritative sources and hosted on a shared infrastructure, for use by government agencies and partners to meet their mission needs and the made openly available.

The content of all datasets and services are required to be verified by the agencies to be consistent with federal privacy, national security, and information quality policies. Additionally, the Geospatial Platform provides access to data from various partners across state, tribal,

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[130] https://geoplatform.gov/

1 regional, and local governments as well as non-governmental organizations. The overall goal is to
2 reduce duplication of efforts and promote the use of open standards among agencies' geospatial
3 programs. The move to a standard Geospatial Platform offers many advantages to its users:

4   • A "one-stop shop" to deliver trusted, nationally consistent geospatial products, with
5   a preference towards interoperable web services.

6   • Tools for the centralized discovery, access, and use of data and services managed
7   and maintained in multiple agencies.

8   • Tools that enable cross-government data to be displayed in a visual context.

9   • Tools enabling on-line collaboration communities focused on mission and/or
10   priority issues, where federal and non-federal agencies and partners can share and
11   create geospatial data and map products to provide common understanding of
12   information for decision making.

13   • Problem-solving applications that are built once and reused many times.

14   • A shared cloud computing infrastructure.

15 Figure 6-2 provides a high-level conceptual depiction of the Geospatial Platform. Some of the
16 features include the migration of the Geospatial Open Source catalog to geo.data.gov, which
17 includes a search interface and community features. In addition to catalog search, users will be
18 able to create and share maps. Agencies are also encouraged to provide content supporting their
19 business cases.
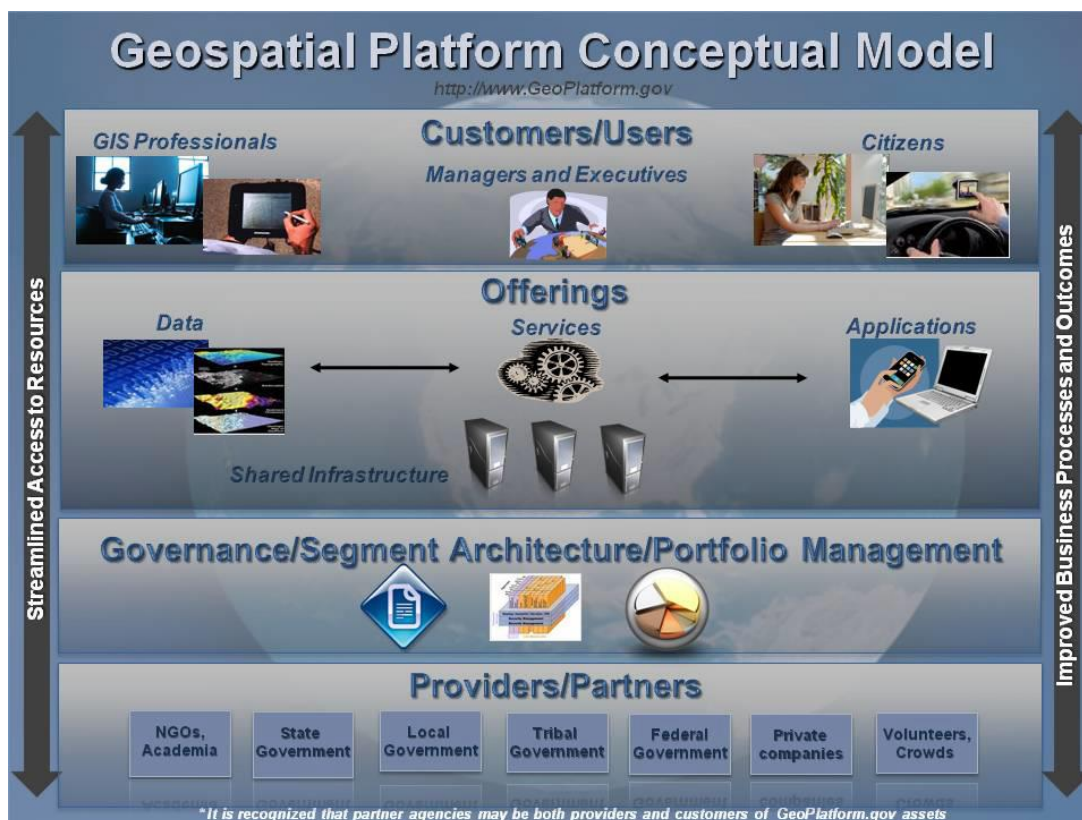
Figure 6-2. Geospatial Platform Conceptual Model

The Geospatial Platform employs a multi-tired, services-based architecture that support open standards. Figure 6-3 provides a more detailed view of the technical architecture. The Geospatial Platform provides users a standard web interface and developers with application programmer interfaces. Web services are provisioned on the platform layer. Data services are managed in a shared data layer.

1
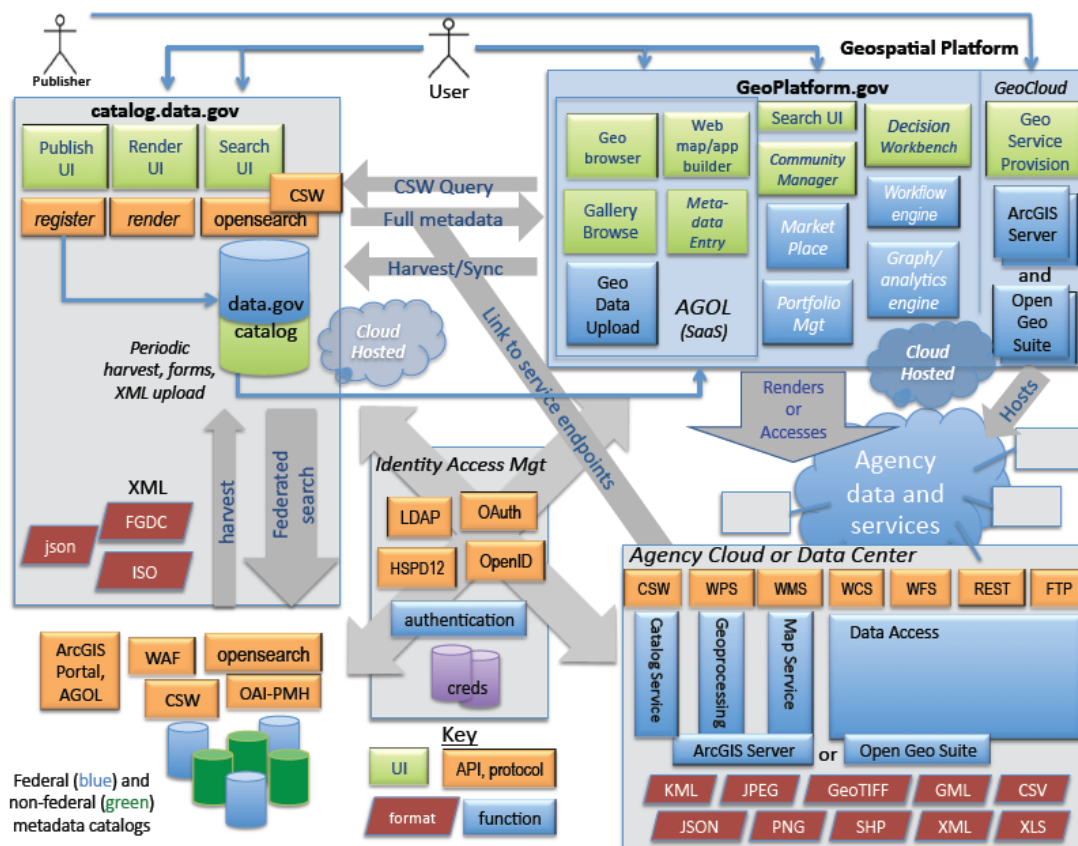
2 Figure 6-3. Geospatial Platform Technical Architecture

3 The Geospatial Platform is expected to expand access to high quality data, enabling the increased
4 sharing and reuse of resources resulting in reduced costs. The integrated approach will mean that
5 the federal portfolio of geospatial data will be better managed, service a broader audience, and
6 be easier to use.

6.6.2 FOR OFFICIAL USE ONLY: GEOSPATIAL INFORMATION INFRASTRUCTURE

9 The Department of Homeland Security's (DHS) Geospatial Information Infrastructure (GII)[131] is a
10 target architecture for the enterprise platform to support multiple missions across the Homeland
11 Security community. It provides access to a wide set of shared capabilities that support geospatial
12 visualization, analysis, processing, modeling and simulation, and content delivery of geospatial
13 information. The GII provides secure hosting services for geospatial web and mobile applications,
14 interoperable access to more than 600 layers of geospatial foundation and infrastructure
15 information that includes high resolution US population information, pre- and post-incident

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[131] https://gii.dhs.gov

1 imagery, public alerts and warnings, and derivative map products. It also includes a general
2 purpose web map viewer called OneView, interoperable web map services for desktop GIS users
3 and system integrators based on OGC standards, support for multiple viewing solutions, and
4 application programmer interfaces (APIs) that allow application developers to extend GII
5 functionality (web services, and data feeds) into customer centric applications. Developers can
6 use the GII APIs with the underlying binaries and programming references to build internet-based
7 mobile or web mapping applications using GII services and components.

8 Figure 6-4 depicts the multi-tiered, services-based architecture for the GII. The GII technical
9 architecture supports open standards for search, web services, APIs, and data publication. GII
10 application hosting and web services are provisioned on the platform layer. Data services are
11 managed in a shared data layer.
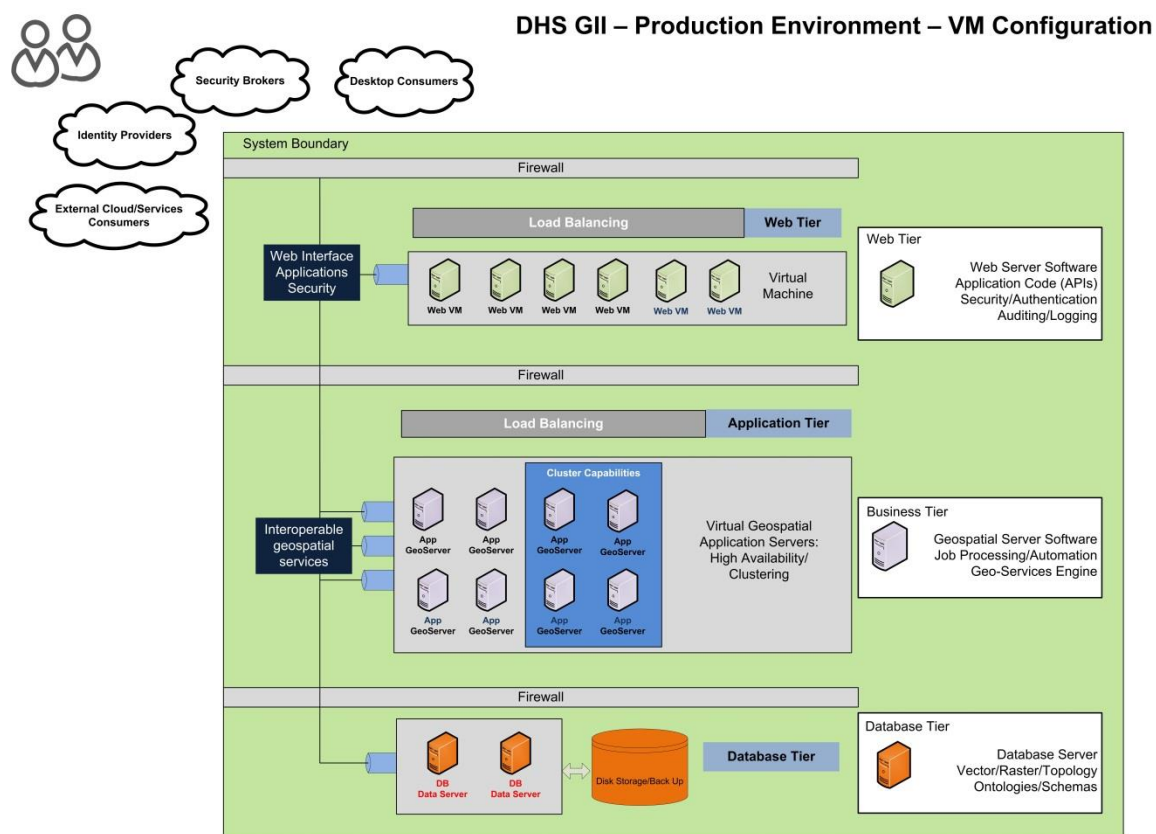
12
13 Figure 6-4. DHS Geospatial Information Infrastructure (GII) Technical Architecture

14 Figure 6-5 illustrates how GII services can be leveraged to support business application and
15 systems as referenced by the DHS Common Operating Picture (COP).

1
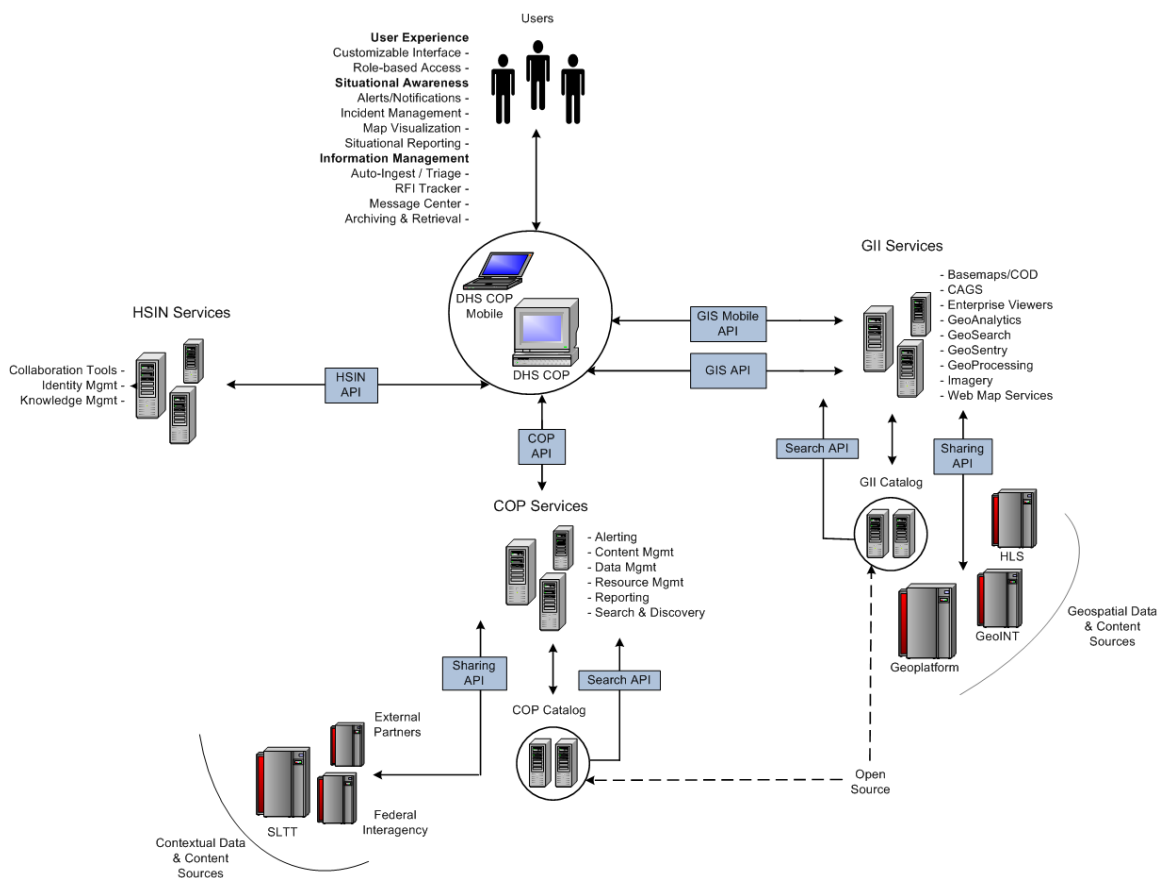
2   Figure 6-5. DHS Common Operating Picture Aligned to DHS Geospatial Information Infrastructure

3

4 6.7 GEOSPATIAL TARGET ARCHITECTURE
5   CONSIDERATIONS

6   As part of the baseline assessment, Solution Architects should make considerations for IT security

7   including cyber security, identity, credentialing, and access management, certification and

8   accreditation (C&A), authority to operate (ATO) and trust boundaries, and network domain (e.g.

9   public, sensitive-but-unclassified, classified). Solution Architects should also evaluate the

10   resiliency requirements for the capability including disaster recovery, failover, and surge capacity.

11   Compliance requirements for Section 508 Accessibility and Privacy Impact Assessments (PIAs) are

12   crucial and support multiple open standards for geospatial information exchange and geospatial

13   search. The Baseline Assessment Matrix (Appendix E) provides a blueprint for assessing these

14   technical considerations during the capital planning and investment process.

15   It is important that Agencies consider the maturity of the investment and not just the technical

16   capability as part of the baseline assessment. Factors to consider are:

- Where is the investment in its lifecycle? Is the technology near end of life or still emergent?

- What is the schedule for technology refresh?

- What is the concept of operations for operating and maintaining the investment?

- How are technical support services provisioned? Is training or help desk support available?

- Does system have a completed certification and accreditation package or authority to operate?

- Is the investment compliant with Agency enterprise architecture policy?

- Is the investment compliance with federal privacy and accessibility requirements?

6.7.1 CLOUD

The *Federal Cloud Computing Strategy* states that, "When evaluating options for new IT deployments, OMB will require that agencies default to cloud-based solutions whenever a secure, reliable, cost-effective cloud option exists."[132] The OMB also requires a Cloud Computing Alternatives Evaluation[133] for an agency's capital planning submission specifying a cloud alternative was evaluated for the investment or components/systems within the investment, per the Cloud First policy. All investments should answer this question regardless of the overall lifecycle stage of the investment, as operational investments may consider performing such an evaluation during or as a result of an operational analysis. The evaluation should indicate one of the following answers:

1. The agency evaluated a cloud alternative and chose a cloud alternative for some or all of the investment.

2. The agency evaluated a cloud alternative but did not choose a cloud alternative for any of the investment.

3. The agency did not evaluate a cloud alternative but plans to evaluate a cloud alternative by the end of the Base Year.

4. The agency did not evaluate a cloud alternative and does not plan to evaluate a cloud alternative by the end of the Base Year.

As part of that evaluation, the Solution Architect and Program Manager should develop an operational requirements document (ORD) that is cross referenced against the Baseline Assessment Matrix. These artifacts should serve as the basis of comparison for completing the cloud computing alternative analysis. The evaluation process should be conducted in two phases.

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[132] Office of Management and Budget, *Federal Cloud Computing Strategy*, February 8, 2011.
[133] http://www.whitehouse.gov/sites/default/files/omb/assets/egov_docs/fy14_guidance_on_exhibits_53_and_300.pdf

The first phase should identify commercial and federal government candidates from a functional and technical perspective and flag these for further evaluation. An application is considered viable if it passes all the steps of the evaluation process as discussed in the following paragraphs. If Phase 1 identified no viable solutions, the alternative analysis would have concluded at the end of Phase 1 and the recommended alternative would be custom build-out or maintain the status-quo. The second phase should perform a comparison of the costs, benefits, and risks associated with each of the potential solutions identified in Phase 1 and the costs, benefits, and risks of custom build-out or maintaining the status-quo.

6.7.1.1 PHASE 1 PROCESS

The Phase 1 evaluation process contains several steps that serve as filters to either eliminate solutions or pass them on for more detailed evaluation. Each step answers a particular set of questions:

- Step 1 – Does the solution provide geospatial cloud services (i.e.; operational requirements)? Does it appear to be a good choice for the Agency's operating environment? Only the solutions with "yes" responses are passed to Step 2.

- Step 2 – Does the solution feature appropriate technical capabilities? How does it compare with other solutions? Only applications with the highest technical capability scores are passed on to Step 3.

- Step 3 – Are technical capabilities present in a robust, flexible, and easy-to-use fashion? Will the solution be difficult to integrate with the Agency's operating environment and existing geospatial software packages and systems? Only applications that appear to have a high probability of success will be passed on to Step 4.

- Step 4 – Is the solution proven technology currently used within the Agency or other federal agencies? Consult technical experts about the suitability of the solution to meet Agency operational requirements, how it compares with its competitors, current user base, financial stability of the vendor, future viability of the solution.

6.7.1.2 PHASE 2 PROCESS

The Phase 2 evaluation process compares the most viable candidate identified in Phase 1 to a custom-build-out or maintain status-quo approach in terms of cost, benefits, and risks.

- Step 1 – Costs. For custom build-out or maintaining status-quo, use Agency infrastructure pricing, supplementary GSA software licensing and existing FTE/Contractor rates. For viable alternatives, compute the cost by adjusting the Agency cost factors for items that will be eliminated or changed to accommodate a

1   commercial solution. Add the costs to acquire the commercial solution. Compare
2   the two costs.

3   • Step 2 – Benefits. Identify a set of possible benefits. Ascertain the probability that
4   these benefits will occur with the commercial solution and with a custom-built
5   solution. Compare the two results.

6   • Step 3 – Risks. Identify the risks for both solutions, along with the probabilities that
7   the risks will occur and the impacts of those occurrences. Compare the two results.

8   • Step 4 – Compare costs, risks, and benefits. Recommend a solution.

9 6.8 STAKEHOLDER PERFORMANCE GUIDE:
10   INFRASTRUCTURE

11 The Performance Guidance provides a summation of the key decision points necessary to
12 determine the most effective and efficient design, development and implementation of the
13 geospatial system investment.

14   Table 6-3. Stakeholder Performance Guide: Infrastructure

STAKEHOLDER PERFORMANCE GUIDE			
CHAPTER 6 – INFRASTRUCTURE			
Role	Responsibility	Approach	Benefit
Executive Leadership	• Executive Steering Committee authorization and commitment to perform Baseline Assessment Matrix: Infrastructure and Technology. • Approve/disapprove a proposed IT solution depending upon its compliance with Enterprise Architecture for inclusion within CPIC process. • Ensure Cloud Option assessment is performed as part of a proposed IT solution.	• Task Program Managers responsible for geospatial system oversight to perform develop and execute the Baseline Assessment. • Ensure that the infrastructure/technology Baseline Matrix capabilities are aligned to EA and proposed new infrastructure/technology aligns to and not duplicative of existing capabilities. • Task Program Manger to apply cloud process review as option for IT solution.	• Provides input for CPIC (53/300) and reporting to OMB as well as establishes the enterprise baseline of the As-Is geospatial investments across the organization. • Promotes interoperability, reduces redundant investments, and allows for cost share. • Complies with Cloud First policy and provides economies for implementation.

STAKEHOLDER PERFORMANCE GUIDE		
CHAPTER 6 – INFRASTRUCTURE		

Role	Responsibility	Approach	Benefit
Program Manager	• Coordinate across organization's geospatial investments to ensure committed participation in Baseline Assessment. • Identify opportunities for shared infrastructure and/or technology based upon Baseline Assessment Matrix comparison. • Review report of finding for cloud options for IT solution and make recommendations to Executive Leadership.	• PMs identify and prioritize capability gaps and planned investments aligned to Operational Requirements Document (ORD) and prepare recommendations and/or options for Execs approval. • Based upon gap analysis, identify candidate investments to leverage, eliminate or new develop based upon ORD priorities. • Coordinate Cloud assessment process evaluation for IT solution architecture.	• Cross organization agreement for prioritized geospatial system development priorities and leveraged resource commitment. • Reduce duplicative IT footprint and identify opportunity to leverage or reprioritize investments. • Complies with Cloud First policy and provides economies for implementation.
Solution Architect	• Develop the Infrastructure Assessment Matrix from across the entire organization's geospatial investments. • Vet 'new' technology insertions to EA and Technical Reference Model to ensure alignment with organization's To-Be environment. • Prepare report of finding for cloud options for IT solution.	• Work with other organization SAs to ensure a complete baseline assessment and perform capability gap analysis for As-Is and To-Be environments. • Determine 'optimal' solution if duplicative investments and ensure alignment to EA for 'new' technology. • Perform Cloud assessment process evaluation for IT solution architecture.	• Ensure broadest possible technical review, adoption and acceptance. • Technical vetting and validation across investments for desired To-Be end-state environment and alignment to EA target ensures compatibility and reduces IT footprint cost. • Provides awareness of architecture investment and solution options.

1

2

7 SECURITY REFERENCE MODEL

7.1 INTRODUCTION

Definition/Description (What) – The *Federal Information Security Management Act* (FISMA)[134] defines information security as "the protection of information and information systems from unauthorized access, use, disclosure, disruption, modification. Or destruction in order to provide confidentiality, integrity, and availability."

Purpose/Function (Why) – There is considerable guidance across the Federal community for security planning, reporting, and monitoring investments. Federal Government IT programs have a wide range of security requirements. FISMA requirements include but are not limited to: compliance with Federal Information Processing Standards agency specific policies; Authorization to Operate requirements; and vulnerability and security event monitoring, logging, and reporting. This chapter will not replicate that guidance; instead, this section will focus upon the Identity and Access Management (IdAM) aspect of security as it is elemental to all of the reference models. This chapter will describe:

- Differences between identity and access management.

- Roles and responsibilities of stakeholders.

Stakeholder Performance Guide (Who & How) – Security transcends each of the Federal Enterprise Architecture Reference Models (e.g., Business, Data, Application/Service, Infrastructure, and Performance) and impacts each of those stakeholders responsible for its implementation. Security compliance should also be included within Governance since it is an enforcement point for Information Technology investments.[135]

7.2 SECURITY PRINCIPLES

The term "security" is exceptionally broad and means many things to many people. In the context of this chapter, the focus is specifically upon the IdAM aspect of security,[136] which is the most common user-facing aspect of security. IdAM is about how a system interacts with its users and includes **Identity** and **Access Management** components. Identity Management is focused on knowing *who* it is (as well as the individual's basic characteristics) that is interacting with a system

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[134] Public Law 107-347-DEC. 17 2002. *Federal Information Security Management Act*, 2002. 44 U.S.C., Sec 3542

[135] Office of Management and Budget, *Federal Enterprise Architecture Framework*, Version 2, (January 29, 2013), available at http://69.89.31.228/~mkerncom/wp-content/uploads/2013/02/Federal-Enterprise-Architecture-Framework-v2-as-of-Jan-29-2013.pdf

[136] Other significant aspects include Certification & Accreditation (now called Assessment & Authorization), FISMA compliance, Physical Security, Network Security, Communications Security, and many others. These aspects are outside of the scope of this document.

1 or data. Access Management is focused on determining whether or not that individual *should* be
2 permitted to interact with a specific resource in a specific way.

3 The *Federal Identity, Credential, and Access Management (FICAM) Roadmap and Implementation*
4 *Guidance*[137] ("FICAM Roadmap") defines the concepts as:

- 5 • **Authorization and Access** - are the processes of granting or denying specific
6 requests for obtaining and using information processing services or data and to
7 enter specific physical facilities. It ensures individuals can only use those resources
8 they are entitled to use and then only for approved purposes, enforcing security
9 policies that govern access throughout the enterprise.

- 10 • **Authentication -** is the process of verifying that a claimed identity is genuine and
11 based on valid credentials. Authentication typically leads to a mutually shared level
12 of assurance by the relying parties in the identity. Authentication may occur
13 through a variety of mechanisms including challenge/response, time-based code
14 sequences, biometric comparison, PKI or other techniques.

