DRAFT FOR COMMENT

Federal Enterprise Architecture
Geospatial Profile
Version 0.1

IMPORTANT NOTE TO REVIEWERS:

This is a draft document provided for the purpose of obtaining community comment only.

To comment on this version, please download a comment form at http://colab.cim3.net/file/work/geocop/commentform.doc, complete it, and submit it to geo-forum@colab.cim3.net by September 23, 2005. Please be sure to read the TODO list so that you don't provide a comment on something that has already been identified as an task to accomplish.

If you are reading this version after September 23, 2005, please visit http://colab.cim3.net/cgi-bin/wiki.pl?CurrentGeospatialProfileDraft for the latest version or for information about the next scheduled version.

Architecture and Infrastructure Committee,

Federal Chief Information Officers Council

And

Federal Geographic Data Committee

September 13, 2005

25 # Executive Summary

26 <mark>To Be Provided</mark>

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126

127   **Acknowledgements**

128   <mark>To Be Provided.</mark>

TODO List

The following is a list of tasks to do that is provided to limit comments on areas where further work is already planned/identified. This should not, however, limit substantive suggestions about how to complete the items on this list including candidate completions by the commenting individuals.

1. Rearrange section 1 into a better flowing order. (Doug/Editor)

2. Further flesh out the geospatial basics in section 1.4 to include some nice graphics. (Doug/Editor)

3. Complete the scenario and insert an overview of the scenario into Chapter 1. (Editor/Raj) There is a place holder in section 1.5.

4. Provide the complete scenario and use case background as an Appendix. (Editor/Raj). There is a place holder in Appendix C.

5. Complete/Edit the sidebars in sections 2.3, 2.4, 2.5, 2.6, and 2.7 to refer to the scenario. (Editor/Raj)

6. Discuss and provide text for section 2.4.2. (BRM group)

7. Edits Chapter 2 further to make the geospatial view sections a bit more consistent in their presentation. (Editor and others TBD)

8. Provide descriptions where noted in the GeoTRM section. (Raj)

9. Provide technologies as noted at the beginning of the GeoTRM into the TRM. Recommend starting with the Technologies listed in the Geospatial Business Language (Appendix E). (Raj/Editor)

10. Provide an Executive Summary (Editor)

11. Provide the Acknowledgements (Doug/Brenda)

12. Identify and provide glossary items for words in the body of the text (has been dome for the GeoSRM up to this point). (Editor)

13. Identify and provide acromyns for the acronym list (completed for the Geospatial Business Language appendix) (Editor)

1   Introduction

Geospatial data and capabilities are integral to virtually all federal, state, local, and tribal government activities. The purpose of the Geospatial Profile is to provide guidance to government organizations to help them identify and describe the geospatial capabilities and needs essential for them to fulfill their missions. The profile supports the development and use of common and shared geospatial resources within the National Spatial Data Infrastructure (NSDI, described in Section 1.3).

The Geospatial Profile is an integral part of the Federal Enterprise Architecture (FEA) program managed by the Office of Management and Budget (OMB). The purpose of the FEA is to coordinate the various activities of individual government agencies towards an overall integrated and interoperable Federal Enterprise Architecture.

In addition, it is intended to provide guidance to the very broad community of state, local, tribal, and private sector organizations that have data and assets that must be readily integrated and shared with Federal organizations.

The Geospatial Profile is designed to encourage the development and implementation of Enterprise Architectures (EA) that integrate the discovery, access, integration, fusion, and application of geospatial data and services that are vital to improved government mission and business performance and decision-making into the organizational EA. The profile also promotes the adoption and use of interoperable, standards-based geospatial tools and technologies.

The Geospatial Profile intends to foster the implementation of a consistent approach for incorporating geospatial data and technologies into all government architectures that comprise the FEA. Applying the Geospatial Profile will help government organizations produce architectures that will enable them to more effectively contribute to, and benefit from, the National Spatial Data Infrastructure.

> *When completed, the Geospatial Profile is intended to be endorsed by the Office of Management and Budget and its FEA Program Management Office as an integral part of the FEA.*

1.1   Geospatial Information Is Everywhere

The value of geospatial information is obvious to many people when it is in the form of a map or satellite image. However, more often its value and presence it is not as obvious when it is embedded within text, statistics, charts, records or other information in a database.

In many cases locations within operational databases are associated with addresses. However, geospatial data is any type of data which can be associated with a location in space and time. So in addition to an address it can be a place name; the position of a vehicle with a GPS receiver; the place a statistic represents or the place where it was gathered; where a cell phone call was made, where it was received or where the speakers are talking about; the room where a patient is in a hospital; or one of an innumerable other ways of relating something to a location. Geospatial services and technologies are software and hardware functions and capabilities which provide for the collection, access, analysis, dissemination, integration, sharing and use of geospatial information. In its fullest sense, geospatial information is ubiquitous, cuts across all lines of business and has tremendous

194 potential as an integrator of information from seemingly disconnected business activities or original
195 sources of input.