15 Information must be protected against unauthorized access for national security, privacy, and
16 other reasons. The government has a wealth of information obtained via a variety of means and
17 has an obligation to ensure that that information is used appropriately. This means ensuring that
18 all access is appropriate, permissible, and accountable. The government also has a responsibility
19 to be financially efficient. A well thought-out IdAM architecture meets both of these goals by
20 allowing a system to effectively control access, improving the security of the data in a system,
21 while at the same time reducing duplication by leveraging external (shared) IdAM services. Fine-
22 grained access control, enabled by IdAM, allows the system owner to manage the system risk by
23 safeguarding use of information without hindering responsible sharing of mission information.

24 Leveraging such external services allows the system owner to focus on the mission need the
25 system is intended for, while leveraging enterprise IdAM and security services which have been
26 designed to meet the specific needs of the IdAM and security domains. This focus not only
27 strengthens the capabilities of the system, but also allows for the enterprise to recognize
28 economies of scale on reusable IdAM and security services. Systems incorporating interfaces to
29 interoperate with such reusable services add flexibility to adapt as such services mature and
30 policy dictates new additional requirements. Security that incorporates the capabilities prescribed
31 in the *FICAM Roadmap* allows system owners to build robust security appropriate to their mission
32 needs that complements other network and cybersecurity activities in a way that meaningfully
33 manages the risk of the system both independently and in conjunction its network environment.

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[137] *Federal Identity, Credential, and Access Management (FICAM) Roadmap and Implementation Guidance*, Version 2.0, December 2, 2011. Federal Chief Information Officers Council. The guidance is available at http://www.idmanagement.gov/sites/default/files/documents/FICAM_Roadmap_and_Implementation_Guidance_v2%200_201112 02_0.pdf

1   Figure 7-1 provides a high-level view of core components of the FICAM Roadmap. FICAM provides
2   the framework for implementing secure role-based and data access capabilities using authorized
3   identities and credentials to secure and safeguard data and information.

4
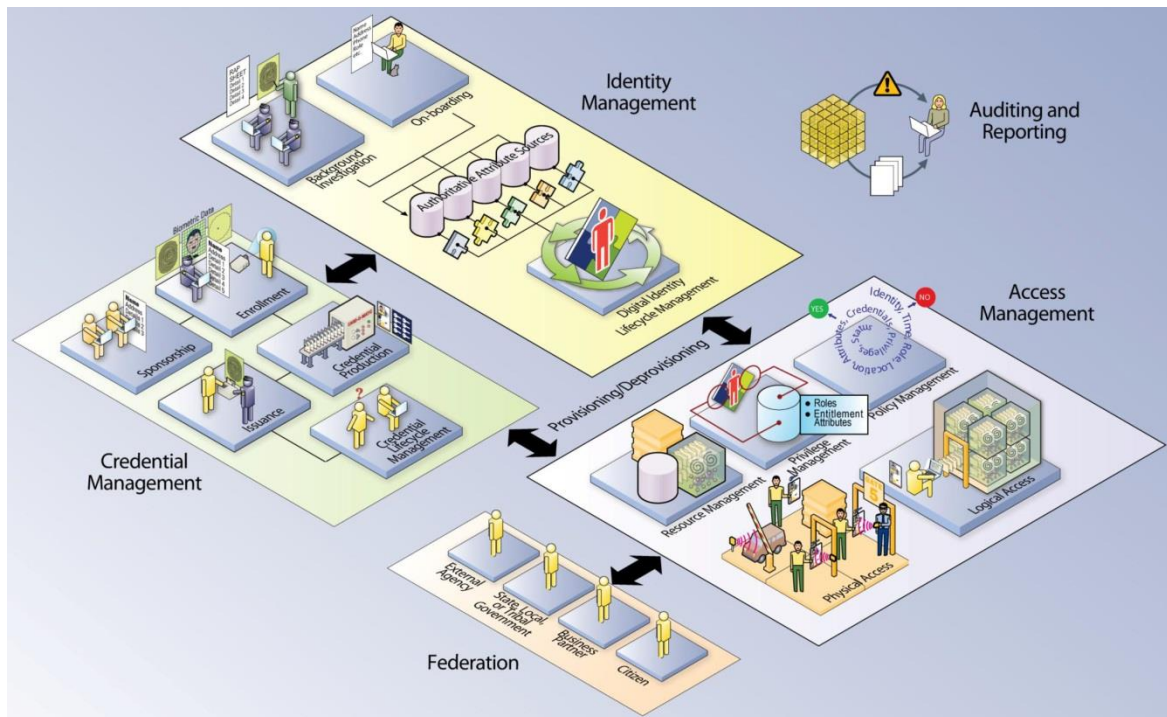
5   Figure 7-1. FICAM Conceptual Diagram

6   IdAM needs to balance the need to safeguard the system and its data with the need to
7   responsibly share information and enable the mission. Identity Management and Access
8   Management are two primary Service Types in the FICAM Roadmap, with Part A, as *the* Federal
9   Government segment architecture for ICAM and IdAM.

10   Appendix F provides a high-level snapshot of the Identity Credential and Access Management
11   activities that will continue to evolve and mature over time. The Appendix is a tri-fold of the ICAM
12   Landscape and describes on-going initiatives and describes common terminology used across the
13   ICAM community.

14   # 7.3 STAKEHOLDER ROLES AND
15   RESPONSIBILITIES

16   IdAM addresses the policies and technical practices defined by a data owner, vetted by
17   governance and oversight bodies, and enacted by a system owner to protect the information
18   contained in the system. These policies and technical practices must be incorporated into the
19   business practices of the system owner, implemented in the technical capabilities of the system,

and enforced as users' access and use the system. As IdAM capabilities become more robust for identifying users and their business purpose in accessing system information, the security model for the system should evolve to take advantage of the additional opportunities for safeguarding system information through fine-grained access control.

Executives must recognize the value of implementing reusable (sharable) IdAM services for mission systems and must reinforce the value provided by such services to their organization through the support of an organizational EA function, aligned with larger federal EA efforts, that identifies and incorporates such shared services. Program Managers must ensure that their system engineering lifecycle incorporates their organization's architecture considerations, as well as larger federal enterprise considerations. The Program Manager must ensure that the requirements for the system incorporate interfaces for external IdAM services so that reusable enterprise shared services can be leveraged for the mission system, and that the timeline for use of such services is aligned with the organizational or federal roadmap and timeline for implementation for those services. The Solution Architect will need to create a system that provides flexible interfaces to interoperate with IdAM and security services and standards. Those interfaces must adapt as those services and standards evolve during the lifecycle of the system.

Data Architects, working with the relevant Data Owners, must ensure that data is accurately tagged in such a way that access control may be maintained over it. An effective access control capability must know certain things about each piece of data, such as its sensitivity, releaseability, or copyright restrictions. These requirements must be incorporated into a data tagging methodology, in alignment with relevant data standards, and built into the system.

System owners must work to balance safeguarding and sharing through appropriate risk management measures, applying IdAM's safeguarding capabilities close to their data and system while additionally leveraging those employed by the fabric, network, or environment as a whole. The security concept for the system should reflect that environment, using the security of the surrounding environment to complement the local system security to provide defense in depth. Network-wide security measures are necessary supporting elements of security, but are not sufficient on their own to satisfy modern information safeguarding needs.

Significant stakeholders in IdAM are diverse and include Data and Mission Owners, Program and Project Managers, System Owners, Enterprise Architects, Information Assurance, and even Procurement personnel.

- **Data and Mission Owners** – are responsible for determining, in plain English, the access control policies for the data they maintain stewardship over. Does their data require users to be from a certain part of the organization? Perhaps have a certain security clearance or have taken certain training? Can their information be accessed by others outside of their Department or Agency? Under what circumstances?

○ These policies must be developed in coordination with, and often approved by, some sort of Governance or Oversight body that often includes General Counsel, the Privacy Office, and others involved in legal and regulatory activities.

- **Program and Project Managers** – are responsible for ensuring the system lifecycle, beginning with the requirements definition through the design and implementation, incorporates the capabilities necessary to meet IdAM and Security requirements for their systems and ensuring that the funding for such capabilities is provided for in the system budget planning.

- **System Owners** – are responsible for ensuring that their systems implement the access control policies defined by Data Owners, as well as for ensuring that their systems implement only the FICAM Service Types that can't be shared.

  ○ The FICAM Roadmap lists the following service types: Digital Identity, Credentialing, Privilege Management, Authentication, Authorization and Access, Cryptography, and Auditing and Reporting.

  ○ A system owner should generally not need to address Digital Identity or Credentialing, as those service types can generally be implemented at the organizational level and shared. System owners may need to incorporate pieces and parts of Privilege Management, Authorization and Access, Auditing and Reporting, and aspects of both Authentication and Cryptography into their system lifecycle.

- **Enterprise Architects** – are responsible for ensuring that shared IdAM-related services are known about and, where appropriate, re-used. Does an in-progress project truly need to have all of its own internal IdAM services? Can it re-use an existing enterprise service?

- **Information Assurance Personnel** – are responsible for ensuring that IdAM is implemented properly, when a shared service is first constructed, when it is re-used, and when a system builds its own internal capabilities.

- **Procurement Personnel** – are responsible for ensuring that IT procurements incorporate the right standards, allowing a system to leverage a shared IdAM service. These personnel are also responsible for ensuring that requests for proposal indicate the desired re-use.

System owners should focus on the IdAM service types inherent to their system, and should leverage reusable services where applicable. Certain FICAM Service Components may be provided by enterprise capabilities (e.g., cryptography for classified communications security) or by shared capabilities (e.g., shared PKI services), and implementers should examine each of the FICAM Service Components, taking into account the security domain on which they operate, to determine which should be reused and which should be built within their system. This "focus on

the system" approach allows the system owner to protect their systems, and data, more robustly than either the traditional perimeter network defense model or a situation where the implementer must account for all FICAM Service Components on their own.

7.4 STAKEHOLDER PERFORMANCE GUIDE: SECURITY AND IDAM

It is the responsibility of the geospatial system investment owner (both existing and pending), to understand and ensure compliance with information security policy and individual agency practices. Information security considerations must occur prior to the procurement and implementation phases of the System Development Life Cycle (SDLC). Security controls, policy, and processes must be built into the SDLC for information security to be implemented successfully and cost-effectively. Each organization should have a mechanism by which risk and security concerns inform the design and implementation of systems and applications, to avoid creating cost and schedule impacts due to security requirements being added at the operations and maintenance stage of the SDLC. The continuous assessment of risk and the effectiveness of controls are required throughout the entire lifecycle of the IT system.[138] Table 7-1 provides an overview ok key security activities that must occur at each phase of the SDLC.

Table 7-1. Key Security Activities by SDLC Phase[139]

SDLC PHASE	KEY SECURITY ACTIVITIES FOR THIS PHASE INCLUDE:
Initiation	Initial delineation of business requirements in terms of confidentiality, integrity, and availability: - Determine information categorization and identification of known special handling requirements to transmit, store, or create information such as personally identifiable information - Determine any privacy requirements - Early planning and awareness will result in cost and timesaving through proper risk management planning. Security discussions should be performed as a part of (not separately from) the development project to ensure solid understanding among project personnel of business decisions and their implications to the overall development project.
Development/ Acquisition	Conduct the risk assessment and use the results to supplement the baseline security controls: - Analyze security requirements - Perform functional and security testing - Prepare initial documents for system authorization and accreditation - Design security architecture
Implementation/ Assessment	Integrate the information system into its environment: - Plan and conduct system certification activities in synchronization with testing of security controls - Complete system accreditation activities
Operations and	Manage the configuration of the system:

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[138] Office of Management and Budget, *Federal Enterprise Architecture Framework*, Version 2, January 29, 2013, available at http://www.whitehouse.gov/omb/e-gov/fea

[139] National Institute of Standards and Technology, NIST Special Publication 800-64 Revision 2, *Security Considerations in the System Development Life Cycle*, October 2008. http://csrc.nist.gov/publications/nistpubs/800-64-Rev2/SP800-64-Revision2.pdf

SDLC PHASE	KEY SECURITY ACTIVITIES FOR THIS PHASE INCLUDE:
Maintenance	• Institute processes and procedures for assured operations and continuous monitoring of the information system's security controls • Perform reauthorization as required
Disposal	Build and execute a Disposal/Transition Plan: • Archive critical information • Sanitize media • Dispose of hardware and software

1 The Performance Guidance (Table 7-2) provides a summation of the key decision points to
2 facilitate the awareness and understanding of the roles and responsibilities of geospatial
3 investment owners for security considerations.

4   Table 7-2. Stakeholder Performance Guide: Security

STAKEHOLDER PERFORMANCE GUIDE			
CHAPTER 7 – SECURITY			
Role	Responsibility	Approach	Benefit

STAKEHOLDER PERFORMANCE GUIDE			
CHAPTER 7 – SECURITY			
Role	Responsibility	Approach	Benefit
Executive Leadership	• Identify appropriate access policy for system data necessary to ensure responsible information sharing according to mission need. • Ensure risk management function for the organization is established and applies repeatable, consistent evaluation criterion. • Embrace the use of reusable, shared services for IdAM and security capabilities within the agency, and ensure Enterprise Architecture provides for adoption of federal shared services, particularly IdAM and security services, as they become available. • Empower organizational enterprise architect to direct the inclusion of relevant IdAM and security standards in organizational IT acquisition actions by holding systems accountable for EA compliance.	• Understand Policy Requirements: 　◦ Mission need for system information security 　◦ Business processes that incorporate the system information 　◦ Severity of risk of unauthorized disclosure • Risk management function should be staffed sufficiently and empowered to reconcile interests of stakeholders. Clear risk management criteria formed with input from all relevant stakeholders (security, privacy, CR/CL, mission owners). • Designate organizational Executive Agents responsible for implementing IdAM and Security EA and policy. Responsible for: 　◦ Organization. EAs represent organization at relevant intergovernmental committees, governance bodies, and WGs. 　◦ Develop acquisition strategy that requires transition of solutions to repeatable shared services. • EA functions include: 　◦ Organizational process for approval of systems to ensure EA for IdAM and Security (services and standards). If compliance not currently feasible, POA&Ms to be required. 　◦ Engage organizational acquisitions and procurement functions to ensure contractual commitments and acquisitions are consistent with IdAM and Security EA and implementation plans. 　◦ Recommend restriction of funding of noncompliant systems.	• A clear statement of information sharing policy can be vetted through the relevant stakeholders and then digitally implemented within mission systems to efficiently execute the mission. • Provides consistent feedback that can be incorporated for system design and avoids delays from inability to plan due to ambiguous guidance or interference from dissatisfied stakeholders. • Assist in complying with Federal policy guidance and drives cost efficiencies through shared, common services. • Ensures that system planning incorporates appropriate guidance from an early stage to avoid delays or wasted expenditures resulting from noncompliant system architecture. • Incorporating EA function into organizational approval process provides enforcement mechanism for EA compliance at an early stage, when noncompliance can be more easily mitigated.

STAKEHOLDER PERFORMANCE GUIDE			
CHAPTER 7 – SECURITY			
Role	Responsibility	Approach	Benefit

Program Manager	• Ensure access policy requirements for the system information are included in system acquisition, tech refresh actions, and system engineering lifecycle.
	• Ensure compliance/evaluation/ approval of the system in accordance with the organizational risk management framework.
	• Ensure requirements for relevant IdAM requirements are included in procurement language.
		• Identify access policy rules that have been enumerated for information contained in the system.
		• Program Manager actively engages with relevant governance bodies from system planning phase onward (see Table 7-1).
		  ◦ Give EA organization visibility into each phase of system lifecycle.
		  ◦ EA communicates emerging requirements to Program Managers.
		• Draft and include approved guidance with system acquisition, tech refresh actions, and system engineering lifecycle documentation.
			• Assist in complying with Federal policy guidance and drives cost efficiencies through shared, common services.
			• Assists in CPIC reporting requirements and drives early security awareness and compliance resulting in cost savings.
			• Assists in CPIC reporting requirements and drives early security awareness and compliance resulting in cost savings.

Solution Architect	• Ensure solution roadmap aligns with *FICAM Roadmap*. • Ensure solution meets requirements of organizational risk management framework. • Implement solution that is compliant with EA model for IdAM and security as well as organizational FICAM implementation plans. • Implement solution with sufficient interfaces to take advantage of enterprise IdAM and security services.	• Detail functionality for currently available capabilities and provide POA&Ms demonstrating alignment for future capabilities. • Clear system with risk management function during planning stage. If system is operational, coordinate roadmap to satisfy RM function. • Solution is described in terms of functional and technical requirements, which are mapped to service types and components of the relevant EA model. • Interfaces are defined sufficiently to show interoperability of system with repeatable shared services and standards.	• Ensures flexibility and adaptablity of systems to incorporate upcoming capabilities. • Expedites development by coordinating risk management requirements into system planning and design phase rather than waiting for approval after build is complete. • Ensures that solutions are engineered or selected to meet all relevant requirements from the planning and design phase. • Ensures that the solution is designed and sufficiently technically implemented to provide flexibility to interoperate with emerging IdAM and security capabilities without the need for extensive re-engineering.

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8 STANDARDS-BASED INTEROPERABILITY

8.1 INTRODUCTION

Definition/Description (What) – is an operational requirement needed to achieve the maximum benefit for geospatial systems investment resulting in increased access to and sharing of functional capabilities for applications, services, data, and infrastructure to meet mission/business requirements.

Purpose/Function (Why) – to serve as a reference guide to an organization in the preparation of documentation for the procurement and/or development of geospatial systems and services. Organizations and enterprise architectures will benefit from standards-based acquisitions and deployment of industry accepted interoperability solutions and technologies to meet their mission/business functions.

Stakeholder Performance Guide (Who & How) – Program Managers responsible for geospatial system and services acquisition and development of procurement language for solicitations and support services. Solution Architects for identifying, understanding and implementing systems and services using industry open standards.

8.2 STANDARDS-BASED INTEROPERABILITY: APPROACH

The requirement for Federal Agencies to implement the *Federal Information Technology Shared Services Strategy*[140] and to make "Shared-First" their default approach to IT service planning and delivery, will require a standards-based approach for implementation. To access and use geospatial Applications/Services (Chapter 5) and leverage existing Infrastructure investments (Chapter 6), the geospatial investment owner must identify and implement industry open standards and best practices to derive mission value.

The *Common Approach to Federal Enterprise Architecture*[141] states that, "services should be standardized within and between agencies where possible," and has as one of its General Principles, criteria against which potential investment and architectural decisions are weighed, to include:

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[140] *Federal Information Technology Shared Services Strategy*, OMB, May 2, 2012
http://www.whitehouse.gov/sites/default/files/omb/assets/egov_docs/shared_services_strategy.pdf
[141] http://www.whitehouse.gov/sites/default/files/omb/assets/egov_docs/common_approach_to_federal_ea.pdf

Interoperability Standards: Federal EA promotes intra- and inter-agency standards for aligning strategic direction with business activities and technology enablement. Agencies should ensure that EA solutions conform to Federal-wide standards whenever possible.

The Standards-based Interoperability Chapter will focus upon identifying sources for open standards that could/should be used in the development of standards-based acquisition. The chapter will not:

- Provide a definitive list or procurement-ready language for geospatial standards required for systems and/or services,

- Include an exhaustive list of all geospatial standards in use or planned by Standards Development Organizations (SDOs),

- Describe the SDO's standards consensus and adoption process, or

- Provide a technical explanation of standards or how to implement them.

8.3 STANDARDS VALUE PROPOSITION

"The value of a [geospatial service] component increases in proportion to the number of places it can be used."[142, 143, 144]

Geospatial service components are a self-contained process, service, or IT capability with pre-determined functionality that may be exposed through a business or technology interface. These components or "building blocks" when built in compliance with industry standard practices and technologies are more likely to integrate efficiently into a multi-agency information sharing and processing environment. Components based upon on a standard such as GML or NIEM will result in greater interoperability since a consortium of organizations have "pre-agreed" to adhere to the standard. Common standards also help ensure a compatible execution environment, which in turn benefit implementation.[145]

There have been numerous citations as to the value of standards across Information Technology in the areas of Enterprise Architecture and geospatial. The United Nation Economic and Social Council's Committee of Experts on Global Geospatial Information Management (UN-GGIM)

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[142] *Federal Enterprise Architecture Geospatial Profile*, Version 1.1, January 27, 2006. (no longer available)

[143] NASA Geospatial Standards Study, http://www.ec-gis.org/sdi/ws/costbenefit2006/reference/ROI_Study.pdf.

[144] German DIN Study on the economic value of standards. http://www.din.de/cmd?level=tpl-artikel&languageid=en&cmstextid=145918

[145] Ibid.

1 prepared a Report of the Secretariat on the "Establishment and implementation of standards for
2 the global geospatial information community."[146] The findings of the report identified that:

3 **"Standardization, the process of developing and implementing technical**
4 **standards, brings uniformity, compatibility and interoperability to millions of**
5 **processes, devices, and applications in all sectors of a global economy. This**
6 **reliance on standards is just as relevant in the geospatial sector, where having**
7 **the right standard-setting procedures and interoperability rules in place create**
8 **the means for geospatial information, devices, applications, data repositories,**
9 **services and networks to all communicate as one."**

10 The report finds that:

11 **"Standardization is a key aspect to enhancing the integration processes of**
12 **geospatial information into daily decision-making at all levels of society.**
13 **Geospatial information, spatial data infrastructures and geospatial web services**
14 **are now widely accessible, shared and reused in many contexts primarily**
15 **because geospatial information, systems, and services are interoperable—that is,**
16 **able to be integrated and shared. Standardization has contributed significantly to**
17 **the evolution and development of the interoperability of geospatial information**
18 **and services."**

19 The *Principles for Federal Engagement in Standards Activities to Address National Priorities*,[147]
20 authored by the Office of Management and Budget, U.S. Trade Representative and Office of
21 Science and Technology Policy, finds that:

22 **"The vibrancy and effectiveness of the U.S. standards system in enabling**
23 **innovation depend on continued private sector leadership and engagement. Most**
24 **standards developed and used in U.S. markets are created with little or no**
25 **government involvement. This approach—reliance on private sector leadership,**
26 **supplemented by Federal Government contributions to discrete standardization**
27 **processes as outlined in OMB Circular A-119, "Federal Participation in the**
28 **Development and Use of Voluntary Consensus Standards and in Conformity**
29 **Assessment Activities[148]—remains the primary strategy for government**
30 **engagement in standards development. Consistent with the Administration's**

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[146] United Nation Economic and Social Council, 14 June 2013, Committee of Experts on Global Geospatial Information Management. http://ggim.un.org/docs/meetings/3rd%20UNCE/E-C20-2013-8-Setting%20Geospatial%20Standards%20Report.pdf

[147] http://www.whitehouse.gov/sites/default/files/omb/memoranda/2012/m-12-08.pdf

[148] http://www.whitehouse.gov/omb/circulars_a119/

commitment to openness, transparency, and multi-stakeholder engagement, all standards activities should involve the private sector."

8.4 STANDARDS VIEW: OPEN STANDARDS VS. OPEN SOURCE[149]

Confusion in the understanding and use of the terms "Open Standards" and "Open Source" resulted in the development of a White Paper prepared collaboratively by the Open Geospatial Consortium (OGC) and the Open Source Geospatial Foundation (OSGeo) to describe how they relate and how they are different.

8.4.1 OPEN STANDARDS

Communication means "transmitting or exchanging through a common system of symbols, signs or behavior." Standards are a pre-requisite for communication, because standardization means "agreeing on a common system." Geospatial software vendors, developers, and users collaborate in the OGC's voluntary consensus standards process to develop and agree on standards that enable information systems to exchange geospatial information and instructions for geoprocessing. The result of these efforts are Open Standards. The OGC defines Open Standards as standards that are:

1. Freely and publicly available – They are available free of charge and unencumbered by patents and other intellectual property.

2. Non-discriminatory – They are available to anyone, any organization, anytime, anywhere with no restrictions.

3. No license fees – There are no charges at any time for their use.

4. Vendor neutral – They are vendor neutral in terms of their content and implementation concept and do not favor any vendor over another.

5. Data neutral – The standards are independent of any data storage model or format.

6. Defined, documented, and approved, by a formal member driven consensus process. The consensus group remains in charge of changes and no single entity controls the standard.

The OGC's Open Standards are specifications for interfaces and encodings that enable interoperability between geoprocessing systems from different developers, whether employed by proprietary product vendors, independent integrators, application developers, or active in Open Source projects.

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[149] Much of the information in this section is taken directly from the Open Source Geospatial Foundation (OSGeo) Wiki. The content of this section is taken from an article that is a white paper (*Open Source and Open Standards*, May 5, 2011) jointly published by the Open Geospatial Consortium (OGC) and OSGeo. The article is available at http://wiki.osgeo.org/wiki/Open_Source_and_Open_Standards.

A standard is like a blueprint that guides people who build things. A standard documents the use of rules, conditions, guidelines or characteristics for products or related processes and production methods. Standards can arise from a single company whose successful products become "de facto" standards. Standards may also be set by agreement among two or more software producers, by government edict, a government-run process, or by representatives from multiple governments. OMB Circular A-119 directs Federal agencies to use voluntary consensus standards in lieu of government-unique standards except where inconsistent with law or otherwise impractical. Alternatively, standards can be developed, as in ISO or the OGC, through a voluntary consensus process governed by well-defined policies and procedures. These standards are agreed upon by the participants in the consensus process.

The OGC's Open Standards are free, publicly available specifications for interfaces, encodings and best practices. They are not software.

8.4.2 OPEN SOURCE

Open Source encompasses two related concepts regarding the way software is developed and licensed. They are codified in the "Free Software" and the "Open Source" definitions. "Free and Open Source Software" refers to software which has been made available under a free software license with the rights to run the program for any purpose, to study how the program works, to adapt it, and to redistribute copies, including modifications. These freedoms enable Open Source software development, a public, collaborative model that promotes early publishing and frequent releases. The Open Source Initiative[150] has developed a set of 10 requirements of any software license that is to be considered an Open Source license.

Open source doesn't just mean access to the source code. The distribution terms of open-source software must comply with the following criteria from the Open Source Definition (http://opensource.org/osd):

1. Free Redistribution – The license shall not restrict any party from selling or giving away the software as a component of an aggregate software distribution containing programs from several different sources. The license shall not require a royalty or other fee for such sale.

2. Source Code – The program must include source code, and must allow distribution in source code as well as compiled form. Where some form of a product is not distributed with source code, there must be a well-publicized means of obtaining the source code for no more than a reasonable reproduction cost preferably, downloading via the Internet without charge. The source code must be the preferred form in which a programmer

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[150] http://opensource.org/

would modify the program. Deliberately obfuscated source code is not allowed. Intermediate forms such as the output of a preprocessor or translator are not allowed.

3. Derived Works – The license must allow modifications and derived works, and must allow them to be distributed under the same terms as the license of the original software.

4. Integrity of the Author's Source Code – The license may restrict source-code from being distributed in modified form only if the license allows the distribution of "patch files" with the source code for the purpose of modifying the program at build time. The license must explicitly permit distribution of software built from modified source code. The license may require derived works to carry a different name or version number from the original software.

5. No Discrimination Against Persons or Groups – The license must not discriminate against any person or group of persons.

6. No Discrimination Against Fields of Endeavor – The license must not restrict anyone from making use of the program in a specific field of endeavor. For example, it may not restrict the program from being used in a business, or from being used for genetic research.

7. Distribution of License – The rights attached to the program must apply to all to whom the program is redistributed without the need for execution of an additional license by those parties.

8. License Must Not Be Specific to a Product – The rights attached to the program must not depend on the program's being part of a particular software distribution. If the program is extracted from that distribution and used or distributed within the terms of the program's license, all parties to whom the program is redistributed should have the same rights as those that are granted in conjunction with the original software distribution.

9. License Must Not Restrict Other Software – The license must not place restrictions on other software that is distributed along with the licensed software. For example, the license must not insist that all other programs distributed on the same medium must be open-source software.

10. License Must Be Technology-Neutral – No provision of the license may be predicated on any individual technology or style of interface.

It is sometimes helpful to understand that Open Source is a matter of liberty, not price. To this end, the Free Software Foundation[151] says that you should think of "free" as in "free speech," not as in "free beer." It means that the program's users have the four essential freedoms (https://gnu.org/philosophy/free-sw.html):

1. The freedom to run the program, for any purpose.

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[151] http://www.fsf.org/

2. The freedom to study how the program works, and change it to make it do what you wish. Access to the source code (Open Source) is a precondition for this.

3. The freedom to redistribute copies so you can help your neighbor.

4. The freedom to distribute copies of your modified versions to others.

These freedoms are the prerequisites to Open Source software development.

The *Federal Shared Service Implementation Guide*[152] suggests, "When adopting a new shared service, determine whether a proprietary-based or open standards-based solution should be purchased. While it may be difficult in some situations to obtain an open standards-based solution, Customer/Partner Agencies should be aware that open standards increase their agility in moving to other providers. Open standard and constructs such as XML [Extensible Markup Language], or open source software, provide levels of agility that help agencies make shared services implementations more agile."

8.5 STANDARDS GOVERNANCE

The Federal *Open Data Policy*[153] requires agencies to collect or create information in a way that supports downstream information processing and dissemination activities. This includes using machine-readable and open formats, data standards, and common core and extensible metadata for all new information creation and collection efforts.

OMB Circular A-119[154] for *Federal Participation in the Development and Use of Voluntary Consensus Standards and in Conformity Assessment Activities* directs agencies to use voluntary consensus standards in lieu of government-unique standards except where inconsistent with law or otherwise impractical. It also provides guidance to agencies on participation in the development of voluntary consensus standards, and articulates policies relating to the use of standards by Federal agencies.

The Federal *Open Data Policy* directs agencies to follow OMB Circular A-119 in the development, maintenance, and use of standards and specifications that are developed through an open, collaborative, and transparent process that is defined by the following attributes:

- Openness
- Balance of interest

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[152] CIO Council *Federal Shared Services Implementation Guide*, April 16, 2013. Available at
https://cio.gov/wp-content/uploads/downloads/2013/04/CIOC-Federal-Shared-Services-Implementation-Guide.pdf

[153] Office of Management and Budget, Memorandum M-13-13, *Open Data Policy – Managing Information as an Asset*, May 9, 2013. Available at http://www.whitehouse.gov/sites/default/files/omb/memoranda/2013/m-13-13.pdf

[154] http://www.whitehouse.gov/omb/circulars_a119

1   • Due process

2   • An appeals process

3   • Consensus

4   The National Science and Technology Council's Subcommittee of Standards developed proposed
5   policy recommendations as *Principles for Federal Engagement in Standards Activities to Address*
6   *National Priorities*,[155] for government engagement in private-sector standards development
7   activities. The report outlines policy recommendations for the government involvement in the
8   standards development activities to include:

9   1. Recognize that in most government-private-sector standards engagements, the primary
10   role of the government will continue to be that of active contributor to the private-sector-
11   led process.

12   2. Identify the context(s) where Federal government leadership/coordination may be
13   appropriate.

14   3. Outline objectives for government engagement in standardization activities to support
15   national priorities.

16   4. Effective coordination and participation by agencies.

17   5. Clarify agency responsibilities with respect to the full range of standards setting
18   alternatives.

19   6. Lay out key principles underpinning voluntary standardization processes.

20   A limited set of foundational attributes of standardization activities are called out in OMB Circular
21   A-119, focusing on voluntary, consensus standards activities. It is important to recognize as well
22   the contributions of standardization activities that take place outside of the formal voluntary,
23   consensus process, particularly in emerging technology areas. The following additional attributes
24   should also be considered, to maximize the impact of those activities on enabling innovation and
25   fostering competition, while also assuring fulfillment of agency regulatory, procurement, and
26   policy missions:

27   • Transparency: essential information regarding standardization activities is
28   accessible to all interested parties.

29   • Open Participation: all interested or affected parties have an opportunity to
30   participate in the development of a standard, with no undue financial barriers to
31   participation.

32   • Flexibility: different product and services sectors rely on different methodologies
33   for standards development that meets their needs.

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[155] http://www.whitehouse.gov/sites/default/files/microsites/ostp/federal_engagement_in_standards_activities_october12-final.pdf

- Effectiveness and Relevance: standards are developed in response to regulatory, procurement and policy needs, and take account of market needs and practices as well as scientific and technological developments.

- Coherence: the process avoids overlapping and conflicting standards.

- International Acceptance: as product and service solutions cross borders, the public and private sectors are best served by standards that are international in scope and applicability.

- Net Benefit: standards used to meet regulatory and procurement needs should maximize net benefits of the use of such standards.

8.5.1 GEOSPATIAL STANDARDS DEVELOPMENT ORGANIZATIONS

The pace at which organizations develop and deploy geospatial information technology applications and services exceeds the ability of Standards Development Organizations (SDOs) to prepare consensus-based standards to help guide their implementation. There are a number of [geospatial] SDOs that play a pivotal role in advancing location-based interoperability standards. Readers are encouraged to review (and participate where possible) the standards, specifications, and best practices documentation these organizations have developed and continue to enhance. This section, although not comprehensive, provides a brief description and links to many of the geospatial SDOs and their efforts:

- **International Organization for Standardization, Technical Committee on Geographic Information/Geomatics (ISO/TC211)[156]** – Responsible for the ISO geographic information series of standards. These standards may specify, for geographic information, methods, tools and services for data management (including definition and description), acquiring, processing, analyzing, accessing, presenting, and transferring such data in digital/electronic form between different users, systems and locations. As of July 2014, ISO/TC211 has published 64 standards related to digital geographic information.[157]

- **International Committee for Information Technology Standards (INCITS), technical committee L1 on Geographic Information Systems[158]** – Work consists of adopting or adapting information technology standards and developing digital geographic data standards. L1 is the U.S. Technical Advisory Group (TAG) to ISO/TC 211.

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[156] http://www.iso.org/iso/home/standards_development/list_of_iso_technical_committees/iso_technical_committee.htm?commid=54904

[157] http://www.iso.org/iso/en/stdsdevelopment/tc/tclist/TechnicalCommitteeDetailPage.TechnicalCommitteeDetail?COMMID=4637

[158] http://standards.incits.org/a/public/group/l1

- **Open Geospatial Consortium (OGC®)**[159] – The OGC is an international voluntary standards organization focused on defining, testing, and maintaining standards that enable geodata discovery, sharing, integration, viewing, and processing across different technologies and vendor products, the web and wireless networks. The OGC is an open membership organization. The OGC offers a range of membership options for industry, government, academic, research and not-for-profit organizations interested in supporting the Consortium's global mission (see http://www.opengeospatial.org/ogc/join/levels). There are nearly 500 member organizations representing private sector GIS companies, commercial open source organizations, government, NGOs, universities, research organizations and system integrators.

- **United States Federal Geographic Data Committee (FGDC)**[160] – Established by the Office of Management and Budget (OMB) under Circular A-16, *Coordination of Geographic Information and Related Spatial Data Activities*, the FGDC is a 32 member interagency committee that promotes the coordinated development, use, sharing, and dissemination of geospatial data on a national basis known as the National Spatial Data Infrastructure (NSDI). The FGDC develops geospatial data standards for implementing the NSDI, in consultation and cooperation with state, local, and tribal governments, the private sector and academic community, and, to the extent feasible, the international community. The FGDC develops geospatial data standards only when no equivalent voluntary consensus standards exist, in accordance with OMB Circular A-119.

- **Geospatial Intelligence Standards Working Group (GWG)**[161] – The GWG is a National System for Geospatial-Intelligence (NSG) forum that serves the Director, National Geospatial-Intelligence Agency (NGA) and the NGA Chief Information Officer who is the delegated functional manager for geospatial intelligence (GEOINT) architecture and standards. The GWG provides the forum for the coordination of GEOINT standard activities where Core members are responsible for reviewing current or emerging standards, coordinating advice with their agency's technical and acquisition experts, and reporting in GWG meetings their agency's position on the standards. The GWG is led and chaired by the NGA's National Center for Geospatial Intelligence Standards (NCGIS).

  o In addition to its designation as an NSG Functional Management forum, the GWG is a Joint Technical Working Group that participates in both the DoD and IC standards governance processes. In the DoD, the GWG votes and manages GEOINT standards lifecycle recommendations reported to the Information

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[159] http://www.opengeospatial.org
[160] http://www.fgdc.gov/standards
[161] http://www.gwg.nga.mil/index.php

Technology Standards Committee (ITSC), the governing group responsible for developing and promoting standards interoperability in support of net-centricity within the Department of Defense (DoD). GWG recommendations for mandating standards for the DoD are approved by the DoD Architecture and Standards Review Group (ASRG). Approved GEOINT standards are then cited in the DoD Information Technology (IT) Standards Registry (DISR), helping to create a centralized database to better enable the discovery, access, integration, dissemination, exploitation, and interoperability of GEOINT.

- **Defence Geospatial Information Working Group (DGIWG)[162]** – DGIWG is the multi-national body responsible for geospatial standardization for the defense organizations of member nations. DGIWG develops and maintains a suite of digital geospatial information (DGI) standards that foster the interchange, access, and use of geographic information between the defense organizations of member nations. DGIWG has been established under a memorandum of understanding between member nations, and addresses the requirements for these nations to have access to compatible geospatial information for joint operations. The DGIWG geospatial standards are built upon the generic and abstract standards for geographic information defined by the International Organization for Standardization (ISO TC/211) and makes use of the service specifications endorsed by the Open Geospatial Consortium (OGC). DGIWG defines information components for use in the development of product specifications and application schemas for military geospatial data. DGIWG also establishes service specifications, encoding formats, and testing methodologies to meet military geospatial intelligence requirements.

8.6 STANDARDS-BASED ACQUISITION GUIDANCE: REFERENCE SOURCES

Geospatial standards-based acquisition guidance in the form of procurement language and 'boiler plate' templates does not readily exist across the community.

While the value of standards are clear, one of the challenges facing standardization is the combination of rapid advancements in Information Technology; the evolution of location-based applications/services as geospatial commodities; the pace of standards development keeping up with technology; and the pace of the government procurement process requiring the inclusion of standards in contracts.

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[162] http://www.dgiwg.org/dgiwg/

Because of the dynamic nature of these challenges, standards-based acquisition guidance is not readily available or maintained and adopted for use in geospatial investments. Several attempts to identify 'base-line' or 'essential' geospatial standards that could be included in scopes of work or procurement compliance language are identified in lieu of an authoritative or consensus-driven guide or template. The following reference documentation have been developed over the past decade and are provided in a general sequence from oldest to most recent, although some are continuing to be maintained.

8.6.1 A GEOSPATIAL INTEROPERABILITY REFERENCE MODEL

The Federal Geographic Data Committee's (FGDC) Geospatial Applications and Interoperability (GAI) Working Group (now inactive) released the Geospatial Interoperability Reference Model (GIRM)[163] in December 2003.

> **"The document references standards and specifications needed for interoperability among distributed geospatial services accessible over the Internet. It describes and explains them within a structured model of geospatial processing, as they apply to the design of geospatial software and services, to guide the reader to the most relevant standards for a given design, policy, or procurement … [GIRM] is intended not as a rigid definition of standards to be implemented, but rather as a consultative tool to help decision makers define what standards apply to a given set of activities, technologies, or organizations, to facilitate interoperable geoprocessing."**

8.6.2 GEOSPATIAL PROFILE OF THE FEDERAL ENTERPRISE ARCHITECTURE, VERSION 2.0

The Federal Enterprise Architecture (FEA) Geospatial Profile[164] document created in 2009 was released by the Architecture and Infrastructure Committee, Federal Chief Information Officers Council and the Federal Geographic Data Committee. Like its predecessor, the document included an Appendix of Geospatial Standards and Extended TRM that made limited reference to "Relevant Standards" for categories of service platform and infrastructure, component framework, and service interface and integration levels.

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[163] http://www.fgdc.gov/standards/organization/GIRM
[164] http://www.fgdc.gov/initiatives/resources/geospatial-profile-of-the-FEA-v2-march-2009.pdf

8.6.3 FEDERAL GEOSPATIAL ARCHITECTURE GUIDANCE, VERSION 1.0[165]

The FGDC, in support of the Federal Chief Information Council, developed the *Segment Architecture Analysis of the Geospatial Platform*[166] as a guidance document to improve the design and deployment of geospatial capabilities. Appendix D: Geospatial Standards and Extended TRM describes a number of specialized systems and standards at the service platform and infrastructure, component framework, and service interface/integration levels.

8.6.4 FEDERAL GEOGRAPHIC DATA COMMITTEE ENDORSED STANDARDS

The FGDC Standards Working Group (SWG) actively promotes and coordinates FGDC standards activities. The SWG provides guidance on FGDC standards policy and procedures, facilitates coordination between subcommittees having overlapping standards activities, and reviews and makes recommendations on the approval of standards proposals, draft standards for public review, and draft standards for FGDC endorsement. The SWG has advanced 27 standards developed within the FGDC[167] to FGDC endorsement at the time of this draft document.

8.6.5 FEDERAL GEOGRAPHIC DATA COMMITTEE ENDORSED EXTERNAL STANDARDS

The FGDC Steering Committee has officially endorsed over 60 non-Federally authored standards that play an important role in enabling geospatial interoperability.[168] The standards include standards from Open Geospatial Consortium; ISO Technical Committee 211, Geographic information/Geomatics; the American National Standards Institute (through International Committee for Information Technology Standards Technical Committee L1, Geographic information systems) and de facto standards.

The FGDC Steering Committee endorsed these standards in accordance with the *FGDC Policy on Recognition of Non-Federally Authored Geographic Information Standards and Specification*. The standards were identified, reviewed and endorsed by the FGDC Steering Committee.

The list comprises a broad range of geospatial standards that include: Reference and Abstract Standards, Common Encoding Standards, Common Service Standards and Content/Code Standards. The FGDC maintains the standards list.

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[165] The information in this section is taken from the *Segment Architecture Analysis of the Geospatial Platform*, Version 1.0, May 14, 2010.

[166] http://www.fgdc.gov/geospatial-lob/draft-segment-architecture-review/Segment-Architecture-Analysis-of-the/view

[167] http://www.fgdc.gov/standards/projects/FGDC-standards-projects/fgdc-endorsed-standards

[168] http://www.fgdc.gov/fgdc-news/fgdc-endorses-64-external-standards

The FGDC maintains a standards tracking spreadsheet that tracks over 200 standards from FGDC, INCITS L1, ISO/TC 211, OGC, GWG, and other standards organizations. It has been maintained continuously for over three years and can be accessed from the FGDC web site at the following: http://www.fgdc.gov/standards/monthlyStandardsUpdate/index.

8.6.6 SDI COOKBOOK, GLOBAL SPATIAL DATA INFRASTRUCTURE[169]

The Spatial Data Infrastructure (SDI) Cookbook[170] is sponsored by the Global Spatial Data Infrastructure Association identifies: existing and emerging standards, open-source and commercial standards-based software solutions, supportive organizational strategies and policies and best practices. Chapter 10: Standards Suites for Spatial Data Infrastructure has the following Problem Statement of:

> **"SDI initiatives worldwide are implementing a variety of international standards for data and service discovery, data access, visualization, and analysis. The use of different combinations and/or versions of these standards limits interoperability between systems and initiatives. Guidance on best practices and approaches to solving these interoperability issues is critical to our ability to define and implement a SDI.**
>
> **This document seeks to answer the following questions:**
>
> - **What standards make up the SDI standards baseline?**
> - **Which versions of core standards should be cited in the SDI standards baseline?**
> - **What tests shall be performed to make sure that software is compliant with standards?"**

The SDI Cookbook notes that geospatial specific standards may be dependent upon other foundational standards. The SDI Cookbook estimates that, "well over 75 standards, including underlying Internet standards, may be relevant to the geospatial domain." Therefore procurement language would need to be inclusive of those industry standards for an effective and interoperable investment.

To address the diversity in the number and type of relevant standards, the SDI Cookbook proposes the establishment of "an SDI standards baseline that allows for the federation of

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[169] Much of the content in this sub-section is taken directly from the GDSI Wiki site. The Wiki is available at http://www.gsdidocs.org/GSDIWiki/index.php/Main_Page

[170] http://www.gsdidocs.org/GSDIWiki/index.php/Main_Page

1   provider-operated services and data to be discovered, visualized, and assessed by Web browsers
2   and software applications," based upon criteria for inclusion. The standards baseline is one of the
3   best examples of a concise listing (e.g., tables) where standards are identified that could be
4   included within procurement language for geospatial investments. The following tables and
5   supporting narrative are taken directly from the SDI Cookbook chapter on standards.

6   Table 8-1 lists foundational standards on which geospatial standards may be dependent. Not all of
7   these standards are required for implementation, but may be required or expected to be present
8   in a community's operating environment.

9   Table 8-1. Standards Used in Deployed SDIs

| W3C Recommendation: eXtensible Markup Language (XML) Version 1.1 |
| W3C Recommendation: XML Schema Version 1.0 |
| W3C Recommendation: Hyper Text Transport Protocol (HTTP) Version 1.1 |
| W3C Recommendation: Simple Object Access Protocol (SOAP) Version 1.2 |
| W3C Note: Web Services Description Language (WSDL), Version 1.1 |
| Oil and Gas Producer (OGP, formerly EPSG) Geodetic Parameter Dataset, Version 6.9 (2006) |
| Geographic Tagged Image File Format (GeoTIFF) Version 1.0 |
| JPEG-2000 (ISO/IEC 15444-1:2004) |
| Information retrieval (Z39.50)—application service definition and protocol specification (ISO 23950:1998) |
| W3C XLink 1.1 Schema |

10   Table 8-2 through Table 8-4 list core, supplemental, and possible future standards for the SDI
11   standards baseline.

12   Table 8-2. SDI Core Standards

| OGC Web Map Service 1.3 |
| OGC Web Feature Service 2.0/ISO 19142:2010 |
| OGC Filter Encoding 1.1 |
| OGC Web Coverage Service 1.1.2 |
| OGC Geography Markup Language 3.2.1 |
| OGC Catalogue Service 2.0.2 HTTP protocol binding (CS-W) |
| OGC Catalogue Service 2.0.2 HTTP protocol binding (CS-W) ebRIM and ISO Profiles |
| ISO 19115:2003 and ISO/TS 19139:2007 |
| OGC KML 2.2 |
| OGC WPS 1.0 + corrigenda |
| GeoRSS-Simple, GeoRSS GML |

13   Table 8-3. SDI Supplemental Standards

| OGC Styled Layer Descriptor 1.1 |
| OGC Web Map Context 1.1/Corrigendum 1 |

1 Table 8-4. SDI Future Standards

OGC Web Coverage Service 2.0, corrigenda, and KVP, XML/POST, XML/SOAP, and GeoTIFF extensions
OGC GML 3.3
OGC Filter Encoding 2.0

2 The SDI Cookbook is inclusive of contributors from public and private communities and was last
3 updated on February 21, 2014 at the time of this draft document

8.6.7 GEOINT STANDARDS[171]

5 GEOINT standards support specific elements of the National System for Geospatial Intelligence
6 (NSG) architecture and represent approximately 25% of all the standards relevant to the
7 architecture. They are formally defined as documented agreements containing technical
8 specifications or other precise criteria to be used consistently as rules, guidelines, or definitions of
9 characteristics to ensure that materials, products, processes, or services are fit for the analysis
10 and visual representation of physical features and geographically referenced activities.

11 GEOINT standards characterize GEOINT data, data constructs, data services, products, and
12 interfaces. They enable the collection, processing, analysis, and exploitation of GEOINT. They also
13 govern GEOINT access, dissemination, and storage. The use of common GEOINT standards
14 reduces the use of multiple and incompatible sets of data and makes it possible to create and
15 share suitable, accurate, comprehensive, and timely GEOINT.

16 Examples of various types of GEOINT standards are shown in Table 8-5.

17 Table 8-5. Types of GEOINT Standards

TYPES OF GEOINT STANDARDS	
• GEOINT metadata	• Geospatial referencing
• Still/motion imagery content/format	• Information transfer
• Sensor modeling	• Data compression
• Geographic feature encoding	• GEOINT reporting
• Feature data dictionaries/catalogs	• GEOINT product specifications
• Geographic portrayal	• GEOINT web services

18
19 As NSG functional manager for GEOINT, the NGA endorsed a suite of web services and other
20 standards developed by the Open Geospatial Consortium (OGC). This suite of OGC standards,
21 along with other standards adopted into the DoD IT Standards Registry (DISR), comprise the
22 current NSG GEOINT Standards Baseline. Standards are added to the baseline as they are
23 matured, approved, and implemented across the NSG. Key standards that compose the NSG
24 GEOINT Standards Baseline are shown in

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[171] Much of the content in this sub-section is taken directly from the Geospatial Intelligence Standards Working Group web site and is available at http://www.gwg.nga.mil/guide.php

1   Table 8-6.

2   Table 8-6. GEOINT Standards Baseline

KEY STANDARDS IN THE NSG GEOINT STANDARDS BASELINE	
OGC® Standards	**Other Standards**
• Web Features Service (WFS) • Web Map Service (WMS) • Web Map Context (WMC) • Web Coverage Service (WCS) • Geography Markup language (GML) • Styled Layer Descriptor (SLD) • Catalog Services (CS-W) • Filter Encoding Specification (FE)	• ISO 19115 Geographic Information – Metadata • ISO 19119 Geographic Information – Services • ISO/IEC 15444-1:2004 Information Technology – JPEG 2000 image coding system: Core coding system • NSG Feature Data Dictionary (NFDD) • NSG Entity Catalog (NEC)

3   The GEOINT standards that support the NSG architecture come from a variety of private sector
4   and government standards bodies. Adopted national and international standards are used
5   whenever feasible in order to reduce reliance on government developed standards. This prevents
6   the development of unnecessary and costly government standards that may be duplicative of
7   existing commercial standards.

8   The GEOINT Standards Working Group (GWG) serves as a technical working group under the DoD
9   Information Technology Standards Committee and recommends the adoption of standards into
10   the DoD IT Standards Registry (DISR). The GWG governs a total of 128 GEOINT standards and as of
11   the time of this draft document. The DISR is updated three times each year. The GWG produces a
12   "Pocket Guide" (see Figure 8-1) that contains all of the IC and DoD GEOINT mandated and
13   emerging schemas, implementation specifications, and web service standards required for use in
14   GEOINT development and acquisitions. The pocket guide provides the list of standards and other
15   additional information like applicability and where/how to acquire the standard.

> **DISR Baseline Release 13-1.0**
>
> **GEOINT Standards Pocket Guide**
>
> [Baseline established: 3/21/2013]
>
> **Citations Summary:**
>
> | | |
> |---|---|
> | **Mandated:** | **129 Citations (8 New)** |
> | **Emerging:** | **31 Citations (6 New)** |
> | **Information/Guidance:** | **13 Citations** |
>
> **Online Resources:**
>
> | | |
> |---|---|
> | GEOINT Standards Citations | (http://nsgreg.nga.mil/DISR) |
> | NSG Standards Registry | (http://nsgreg.nga.mil/) |
> | GWG (GEOINT Standards Working Group) | (http://www.gwg.nga.mil/) |
> | DISRonline Registry | (https://gtg.csd.disa.mil/) |
>
> National Geospatial-Intelligence Agency
> Prepared: 23 March 2013

1

2   Figure 8-1. GEOINT Standards Pocket Guide

8.6.8 DEFENCE GEOSPATIAL INFORMATION WORKING GROUP (DGIWG) STANDARDS[172]

The DGIWG creates and maintain standards and implementation profiles for geospatial web services which foster the discovery, retrieval, exchange, and use of geospatial data and products. It addresses the technical issues related to geospatial information services, respective interfaces, and required formats. The DGIWG geospatial standards are built upon the generic and abstract standards for geographic information defined by the International Organization for Standardization (ISO TC/211) and makes use of the service specifications endorsed by the Open Geospatial Consortium (OGC).

DGIWG released the Web Services Roadmap – 909[173] as a technology Roadmap for the integration of new interfaces and services within the DGIWG community. This roadmap has been developed in order to facilitate current and future planning of DGIWG Web Services activity. DGIWG requires a Web Service Roadmap that looks three years into the future from the Roadmap completion (2013 to 2016) for current standards and up to six years to track industry for future research and development (emerging standards).

DGIWG defines Base Services as those that allow users to discover, access, and view data. Base services can be further defined as:

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[172] The content in this sub-section is taken directly from the Defense Geospatial Information Working Group (DGIWG) web site and supporting documents and is available at http://www.dgiwg.org/dgiwg/

[173] DGIWG – 909 Web Services Roadmap, 3 October 2013. This document is approved for public release and is available on the DGIWG website, http://www.dgiwg.org/dgiwg/htm/documents/committee_enterprise_documents.htm

1   •   Viewing services – provide an interface for users to visualize geospatial data.

2   •   Data access – provides an interface for users to access and write geospatial data.

3   •   Data discovery – allow users to search using metadata from the data.

4   DGIWG also identifies Emerging Services that will require long term projects to develop profiles or
5   services (e.g., Cloud Computing). The relationship between OGC standards and DGIWG Base
6   Services for profiles and projects can be seen in Figure 8-2.
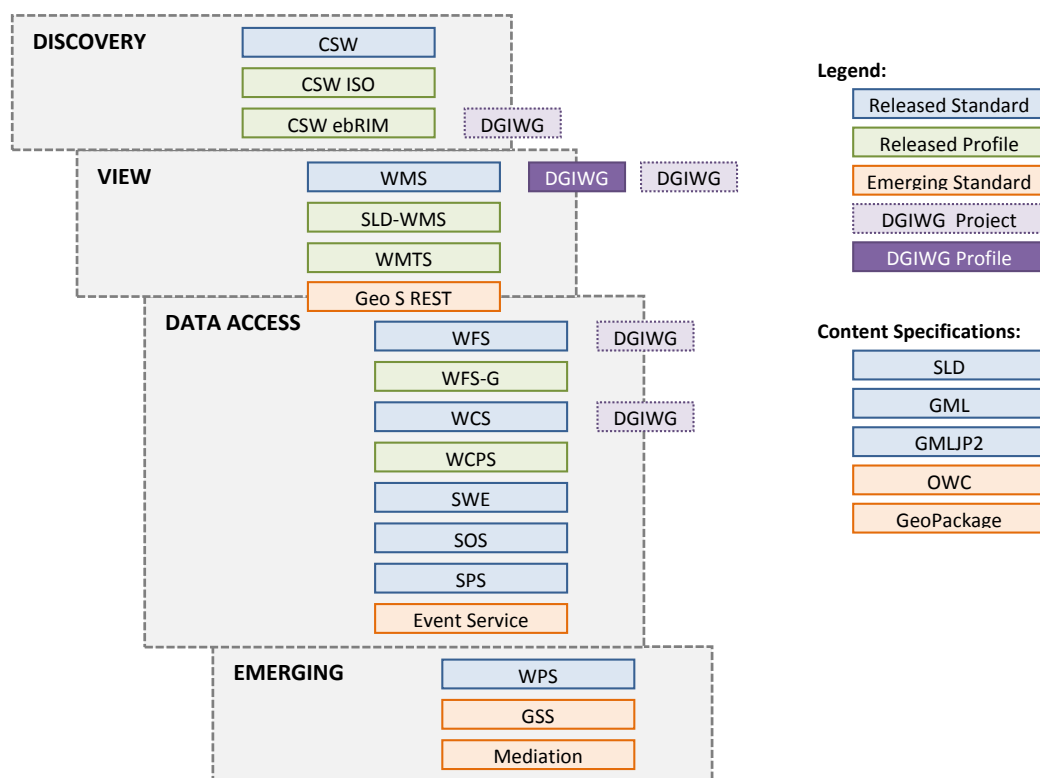
7
8   Figure 8-2. DGWIG and OGC Service Types and Profiles[174]

8.6.9 OPEN GEOSPATIAL CONSORTIUM (OGC) REFERENCE MODEL

11 OGC standards are technical documents that detail interfaces or encodings. These standards are
12 the main "products" of the Open Geospatial Consortium and have been developed by the
13 membership to address specific interoperability challenges. The OGC Reference Model (ORM)
14 provides a framework for the ongoing work of the OGC. The ORM describes the OGC Standards
15 Baseline[175] focusing on the relationships between the various OGC standards. The OGC Standards

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[174] http://www.dgiwg.org/dgiwg/htm/documents/committee_enterprise_documents.htm

[175] The Open Geospatial Consortium Reference Model, Version 2.1, December 12, 2011, Reference number OGC 08-062r7. The document is available at http://www.opengis.net/doc/orm/2.1

1   Baseline consists of the approved OGC Abstract and Implementation Standards (Interface,
2   Encoding, Profile, and Application Schema – normative documents) and OGC Best Practice
3   documents (informative documents). OGC publishes several types of documents and

1   Table 8-7 provides an extract of the OGC document types describing Abstract and Implementation
2   Standards as well as Best Practices.
3

1 Table 8-7. OGC Document Types

DOCUMENT TYPE	DESCRIPTION
OpenGIS Implementation Standard	A document containing an OGC consensus, technology dependent standard for application programming interfaces and related standards based on the Abstract Specification or domain-specific extensions to the Abstract Specification. There are five subtypes: Interface, Encoding, Profile, Application Profile, and Application Schema.
Abstract Specification	A document (or set of documents) containing an OGC consensus, technology-independent standard for application programming interfaces and related standards based on object-oriented or other IT accepted concepts. It describes and/or models an application environment for interoperable geoprocessing and geospatial data and services products.
Best Practices	A document containing discussion related to the use and/or implementation of an adopted OGC document. Best Practices Documents are an official position of the OGC and thus represent an endorsement of the content of the paper.

2 The OGC provides considerable guidance documentation for standards understanding and
3 implementation. The following links provide several key resources for open standards:

4 • **OGC Standards List:** http://www.opengeospatial.org/standards

5 • **OGC Abstract Specification:** http://www.opengeospatial.org/standards/as
6 Abstract Specification provides the conceptual foundation for most OGC standard
7 development activities. OGC standards are built and referenced against the
8 Abstract Specification, thus enabling interoperability between different brands and
9 different kinds of spatial processing systems. The Abstract Specification provides a
10 reference model for the development of OGC standards.

11 • **OGC Implementation Specifications:** http://www.opengeospatial.org/standards/is
12 Implementation Standards are different from Abstract Specifications. They are
13 written for a more technical audience and detail the interface structure between
14 software components. When two or more software engineers independently
15 implement an IS, the results are plug-and-play components at that interface.

16 • **OGC Best Practices:** http://www.opengeospatial.org/standards/bp
17 Documents containing discussion of best practices related to the use and/or
18 implementation of an adopted OGC document and for release to the public. Best
19 Practices Documents are an official position of the OGC and thus represent an
20 endorsement of the content of the paper. Schemas for some of these documents
21 can be at http://bp.schemas.opengis.net/. Any Schemas (xsd, xslt, etc.) that support
22 an approved Implementation Standard can be found in the official OGC Schema
23 Registry.

24 • **OGC Schema Updates:**
25 http://www.opengeospatial.org/standards/ogc_schema_updates

26 • **OGC Cookbooks** are free, online, easy-to-use technical documents for developers.

27 • **On-line demonstrations** of OGC specifications and interoperable software are
28 available from previous OGC Interoperability Program initiatives.

- **OGC Network**™ contains information on OGC-compatible software, services, and information models (e.g., GML profiles, SLD examples, etc.). From this site you can quickly locate OGC-compatible geospatial web services, the latest XML schema documents, discussion forums, conformance testing resources, and GML profile working areas.

8.6.10 UNITED NATIONS GLOBAL GEOSPATIAL INFORMATION MANAGEMENT

The United Nations Global Geospatial Information Management (UN-GGIM) is "an inter-governmental mechanism spearheaded by the United Nations which seeks to guide the making of joint decisions and set directions on the production and use of geospatial information within national and global policy frameworks."[176] It provides a forum to liaise and coordinate among Member States, and between Member States and international organizations to improve policy, institutional arrangements, and legal framework; thereby making accurate, authoritative, reliable geospatial information readily available to support national, regional, and global development.

The UN-GGIM is mandated, among other tasks, to provide a platform for the development of effective strategies on how to build and strengthen national capacity on geospatial information. It is also tasked to compile and disseminate best practices and experiences of national, regional, and international bodies on geospatial information related to legal instruments, management models, and technical standards.

In keeping with those objectives, the UN-GGIM Secretariat requested from key standards organizations—International Organization for Standardization (ISO) Technical Committee 211, International Hydrographic Organization (IHO), and the Open Geospatial Consortium (OGC)—to advance a "core essential standards guide" for use by member nations to improve their understanding of the value of standards, and guide the adoption and application of open geospatial standards to meet their geospatial missions.[177] The pending release (Fall 2014) of the UN-GGIM's *A Guide to the Role of Standards in Geospatial Information Management* (hereafter called the UN Standards Guide) is intended to "inform policymakers and Program Managers in Member States about the value in using and investing in geospatial standardization and describe the benefits of using 'open' geospatial standards."[178] The goal is an easy to understand, and relatively non-technical document focusing on communicating and educating key decision makers within member nations on topics such as:

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[176] http://ggim.un.org/

[177] OGC "Call for Volunteers to advance UN-GGIM Core Standards Guide" memo to Technical Committee and Business Value Committee members. January 23, 2014.

[178]UNGGIM's *A Guide to the Role of Standards in Geospatial Information Management*, (Draft version), May 30, 2014. Prepared cooperatively by the Open Geospatial Consortium (OGC); ISO/TC 211, *Geospatial Information/Geomatics*; and the International Hydrographic Organization (IHO). External identifier of this document: http://www.opengis.net/doc/WP/unggim-standards/1.0.

- Role and value of open geospatial standards

- Core geospatial standards and related best practices explained

- Implementation examples

- References (e.g., national, regional, and international cookbooks, Spatial Data Infrastructure guides, etc.)

It is anticipated that the UN Standards Guide will provide "Geospatial Standards and Related Best Practices for Geospatial Information Management" that frames the phases of an organization's geospatial capability maturation and the adoption and use of key geospatial standards used to achieve those capability levels. It is hoped that the development of this Guide, will provide a line-of-sight for a sequence of standards identification and adoption for an organization to adopt and implement.

8.7 STAKEHOLDER PERFORMANCE GUIDE: STANDARDS

It is incumbent upon an organization's procurement documentation to ensure the inclusion of the appropriate standards compliance references when contracting for geoprocessing software, data, technology, applications and services; whereby promoting vendor neutrality. This will enable exploitation by a broad range of technology offerings leading to the purchase of solutions that implement the use of standards-based products and interchangeable services and components.

While geospatial standards-based acquisition guidance in the form of procurement language and boiler plate templates does not readily exist across the community, there are several organizations and sources that provide lists of "key" or "baseline" geospatial standards and maintain status updates as new standards evolve. The Performance Guidance (Table 8-8) provides a summation of the key decision points to facilitate the identification, adoption, and use of geospatial standards for the efficient design, development, and implementation of geospatial system investments.

1

Table 8-8. Stakeholder Performance Guide: Standards

STAKEHOLDER PERFORMANCE GUIDE			
CHAPTER 8 – STANDARDS			
Role	Responsibility	Approach	Benefit
Executive Leadership	• Develop and adopt Standards Policy within and across the Geospatial Executive Steering Committee and your Department or Agency. • Ensure all geospatial procurements/awards have the appropriate Standards Compliance Section included in the contract language. • Standards resourcing for subject matter expertise (SME) and SDO involvement.	• Working with Executive Leadership across geospatial investments, the Office of the Chief Information Officer; Financial Management Office; and Grants Office, agree upon and include Standards-based acquisition language for procurements and awards. • Review procurement action prior to sign-off and the assign Program Manager the responsibility to include the necessary language in the procurement/award action. • Budget for a staffing position (e.g., full or part time) to perform standards guidance. Position would participate on and provide into to SDOs and cross organization geospatial investments.	• Ensure contract continuity and compliance for consistent geospatial investments. Enforces vendor neutrality and promotes competition for industry standards adoption. Drives interoperability across investments. • Ensures procurement/award consistency and compliance. • Provides awareness and understanding of standards requirements, benefits and advancement in geospatial standards development and adoption.
Program Manager	• Coordinate across other internal Department and Agency investment PMs for identification and agreement on content for Standards Policy development. • Prepare "boiler plate" standards-based procurement language for inclusion need contracts/awards. • Determine resourcing requirements and availability for geospatial standards capability development for: 　◦ Subject Matter Expert 　◦ SDO participation	• Draft Standards Policy for procurement and grants guidance. Work with and vet for completeness and currency across organization and review SDO listings. • Work with OCIO, OFM, and Grants Offices to determine process for standards-based procurement / grant language inclusion within policy guidance and contract vehicles. • Prepare Position Description for Geospatial Standards SME as a core competency within job category (e.g., GS-2210: Information Technology Management Series). Participate on and/or contribute to geospatial SDO initiatives.	• Provides awareness and understanding of baseline and current standards requirements. Allows for a definition of "Value Proposition" of standards-based interoperability. • Policy-based guidance for government and industry understanding and compliance. • Increase internal capacity for geospatial standards understanding and compliance.
Solution Architect	• Document current standards in use within/across organization geospatial investments. • Contribute to development of baseline standards for inclusion into Policy Guidance. • Contribute to identification of SME resource for geospatial standards. Ensure awareness of geospatial standards for inclusion in system procurement and development.	• Coordinate with SAs across organization's geospatial investments to identify and document geospatial standards usage. • Develop baseline of key geospatial standards derived from Federal and SDO current and emerging standards documentation. • Provide input for Position Description for Geospatial Standards SME. Participate on SDOs for awareness of geospatial standards development and update.	• Technical vetting and validation across investments for As-Is standards usage. • Ensure broadest possible technical review and allows identification of gaps and deficiencies for enhancement. • Strengthen breadth of geospatial standards awareness across organization's geospatial investments.

2

9 PERFORMANCE REFERENCE MODEL

9.1 INTRODUCTION

Definition/Description (What) – "links agency strategy, internal business components, and investments, providing a means to measure the impact of those investments on strategic outcomes."[179]

Purpose/Function (Why) – to provide documentable value to all stakeholders by setting manageable and measurable metrics to achieve the geospatial system investment goals as defined by the stakeholders. The chapter will provide:

- References to performance guidance and implementation approaches.

- Examples of performance indices.

Stakeholder Performance Guide (Who & How) – driven by mission/business requirements and the associated functional capabilities identified in the Operational Requirements Document, performance is a shared responsibility that provides the Executive Leadership metrics to monitor and take corrective action to address program progress and demonstrate benefit to the stakeholders. Often administered by the Program Manager and documented by the Solution Architects, performance is a measure of value.

Value is defined by the user … but quantified by the usage.

9.2 APPLYING THE PERFORMANCE REFERENCE MODEL: APPROACHES

Performance spans all of the Reference Models of the Federal Enterprise Architecture (FEA) guidance. The GIRA Chapters includes a Performance Guide Table for each of the three (3) stakeholders (e.g., Executive Leadership, Program Managers, and Solution Architects). These tables are combined within Appendix G as a consolidate geospatial investment performance indicators, but only serve as a starting point for consideration.

The Common Approach to Federal Enterprise Architecture[180] uses the performance reference model to show the linkage between internal business components and the achievement of business and customer-centric outputs and outcomes. Performance measures help support

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[179] Office of Management and Budget, *Federal Enterprise Architecture Framework*, Version 2, January 29, 2013, available at http://69.89.31.228/~mkerncom/wp-content/uploads/2013/02/Federal-Enterprise-Architecture-Framework-v2-as-of-Jan-29-2013.pdf.

[180] Office of Management and Budget, *The Common Approach to Federal Enterprise Architecture*, May 12, 2012, available at http://www.whitehouse.gov/sites/default/files/omb/assets/egov_docs/common_approach_to_federal_ea.pdf

planning and decision-making based upon comparative determinations of which programs and services are more efficient and effective. The Performance Reference Model focuses on three main objectives:

- Produce enhanced performance information to improve strategic and daily decision-making.

- Improve the alignment and better articulate the contribution of inputs to outputs, thereby creating a clear "line of sight" to desired results.

- Identify performance improvement opportunities that span traditional organizational structures and boundaries.

One of the most visible uses of the Performance Reference Model is for the OMB reporting as part of Exhibit 300 investment proposals. Federal agencies are required to:[181]

- **Describe the relationship between investment and agency strategic goals.** A narrative explanation of the investment's specific contribution to mission delivery and management support functions is required in Section B for the Exhibit 300A. Investment owners must identify how the investment contributes to the agency target architecture and links to performance objectives in the published agency strategic plan.

- **Provide investment-specific performance measures** that quantify the intended performance benefits. Each measure must be categorized using a FEA Performance Measurement Category, and investment owners must ensure that the measures are balanced and drawn from multiple measurement categories. Performance metrics will be reported on the IT Dashboard.

- **Report on investment results** using these measures monthly, quarterly, semi-annually and annually.

Reporting on investment results, using the Governance processes established through the Executive Steering Committee (see Chapter 2), provides an opportunity to validate success and make course corrections to meet changing stakeholder requirements (see Section 3.3). The *Federal Shared Services Implementation Guide*[182] recommends when developing their organization's strategic plans and performance goals, Executive Leadership and Program Managers should evaluate the prior performance of their investments. This presents an opportunity to question and assess the following:

- What is the performance of existing processes and services?

- What existing capabilities can be improved?

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[181] Office of Management and Budget, *Federal Enterprise Architecture Framework*, Version 2, January 29, 2013.

[182] https://cio.gov/wp-content/uploads/downloads/2013/04/CIOC-Federal-Shared-Services-Implementation-Guide.pdf

1   • What is the cost structure of current capabilities?

2   • How efficient is service delivery?

3   • What new capabilities are needed and funded by the organization?

4   The *Shared Services Implementation Guide* also recommends that the Agencies should objectively
5   and continuously assess their IT investment portfolios throughout the investment lifecycle as part
6   of Capital Planning and Portfolio Management oversight. Each checkpoint should be considered
7   an opportunity to re-evaluate whether an investment is still performing as desired and continues
8   to deliver the level of business value and capabilities required by end users and key stakeholders.
9   For this reason, capital planning, business, and IT Program Managers should discuss whether
10   there is an opportunity to leverage an existing shared service before embarking on development
11   of a new initiative that will incur significant costs, as well as risks.

12   The *Segment Architecture Analysis of the Geospatial Platform*, Version 1.0[183] describes
13   performance architecture as a means to align strategic goals and objectives with specific metrics
14   that can be applied to processes, systems, and technology in order to evaluate success against
15   those goals. The performance metrics creates a reporting framework to measure the geospatial
16   activities and investments across the enterprise. Improved performance is realized through
17   greater focus on mission, agreement on goals and objectives, and timely reporting of results. The
18   *Segment Architecture Analysis* also outlines the ways in which these performance metrics should
19   evolve in order to align geospatial initiatives across an enterprise's stovepipes and incorporate
20   additional considerations critical to geospatial functionality. The document concludes by
21   providing high-level recommendations for the development of a "Geospatial Transition Roadmap
22   and Milestones" for the federal geospatial community to consider; including nine (9) government-
23   wide level governance initiatives.

24   The *Geospatial Profile of the Federal Enterprise Architecture, Version 2.0*[184] notes that "the PRM is
25   of particular use to the development of fledgling geospatial programs across government because
26   it provides a structure for analyzing both means and ends. Using performance measures allow
27   agencies to define how much more effective their business processes are by incorporating
28   geospatial resources, approaches, or methods.

29   All activities of an agency's geospatial program—developing policies and using standards,
30   implementing geospatial services and geo-enabling functions within the organization, and
31   implementing and providing geospatial data services both inside and outside the agency—can
32   benefit by evaluating performance. There are two primary measures for evaluating performance:

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[183] http://www.fgdc.gov/geospatial-lob/draft-segment-architecture-review/Segment-Architecture-Analysis-of-the/view
[184] http://www.fgdc.gov/initiatives/resources/geospatial-profile-of-the-FEA-v2-march-2009.pdf

- Measures of the performance of business processes incorporating geospatial resources and investments (how much does the business process save by using geospatial technology and data, how many users does it support).

- Measures of the maturity of a geospatial program responsible for developing an agency's geospatial architecture (is the program progressing towards offering better services to more customers and does its geospatial data meet quality standards)."

9.3 PERFORMANCE INDICES

Performance measures are often seen as an administrative burden and additional cost to the system investment. However, performance metrics, if reflective of the stakeholder requirements, provides awareness of the value of the investment and enables effective management for operations and maintenance.

> **"You cannot manage what you cannot measure."**
> – Anonymous

The Enterprise Architecture and Geospatial communities of practice have several performance indices that may be used in part or whole to help design and develop meaningful measures for investments. Performance indices (e.g., Maturity Models) may provide a normalizing or level-setting functional for an organization to better understand the range of capabilities and investments and also contribute to the baseline assessment activities (see Section 3.4) when an organization performs its Operational Requirements Document (Section 3.3).

One of the challenges of any maturity model is the general lack of a Return on Investment (ROI) indicator for moving from one level to the next in the maturity progression ladder. A maturity or capability model may have ~ 5 levels of maturity and while an organization assesses its maturity to be a "3" there are generally no explicit cost/benefit to determine the value proposition for moving to the next level. In fact, there may be diminishing returns and the stakeholders will need to determine the optimal level of geospatial proficiency that meets the needs of the entire investment. However; a performance management framework for geospatial capabilities that are embedded within a larger system environment may include the necessity to tie the value to the overall or 'parent' enterprise architecture investment.

9.3.1 OFFICE OF MANAGEMENT AND BUDGET: ENTERPRISE ROADMAP

OMB's Memorandum for *Increased Shared Approached to Information Technology Services*[185] "provides Federal Agencies with policy guidance and management tools to use in increasing shared approaches to information technology (IT) service delivery across mission, support, and commodity areas." The policy memo directs Federal Agency Chief Information Officers to submit an "Enterprise Roadmap" each year that documents an agency's current and future views of its business and technology environment from an architecture perspective. In the 2013 submission of the Enterprise Roadmap includes:[186]

1. *Business and Technology Architecture* (Main Body): a high-level, integrated description of the agency's IT-related strategic goals, business objectives, and enabling IT capabilities across all operating units, and program areas.

2. *Enterprise Architecture (EA) Maturity Measurement Template* (Appendix 1): a self-evaluation of the maturity of the Agency's EA Program.

3. *EA Outcomes and Measurements Template* (Appendix 2): a self-evaluation of the effectiveness of the agency's enterprise architecture program, examples of contributions to beneficial outcomes, areas for improvement, and measurement of value using the attached template.

4. *IT Asset Inventory* (Appendix 3) (Optional): a list of IT systems and applications that support mission, administrative, and commodity IT services, using the attached template and the Federal Enterprise Architecture Reference Models that are provided in the Common Approach. This Appendix will be considered "For Official Use Only."

The EA Maturity Measurement Template (see Appendix G.1) provides a matrix that includes the primary evaluation categories (e.g., Spending, Systems, Services, Security) and requires the inclusion of IT investment Inventory and Outcomes with descriptions for; Area of Measurement, Specific Measurement Indicators, Measurement Method and Targets (Timeline), and Comments/Artifacts. Depending upon the category of Inventory or Outcome, the Areas of Measurement may include:

Table 9-1. EA Maturity Measurement Template: Areas of Measurement

INVENTORY & OUTCOME	AREA OF MEASUREMENT
Inventories	Completeness
	Accuracy
	Ratio

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[185] OMB Memo: *Increasing Shared Approaches to Information Technology Services*, May 2, 1012, available at http://www.whitehouse.gov/sites/default/files/omb/assets/egov_docs/sharedapproachmemo_0502.pdf

[186] OMB Memorandum to Agency Chief Architects, *Guidance on 2013 Federal Agency Enterprise Roadmaps*, March 29, 2013.

INVENTORY & OUTCOME	AREA OF MEASUREMENT
Outcomes	Cost Savings/ Avoidance
	Reduction of Duplication
	Efficiency
	IT Enablement

9.3.2 ISE INFORMATION INTEROPERABILITY FRAMEWORK: INTEROPERABILITY MATURITY MODEL

The Information Sharing Environment (ISE) Interoperability Framework (I^{2}F) is used to guide the implementation of the ISE information sharing capabilities.[187] The ISE I^{2}F leverages existing systems architecture guidance, suggested standards, tools, and methodologies to foster the linkage of systems as well specifying the development of common artifacts that are intended to enable disparate architectures to improve information sharing.

The Interoperability Maturity Model of the ISE I^{2}F is aligned with the OMB guidance *Federal Enterprise Architecture Framework* and *The Common Approach to Federal Enterprise Architecture* and is broken down by domains (e.g., Business, Data, Applications, Infrastructure, Security, and Performance). The model establishes characteristics for each level of interoperability (e.g., ad hoc, repeatable, enhanced, managed, and optimized) for each interoperability requirement. Each row in the maturity model represents a functional area within the domain. Each column represents a different stage of maturity. Interdependences between functional areas exist but the goal is to assess a system independently for each functional area.

Within the I^{2}F Performance Domain maturity model, it is divided into functions or process groups (rows) and maturity levels (column). The maturity model is then followed by several supporting questions.

Table 9-2. I^{2}F Performance Domain Maturity Model Metrics

	⓪ ABSENT ① AD HOC	② REPEATABLE	③ ENHANCED ④ MANAGED	⑤ OPTIMIZED
Metrics	Formalized performance metrics that provide direct line of sight between strategic planning and the investment review process do not exist.	Formalized performance metrics exist and align with strategic goals of organization as well as to applicable policy, guidance, and laws.	Formalized performance metrics that identify common performance elements across investments or activities exists.	Formalized performance metrics are used to inform gap analysis of interoperability requirements and adhere to relevant performance goals.

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[187] Program Manager – Information Sharing Environment (PM-ISE), *Information Interoperability Framework (I^{2}F)*, Version 0.5, March 2014, available at http://ise.gov/ise-information-interoperability-framework.

9.3.3 DHS COMMON OPERATING PICTURE: KEY PERFORMANCE INDICATORS AND MEASURES

The Department of Homeland Security has chartered an Executive Steering Committee (ESC) for its Common Operating Picture (COP)/User Defined Operating Picture (UDOP) Domain. The Components of DHS have invested in multiple COP/UDOP capabilities to support situational awareness for law enforcement, emergency management, intelligence, and homeland security/defense mission activities. The goal of the COP ESC has been to increase COP interoperability, effectiveness, and shared capabilities while reducing the Department's collective operational costs by managing COP systems as enterprise mission service investments. It is expected to promote and guide the development and operation of, and investment in the DHS Common Operating Picture domain. The COP ESC will provide analytical support and provide recommendations, guidance, and procedures for improving the sharing of data, information, infrastructure, tools, and services across DHS COP investments.

In support of the COP ESC, the DHS Geospatial Management Office prepared the *DHS Sensitive But Unclassified COP/UDOP Segment Architecture*[188] document is to provide a holistic and conceptual view of the future consolidated or interoperable state of the COP domain for Homeland Security. This initial version focused upon the target technical architectural areas: business, data, services, technology, security, and performance. It presents a Target Architecture based on a common services framework that relies on shared services and enterprise delivery of core data, software, and infrastructure using approved standards. This shared services approach ensures data and system interoperability and reliable exchange of information in a usable and geospatial format.

The target performance architecture for the DHS COP segment architecture prepared a performance management scorecard (Appendix G.2) to tracking progress and effectiveness toward achieving the strategic goals and objectives for the COP domain. The scorecard is based on the key performance indicators (KPIs) to include; Governance, Information Sharing, Mission Enablement and Technology Management. These scorecard metrics were established from the COP Domain priorities for interoperability, effectiveness, authoritative/trusted information in a geospatial format, standards-based information exchanges, reliability, and shared capability.

9.3.4 NATIONAL STATES GEOGRAPHIC INFORMATION COUNCIL: GEOSPATIAL MATURITY ASSESSMENT

The National States Geographic Information Council's (NSGIC) Mission is to promote statewide geospatial coordination activities in all states and to be an effective advocate for states in national geospatial policy and initiatives, thereby enabling the National Spatial Data Infrastructure

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[188] Department of Homeland Security, *COP/UDOP Sensitive But Unclassified Segment Architecture*, Version 1.0 (DRAFT), April 27, 2012, prepared by the Geospatial Management Office.

(NSDI).[189] NSGIC maintains a Geospatial Maturity Assessment (GMA) that is a "baseline assessment methodology to routinely and continuously monitor and validate statewide geospatial capabilities." [190] The GMA included eighty three (83) questions that characterized their geospatial programs. The assessment is over one-half data focused, but also includes questions on staffing and budget, strategic and business planning, and interagency coordination and data sharing.

9.3.5 URBAN AND REGIONAL INFORMATION SYSTEMS ASSOCIATION: GIS CAPABILITY MATURITY MODEL

The Urban and Regional Information Systems Association (URISA)[191] promotes the effective and ethical use of spatial information and information technologies for the understanding and management of urban and regional systems. URISA members and participants typically use geospatial and other information technologies to solve challenges in government agencies. URISA provides educational programs, offers volunteer GIS expertise through its GISCorps program, and assists government agencies with benchmarking GIS maturity through its GIS Management Institute®.

"The URISA GIS Capability Maturity Model[192] is a key component of the GIS Management Institute. Its primary purpose is to provide a theoretical model of a capable and mature enterprise GIS operation within a designated organization. The URISA Model is intended to serve the GIS community as a stand-alone document to define the framework for an effective enterprise GIS. The Model was developed initially with a focus on local government agencies (e.g., cities, counties, regional agencies, and other similar entities) but it is intended for future use by any enterprise GIS. As a stand-alone document, the Model is intended to facilitate discussion amongst GIS managers and the decision makers who deploy and fund GIS to maximize effectiveness and return on investment from a given level of investment."

The Capability Maturity Model assumes two (2) broad areas of GIS operational development:

- Enabling Capability – the technology, data, resources, and related infrastructure that can be bought, developed, or otherwise acquired to support typical enterprise GIS operations. Enabling capability includes GIS management and professional staff.

- Execution Ability – the ability of staff to utilize the technology at their disposal (subject to separate assessment as part of the Model).

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[189] http://www.nsgic.org/

[190] http://www.nsgic.org/geospatial-maturity-assessment/

[191] http://www.urisa.org/main/about-us/

[192] http://www.urisa.org/clientuploads/directory/GMI/GISCMM-Final201309%28Endorsed%20for%20Publication%29.pdf

9.4 STAKEHOLDER PERFORMANCE GUIDE: PERFORMANCE

The Performance Guide provides several key considerations and decision points that may influence the design and development of the performance metrics necessary to assess the most effective and efficient design, development, and implementation of the geospatial system investment. Appendix G.3 provides a consolidated Performance Guide for all of the reference models (e.g., Business, Data, Applications/Services, Infrastructure, Security, and Performance).

Table 9-3. Stakeholder Performance Guide: Performance

STAKEHOLDER PERFORMANCE GUIDE			
CHAPTER 9 – PERFORMANCE			
Role	Responsibility	Approach	Benefit
Executive Leadership	• Define mission context for geospatial investments across the enterprise. • Ensure Performance metrics and indicators are included in all CPIC (OMB 300/53) geospatial investments.	• Provide overall mission context and expected contribution of geospatial to/within programs to Program Managers, and align program success to improved performance of business functions. • Using Performance indicators for each reference model (e.g., Business, Data, Applications/Services, Infrastructure, Security, and Performance) prepare matrix for ESC review and adoption and monitoring.	• Creates quantifiable measures and expected outcomes (mission and resource impact) of a geospatial investment. • Ensures OMB reporting compliance and senior leadership commitment to managed/measured success of investment.
Program Manager	• Define measures of effectiveness and success criteria for geospatial investments under oversight. • ESC to oversee cost, schedule, and scope of geospatial investments across enterprise.	• Provide clear guidance to Solution Architects for requirements and dependencies of required solutions. • Communicate with Executive Leadership and stakeholder community (mission holders) to foster an understanding of the value of current efforts with the overall mission success.	• Creates clarity as to the value of programs being managed to overall mission effectiveness. • Enables easier management through a better understanding of how measures of effectiveness translate into system requirements and benefits.
Solution Architect	• Derive functional and technical requirements and associated quantifiable performance success measures given target objective. • Oversee technical implementation and schedule and provide status to leadership and recommended course corrections as needed.	• Analyze program requirements and measures of effectiveness and identify solution elements that will enable the program to meet success criteria. • Create a clear understanding of how the project scope, schedule, and budget is progressing and provides line-of-sight with respect to the overall program and enterprise requirements.	• Demonstrable solution effectiveness, tied directly to executive-level interests which enables an end-to-end picture of how delivered solutions fit into an enterprise-level mission • Enables clear communication with the Project Managers and Executive Leadership regarding schedule and scope of system delivery.

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APPENDIX A:
GOVERNANCE

A.1 EXECUTIVE STEERING COMMITTEE CHARTER TEMPLATE

[Note: Replace underlined text with organization specific information.]

EXECUTIVE STEERING COMMITTEE CHARTER
FOR
GEOSPATIAL SYSTEM INVESTMENT (GSI)

PURPOSE

This Charter defines the mission, authority, membership, responsibilities, and operating principles for the Department/Agency's Executive Steering Committee (ESC) for geospatial system investment coordination. The GSI ESC is charted by the Department/Agency's sponsoring body. (if applicable).

MISSION

The GSI ESC will promote and guide the development and operation of, and investment in the Department/Agency's geospatial technology domain.

OBJECTIVE

The objective of the GSI ESC is to increase geospatial interoperability, effectiveness, and shared capabilities while reducing the Department/Agency's collective operational costs by managing geospatial systems as enterprise mission service investments.

BACKGROUND

The operational organizations with the Department/Agency have invested in multiple geospatial capabilities to support mission activities.

[Note: Additional, organization mission specific information can be included, especially if member representation would include non-geospatial equities such as OGC, Finance, Policy, Civil Right Civil Liberties, CIO, etc.]

1 **SCOPE**

2 The GSI ESC will provide governance and guidance, oversight of, and recommendations
3 concerning, all aspects of the Department/Agency's geospatial domain. This includes investments,
4 systems, data, policies, and procedures needed to ensure mission partners have an enduring
5 capability to effectively, efficiently, and rapidly access needed data, geospatial referencing of
6 data, and information; integrate and fuse data, provide timely, accurate, and tailored displays of
7 data and geographic views; facilitate collaborative planning; and enhance situational awareness.
8 The GSI ESC will oversee the review of geospatial equities and provide recommendations,
9 guidance, and procedures for improving the sharing of data, information, infrastructure, tools,
10 and services across Department/Agency's geospatial investments.

11 **AUTHORITY**

12 The GSI ESC has the authority to oversee and make recommendations regarding the
13 Department/Agency's geospatial domain. The GSI ESC will execute its duties within the scope of
14 this Charter, as informed by any applicable laws, regulations, Department/Agency's directives,
15 and any additional assignments of responsibility from senior governance bodies. The GSI ESC will
16 work to align the geospatial domain with applicable strategic goals and objectives established by
17 the Department/Agency's and senior governance bodies. As the need arises for decisions outside
18 the level of authority of the GSI ESC, the GSI ESC will formulate recommendations for
19 consideration by the Department/Agency's sponsoring body.

20 The GSI ESC may also charter and oversee advisory bodies, subcommittees, working groups,
21 integrated project teams, etc., as necessary to assist the GSI ESC.

22 **MEMBERSHIP**

23 GSI ESC Chair and/or Co-Chairs are designated positions and serve for a period of _____.

24 [Note: designation assumes that the ESC is sponsored by a Department/Agency as required by that
25 organizations policy guidance. If not sponsored, then the positions may be by volunteer or election. Service
26 duration may be indefinite or specified time frame, usually 2 years.]

27 GSI ESC membership is designated positions from the organization's executive leadership and
28 serves for a period of _____.

29 GSI ESC membership is subject to change at the direction of the Department/Agency or by mutual
30 agreement of the members based on the needs of their Department/Agency and the ESC. A roster
31 of the individuals who hold those positions shall be maintained by the GSI ESC and updated as
32 necessary.

1   GSI ESC members must have the authority to represent and make decisions on behalf of their

2   offices/organizations, and are expected to fully participate in the work of the GSI ESC. If principal

3   members cannot attend, they will designate a single alternate to consistently participate on their

4   behalf. The designated alternate should be from the same organization as the regular member

5   and will be delegated the same powers as the regular member at the GSI ESC meeting.

6   **ESC Co-Chairs:**

7   • Department/Agency #1

8   • Department/Agency #2

9   **ESC Members:**

10   *Voting Members:*

11   [Note: Generally the operational mission owner often with existing geospatial investment. If a

12   Department/Agency has more than one Program or Office with geospatial equities, that Department/Agency

13   should coordinate across their constituencies to ensure awareness and involvement. However, if the ESC

14   allows multiple representatives from a Department/Agency the voting should remain "one Department/Agency

15   one vote," so as to not to unduly influence decision-making approval authorities.]

16   • Department/Agency Mission Area #1

17   • Department/Agency Mission Area #2

18   • Department/Agency Mission Area #3

19   • Department/Agency Mission Area #4

20   • Department/Agency Mission Area #N

21   *Non-Voting Members:*

22   [Note: Generally the non-operational mission support providers with no geospatial investment but perhaps

23   geospatial needs impacts as exampled below.]

24   • Office of the Chief Information Officer

25   • Office of Research and Development

26   • Office of Chief Procurement Officer

27   • Office of the Chief Financial Officer

28   • Office of the General Counsel

29   • Office of Legislative Affairs

30   • Privacy Office

31   • Office for Civil Rights and Civil Liberties

1 • Office of Policy

ROLES AND RESPONSIBILITIES

ESC Co-Chair(s)

- Serve as the executive champion of the mission and work of the GSI ESC.

- Develop processes and priorities for the work of the GSI ESC to ensure that relevant issues are elevated to the GSI ESC and addressed promptly.

- Set the schedule, agenda, and guest list for GSI ESC meetings with assistance from the ESC Secretariat and in consultation with the GSI ESC members.

- Co-Chair the GSI ESC meetings:

- Review action items

- Facilitate discussion and collaboration

- Identify consensus decisions or initiate voting

- Elevate unresolved issues, or issues outside the scope of ESC authority, to the Department/Agency's sponsoring body [if applicable] and other appropriate senior governance bodies.

- Ensure appropriate reporting of GSI ESC activities and decisions to senior governance bodies components, and other stakeholders as appropriate.

- Recommend GSI ESC operational changes to the appropriate senior executives or governance bodies.

- Communicate taskings to subcommittees, working groups or integrated project teams as appropriate.

ESC Members

- Provide strategic recommendations; identify and communicate issues and concerns in a clear and timely manner.

- Serve as a liaison between the geospatial domain and the member's functional area and/or organization; ensure organizational support for the activities of the GSI ESC.

- Execute activities, as assigned, in support of the GSI ESC.

- Identify subcommittee, working group and/or integrated project team members to represent their respective business function(s) and Department/Agency.

NON-MEMBERS

The GSI ESC Co-Chairs and members may invite subject matter experts to attend GSI ESC meetings to present information and participate in discussions, as appropriate. Members may also invite an appropriate number of support staff to attend GSI ESC meetings in order to facilitate the member's GSI ESC participation. Other observers may attend and participate in meetings at the discretion of the Co-Chairs. The Chair may exclude non-members in situations the Co-Chairs deems sensitive or inappropriate for non-member review, or if non-member attendance is not otherwise practical.

ESC Secretariat

- The Department/Agency will serve as Secretariat and provide logistical support for ESC deliberations. It will:

- Develop meeting agendas and recommend agenda priorities in conjunction with the Co-Chairs.

- Plan and schedule GSI ESC meetings and meeting rooms.

- Consolidate and disseminate meeting agendas and briefing materials in advance of the meeting.

- Assist the GSI ESC to adhere to criteria and thresholds for issue consideration, documentation requirements, and other procedures as established by the GSI ESC.

- Track and report all GSI ESC action items, decisions, and recommendations to conclusion.

- Develop and disseminate all GSI ESC meeting minutes.

- Utilize a collaboration GSI ESC website [if applicable] to manage and report GSI ESC activities and serve as the GSI ESC site administrator.

ESC OPERATIONS

Frequency of Meetings

The GSI ESC will meet on a schedule determined by the Co-Chairs based on the needs of the geospatial domain, but no less than every other month.

Attendance, Quorum

The Co-Chairs, GSI ESC Voting Members, and a representative from the Secretariat are required to attend all meetings.

1 GSI ESC Voting Members must notify the Co-Chairs at least one day in advance of the meeting
2 when unable to attend and are responsible for arranging for the attendance of an approved
3 alternate.

4 At a minimum, sixty percent (60%) of GSI ESC Voting Members (either the approved regular or
5 alternate members) must be in attendance to constitute a quorum for a meeting and eighty
6 percent (80%) voting.

7 **Decision Making**

8 The Co-Chairs will strive to reach decisions through consensus of the committee members. Once a
9 consensus is reached, the Co-Chairs will clearly summarize the consensus decision, which will be
10 recorded in the minutes.

11 If the Co-Chairs determine that a consensus decision or recommendation cannot be reached
12 within a reasonable time, the Co-Chairs may either call for a vote or escalate the issue to a senior
13 decision authority.

14 In the event of a vote, each GSI ESC Voting Member (either the approved regular or alternate
15 member) has one vote. The Co-Chairs do not vote except in the event of a tie, in which case they
16 may break the tie or decide to escalate the issue to a senior decision authority. If the Co-Chairs
17 cannot agree, the issue must be elevated to a senior decision authority.

18 The Co-Chairs may invoke electronic comment and/or voting (or "E-Vote") via email or the GSI
19 ESC team site.

20 [Note: the ESC may decide an electronic voting protocol and time duration for responding to votes where no
21 response equals concurrence and a NO vote should be scheduled for discussion and resolution when
22 possible.]

23 **Communication**

24 Read-ahead information will be provided to the membership at least three business days in
25 advance of meetings.

26 Meeting minutes and action items will be distributed no later than three business days after the
27 meeting. Members shall submit comments on the minutes within five business days after receipt.
28 The minutes from the previous GSI ESC meeting shall be reviewed and approved at the next
29 subsequent GSI ESC meeting.

30 A teleconference line may be established for the GSI ESC meetings at the discretion of the Co-
31 Chairs.

1 Non-member individuals may be included on communications distribution lists for any reason
2 deemed appropriate by the Co-Chairs.

3 **EFFECTIVE DATE AND TERMINATION**

4 This Charter shall be effective upon approval by the Department/Agency and signed by the Co-
5 Chairs. This Charter will remain in effect until amended or replaced or until terminated by the
6 Department/Agency and/or mutual agreement of the member representatives.

7

8 **SIGNATORY APPROVAL**

Department/Agency #1   Date

9

Department/Agency #2   Date

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A.2 INFORMATION SHARING AGREEMENT CHECKLIST[193]

Please provide the requested information in the space provided below and return this form to the Geospatial Executive Steering Committee.

A. GENERAL INFORMATION

1. Requestor Information:

   Organization: _____

   Phone Number: _____

2. Intended recipient/end user: _____

3. Provider Information:

   Organization: _____

   Phone Number: _____

4. Provide a general description of the information/data to be shared.

5. List the system(s) associated with the shared information/data.

6. Provide the purpose for the information sharing relationship.

B. INTERNAL INFORMATION SHARING REQUESTS

1. Describe the use(s) for which the recipient/end user organization will obtain the information.

2. Number of individual users contemplated: _____

3. All users have "need to know" information to perform job functions? ___Yes ___ No

4. Describe how "need to know" will be verified for each user and each access event.

5. Department/Agency Component:

   a. Source/Originator of the information (i.e., what organization originally collected the information):

      Name of organization: _____

      Department/Agency? ___Yes ___ No

      If no, complete 5b. If yes, skip to 6.

   b. Was information obtained subject to a written ISAA or other agreement? ___Yes ___ No

      If yes, complete 5c. If no, skip to 6.

   c. Confer with Office of General Council (OGC) re: whether existing agreement is compliant and covers the contemplated information sharing:

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[193] Department of Homeland Security, *Information Sharing and Access Agreements Guidebook and Templates*, revision version 2.1, October 2010.

1   ___ New ISAA with originating party needed

2   ___ Internal Department/Agency Sharing permitted under existing agreement

3   6. Office of General Counsel (OGC):

4   a. Confer with OGC re: whether there are any legal prohibitions to recipient
5   obtaining/receiving the information:

6   ___ No legal prohibitions to recipient obtaining/receiving the information

7   (If there are legal prohibitions, work with OGC to attempt to mitigate or resolve them.)

8   b. Confer with OGC re: whether recipient may further disseminate information (if applicable):

9   ___ New ISAA must restrict further dissemination of information within
10   Department/Agency

11   ___ New ISAA must restrict further dissemination of information outside of
12   Department/Agency

13   ___ No restrictions on further dissemination of data (subject to a new ISAA)

14   7. Purpose for which information was originally collected.

15   a. Identify applicable SORNS, if any.

16   8. List any conditions required to properly size/scope the required data elements.

17   a. List any mandated data exchange protocols that must be followed.

18   9. Are there other Department/Agency Components with concurrent jurisdiction/need for the
19   same information? ___ Yes ___ No

20   If yes, describe:

21   10. Personally Identifiable Information (PII):

22   a. Does the information include PII? ___Yes ___ No

23   If yes, describe:

24   If yes, go to 10b. If no, skip to 10c.

25   b. Is use of anonymized data possible and sufficient for recipient purposes? ___Yes ___ No

26   If no, explain:

27   c. Conferred with Department/Agency Privacy Office re: privacy considerations and need for
28   PIA?
29   ___Yes ___ No

30   11. Does the data require any context to be properly understood? ___Yes ___ No

31   If yes, describe:

32   a. Will training be provided to accomplish this? ___Yes ___ No

33   If yes, describe:

34   12. Describe how the parties will protect the information from unauthorized access, misuse,
35   disclosure during transmission, use and maintenance.

36   13. What is the classification level of the information?

1 14. Describe auditing functions/trails/logs to be maintained by the recipient.

2 **C. EXTERNAL INFORMATION SHARING REQUESTS**

3 Note: This section should be used in conjunction with the DARP Questionnaire (Appendix A.3) for
4 data requests from non-Department/Agency external parties.

5 1. Source/originator of information (i.e., what organization originally collected the information):
6   Name of organization: _____

7 2. DARP Questionnaire completed and submitted? ___Yes ___ No

8 3. Review existing ISAAs to determine whether sharing is covered under an existing ISAA?
9   ___Yes ___ No

10 4. Purpose for which information was originally collected:

11   a. Identify applicable SORNS, if any:

12 5. Civil Rights and Civil Liberties – Confer with Civil Rights and Civil Liberties (CRCL) re:

13   a. Whether there are any prohibitions/concerns related to recipient obtaining information?
14   ___Yes ___ No

15   b. Whether information may be used, in whole or in part, to interfere with an individual's
16   exercise of lawful First Amendment activities? ___Yes ___ No

17   (Note: For requests made by external parties, this step will be part of the DARP process.)

18 6. Privacy – Confer with Office of Privacy (PRIV) re:

19   a. Whether the proposed sharing and use of the information is compatible with "routine
20   uses" identified in an applicable SORN? ___Yes ___ No

21   b. Whether there are any prohibitions/concerns related to recipient obtaining information?
22   ___Yes ___ No

23 7. Conferred with OGC and Geospatial Executive Committee re: whether there are any
24   prohibitions/concerns related to recipient obtaining information? ___Yes ___ No

25 8. Conferred with OGC, CRCL, and PRIV re: necessary restrictions on additional dissemination of
26   information shared:

27   OGC: ___Yes ___ No   CRCL: ___Yes ___ No   PRIV: ___Yes ___ No

28   a. Describe restrictions on further dissemination to be incorporated into ISAA.

29 9. List any conditions required to properly size/scope the required data elements.

30 10. List any mandated data exchange protocols that must be followed.

31 11. Are there other Department/Agency Components with concurrent jurisdiction/need for the
32   same information? ___Yes ___ No

33   If yes, describe:

34 12. Personally Identifiable Information (PII):

35   a. Does the information include PII? ___Yes ___ No

1   If yes, describe:

2   If yes, go to 13b. If no, skip 12b.

3   b. Is use of anonymized data possible and sufficient for the recipient's purposes?
4   ___Yes ___ No

5   If no, explain:

6   c. Confer with Department/Agency Privacy Office re: privacy considerations and need for
7   Privacy Impact Assessment (PIA)? ___Yes ___ No

8   (If a PIA is required, work with your Office of Privacy to resolve any issues.)

9   13. Contextual Understanding:

10   a. Does the data require any context to be properly understood? ___Yes ___ No

11   If yes, describe:

12   If yes, go to 13b. If no, skip 14b.

13   b. Will training be provided to accomplish this? ___Yes ___ No

14   If yes, describe:

15   14. How will recipient authenticate individual users/access events to the data?

16   15. What is the classification level of the information?

17

18

A.3 DATA ACCESS REQUEST PROCESS – QUESTIONNAIRE[194]

This questionnaire is intended to facilitate the creation of an Information Sharing Access Agreement (ISAA) between the requesting department/agency (Requesting Agency) and provisioning department/agency (Providing Agency). This questionnaire is a preliminary document and does not bind or otherwise constrain either party. The ISAA will serve as the official data access agreement between both parties.

Information Sharing and Access Agreement (ISAA): An ISAA is an agreement that defines the terms and conditions of information/data exchanges between two or more parties. The term encompasses agreements any form, including Memoranda of Understanding, Memoranda of Agreement, Letters of Intent, etc.

Please respond to the questions listed below in and be as specific as possible. Upon completion of the form, please submit the form to _____.

SECTION 1: INITIATE REQUEST FOR PROVIDING AGENCY DATA (Completed by Requesting Agency)

A. Points of Contact

1. Requesting Agency/Department?
2. What is the general mission of the requesting agency?
3. Requesting agency POC?
4. Requesting agency General Counsel POC?
5. Requesting agency technical POC?
6. Requesting agency Privacy POC?
7. Requesting agency Civil Rights and Civil Liberties POC?

B. Data Request

1. Requesting access to which system(s) or data set(s)?
2. What data elements are needed?
3.
   a. How do you envision receiving this data? (i.e., account access, bulk transfer, other)?

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[194] Department of Homeland Security, *Information Sharing and Access Agreements Guidebook and Templates*, revision version 2.1, October 2010.

b. For a data transfer scenario how often does the requesting agency envision receiving the data (e.g., real-time, hourly, daily, weekly, etc.)?

4. Are there any known or potential technical constraints? If yes, please describe.

C. Purpose

1. Why does the requesting agency need the data?

2. What will the data be used for, and how will it be used? (Please be specific)

3.

a. With whom, internal to your Department/Agency might the information derived from Providing Agency data be shared with? (Please be specific as to the other components within your Department/Agency.)

b. If you plan to share the data with others external to your Department/Agency, please list the third parties and describe the circumstances and means by which the data will be shared.

(Note: Any sharing external to your Department/Agency will be predicated upon the express authorization of that sharing by Providing Agency).

4. What is the anticipated number of people within your Department/Agency who will have access to the information derived from the system(s)?

5. What benefits, if any, are there to the Providing Agency mission to provide your Department/Agency with the data?

6. If Providing Agency is expected to receive any information in return, can Provider presume that it will be able to share this information across other Provider's Components and Offices that have the need for the information in the performance of their official duties?

(Note: If this is NOT the case, the Requestor must work with Providing Agency to have the Provider Component send a request for an exemption.)

7. If your request is for account access to a Provider system, what is the anticipated number of users from your Department/Agency?

D. Authorities – Requesting Agency

1. What is your Department/Agency's authority, under law, to use the data for the purpose stated above? (Please provide a specific citation to the relevant statute, regulation, or link to other document.)

2. What SORN(s) cover(s) the system(s) into which the requested data will be entered? (Please provide federal register citation.)

E. Privacy and Civil Liberties Protections

1. Redress: What mechanisms will the Requesting Agency use to correct out-of-date or expunged data in their own system?

2. Data Integrity/Deconfliction: How will the Requesting Agency notify Providing Agency when it finds incorrect or conflicting information, or updates to the data?

3. Accountability: Assuming Providing Agency grants express authorization, how will the Requesting Agency share the data with third parties? What mechanisms will the Requesting Agency use to ensure the data is limited to authorized users, for the purpose authorized under the SORN/planned MOU (i.e., account controls, audit logs). Please describe the circumstances and means by which data would be shared with third parties.

4. Auditing: Will the requesting agency audit the use of PII in the system into which the requested data will be placed?

5. Data Minimization: Is the request only seeking that PII which is directly necessary to accomplish the specified purpose?

6. Please describe the privacy and civil liberties training the requesting agency provides to employees and contractors who will be accessing Provider systems or using the system(s) into which the requested data will be placed.

7. Does the Requesting Agency plan to use the system(s) the requested data will be entered into to conduct data mining?

8. Does the system(s) the requested data will be entered into permit retrieval of information via queries based on religion, race, national origin, or ethnicity? Will the Requesting Agency use this function?

9. Is a written policy for privacy and civil rights and civil liberties protections in place that applies to the requesting agency's use of the requested data? (Y/N) If yes, please provide the policy.

10. Does the system(s) into which the requested data will be entered have a PIA? (Please provide a citation or link to any relevant PIAs.)

F. Information Security Controls

1. Detail the security safeguards against risks such as loss, unauthorized access or use, destruction, modification, or unintended or inappropriate disclosure the Requesting Agency intends to implement.

2. Does the requesting agency have a data breach policy in place to respond to an incident?

SECTION 2: PARTIES ACCOUNTABLE TO ADJUDICATE REQUEST IN A TIMELY MANNER (Completed by Providing Agency and Communicated to Requesting Agency)

A. Points of Contact

1. Reviewing official?

2. System/Data Steward POC?

3. Privacy POC?

1   4.   General Counsel POC?

2   5.   Civil Rights/Civil Liberties POC?

3   6.   Technical POC?

4   **B. Authorities**

5   1.   What system(s) contain the information requested?

6   2.   If the request seeks a subset of data, can it be parsed in the requested manner?

7   3.   What SORN routine use covers the sharing of this information with the Requesting Agency?

8   4.   Is the proposed use of the requested data discussed in the PIA for the requested database?

9

10   By signing below, I hereby affirm that the information on this form, and on any attachments to it,
11   are true, complete, and correct to the best of my knowledge and belief and are made in good
12   faith.

Requesting Agency/Department Official   Date

13

Providing Agency Official   Date

14

15

A.4 STANDARD TEMPLATE – EXTERNAL INFORMATION SHARING[195]

Templates are provided as a guide to writing ISAAs and may be adapted to suit any type of information sharing arrangement. Information to be completed by the drafting party is indicated in [brackets]. Sample language and additional instructions are noted in *italics*.

NOTE: This template is for reference guidance only and should be reviewed by your Department/Agency Office of General Council (OGC) for review and approval prior to its use or establishing formal agreements.

<div align="center">

MEMORANDUM OF AGREEMENT

BETWEEN

DEPARTMENT/AGENCY #1

[INTERNAL PARTY]

AND

DEPARTMENT/AGENCY #2

[EXTERNAL PARTY]

REGARDING

[SUBJECT MATTER]

</div>

1. INTRODUCTION AND PURPOSE. The Department #1 [INTERNAL PARTY] and Department #2 [proposed recipient, External Party], hereinafter collectively referred to as the "Parties," have entered into this Memorandum of Agreement ("MOA" or "Agreement") to govern the collection, use, access, disclosure, security, retention, and other usage of data and information described herein for the purpose of [briefly describe purpose].

2. BACKGROUND.

[Provide a brief description of **INTERNAL PARTY** responsibility related to subject matter of agreement and authority to share].

[Provide a brief description of **EXTERNAL PARTY** responsibility related to subject matter of agreement and authority to share.]

[If access to a system is to be provided, **also add** a brief description of system.]

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[195] Department of Homeland Security, *Information Sharing and Access Agreements Guidebook and Templates*, revision version 2.1, October 2010.

1

2 **3. DEFINITIONS.** As used in this Agreement, the following terms will have the following meanings:

3 a. INFORMATION: **INTERNAL PARTY** shall share [specify the information or system to be made
4 available or exchanged. Include specific information on the sources of the data and data fields to
5 be shared or exchanged]. **EXTERNAL PARTY** shall [specify the information or system to be made
6 available or exchanged. Include specific information on the sources of the data and data fields to
7 be shared or exchanged]. Collectively, all information described under this subpart is
8 "Information," under the terms of this Agreement.

9 b. INFORMATION SHARING ENVIRONMENT (ISE): Include this definition if Parties are members of
10 the ISE. The Information Sharing Environment (ISE) as established by section 1016(b)(1)(A) and
11 defined in section 1016(a)(3) of the Intelligence Reform and Terrorism Prevention Act of 2004
12 (IRTPA), (as amended by the Implementing Recommendations of the 9/11 Commission Act of
13 2007).

14 c. INFORMATION INCIDENT: (a) The loss of control, compromise, unauthorized disclosure,
15 unauthorized acquisition, unauthorized access, or any similar term referring to situations where
16 persons other than authorized users, and for an other than authorized purpose, have access or
17 potential access to the Information in usable form, whether physical or electronic; and/or (b) any
18 violation of any of the terms of this Agreement. The term encompasses both suspected and
19 confirmed incidents.

20 d. PERSONALLY IDENTIFIABLE INFORMATION (PII): means any information that permits the
21 identity of an individual to be directly or indirectly inferred, including other information that is
22 linked or linkable to an individual. For example, when linked or linkable to an individual, such
23 information includes a name, social security number, date and place of birth, mother's maiden
24 name, account number, license number, vehicle identifier number, license plate number, device
25 identifier or serial number, internet protocol address, biometric identifier (e.g., photograph,
26 fingerprint, iris scan, voice print), educational information, financial information, medical
27 information, criminal or employment information, and information created specifically to identify
28 or authenticate an individual (e.g., a randomly generated number).

29 e. PROTECTED INFORMATION: Include this definition if Parties are members of the ISE.
30 Information related to terrorism, homeland security, or weapons of mass destruction as those
31 terms are used in the Intelligence Reform and Terrorism Prevention Act of 2004 (IRTPA), (as
32 amended by the Implementing Recommendations of the 9/11 Commission Act of 2007). The term
33 includes information about U.S. citizens and legal permanent residents that is subject to
34 information privacy, civil rights, and civil liberties protections required under the U.S. Constitution
35 and Federal laws of the United States. Under **INTERNAL PARTY** policy, any PII that is collected,
36 used, maintained, and/or disseminated in connection with a mixed system is treated as a system
37 of records subject to the administrative protections of the Privacy Act regardless of whether the
38 information pertains to a U.S. citizen, legal permanent resident, visitor, or alien.

1   f. [Define additional terms specific to this Agreement.]

2   **4. AUTHORITY.** The information sharing and enhanced cooperation among the Parties to this
3   Agreement is authorized under and complies with the provisions of:

4   a. **INTERNAL PARTY** authorizing legislation citation;

5   b. [Insert Component specific authorities;]

6   c. 5 U.S.C. § 552a, Privacy Act of 1974; [Insert specific **INTERNAL PARTY** System of Records Notice,
7   Date and Federal Register Citation];

8   d. Public Law 107-347, §208, "The E-Government Act of 2002; [Insert specific **INTERNAL PARTY**
9   Privacy Impact Assessment, as appropriate];

10   e. [If parties are part of the federal ISE, include:] Public Law 108-458, "Intelligence Reform and
11   Terrorism Prevention Act (IRTPA) of 2004," as amended;

12   f. [If parties are part of the federal ISE, include:] Public Law 110-53, "Implementing
13   Recommendations of the 9/11 Commission Act of 2007;"

14   g. [If parties are part of the federal ISE, include:] Program Manager's Office, Information Sharing
15   Environment, "Privacy Guidelines," December 4, 2006;

16   h. [If parties are part of the federal ISE, include:] Privacy and Civil Liberties Policy Guidance
17   Memorandum 2009-01.

18   i. [list all additional applicable statutory and regulatory authorities for each party].

19   **5. RESPONSIBILITIES.** The following roles and responsibilities have been defined for each of the
20   parties to this Memorandum of Agreement (MOA):

21   A. DATA SENSITIVITY. It is the intent of the Parties to conduct the exchange of the Information at
22   the [Enter the sensitivity or classification level of the information to be exchanged. Use the
23   highest sensitivity or classification for any of the Information to be shared, e.g., Controlled but
24   Unclassified] level. Specific technical and security details appropriate to this level of data
25   sensitivity are set forth in the SAFEGUARDS section, below, [optional clause: and in separate
26   technical documentation, titled [insert documentation title or other direction] and attached as
27   Attachment A to this Agreement and incorporated herein.]

28   B. DELIVERY OF DATA. [Enter a description of the requirements pertinent to the exchange of
29   information/data among and between the parties, using one of the 3 options provided. If direct
30   access to a system is allowed, use option 3.]

31   Option 1: Use if separate documents define technical standards. Must use this option if the DATA
32   SENSITIVITY optional clause was used and no direct access of the system is contemplated. The
33   technical standards related to transfer of data between **INTERNAL PARTY EXTERNAL PARTY** as
34   provided in this Agreement are attached and incorporated into this Agreement at Appendix
35   [letter]. In general, the Parties agree to use efficient, commercially available network and

1   database technology that meets or exceeds industry standards to securely store and transfer data

2   in a manner that will allow data to be transferred and updated in a real time or near real time

3   manner. The Parties are committed to updating the technologies employed to implement this

4   Agreement to ensure maximum efficiency and data-sharing as data volumes increase and more

5   efficient technologies become available.

6   OR

7   Option 2: **INTERNAL PARTY** will electronically transmit the Information to the [title of **EXTERNAL**

8   **PARTY** person responsible for receiving the Information]. **INTERNAL PARTY** will transmit the

9   Information to **EXTERNAL PARTY** via an agreed upon secure delivery system based on best

10   practices and strong privacy and data security protections.

11   OR

12   Option 3: Use if direct access to a system is to be provided. [Insert language that describes

13   delivery and security parameters for direct access to a system by external users. Specify the

14   security parameters that are exchanged among/between systems that authenticate requests and

15   classes of service as being within the proper scope of this Agreement. Describe the number and

16   types of users that will be permitted access. Also, any additional security parameters that are

17   required to allow the system to determine whether a user is authorized to receive the

18   information and/or services requested and whether all details of the transaction fall within the

19   scope of user services authorized by this Agreement (such as personal accountability) should be

20   specified here. See example below]

21   **Example: INTERNAL PARTY** will establish [insert number] user accounts providing access to the

22   [system] programs for **EXTERNAL PARTY** personnel at specified locations, including [specified

23   locations, if any] [optional clause: and locations where **EXTERNAL PARTY** and **INTERNAL PARTY**

24   personnel are co-located]. **EXTERNAL PARTY** agrees to limit access to the [system] to only

25   individuals to whom access accounts have been properly issued and who have successfully

26   completed the training required under this Agreement. In no case will more than [insert same

27   number from above] distinct individuals be provided access to the [system]. **INTERNAL PARTY** will

28   transfer records on a timely, periodic basis to **EXTERNAL PARTY** from the [system] programs, as

29   described in this Agreement. The periodic transfer of records will begin as soon as practicable.

30   The specific technical and operational requirements for the establishment of user accounts and

31   the periodic transfer of data as described in this section are set forth in [name of separate

32   documentation], attached at [Appendix identification] and incorporated herein.

33   C. USE.

34   The information shared in accordance with this Agreement will be used only as described and for

35   the purposes stated in this Agreement, and in a manner consistent with any statutory or

36   regulatory requirements, including privacy compliance requirements.

37   Add if applicable: Each party will use the data only for the purpose stated in [statutory citation].

38   [Describe any additional limits on authorized use of information].

1   D. RECORDS.

2   The Parties will retain the Information for only as long as is needed to fulfill the purposes stated in
3   Section 1. In no instance will the retention period for any data item exceed [fill in time period] or
4   the maximum period permissible by applicable legal and regulatory requirements or official
5   retention policies. Each Party will dispose of the Information accessed under this Agreement in
6   accordance with its own records retention authorities and policies, as well as applicable laws and
7   regulations, whichever is shorter.

8   [Describe any additional specific requirements for disposition/retention of records].

9   E. DISSEMINATION.

10 The Parties will limit access to information covered under this Agreement to only those
11 authorized personnel who have a mission need for the data to carry out their official duties. The
12 Information will not be disseminated outside **INTERNAL PARTY** without the expressed consent of
13 [External Party]. The Information will not be disseminated outside of **EXTERNAL PARTY** without
14 the express consent of **INTERNAL PARTY**.

15 Before any information originating from **INTERNAL PARTY** records can be disclosed to any third
16 party other than those identified in the DISSEMINATION section above (for example Congress,
17 Government Accountability Office, the courts, and the general public), the **EXTERNAL PARTY** will
18 contact **INTERNAL PARTY** to determine the appropriate action or response. Should **INTERNAL
19 PARTY** and **EXTERNAL PARTY** agree to **EXTERNAL PARTY**'s disclosure of the information,
20 **EXTERNAL PARTY** shall document the disclosure and provide such documentation to **INTERNAL
21 PARTY**. Likewise, before any information originating from **EXTERNAL PARTY** records can be
22 disclosed to any third party other than those identified in the DISSEMINATION section above (for
23 example Congress, Government Accountability Office, the courts, and the general public),
24 **INTERNAL PARTY** will contact **EXTERNAL PARTY** to determine the appropriate action or response.
25 Should **INTERNAL PARTY** and **EXTERNAL PARTY** agree to **INTERNAL PARTY**'s disclosure of the
26 information, **INTERNAL PARTY** shall document the disclosure and provide such documentation to
27 **EXTERNAL PARTY**. For the purposes of disclosure under this Agreement, Components within
28 **INTERNAL PARTY** are not considered third parties or agencies.

29 [Optional clause] Added to respond to (in part) **INTERNAL PARTY** concern relating to applicability
30 of state and local laws to **INTERNAL PARTY** data: This is the only formal preemption of state and
31 local privacy laws for federal data of which we are aware, so any need for further guidance on this
32 point should be addressed to the OGC for specific ISAAs.

33 Dissemination of information from one Party to another shall not be considered a release of
34 information to the public, nor shall it constitute a waiver of any exemption to the relation of
35 information under the Freedom of Information Act (FOIA), 5 U.S.C. §522 or similar state law.

36 Add, if applicable:

37 Notwithstanding any other provision of this Agreement, pursuant to 6 U.S.C. § 482, information
38 obtained by a State or local government from a Federal agency shall remain under the control of

1   the Federal agency, and State or local law authorizing or requiring such a government to disclose
2   information shall not apply to such information. The state or local agency shall: (a) withhold such
3   information from any response; (b) release such information only with the expressed approval of
4   the Federal agency; or (c) refer the request to the originating Federal agency for a direct response
5   to the requester.

6   Each Party shall ensure that access to [insert marking level] information is limited to those
7   persons who possess requisite security clearances [optional clause: and who have executed a
8   non-disclosure' agreement prohibiting unauthorized use and disclosure of information.] All
9   **EXTERNAL PARTY** personnel who receive user account access to the [system] programs must be
10 verified as having a current [required security level, e.g., secret] or higher security clearance
11 before being allowed access to the information.

12 F. SUPPORT. [Describe the nature of analytic or technical services to be offered by each
13 organization].

14 G. SAFEGUARDS. The Parties agree to maintain reasonable physical, electronic, and procedural
15 safeguards designed to appropriately protect the Information shared under this Agreement
16 against loss, theft, or misuse, as well as unauthorized access, disclosure, copying, use,
17 modification or deletion. When the information is no longer used by the Parties, the Parties will
18 destroy all electronic data from their systems as well as all paper records that they have in their
19 possession as a result of this Agreement in such a manner as to render it unreadable and
20 unrecoverable.

21 AND if appropriate:

22 **INTERNAL PARTY** considers the Information to be [category of information] under [statutory and
23 regulatory citation] and will be handled in accordance with requirements for handling of [category
24 of information].

25 [Add additional safeguards related to the transmission, storage, and retention of the Information]

26 H. TRAINING. [Enter the details of any security awareness or training requirements and the
27 assignment of responsibility for conducting it. If existing training will be used, so state. If the
28 information shared includes PII, include the additional clause below.]

29 **Example:** Upon request from **INTERNAL PARTY**, **EXTERNAL PARTY** will provide sufficient training
30 and technical assistance to implement the transfer of [system] information and ensure
31 appropriate interpretation of such information. This includes general training of a core group of
32 users in the functions of [system] to ensure accurate interpretation of the information. The core
33 users would be utilized in a train the trainer program.

34 If the information to be shared includes PII, also include the following:

35 The Parties, including all personnel with access to the Information, shall be appropriately
36 educated and trained regarding the proper handling of personally identifiable information and
37 proper care of the information systems to ensure the overall safeguarding and security of the

Information. Each Party will ensure that its employees, including contractors with access to any of the Information, have completed privacy training on the handling of personally identifiable information which includes information on applicable laws, regulations and policies related to information privacy and security.

I. PRIVACY.

The collection, use, disclosure, and retention of personally identifiable information shall be limited to that which is necessary for purposes of the Parties as set forth in this Agreement. Personally identifiable information shall be protected by administrative, technical and physical safeguards appropriate to the sensitivity of the information. Personally identifiable information will only be disclosed to authorized individuals with a need to know and only for uses that are consistent with the stated purposes under this Agreement and for which the information was originally collected.

Add, if applicable:

The Parties are members of the Information Sharing Environment (ISE) as established by section 1016(b)(1)(A) of the Intelligence Reform and Terrorism Prevention Act of 2004 (IRTPA), (as amended by the Implementing Recommendations of the 9/11 Commission Act of 2007). As such, the Parties understand and acknowledge that their collection, use, maintenance, and dissemination of protected information under this Agreement must conform to the requirements established for ISE members by the President, the Program Manager for the ISE (PM-ISE), and the PM-ISE's Privacy Guidelines Committee. The Parties also acknowledge that they will collect, use, maintain and disseminate protected

J. CORRECTION AND REDRESS. If Information includes PII, include the following:

Personally identifiable information shared and/or maintained under this Agreement shall, to the extent feasible, be as accurate, complete, and current as necessary for the purposes identified in this Agreement. The Parties shall cooperate with each other in this regard. The **EXTERNAL PARTY** will, in a timely manner, take appropriate action with regard to any request made by **INTERNAL PARTY** for access, additions, changes, deletions, or corrections of PII. In addition, the **EXTERNAL PARTY** will, in a timely manner, notify **INTERNAL PARTY** of any data errors that it discovers.

The **EXTERNAL PARTY** shall maintain an ability to locate and alter PII provided under this Agreement. Additionally, the **EXTERNAL PARTY** shall correct any disseminated information based on the Information shared under this Agreement that is later deemed to be erroneous. Location and correction of records shall be accomplished in not more than three working days and **EXTERNAL PARTY** will provide written confirmation to **EXTERNAL PARTY** of the corrections made.

K. COOPERATION/DECONFLICTION. [Describe any coordination and/or deconfliction responsibilities]

The Parties shall work together to the greatest extent possible to achieve the maximum preventative, preemptive, and disruptive effect on potential threats, including coordinating simultaneous and complementary activities when appropriate. The parties agree to coordinate

operational activities to the greatest possible extent. Specifically, each party shall take all reasonable steps to ensure coordination and de-confliction of homeland-security-related law enforcement or intelligence activities under its authority, with such activities of the other party.

If Parties contemplate coordination of investigative or enforcement activities include the following:

Where the Parties have a mutual investigative interest based on information shared pursuant to this Agreement, the Parties will coordinate with each other to determine the appropriate investigative/enforcement course of action. In such matters, unless there are exigent circumstances requiring immediate action, the **EXTERNAL PARTY** will verify information and coordinate with **INTERNAL PARTY** before taking action on leads or disseminating intelligence products developed as a result of information shared pursuant to this Agreement. In the event of exigent circumstances, the **EXTERNAL PARTY** will notify the designated **INTERNAL PARTY EXTERNAL** representative as soon as possible but no longer than 24 hours after taking the action. This section does not apply to matters in which **INTERNAL PARTY** and **EXTERNAL PARTY** do not have a mutual investigative interest.

L. REPORTING AND COMPLIANCE. [Use this section to describe the responsibilities concerning the reporting of and responses to information sharing incidents for both organizations.]

The Parties will provide notice, written unless otherwise specified, of any information incidents. Such notice is to be provided to the **INTERNAL PARTY** point of contact listed in this agreement immediately after the party first learns of the unauthorized information incident. The Parties agree to cooperate with any Party's investigation or auditing of such information incidents and measures taken in response to same.

To further safeguard the privacy, security, confidentiality, integrity and availability of the connected systems and the information they store, process and transmit, the Parties agree to maintain records of information provided to each other under the terms of this Agreement consistent with applicable law, as well as established records retention policies and guidance of the respective Parties.

The Parties shall designate responsible officials to meet annually, or at the request of any Party, to discuss and review the implementation of this Agreement. Any disagreement over the implementation of this Agreement shall be resolved in accordance with the ISSUE RESOLUION paragraph, below.

M. AUDITING. [Enter a description of how the audit trail responsibility, if any, is to be shared by participating systems and what events each shall note. Also be sure to identify audit timeframes and schedules.]

Both Parties shall work together to develop review standards to conduct annual self-audits of their compliance with the privacy, redress, and security requirements set forth in this Agreement. The results of such audits shall be exchanged with the other party. The [official to receive reports] shall be provided copies of the self-audits of both Parties for review. As part of this responsibility,

1   the **EXTERNAL PARTY** further agrees to conduct its own annual audits of compliance with the

2   terms of this Agreement, and to provide the results of these audits to [title of **INTERNAL PARTY**

3   person to receive audit reports].

4   The **EXTERNAL PARTY** will cooperate fully with any **INTERNAL PARTY** audit of the collection, use,

5   access, disclosure, security, and retention of Information under this Agreement, and/or of

6   compliance with this Agreement. The **EXTERNAL PARTY** agrees to provide the **INTERNAL PARTY**

7   with timely and reasonable access to records and information demonstrating compliance with this

8   Agreement, upon request.

9   Additional optional language: **INTERNAL PARTY** may also verify compliance through a Computer-

10   Based Training course and an automated certification test. All **EXTERNAL PARTY** [system] users

11   will be required to pass this certification test in order to access any functions or data in [system].

12   N. [Enter any additional specific roles or requirements of each participating party.]

13   O. Sanctions

14   **EXTERNAL PARTY** will report to **INTERNAL PARTY** in writing any instance in which information

15   under this MOA is accessed, disseminated, or used in an unauthorized manner. Such notice is to

16   be provided immediately after the party first learns of the unauthorized access, dissemination, or

17   use.

18   Any user who is determined by [external group] or **INTERNAL PARTY** to be in systemic or

19   repeated violation of applicable laws and procedures governing access to and use of the

20   information under this Agreement will have access to the information subject to this Agreement

21   revoked, and may be prosecuted or fined, when appropriate, under applicable federal or state

22   law, or may be subject to administrative or disciplinary actions.

23   **6. POINTS OF CONTACT.** The individuals responsible for implementation of this MOA and the

24   resolution of issues hereunder shall be:

25   [Identify the POCs for **INTERNAL PARTY** and **EXTERNAL PARTY**, including office symbol, address

26   and phone number (fax number and e-mail or internet addresses can also be included).]

27   **7. SEVERABILITY.** Nothing in this Agreement is intended to conflict with current law or regulation

28   or the directives of the **INTERNAL PARTY** or **EXTERNAL PARTY**. If a term of this agreement is

29   inconsistent with such authority, then that term shall be invalid, but the remaining terms and

30   conditions of this agreement shall remain in full force and effect.

31   **8. NO PRIVATE RIGHT.** This MOA is an agreement between **INTERNAL PARTY** and **EXTERNAL**

32   **PARTY**. It does not create or confer any right or benefit, substantive or procedural, enforceable by

33   any third party against the Parties, the United States, or the officers, employees, agents, or

34   associated personnel thereof. Nothing in this MOA [or its appendices] is intended to restrict the

1   authority of either party to act as provided by law, statute, or regulation, or to restrict any party

2   from administering or enforcing any laws within its authority or jurisdiction.

3   **9. FUNDING.** This MOA is not an obligation or commitment of funds, nor a basis for transfer of

4   funds. Unless otherwise agreed to in writing, each Party shall bear its own costs in relation to this

5   MOA. Expenditures by each Party will be subject to its budgetary processes and to the availability

6   of funds and resources pursuant to applicable laws, regulations, and policies. The Parties

7   expressly acknowledge that this in no way implies that Congress will appropriate funds for such

8   expenditures.

9   **10. ISSUE RESOLUTION.** Throughout the course of this Agreement, issues such as scope of the

10   Agreement, interpretation of its provisions, unanticipated technical matters, including

11   improvements, and other proposed modifications can be expected. Both parties agree to appoint

12   their respective points of contact to work in good faith towards resolution. Disputes arising under

13   or relating to this Agreement shall be resolved only through consultations between the Parties.

14   Such disputes shall not be referred to any outside Party or to any other settlement without the

15   consent of both Parties. This Agreement shall be governed United States law exclusively.

16   **11. EFFECTIVE DATE.** The terms of this agreement will become effective on [insert the effect

17   date].

18   **12. ENTIRE AGREEMENT**. This MOA [including all appendices] constitutes the entire agreement

19   between the parties.

20   **13. MODIFICATION.** This agreement may be modified upon the mutual written consent of the

21   parties.

22   **14. TERMINATION.** The terms of this agreement, as modified with the consent of both parties,

23   will remain in effect until [date, completion of project, or upon agreement of parties.] The

24   agreement may be extended by mutual written agreement of the parties. Either party upon

25   [number] days written notice to the other party may terminate this agreement.

26   The forgoing represents the agreement reached by the **INTERNAL PARTY** and **EXTERNAL PARTY**.

27   **APPROVED BY:**

28   [Give the name and position of the official signing and dating for the **INTERNAL PARTY**. If known,

29   give the name and position of the official signing and dating for the **EXTERNAL PARTY**.]

30

_____   _____
[Name]   Date
[Position]
INTERNAL PARTY

1

_____   _____
[Name]   Date
[Position]
EXTERNAL PARTY

2

3

1 APPENDIX B:

2 # BUSINESS REFERENCE MODEL

3 ## B.1 BASELINE GEOSPATIAL ASSESSMENT
4 ## MATRIX: CORE CAPABILITY

5

Enterprise Investment	Visualization	Geo-Analysis/ Processing	Reporting	Search & Discovery	Alerts & Notifications	Collaboration	Content Mgmt	Resource Mgmt	Data Mgmt	Asset Mgmt	Decision Support	IT Security	Other
Org #1	C	C	C	P	P	P	P	C	C	P	P	C	
Org #2	C	C	C	C	C		P	C	C	C		C	
Org #3	C	C	C	C	C	C			C		C	C	
Org #4	C	C	C	C	C			C	C			C	
Org #5	C	C	C	C	C	C	C	C	C		C	C	
Org #6	C	C	C	C	C	C	C		P	C		P	
Org #7	P				P							P	
Org #8	C	C				C			C		C	C	
Org #9	C				C	C					C	C	
Commonality Score Percent (%)	9	7	6	6	8	6	4	4	7	3	5	9	0
	100%	78%	67%	67%	89%	67%	44%	44%	78%	33%	56%	100%	0%

Status: C = Current, P = Planned

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1 APPENDIX C:
2 # DATA REFERENCE MODEL

3 ## C.1 BASELINE GEOSPATIAL ASSESSMENT
4 ##   MATRIX: DATA INPUTS
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Geospatial Baseline Assessment: Data Inputs							Common Score	Pct %
Data Inputs	**Org #1**	**Org #2**	**Org #3**	**Org #4**	**Org #5**	**Org #6**		
Email	P	P	C	C	C	C	6	100%
SMS / Text Messages	P	C	C	P	C	C	6	100%
Internet Media	P		C	P	C	C	5	83%
Critical Infrastructure	C	C	C	C	C	C	6	100%
Suspicious Activity Reports	P	P	C		C	P	5	83%
Weather Service Forecasts / Warnings	P	C	C	C	C	C	6	100%
Natural Hazards	P	C	C	C	C	C	6	100%
Base Maps (see GIRA Appendix F-2)	P	C	C	C	C	C	6	100%
Business Directories	P	P	C	C	C		5	83%
Personnel / Blue Force Tracking	P	C	C				3	50%
Asset / Vessel Tracking	P	C	C	C			4	67%
Elevation & Terrain	P	C	C	C			4	67%
Navigation & Reference Grids	P	C	C				3	50%
Population / Demographics	C	C	C			C	4	67%
Travel Conditions	P	C	C	C		C	5	83%
Political Jurisdictions	P	C	C	C			4	67%
Tax Parcels		P	C				2	33%
Law Enforcement	P		C				2	33%
Emergency Services	P		C			P	3	50%
Health & Disease Outbreaks	P	P	C			C	4	67%
Aerial Photography	C	C	C	C	C	C	6	100%
Satellite Imagery	C	C	C	C	C	C	6	100%
Traffic Camera / Feeds	P	C	C	C	C	C	6	100%
Camera Feeds / live video	P	C	C	C	C	C	6	100%
Business Partners Operating Status		P				P	2	33%
Personal Identifiable Information (PII)		P				P	2	33%
Classified / FOUO sensitivie data		P				P	2	33%
Others							2	33%
Status C - Current P - Planned								0%

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C.2 BASELINE GEOSPATIAL ASSESSMENT MATRIX: DATASETS

Geospatial Baseline Assessment: Datasets

Datasets[1]	Org #1	Org #2	Org #3	Org #4	Org #5	Org #6	Common Score	Pct %
Base Map[2] (* indicates OMB A-16 Framework Layer)								
Baseline (Maritime)					C		1	17%
Biological Resources		C	C	C			3	50%
Boundaries			C	C			2	33%
Cadastral*	C	P					2	33%
Cadastral* (Offshore)			P	P	C	C	4	67%
Climate					C		1	17%
Cultural and Demographic Statistics		P	P		C		3	50%
Cultural Resources			C	C		C	3	50%
Digital Ortho Imagery*			C	C			2	33%
Earth Cover (Land Use / Land Cover)	C	P					2	33%
Elevation Bathymetric*			P	P	C	C	4	67%
Elevation Terrestrial*					C		1	17%
Buildings and Facilities		P	P		C		3	50%
Federal Land Ownership Status					C		1	17%
Flood Hazards		C	C	C			3	50%
Geodetic Control*			C	C			2	33%
Geographic Names	C	P					2	33%
Geologic			P	P	C	C	4	67%
Government Units*					C		1	17%
Housing			C	C		C	3	50%
Hydrography*			C	C		C	3	50%
International Boundaries			C	C			2	33%
Law Enforcement Statistics	C	P					2	33%
Marine Boundaries			P	P	C	C	4	67%
Offshore Minerals					C		1	17%
Outer Continental Shelf Submerged Lands			P	P	C		3	50%
Public Health					C		1	17%
Public Lands Conveyance (patent) Records			C	C		C	3	50%
Shoreline					C		1	17%
Soils	C	P					2	33%
Transportation*			P	P	C	C	4	67%
Transportation (Marine)					C		1	17%
Vegetation		P	P		C		3	50%
Watershed Boundaries					C		1	17%
Wetlands			C	C		C	3	50%
Others								0%
Agriculture/Food								
Animal Health Surveillance	C	P					2	33%
Mobile Food			P	P	C	C	4	67%
Processing / Packaging / Production					C		1	17%
Product Distribution		P	P		C		3	50%
Product Storage					C		1	17%
Product Transportation					C		1	17%
Supply					C		1	17%
Support Facilities					C		1	17%
Other					C		1	17%
Banking / Finance								
Banking and Credit					C		1	17%
Securities / Commodities / Financial Investments					C		1	17%
Other								0%

Chemical and Hazardous Materials									
Manufacturing Facilities			C					1	17%
Release		C						1	17%
Storage	C							1	17%
Superfund Sites	C	P				C		3	50%
Transportation Routes	C					C		2	33%
Other	C					C		2	33%
Commercial Assets									
Industry	C	P	C	C		C		5	83%
Lodging	C					C		2	33%
Manufacturing	C					C		2	33%
Mining	C					C		2	33%
Public Venues	C					C		2	33%
Retail Facilities	C					C		2	33%
Other									0%
Dams									
Dam Types									
Defense Industrial Base									
Defense Industrial Base									
Emergency Services									
American Red Cross									0%
Emergency Management / Operations Centers									0%
Emergency Resources									0%
Fire									0%
Law Enforcement									0%
Rescue and Emergency Medical Services									0%
Others									0%
Energy									
Electricity									0%
Natural Gas									0%
Petroleum									0%
Other									0%
Event Impact									
Animal Impact									0%
Damage - Infrastructure									0%
Evacuation Routes									0%
Event Location									0%
Impacted Area									0%
Impact-Human									0%
Modeling									0%
Other									0%
Field Operating Locations									
Federal									0%
Blue Force Tracks									0%
Other									0%
Government Facilities									
Federal									0%
State/Local/Tribal/Territory									0%
GSA									0%
COOP Sites									0%
Foreign									0%
Judicial									0%
Military Installations									0%
Field Offices or Operating Locations									0%
Other									0%

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Telecommunications								
Broadcasting								0%
Communications								0%
Internet								0%
Priority / Emergency Assets								0%
Satellite								0%
Transport Facilities								0%
Wired								0%
Wireless								0%
Other								0%
Threat / Suspicious Activity								
Reports								0%
Surveillance								0%
Aviation								0%
Intermodal								0%
Maritime								0%
Mass Transit								0%
Railroad								0%
Road								0%
Other								0%
Water								
Raw Water Storage								0%
Raw Water Supply								0%
Treated Water Distribution Systems								0%
Treated Water Storage								0%
Wastewater Facilities								0%
Other								0%

Sources: 1) GeoCONOPS v5.0, Appendix B: Authoritative Data Matrix,   GeoCONOPS located at - http://www.napsgfoundation.org/attachments/article/81/GeoCONOPS_v5.pdf

Sources: 2) Basemaps: OMB Circular A-16 Supplemental Guidance, Appendix E: National Geospatial Data Asset Themes

* - indicates A-16 Framework theme

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1 APPENDIX D:

2 APPLICATIONS/SERVICES REFERENCE
3 MODEL

4 D.1 APPLICATIONS AND SERVICES
5 FUNCTIONALITY CATEGORIES

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Geospatial Baseline Assessment: Functionality								
	Ops	OHA	DNDO	Mgmt	CIS	DOD	Common	
Category	Org #1	Org #2	Org #3	Org #4	Org #5	Org #5	Score	Pct %
Geospatial: Visualization	C	C	P	C	C	C	6	100%
Geospatial: Analysis / Processing	C	C		C	C	C	5	83%
Reporting	C	C		P	C	C	5	83%
Search & Discovery	P	C		C		C	4	67%
Alerts & Notifications	P	C	P	P	C	C	6	100%
Collaboration	P	C			C	C	4	22%
Content Management	P	C			C	C	4	22%
Resource Management	C				C	C	3	50%
Data Management	C	P		C	C	C	5	83%
Modeling	C	P	P	P	P	C	6	100%
Analytics	C	C	P	C	C	C	6	100%
IT Security	C	P	P	C	C	C	6	100%
Other								0%
Status c - Current P - Planned								

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D.2 FUNCTIONALITY OF APPLICATIONS AND SERVICES

Geospatial Baseline Assessment: Functionality of Applications and Services

Functionality	Category	Org #1	Org #2	Org #3	Org #4	Org #5	Org #6	Common Score	Pct (%)
GIS Visualization	Geospatial	C	C	C	C	C	C	6	100%
ANSI 415 Map Symbology	Geospatial	C		C		P	P	4	67%
Mil 2525B Map Symbology	Geospatial						P	1	17%
Geocode Address / Place	Geospatial	C	C	C	C	C	C	6	100%
Reverse Geocode	Geospatial	C	P	C		C	P	5	83%
Batch Geocode	Geospatial	P	P	C		C	C	5	83%
Gazeteer	Geospatial	P	C	C		C	C	5	83%
Translate Coordinate Systems / Grids	Geospatial	P	C	C			C	4	67%
Decimal Degrees	Geospatial	P	C	C	C	C	C	6	100%
Decimal Minutes Seconds	Geospatial	P	C	C		C	C	5	83%
Other Coordinate Systems / Projections	Geospatial			C		C		2	33%
US National Grid	Geospatial	P	C	C			C	4	67%
Military Reference Grid	Geospatial	P		C	C			3	50%
Add Custom GIS data	Geospatial	P	P	C		C	C	5	83%
Export Data Layers	Geospatial	P	P	C		C	C	5	83%
Print Map	Geospatial	C	P	C	C	C	C	6	100%
Export Map	Geospatial	P	P	C	C	C	C	6	100%
GIS analysis / processing	Geospatial	C	C				C	3	50%
Imagery Visualization	Digital Photography / Streaming Video	C	P	C	C		C	5	83%
Streaming Video	Digital Photography / Streaming Video	P	P	C	C		C	5	83%
Live Camera Feeds	Digital Photography / Streaming Video	P	P	C	C		C	5	83%
Reporting	Reporting	C	P	C	C	C	C	6	100%
Reporting Templates	Reporting	C	P	C	C	C	C	6	100%
Standard Form Generation	Reporting	P	P	C	C	C	C	6	100%
Export Reports / Output	Reporting	C	P	C	C	C	C	6	100%
Search Tools	Search & Discovery	P	C	C	C	C	C	6	100%
Auto-ingest / Harvesting	Search & Discovery	P	C	C	C	C	C	6	100%
Unstructured Text / Document Search	Search & Discovery	P	P	C	C	C	C	6	100%
Cataloging	Search & Discovery	P		C		C	C	4	67%
Indexing	Search & Discovery	P		C		C	C	4	67%
Tagging	Search & Discovery	P		C		C	C	4	67%
Geotagging	Search & Discovery	P	P	C		C	C	5	83%
Entity Extraction	Search & Discovery	P	C	C			C	4	67%
Triage / Filtering	Search & Discovery	P	C	C			C	4	67%
Federated Queries	Search & Discovery	P	P				C	3	50%
Contextual Search	Search & Discovery	P	P				C	3	50%
Rank Profiles / Best Bets	Search & Discovery	P					C	2	33%
Taxonomy Integration	Search & Discovery	P	P			C	P	4	67%
Alert Notification Tools	Alerts & Notifications	P	C	C	C	C	C	6	100%
Publish Alerts	Alerts & Notifications	P	P		C	C	C	5	83%
Subscribe to Alerts	Alerts & Notifications	P	P	C	C	C	C	6	100%
Manage Alerts	Alerts & Notifications	P	P	C	C	C	C	6	100%
Messaging Services	Alerts & Notifications	P	C	C	C	C	C	6	100%
Chat	Collaboration	P		C		C	C	4	67%
Email	Collaboration	P		C	C	C	C	5	83%
Videoconferencing	Collaboration	P		C		C	C	4	67%
Shared Workspace	Collaboration	P		C			C	3	50%
Message Boards	Collaboration	P		C		C	C	4	67%
Customer Segmentation / Communities of Interest	Content Management	P	P		C	C	C	5	83%
Input Forms	Content Management	C	P			C	C	4	67%
Workflow Management	Content Management	C				C	C	3	50%
Document Repository	Content Management	C	P	C		C	C	5	83%

Capability	Category							Count	%
Secure / Restricted Access	IT Security	C	C	C	C	C	P	6	100%
User Account Management	IT Security	C	C	C	C	C	C	6	100%
Identity Management	IT Security	C	C		C	C	C	5	83%
Access Controls	IT Security	C	P	C	C	C	C	6	100%
Change Detection	Analytics		P			C		2	33%
Line of Sight	Analytics		P			C		2	33%
Flood Inundation / Modeling	Analytics		P			C		2	33%
Population Interpolation	Analytics	P	P	C		C		3	50%
Service Area Analysis	Analytics	P	C			C		3	50%
Nearest Point	Analytics	P	C		C	C		4	67%
Routing Analysis	Analytics	C	C		P	C		4	67%
Surface Profile	Analytics		P			C		2	33%
Calculate Viewshed	Analytics		P			C		2	33%
Plume Modeling	Analytics		P	C		C		3	50%
Suspicious Activity Report Analysis	Analytics	P	P			C	C	4	67%
Search & Rescue Report Analysis	Analytics		P					1	17%
Recidivist Analysis	Analytics							0	0%
Point Context Service	Analytics	P	P	C	C	C	C	6	100%
Distance and Azimuth Service	Analytics	P	P	C	C	C	C	6	100%
Employee Proximity Analysis	Analytics							0	0%
Point/Poly Buffer Analysis	Analytics	P	P	C	C	C	C	6	100%
Drift Modeling	Analytics							0	0%
Optimized Effort Allocation	Analytics							0	0%
Probability of Success (POS) reporting	Analytics							0	0%
Search Pattern Generation and Edit	Analytics						C	1	17%
Range and Bearing Measurement	Analytics	P	P	C	C	C	C	6	100%
Wind and Current Vector Field Display	Analytics	P	P	C	C	C	C	6	100%
Prability Densitu Graphic Support (heat maps)	Analytics							0	0%
Temporal Animation	Analytics						C	1	17%

Status   C-Current   P-Planned

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1 # APPENDIX E:

2 # INFRASTRUCTURE REFERENCE MODEL

3 ## E.1 BASELINE GEOSPATIAL ASSESSMENT
4 ## MATRIX: INFRASTRUCTURE

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Geospatial Baseline Assessment: Infrastructure

Infrastrcuture	Core Capability	Org #1	Org #2	Org #3	Org #4	Org #5	Org #6	Score	Pct
Initial Operating Capability	System Maturity Level	C				C		2	33%
Full Operating Capability	System Maturity Level			C	C		C	3	50%
Prototype	System Maturity Level		C					1	17%
Other	System Maturity Level							0	0%
COTS Solution	Software Components	C	C	C	C	C	C	6	100%
GOTS Solution	Software Components	C					C	2	33%
Open Source Solution	Software Components						C	1	17%
Custom Solution	Software Components	C	C			C		3	50%
Internal Hosting	Hosting Capability		C	C				2	33%
External Hosting	Hosting Capability					C	C	2	33%
Datacenter	Hosting Capability	P					C	2	33%
Disaster Recovery / Failover Capability	Hosting Capability	P	P	C	P	C		5	83%
Certification & Accreditation Complete	IT Security	P	P	C	C	C	P	6	100%
Authority to Operate	IT Security	P	C	C	C	C	P	6	100%
Section 508 Compliance	User Accessibility	C				C		2	33%
NIEM Compliant	Information Exchange	P					C	2	33%
Unclassified	System Designation		C	C	C		C	4	67%
Sensitive But Unclassified	System Designation	P				C	P	3	50%
Classified	System Designation						P	3	50%
Public	System Designation		C				P	2	33%
Network #1	Operating Environment	P					C	2	33%
Network #2	Operating Environment							0	0%
Network #3	Operating Environment							0	0%
Other Network	Operating Environment					C	C	2	33%
Data Exchange Agreements	System Overview		P		C			2	33%
Service Level Agreements	System Overview				P			1	17%
< 1,000 Current Users	System Capacity	C	C	C		C	C	5	83%
1,000-5,000 Current Users	System Capacity	P						1	17%
>10,000 Current Users	System Capacity							0	0%
> 5,000 Surge Users	System Capacity		C					1	17%
5,000-10,000 Surge Users	System Capacity							0	0%
> 10,000 Surge Users	System Capacity	P						1	17%
Mobile Version	Interoperability	P	P	C	P	C		5	83%

Status: C = Current   P = Planned

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E.2 BASELINE GEOSPATIAL ASSESSMENT MATRIX: TECHNOLOGY

Geospatial Baseline Assessment: Technology							
Technology	Core Capability	Org #1	Org #2	Org #3	Org #4	Score	Pct
Internet Explorer	Web Browser	C	C	C	C	4	100%
Chrome	Web Browser			C		1	25%
Firefox	Web Browser	C	C	C		3	75%
Opera	Web Browser					0	0%
Safari	Web Browser					0	0%
Other Web Browsers	Web Browser					0	0%
Windows OS	Operating System	C	C	C	C	4	100%
Linux OS	Operating System			C	C	2	50%
UNIX	Operating System					0	0%
Other OS	Operating System					0	0%
Anakam	IT Security	P				1	25%
Open SSO	IT Security	P				1	25%
Active Directory	IT Security		C			1	25%
Other IT Security	IT Security	C				1	25%
.Net Framework	Programming Framework	C			C	2	50%
Flash	Programming Framework		C			1	25%
JAVA	Programming Framework		C		C	2	50%
Other Frameworks	Programming Framework			C		1	25%
AJAX	API				C	1	25%
FLEX	API			C		1	25%
Silverlight	API	C		C		2	50%
Rest	API		C			1	25%
Other APIs	API			C		1	25%
ESRI Flex API	API		C			1	25%
ESRI Silverlight API	API					0	0%
ESRI Javascript API	API					0	0%
ESRI ArcExplorer API	API					0	0%
Oracle	Database Software	C		C	C	3	75%
SQLServer	Database Software	P	C	C		3	75%
MySQL	Database Software			C		1	25%
Other Database	Database Software			C		1	25%
ESRI ArcGIS Server	GIS Software	C	C	C		4	100%
GoogleEarth Enterprise Server	GIS Software					0	0%
Pitney Bowes AddressBroker	Geocoding Software					0	0%
BingMaps Geocoder	Geocoding Software	C				1	25%
GoogleMaps Geocoder	Geocoding Software					0	0%
ArcGIS Online Geocoder	Geocoding Software		C			1	25%
Other Geocoder	Geocoding Software					0	0%

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Geospatial Baseline Assessment: Technology							
Technology	**Core Capability**	**Org #1**	**Org #2**	**Org #3**	**Org #4**	Score	Pct
OpenMap	GIS Visualization					0	0%
BingMaps	GIS Visualization	C	C	C		3	75%
GoogleMaps	GIS Visualization					0	0%
ArcGIS Online	GIS Visualization		C			1	25%
Other GIS Visualization	GIS Visualization					0	0%
DRMS Reporting Software	Reporting Software					0	0%
Microsoft SQL Server Report	Reporting Software	P				1	25%
Oracle Reports	Reporting Software					0	0%
ArcGIS Server Reports	Reporting Software		C			1	25%
Other Reporting Software	Reporting Software					0	0%
Microsoft Exchange Email	Email	P				1	25%
ListServ	Email					0	0%
Real-Time Alert Manager	Email					0	0%
Google Mail (Gmail)	Email		C			1	25%
Jabber Chat	Chat	P	C			2	50%
Pokein.com	Chat					0	0%
VideoConferencing	VTC	P				1	25%
Apache Tomcat Webserver	Web Server		C			1	25%
Microsoft IIS Webserver	Web Server	C			C	2	50%
IBM Websphere	Web Server					0	0%
Other Webserver	Web Server					0	0%
Sharepoint Portal	Portal Technology			C		1	25%
ESRI GeoPortal / Portal Toolkit	Portal Technology					0	0%
Other Portal	Portal Technology					0	0%
GoogleSearch	Search Technology					0	0%
Microsoft Search	Search Technology					0	0%
FAST Search	Search Technology	P				1	25%
Lucene OpenSearch	Search Technology					0	0%
Tripwire Analytic Capability	Search Technology					0	0%
Apache Solr	Search Technology					0	0%
Other Search Technology	Search Technology					0	0%
ESRI GeoPortal Search	Search Technology		C			1	25%
GeoFinder for the Environment	Search Technology					0	0%

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Geospatial Baseline Assessment: Technology							
Technology	**Core Capability**	**Org #1**	**Org #2**	**Org #3**	**Org #4**	Score	Pct
XML Format	Information Exchange	P	C	C	C	4	100%
JSON	Information Exchange		C			1	25%
OGC WMS	Information Exchange	P	C	C	C	4	100%
OGC WMTS	Information Exchange	P		C	C	3	75%
OGC WCS	Information Exchange	P		C	C	3	75%
OGC WFS	Information Exchange	P	C	C	C	4	100%
KML	Information Exchange	P	C	C		3	75%
GeoRSS	Information Exchange	P	C	C	C	4	100%
SMS	Information Exchange	P	C	C		3	75%
Email	Information Exchange	P	C	C	C	4	100%
ESRI Native	Information Exchange		C		C	2	50%
REST	Information Exchange	P	C			2	50%
GeoPDF	Output Format		P			1	25%
JPEG	Output Format	C	P			2	50%
PNG	Output Format	C				1	25%
PDF	Output Format	C	P			1	25%
PPT	Output Format		P			1	25%
RTF	Output Format					0	0%
Word	Output Format					0	0%
Other File formats	Output Format					0	0%
Status	**C-Current**	**P-Planned**					

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APPENDIX F:
SECURITY REFERENCE MODEL

F.1 ICAM LANDSCAPE

F.1.1 FEDERAL IDENTITY, CREDENTIAL, AND ACCESS MANAGEMENT (FICAM)

The FICAM Roadmap lays out an architecture and common terminology for use across organizations. This ensures a common understanding of terms, so when a document uses a term it means the t thing to the author and the reader.

FICAM 2.0 divides the ICAM mission space into seven types of services—four of which have active PM-ISE-related efforts:

- **Digital Identity** – capture and validate information to uniquely identify an individual, and manage that information over its lifecycle
- **Credentialing** – bind an identity to a physical or electronic token
- **Authentication** – verify a claimed identity is genuine and based on valid credentials
- **Authorization** – grant or deny requests for services, data, or to enter a physical facility

FICAM also defines the **Privilege Management**, **Cryptography**, and **Auditing** service types which do not currently have active PM-ISE-related efforts.

Additionally, while FICAM includes the concept of Federation, it is not a defined FICAM service type.

- **Federation** – the capability to perform the FICAM types of service between organizations

As a conceptual architecture, FICAM is a combination of many technical solutions, policies, and processes: you won't find a FICAM for sale in a catalog.

F.1.2 STATE IDENTITY CREDENTIAL AND ACCESS MANAGEMENT (SICAM)

The SICAM Guidance and Roadmap outlines a strategic vision for a state-based trusted digital identity environment. This NASCIO sponsored guidance provides a state-oriented architecture, analogous to, but wholly separate from, FICAM, that is comprised of programs, processes, and

1 technologies addressing trust, interoperability, security, and process improvement enabling states
2 and their partners to ensure the integrity of the data entrusted to them.

3 F.1.3 THE SBU FABRIC

4 The primary source of governance for the ICAM landscape for the SBU Fabric is the Federal CIO
5 Council and its various subordinate organizations, as supported by GSA's Office of Government
6 wide Policy (OGP) Information Assurance and Trusted Access Division (IATAD).

7 F.1.3.1   FICAM TRUST FRAMEWORK SOLUTIONS

DIGITAL IDENTITY	CREDENTIALS

8 FICAM TFS provides a mechanism for non-federal entities to become approved issuers of
9 credentials trusted by the federal government for secure citizen and business facing online service
10 delivery.

11 F.1.3.2   NATIONAL IDENTITY EXCHANGE FEDERATION

DIGITAL IDENTITY	CREDENTIALS

12 NIEF is one of several non-federal entities undergoing approval under the FICAM TFP. Once
13 approved, credentials issued by NIEF members will be trusted under the FICAM framework and
14 will be eligible for acceptance by appropriate federal IT systems.

15 F.1.3.3   NIEF QUICKSTART

FEDERATION

16 NIEF QuickStart is a joint effort between NIEF and NASCIO to expand participation in the NIEF
17 federation by lowering the bar to entry.

18 F.1.3.4   NATIONAL STRATEGY FOR TRUSTED IDENTITIES IN
19 CYBERSPACE

DIGITAL IDENTITY	FEDERATION

20 NSTIC applies similar third-party credentialing concepts to the Citizen-to-Business and Citizen-to-
21 Government use case. For example, NSTIC envisions a citizen using a University-issued credential
22 to access an IRS website in order to submit tax returns.

23 F.1.3.5   TRUSTMARK

FEDERATION

24 TrustMark is an effort to enable interoperability between various disjointed, siloed identity
25 federations without requiring explicit bilateral agreements.

26 F.1.3.6   GLOBAL FEDERATED IDENTITY AND PRIVILEGE
27 MANAGEMENT

DIGITAL IDENTITY	AUTHENTICATION	AUTHORIZATION	CREDENTIALS	FEDERATION

GFIPM is a collection of SAML-based specifications that allow systems and agencies to securely exchange user identity and attribute information to facilitate authentication and authorization decisions. GFIPM defines both the protocol for exchange of attributes as well as the attribute set (vocabulary) available (and required) for exchange.

F.1.3.7   BAE PILOT ON SBU

AUTHORIZATION   FEDERATION

The BAE Pilot on SBU is an effort to allow Texas Department of Public Safety (DPS) users on an internal network access to controlled content on RISSNet, an external system, without their having to be provisioned access in advance based on attributes maintained by the Bureau of Justice Assistance (BJA). RISSNet requests the user's attributes on demand from BJA, enabling immediate, automated access decisions.

F.1.3.8   PERSONAL IDENTITY VERIFICATION

AUTHENTICATION   CREDENTIALS

PIV is a federal-wide credential, bearing name, photo, affiliation, and other information, issued under HSPD-12 that provides for both physical and logical (PKI-based) access capabilities. PIV is defined in the FIPS 201 standard.

F.1.3.9   PIV INTEROPERABLE

AUTHENTICATION   CREDENTIALS

PIV-I is a way for non-federal credentials to be treated as trustworthy as equivalent federal PIV credentials.

F.1.3.10   FIRST RESPONDER AUTHENTICATION CREDENTIAL

AUTHENTICATION   CREDENTIALS

FRAC is a major initiative to develop a FIPS-201 compliant smart identity credentialing system for emergency response officials (EROs) that is interoperable between local, state, and federal organizations. FRAC credentials will provide EROs the ability to quickly and easily access government facilities in the event of a disaster.

F.1.3.11   IISC SBU IDENTITY AND AUTHORIZATION ATTRIBUTES FEDERATION

AUTHORIZATION   FEDERATION

IISC SBU IAAF is an emerging effort establishing the governance and technical means to share identification and authorization attributes among members in a secure, scalable, and cost-effective manner. IISC SBU IAAF members represent federal, state, and local interests. An Attribute Registry Service effort is ongoing to facilitate use of these attributes.

F.1.4 THE SECRET FABRIC

The primary source of governance for the ICAM landscape for the Secret Fabric is the Committee for National Security Systems.

F.1.4.1   SECRET FABRIC ATTRIBUTE EXCHANGE

AUTHORIZATION	FEDERATION

The SFAE is a BAE-based attribute exchange, initially between DHS and an Intelligence Community element. SFAE will operate in much the same way as the BAE Pilot on SBU.

F.1.4.2   FICAM ON SECRET IMPLEMENTATION GUIDANCE

DIGITAL IDENTITY	AUTHENTICATION	AUTHORIZATION	CREDENTIALS	FEDERATION

The FICAM on Secret Implementation Guidance provides a roadmap of sequenced activities, milestones, and timelines for the implementation of FICAM on the Secret fabric in alignment with Priority Objective 4 of the National Strategy for Information Sharing and Safeguarding.

F.1.4.3   SECRET FABRIC TOKEN

AUTHENTICATION	CREDENTIALS

The Secret Fabric Token is a physical smart card being issued for logical access to the Secret Fabric. This card will replace login names and passwords, providing for better security. While similar to the way PIV is used for login to the SBU fabric, the Secret Fabric Token is not a PIV, is not used for physical access, and does not have a name, photo, or other identifying information printed on it.

F.1.5 THE TOP SECRET/SCI FABRIC

The primary source of governance for the ICAM landscape for the TS/SCI Fabric is the IC CIO.

The TS/SCI fabric is managed by the Intelligence Community (IC). The IC Identity, Access and Authorization (IAA) effort is responsible for ICAM on the TS/SCI fabric. More information is available via classified networks.

F.1.6 RELATED SPECIFICATIONS

F.1.6.1   BACKEND ATTRIBUTE EXCHANGE

BAE is a SAML-based specification that allows systems to securely exchange user identity and attribute information to facilitate authorization decisions. Unlike GFIPM, BAE does not define an attribute vocabulary, merely the protocol for the exchange of whatever attributes are agreed-to by the members of the federation.

F.1.6.2   XML ACCESS CONTROL MARKUP LANGUAGE

XACML is an open OASIS specification that provides a common machine-readable language for expressing security policy. XACML allows organizations to express complex access control policies, including those based on user attributes, data tags, and other environmental or contextual information.
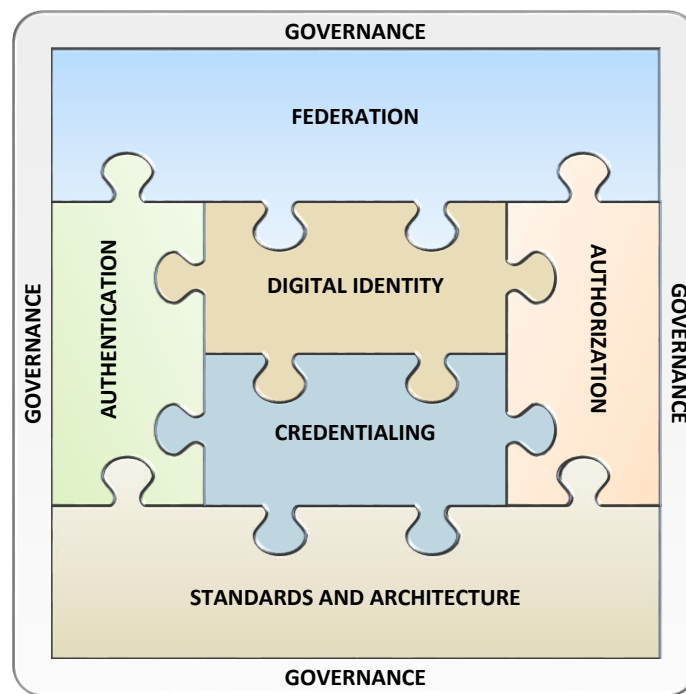

Figure F-1. ICAM Components

1 APPENDIX G:

2 # PERFORMANCE REFERENCE MODEL

3 ## G.1 ENTERPRISE ARCHITECTURE OUTCOMES
4 ## AND MEASUREMENTS TEMPLATE

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PERSPECTIVES	INVENTORY & OUTCOME	AREA OF MEASUREMENT	SPECIFIC MEASUREMENT INDICATOR	MEASUREMENT METHOD & TARGETS (TIMELINE)	COMMENTS AND ARTIFACTS
Spending "Ensure effective IT spending through informed decision making"	Inventories	Completeness	% of IT investments going through the IRB that have been reviewed by the EA Team		
			% of the Agency IT spend represented in the Enterprise Roadmap		
		Accuracy	% of IT investments approved by the IRB aligned to the Target Architecture		
		Ratio	O&M to DME Spending		
	Outcomes	Cost Savings/ Avoidance	# of dollars saved or how the EA Program contributes in cost savings or avoidance		
		Reduction of Duplication	# of duplicate investments EA helped identify		
		Efficiency	% of IT governance processes that EA participates in		
			% of acquisitions aligned to the standards product list		
Systems "Ensure IT supports the Mission" "Derive Cost Savings through system consolidation"	Inventories	Completeness	% of Agency's systems identified in Agency's Technical and Application Architectures (i.e., IRM and ARM)		
	Outcomes	Cost Savings/ Avoidance	# of dollars saved or how the EA Program contributes in cost savings through system consolidation		
		Reduction of Duplication	# of duplicate systems EA helped identify		
		Efficiency	% of cycle time reduced or how the EA Program contributes to reduction in cycle time		
			# of FTEs reduced or how the EA Program contributes to alignment of FTEs to Agency's missions		
		IT Enablement	EA contribution to new IT adoption, using Technical and/or Application Architecture		

PERSPECTIVES	INVENTORY & OUTCOME	AREA OF MEASUREMENT	SPECIFIC MEASUREMENT INDICATOR	MEASUREMENT METHOD & TARGETS (TIMELINE)	COMMENTS AND ARTIFACTS
Services "Identify services for adoption or expansion throughout the Agency"	Inventories	Completeness	% of Agency services defined in Business Architecture (i.e., PRM and BRM)		
		Accuracy	% of Agency services that are up to date and accurate		
	Outcomes	Cost Savings/ Avoidance	Cost savings/ avoidance gained from consolidating and sharing services		
		Reduction of Duplication	# of duplicate services EA helped identify		
		Efficiency	% of survey participants rating EA services satisfaction (e.g., high / medium / low)		
			# of new shared services implemented every two years		
Security "Increased IT Security"	Inventories	Completeness	% of investments mapped to the SRM		
		Accuracy	% of Security Architecture that is accurate and up to date		
	Outcomes	Cost Savings/ Avoidance	# of dollars saved or how the EA Program contributes in security cost savings		
		Reduction of Duplication	# of duplicate security implementations EA helped identify		
		Efficiency	# of FTEs reduced or how the EA Program contributes to alignment of FTEs to Agency's missions		
		IT Enablement	How EA contributes in improving security architecture for new IT adoption		
Others	Inventories				
	Outcomes				

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G.2 DHS COMMON OPERATING PICTURE (COP): PERFORMANCE MANAGEMENT SCORECARD

	OVERALL SCORE	Total Anticipated Investments	Total IT Investments Tracked	GOVERNANCE						INFORMATION SHARING						MISSION ENABLEMENT						TECHNOLOGY MANAGEMENT						
				Steering Committee Engagement	Working Groups Participation	Investment Transition Plans	Investment Aligned to Architecture	Shared Investment/ Collaboration Activities	Governance SCORE	Enterprise Data Sharing Agreements	Datasets Geocoded/ Geotagged	Datasets Compliant with NIEM/OGC Standards	Data Services Registered to COP/GII	Data Services Published using Symbology Standards	Information Sharing SCORE	Enterprise Services Adoption	Data Service Adoptions	Symbology Standards Adoption	Enterprise Software Adoption	Liscensed Data/Services Adoption	Mission Enablement SCORE	ELAs for Common Software	ELAs for Commercial Data/Services	Cost Avoidance for Software	Cost Avoidance for Licensed Data/Services	Cost Avoidance for Shared Investment/Collaboration Activities	Technology Management SCORE
Agency 1																											
Agency 2																											
Agency 3																											
Agency 4																											
Agency 5																											
Agency 6																											
COP ESC→																											

3   3   4   3   5

Score Legend: Not So Good 0 1 2 3 4 5 Really Good

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INDICATOR	MEASURES	DESCRIPTION
Governance	Executive Steering Committee Engagement	This score measures the level of participation in governance activities such as decisions, policy, and attendance at ESC meetings.
	Working Group Participation	This score measures the level of participation in collaborative working groups and participation in COP ESC Governance or Resources and Capabilities working group activities.
	Investment Transition Plans	This score measures the number of investments that have submitted transition plans for alignment to the COP architecture. This score is a percentage of the number of investments with transition plans against the number of investments.
	Investments Aligned to Technology Architecture	This score measures the number of investments that are aligned to the COP architecture based on COP ESC review and/or implementation of an approved transition plan.
	Shared Investments/ Collaboration Activities	This score indicates Component involvement in shared investments or collaboration activities.
Information Sharing	Enterprise Data Sharing Agreements	This score measures the number of enterprise data sharing agreements in place to support operating data requirements.
	Datasets Geocoded/ Geotagged	This score measures the number of datasets that have been geocoded/geotagged based on operating data requirements.
	Data Services compliant with NIEM/ OGC Standards	This score measures the number of data services that are NIEM / OGC compliant to ensure interoperability.
	Data Services Registered to COP/ GII	This score measures the number of data services that have been registered to the COP / GII based on operating data requirements.
	Data Services published using	This score measures the number of data services that have

INDICATOR	MEASURES	DESCRIPTION
	Symbology Standards	been published using symbology standards based on operating data requirements.
Mission Enablement	Adoption of Enterprise Services	This score measures the number of investments that have adopted enterprise services described in the COP architecture.
	Adoption of Data Services	This score measures the number of investments that have adopted data services described in the COP architecture.
	Adoption of Symbology Standards	This score measures the number of investments that have adopted symbology standards described in the COP architecture.
	Adoption of Enterprise Software	This score measures the number of investments that have adopted enterprise software described in the COP architecture.
	Adoption of Licensed Data / Services	This score measures the number of investments that have adopted licensed data or services described in the COP architecture.
Technology Management	Enterprise Licensing Agreements for Common Software	This score measures the number of enterprise licensing agreements for common software.
	Enterprise Licensing Agreements for Commercial Data/ Services	This score measures the number of enterprise licensing agreements for commercial data or services.
	Cost Avoidance from Enterprise Licensing of Software	This score measures the amount of cost avoidance derived from enterprise licensing of common software.
	Cost Avoidance from Enterprise Licensing of Commercial Data/ Services	This score measures the amount of cost avoidance derived from enterprise licensing of commercial data or services.
	Cost Avoidance from Shared Investment/ Collaboration Activities	This score measures the amount of cost avoidance derived from shared investment or collaboration activities such as cross-component mission project or partnerships.
Overall	Total Anticipated Investments	This measure is a count of investments identified during portfolio reviews across the HLS enterprise architecture.
	Total Investments Tracked	This measure represents the number of investments used in tracking Component progress.
	Overall Score	This is an average of the indicator scores and indicates a level of maturity of the COP Domain.

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1 G.3 STAKEHOLDER PERFORMANCE GUIDE

2 G.3.1 GOVERNANCE

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STAKEHOLDER PERFORMANCE GUIDE			
GOVERNANCE			
Role	Responsibility	Approach	Benefit
Executive Leadership	• Establish and/or Co-Chair to Chartered governance (ESC/IPT) body. • Signatory to establish Investment Technology Acquisition Review (ITAR) framework. • Signatory to ISAs for access or dissemination of data and/or services.	• Work with other Executives to frame Charter goals/objectives and commitment to level-of-effort support/involvement. • Establish review board with CIO/CFO representation and consider policy to ensure participation and commitment. • Establish or follow General Council process and review and maintain repository of Agreements.	• Signatory with defined responsibility and stated measurable results (e.g., ELAs with % cost reduction, shared services with defined Steward, etc.). • Promotes interoperability, reduces redundant investments, and allows for cost share. • Reduce cost for data acquisition and/or document need for establishing an Enterprise License Agreement.
Program Manager	• Coordinate across other internal Department/Agency investment PMs for recommendations to Execs for strategic and tactical objectives. • Staff and perform Working Group tasks as defined within the ESC/IPT Charter. • Develop performance measures and target end-state (To-Be) environment. • Ensure geospatial (sub-system at a minimum) is identified within the CPIC submission process.	• PMs identify and prioritize capability gaps and planned investments to determine To-Be end-state vs. As-Is environment and prepared business plan and value proposition for Execs approval. • Recommend Working Group priority, short-term/high-value tasks and deliver early results to demonstrate benefits. • Within Charter define Working Group roles/responsibilities and prepare a work plan with Plan of Action & Milestones (POA&M). • Within the annual CPIC submission (e.g., 53/300) process, ensure geospatial capability is identified so that search and identification across system investments can be performed.	• Early adoption/visibility to strengthen long-term commitment from Executive Leadership. • Working Group member awareness of multiple investments across enterprise promotes coordination resulting in leveraged investments. • Results oriented for measurable and quantifiable results demonstrating value of collaboration. • Facilitates the search and identification of geospatial investments (especially for smaller systems) across the entire enterprise to foster participation within the Executive Steering Committee and technical solution teams.
Solution Architect	• SME and reach back for Working Group participation. • Validate technical requirements for work plan.	• Develop baseline assessment and perform capability gap analysis for As-Is and To-Be environments. • Develop technical approach for work plan tasks and POA&M.	• Technical vetting and validation across investments for desired To-Be end-state environment. • Ensure broadest possible technical review, adoption and acceptance.

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1 # G.3.2 BUSINESS
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STAKEHOLDER PERFORMANCE GUIDE			
BUSINESS			
Role	**Responsibility**	**Approach**	**Benefit**
Executive Leadership	• Establish and/or Co-Chair to Chartered governance (ESC/IPT) body. • Signatory to establish Investment Technology Acquisition Review (ITAR) framework. • Signatory to ISAs for access or dissemination of data and/or services.	• Work with other Executives to frame Charter goals/objectives and commitment to level-of-effort support/involvement. • Establish review board with CIO/CFO representation and consider policy to ensure participation and commitment. • Establish or follow General Council process and review and maintain repository of Agreements.	• Signatory with defined responsibility and stated measurable results (e.g., ELAs with % cost reduction, shared services with defined Steward, etc.). • Promotes interoperability, reduces redundant investments, and allows for cost share. • Reduce cost for data acquisition and/or document need for establishing an Enterprise License Agreement.
Program Manager	• Coordinate across other internal Department/Agency investment PMs for recommendations to Execs for strategic and tactical objectives. • Staff and perform Working Group tasks as defined within the ESC/IPT Charter. • Develop performance measures and target end-state (To-Be) environment.	• PMs identify and prioritize capability gaps and planned investments to determine To-Be end-state vs. As-Is environment and prepared business plan and value proposition for Execs approval. • Recommend Working Group priority, short-term/high-value tasks and deliver early results to demonstrate benefits. • Within Charter define Working Group roles/responsibilities and prepare a work plan with Plan of Action & Milestones (POA&M).	• Early adoption/visibility to strengthen long-term commitment from Executive Leadership. • Working Group member awareness of multiple investments across enterprise promotes coordination resulting in leveraged investments. • Results oriented for measurable and quantifiable results demonstrating value of collaboration.
Solution Architect	• SME and reach back for Working Group participation. • Validate technical requirements for work plan.	• Develop baseline assessment and perform capability gap analysis for As-Is and To-Be environments. • Develop technical approach for work plan tasks and POA&M.	• Technical vetting and validation across investments for desired To-Be end-state environment. • Ensure broadest possible technical review, adoption and acceptance.

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G.3.3 DATA

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STAKEHOLDER PERFORMANCE GUIDE			
DATA			
Role	Responsibility	Approach	Benefit
Executive Leadership	• Authorize a Business Needs Analysis to identify geospatial data requirements using the Baseline Assessment Matrix: Data. • Agreed upon data authorized source to reduce redundancy and determine Enterprise License Agreement (ELA) opportunity with data provider/vendor. • Require any/all funded data creation or enhancement initiatives (e.g., contract award, cost-share, grant, etc.) include metadata standard compliance.	• Work with other Executives to acknowledge the need to reduce data costs by leveraging investment and performing the Baseline Assessment based upon mission/business needs. • Based upon business/mission need during Data Matrix assessment, may require Service Level Agreement and cost share for availability and Enterprise License Agreement (ELA) with vendor/provider. • Working with Exec Leadership approach Chief Procurement Officer to require contract language for the inclusion for all financial obligations.	• Signatory with defined responsibility and stated measurable results (e.g., IT Asset Inventory for OMB Open Data Policy reporting and a quantifiable data resource inventory). • The inventory would facilitate the identification of desired datasets; identifies redundant data assets for decommissioning; identifies opportunities to reuse or extend a data asset rather than creating a new one; and the opportunity to reduce redundancy costs based upon the establishment of enterprise licensing agreements and allows for cost share for economies of scale. • Provides a way to uniformly describe data, thereby supporting its discovery and sharing resulting in cost avoidance. Compliance with government *Open Data Policy*.
Program Manager	• Coordinate across organization's geo investment PMs for completion of Data Matrix and document business/mission functional requirements that drive data needs. • Determine which dataset will be used enterprise-wide based upon data content, currency and availability. • Work with PMs across enterprise to perform review of internally produced data includes metadata with a common taxonomy and cataloged for discovery. • Post datasets in open standards to appropriate catalogs for discovery.	• PMs prepare Data Matrix and schedule survey and follow-on interviews to clarify Data findings with business owners to understand functional needs. • Detailed assessment of datasets and how they meet the mission/business functional requirements. May require ELA with broader use terms and additional attributes requiring cost-share. • Review procurement vehicles to ensure metadata standard compliance language. Develop a common taxonomy for cataloging the metadata enhanced data resources. • Ensure enterprise data are exposed or 'harvestable' to appropriate web catalog services.	• Awareness and understanding of enterprise data requirements and business/mission owner functional needs that drive data. • Reduced contracting for vendor provided data, ELA discounts for volume-based pricing, data Steward responsibility as opposed to multiple posting/storage of datasets. • Ability to identify, search, discover and share datasets across the enterprise. • Facilitates the search and identification of geospatial data sharing. Compliance with government *Open Data Policy*.

STAKEHOLDER PERFORMANCE GUIDE			
DATA			
Role	**Responsibility**	**Approach**	**Benefit**
Solution Architect	• Data Assessment Matrix design and development. • Ensure data are cataloged and available in open standards and posted to web catalog service.	• Assist the data matrix interview with mission/business owner to determine functional requirements that drive data and application needs. • Develop technical approach for ensuring enterprise data resources are available, vetted and provided in compliance with open data requirements.	• Technical vetting and validation across investments for desired To-Be end-state environment. Understand functional requirements to optimize application development and data resource acquisition. • Facilitates the search and identification of geospatial data sharing. Compliance with government Open Data Policy.

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G.3.4 APPLICATIONS/SERVICES

STAKEHOLDER PERFORMANCE GUIDE			
APPLICATIONS/SERVICES			
Role	**Responsibility**	**Approach**	**Benefit**
Executive Leadership	• Authorize the Application and Service inventory using the Baseline Assessment and catalog App/Svc capabilities across the enterprise using a common taxonomy. • As part of the Investment Technology Acquisition Review (ITAR) framework, require all new applications and services be compared against the App/Svc Catalog to determine shared first requirement. • Apply the Shared Services Implementation Step-wise Process to geospatial investment.	• Work with other Executives to acknowledge the need to reduce data costs by leveraging investment and performing the Baseline Assessment based upon mission/business needs. • Establish review board with CIO/CFO representation and consider policy to ensure participation and commitment. • During annual budget review/planning cycle or with proposed new investments review against process.	• Signatory with defined responsibility and stated measurable results (e.g., IT Asset Inventory for OMB Open Data Policy reporting and a quantifiable App/Svc resource inventory). • Promotes interoperability, reduces redundant investments, and allows for cost share. • Reduce cost for App/Svc development/acquisition alignment to Share-First policy.
Program Manager	• Coordinate across other internal Department/Agency investment PMs to establish Geospatial Taxonomy Working Group and Geospatial App/Svc Catalog. • Staff and perform inventory and of existing/proposed App/Svc investment. • Staff and perform Shared Services Implementation Step-wise Process to assess geospatial investments.	• Initiate the Taxonomy development and perform App/Svc inventory for documenting App/Svc and creating a catalog. • Perform Baseline Assessment: Apps/Svcs across enterprise and populate catalog. • Develop repetitive process for evaluating investment to share services.	• Shared awareness of investment and value of geospatial capabilities across the organization. Basis for shared service capabilities. • Provides baseline for shared service investment and leveraged capability • Catalog meets Share First policy and forms basis for reduced investment.
Solution Architect	• SME and reach back for Taxonomy Working Group participation. • Perform technical evaluation of App/Svc investments to determine commonality and alignment.	• Develop baseline assessment and perform inventory of App/Svcs. • Technical review of services for alignment to TRM and Infrastructure compatibility (Section 6.3).	• Cross enterprise collaboration for technical exchange and comparison. • Ensure broadest possible technical review, adoption and acceptance.

G.3.5 INFRASTRUCTURE

STAKEHOLDER PERFORMANCE GUIDE			
CHAPTER 6 – INFRASTRUCTURE			
Role	Responsibility	Approach	Benefit
Executive Leadership	• Executive Steering Committee authorization and commitment to perform Baseline Assessment Matrix: Infrastructure and Technology. • Approve/disapprove a proposed IT solution depending upon its compliance with Enterprise Architecture for inclusion within CPIC process. • Ensure Cloud Option assessment is performed as part of a proposed IT solution.	• Task Program Managers responsible for geospatial system oversight to perform develop and execute the Baseline Assessment. • Ensure that the infrastructure/technology Baseline Matrix capabilities are aligned to EA and proposed new infrastructure/technology aligns to and not duplicative of existing capabilities. • Task Program Manger to apply cloud process review as option for IT solution.	• Provides input for CPIC (53/300) and reporting to OMB as well as establishes the enterprise baseline of the As-Is geospatial investments across the organization. • Promotes interoperability, reduces redundant investments, and allows for cost share. • Complies with Cloud First policy and provides economies for implementation.
Program Manager	• Coordinate across organization's geospatial investments to ensure committed participation in Baseline Assessment. • Identify opportunities for shared infrastructure and/or technology based upon Baseline Assessment Matrix comparison. • Review report of finding for cloud options for IT solution and make recommendations to Executive Leadership.	• PMs identify and prioritize capability gaps and planned investments aligned to Operational Requirements Document (ORD) and prepare recommendations and/or options for Execs approval. • Based upon gap analysis, identify candidate investments to leverage, eliminate or new develop based upon ORD priorities. • Coordinate Cloud assessment process evaluation for IT solution architecture.	• Cross organization agreement for prioritized geospatial system development priorities and leveraged resource commitment. • Reduce duplicative IT footprint and identify opportunity to leverage or reprioritize investments. • Complies with Cloud First policy and provides economies for implementation.
Solution Architect	• Develop the Infrastructure Assessment Matrix from across the entire organization's geospatial investments. • Vet 'new' technology insertions to EA and Technical Reference Model to ensure alignment with organization's To-Be environment. • Prepare report of finding for cloud options for IT solution.	• Work with other organization SAs to ensure a complete baseline assessment and perform capability gap analysis for As-Is and To-Be environments. • Determine 'optimal' solution if duplicative investments and ensure alignment to EA for 'new' technology. • Perform Cloud assessment process evaluation for IT solution architecture.	• Ensure broadest possible technical review, adoption and acceptance. • Technical vetting and validation across investments for desired To-Be end-state environment and alignment to EA target ensures compatibility and reduces IT footprint cost. • Provides awareness of architecture investment and solution options.

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G.3.6 SECURITY

STAKEHOLDER PERFORMANCE GUIDE			
SECURITY			
Role	**Responsibility**	**Approach**	**Benefit**

Executive Leadership	• Identify appropriate access policy for system data necessary to ensure responsible information sharing according to mission need.
	• Ensure risk management function for the organization is established and applies repeatable, consistent evaluation criterion.
	• Embrace the use of reusable, shared services for IdAM and security capabilities within the agency, and ensure Enterprise Architecture provides for adoption of federal shared services, particularly IdAM and security services, as they become available.
	• Empower organizational enterprise architect to direct the inclusion of relevant IdAM and security standards in organizational IT acquisition actions by holding systems accountable for EA compliance.
		• Understand Policy Requirements:
		  ◦ Mission need for system information security
		  ◦ Business processes that incorporate the system information
		  ◦ Severity of risk of unauthorized disclosure
		• Risk management function should be staffed sufficiently and empowered to reconcile interests of stakeholders. Clear risk management criteria formed with input from all relevant stakeholders (security, privacy, CR/CL, mission owners).
		• Designate organizational Executive Agents responsible for implementing IdAM and Security EA and policy. Responsible for:
		  ◦ Organization. EAs represent organization at relevant intergovernmental committees, governance bodies, and WGs.
		  ◦ Develop acquisition strategy that requires transition of solutions to repeatable shared services.
		• EA functions include:
		  ◦ Organizational process for approval of systems to ensure EA for IdAM and Security (services and standards). If compliance not currently feasible, POA&Ms to be required.
		  ◦ Engage organizational acquisitions and procurement functions to ensure contractual commitments and acquisitions are consistent with IdAM and Security EA and implementation plans.
		  ◦ Recommend restriction of funding of noncompliant systems.
			• A clear statement of information sharing policy can be vetted through the relevant stakeholders and then digitally implemented within mission systems to efficiently execute the mission.
			• Provides consistent feedback that can be incorporated for system design and avoids delays from inability to plan due to ambiguous guidance or interference from dissatisfied stakeholders.
			• Assist in complying with Federal policy guidance and drives cost efficiencies through shared, common services.
			• Ensures that system planning incorporates appropriate guidance from an early stage to avoid delays or wasted expenditures resulting from noncompliant system architecture.
			• Incorporating EA function into organizational approval process provides enforcement mechanism for EA compliance at an early stage, when noncompliance can be more easily mitigated.

STAKEHOLDER PERFORMANCE GUIDE			
SECURITY			
Role	**Responsibility**	**Approach**	**Benefit**

Program Manager	• Ensure access policy requirements for the system information are included in system acquisition, tech refresh actions, and system engineering lifecycle.
	• Ensure compliance/evaluation/ approval of the system in accordance with the organizational risk management framework.
	• Ensure requirements for relevant IdAM requirements are included in procurement language.
		• Identify access policy rules that have been enumerated for information contained in the system.
		• Program Manager actively engages with relevant governance bodies from system planning phase onward (see Table 7-1).
		  ◦ Give EA organization visibility into each phase of system lifecycle.
		  ◦ EA communicates emerging requirements to Program Managers.
		• Draft and include approved guidance with system acquisition, tech refresh actions, and system engineering lifecycle documentation.
			• Assist in complying with Federal policy guidance and drives cost efficiencies through shared, common services.
			• Assists in CPIC reporting requirements and drives early security awareness and compliance resulting in cost savings.
			• Assists in CPIC reporting requirements and drives early security awareness and compliance resulting in cost savings.

Solution Architect	• Ensure solution roadmap aligns with *FICAM Roadmap*. • Ensure solution meets requirements of organizational risk management framework. • Implement solution that is compliant with EA model for IdAM and security as well as organizational FICAM implementation plans. • Implement solution with sufficient interfaces to take advantage of enterprise IdAM and security services.	• Detail functionality for currently available capabilities and provide POA&Ms demonstrating alignment for future capabilities. • Clear system with risk management function during planning stage. If system is operational, coordinate roadmap to satisfy RM function. • Solution is described in terms of functional and technical requirements, which are mapped to service types and components of the relevant EA model. • Interfaces are defined sufficiently to show interoperability of system with repeatable shared services and standards.	• Ensures flexibility and adaptability of systems to incorporate upcoming capabilities. • Expedites development by coordinating risk management requirements into system planning and design phase rather than waiting for approval after build is complete. • Ensures that solutions are engineered or selected to meet all relevant requirements from the planning and design phase. • Ensures that the solution is designed and sufficiently technically implemented to provide flexibility to interoperate with emerging IdAM and security capabilities without the need for extensive re-engineering.

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G.3.7 STANDARDS

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	STAKEHOLDER PERFORMANCE GUIDE		
	STANDARDS		
Role	**Responsibility**	**Approach**	**Benefit**
Executive Leadership	• Develop and adopt Standards Policy within and across the Geospatial Executive Steering Committee and your Department or Agency. • Ensure all geospatial procurements/awards have the appropriate Standards Compliance Section included in the contract language. • Standards resourcing for subject matter expertise (SME) and SDO involvement.	• Working with Executive Leadership across geospatial investments, the Office of the Chief Information Officer; Financial Management Office; and Grants Office, agree upon and include Standards-based acquisition language for procurements and awards. • Review procurement action prior to sign-off and the assign Program Manager the responsibility to include the necessary language in the procurement/award action. • Budget for a staffing position (e.g., full or part time) to perform standards guidance. Position would participate on and provide into to SDOs and cross organization geospatial investments.	• Ensure contract continuity and compliance for consistent geospatial investments. Enforces vendor neutrality and promotes competition for industry standards adoption. Drives interoperability across investments. • Ensures procurement/award consistency and compliance. • Provides awareness and understanding of standards requirements, benefits and advancement in geospatial standards development and adoption.

Program Manager	• Coordinate across other internal Department and Agency investment PMs for identification and agreement on content for Standards Policy development.
	• Prepare "boiler plate" standards-based procurement language for inclusion need contracts/awards.
	• Determine resourcing requirements and availability for geospatial standards capability development for:
	  ◦ Subject Matter Expert
	  ◦ SDO participation
		• Draft Standards Policy for procurement and grants guidance. Work with and vet for completeness and currency across organization and review SDO listings.
		• Work with OCIO, OFM, and Grants Offices to determine process for standards-based procurement / grant language inclusion within policy guidance and contract vehicles.
		• Prepare Position Description for Geospatial Standards SME as a core competency within job category (e.g., GS-2210: Information Technology Management Series). Participate on and/or contribute to geospatial SDO initiatives.
			• Provides awareness and understanding of baseline and current standards requirements. Allows for a definition of "Value Proposition" of standards-based interoperability.
			• Policy-based guidance for government and industry understanding and compliance.
			• Increase internal capacity for geospatial standards understanding and compliance.

Solution Architect	• Document current standards in use within/across organization geospatial investments. • Contribute to development of baseline standards for inclusion into Policy Guidance. • Contribute to identification of SME resource for geospatial standards. Ensure awareness of geospatial standards for inclusion in system procurement and development.	• Coordinate with SAs across organization's geospatial investments to identify and document geospatial standards usage. • Develop baseline of key geospatial standards derived from Federal and SDO current and emerging standards documentation. • Provide input for Position Description for Geospatial Standards SME. Participate on SDOs for awareness of geospatial standards development and update.	• Technical vetting and validation across investments for As-Is standards usage. • Ensure broadest possible technical review and allows identification of gaps and deficiencies for enhancement. • Strengthen breadth of geospatial standards awareness across organization's geospatial investments.

1 ## G.3.8 PERFORMANCE
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STAKEHOLDER PERFORMANCE GUIDE			
PERFORMANCE			
Role	Responsibility	Approach	Benefit
Executive Leadership	• Define mission context for geospatial investments across the enterprise. • Ensure Performance metrics and indicators are included in all CPIC (OMB 300/53) geospatial investments.	• Provide overall mission context and expected contribution of geospatial to/within programs to Program Managers, and align program success to improved performance of business functions. • Using Performance indicators for each reference model (e.g., Business, Data, Applications/Services, Infrastructure, Security, and Performance) prepare matrix for ESC review and adoption and monitoring.	• Creates quantifiable measures and expected outcomes (mission and resource impact) of a geospatial investment. • Ensures OMB reporting compliance and senior leadership commitment to managed/measured success of investment.
Program Manager	• Define measures of effectiveness and success criteria for geospatial investments under oversight. • ESC to oversee cost, schedule, and scope of geospatial investments across enterprise.	• Provide clear guidance to Solution Architects for requirements and dependencies of required solutions. • Communicate with Executive Leadership and stakeholder community (mission holders) to foster an understanding of the value of current efforts with the overall mission success.	• Creates clarity as to the value of programs being managed to overall mission effectiveness. • Enables easier management through a better understanding of how measures of effectiveness translate into system requirements and benefits.
Solution Architect	• Derive functional and technical requirements and associated quantifiable performance success measures given target objective. • Oversee technical implementation and schedule and provide status to leadership and recommended course corrections as needed.	• Analyze program requirements and measures of effectiveness and identify solution elements that will enable the program to meet success criteria. • Create a clear understanding of how the project scope, schedule, and budget is progressing and provides line-of-sight with respect to the overall program and enterprise requirements.	• Demonstrable solution effectiveness, tied directly to executive-level interests which enables an end-to-end picture of how delivered solutions fit into an enterprise-level mission. • Enables clear communication with the Project Managers and Executive Leadership regarding schedule and scope of system delivery.

3