1.2   Challenges To Be Addressed

197 According to the Office of Management and Budget's (OMB) FY 2003 Report to Congress on
198 Implementation of The E-Government Act (March 8, 2004)[1]:

199 *Although a wealth of geospatial information exists, it is often difficult to locate, access, share, and*
200 *integrate in a timely and efficient manner. Many Federal, state, and local agencies collect and use*
201 *geospatial data in different formats and standards based on their requirements. This results in wasteful*
202 *spending, redundant data collection, and can hinder the ability of federal, state, and local governments to*
203 *effectively and efficiently provide information and services to each other, citizens, and business.*

204 In addition, the following challenges impact the effective use of geospatial information and
205 services to support government business activities:

206 ■ Organizations are not able to interoperate with other government agencies or
207 businesses particularly in times of emergencies or where rapid decisions are needed
208 for business purposes

209 ■ Interoperability among providers and consumers of geospatial data and services
210 requires a shared understanding of semantics and functional capabilities

211 ■ Organizations often do not take advantage of information resources that are
212 available through existing spatial data infrastructure services and networks, and
213 therefore unknowingly create redundant capabilities

214 ■ Geographic information and services are not planned, acquired, managed, and
215 shared consistently within organizations and across organizations

216 ■ Geospatial data and services are not readily made available to users and applications
217 through a web browser or service-oriented architecture

218 The National Spatial Data Infrastructure Initiative was created to solve the challenges discussed
219 above. The key objective is to increase and improve the availability and use of geospatial information
220 across all sectors within the United States.

1.3   The National Spatial Data Infrastructure

222 The National Spatial Data Infrastructure was established by the Federal government in
223 partnership with state and local organizations to increase and improve the availability and use of
224 geospatial information across all sectors within the United States. For the purposes of this section,
225 the NSDI is presented as another tool that should be considered once you have determined that
226 there is a place/location component to your business operation. The NSDI and the associated
227 Geospatial-One Stop Portal can be used to support the implementation of most of the FEA lines of
228 business that comprise the business of a Federal Enterprise and support all modes of delivery
229 identified in the FEA through:

230 1) Providing access to geospatial data and services for all lines of business

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[1]   http://www.whitehouse.gov/omb/egov/fy03_egov_rpt_to_congress.pdf

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231 2) Enabling the widest possible use of geospatial data and services ensuring that
232   providers and users have knowledge of lineage and quality and means of
233   ensuring appropriate security

234 3) Facilitating the sharing and reuse of data and services through standards and
235   specifications for interoperability

236 4) Providing a client centered delivery system which enables multiple means of
237   delivery

238 5) Ensuring that redundancy and waste are reduced to the minimum and that
239   data and services meet users needs and are easy to use

240   The NSDI benefits by having adopted practices and standards espoused in the profile and
241 promoted through groups like the FGDC, National States Geographic Information Council
242 (NSGIC), National Association of Counties (NACO), National Association of State Chief
243 Information Officers (NASCIO) and others who all have an interest in people and systems working
244 well together.

245   Figure 1 shows the key components of the NSDI.

Figure 1: Key components of the National Spatial Data Infrastructure (NSDI)
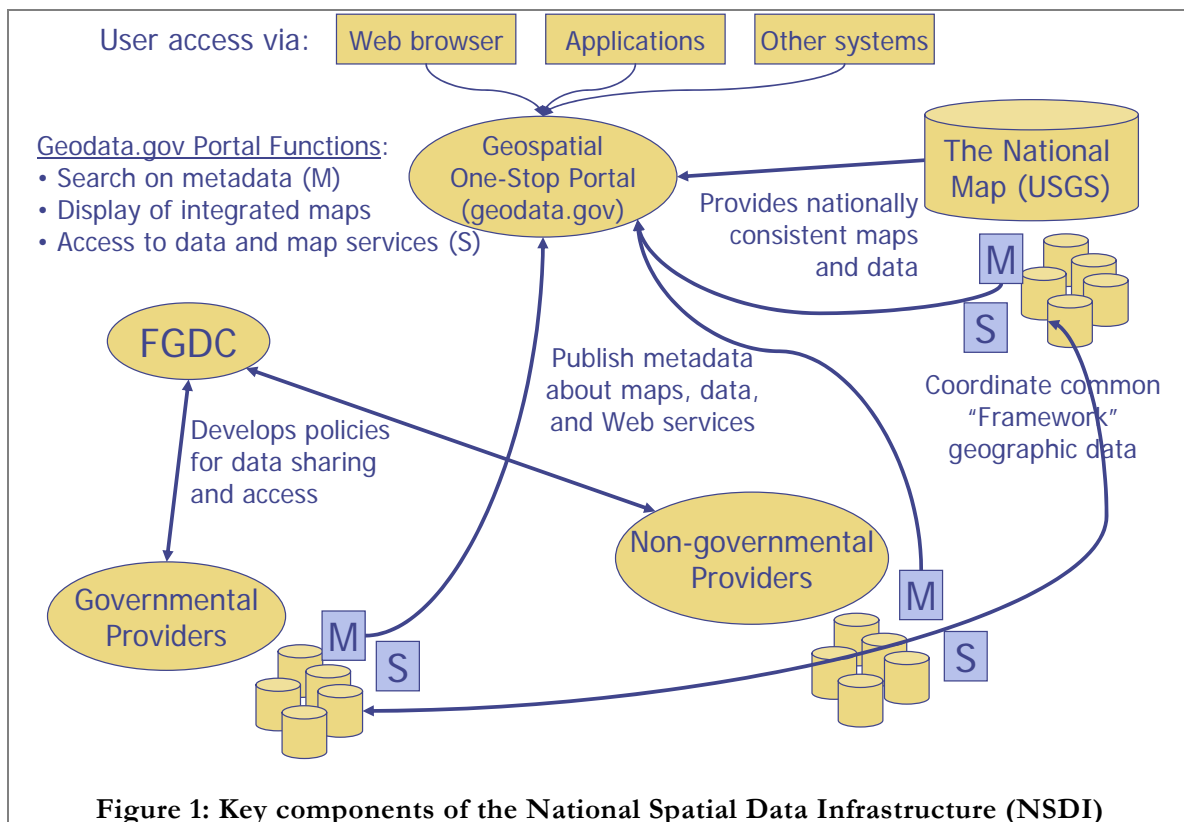
248   The Geospatial One-Stop initiative provides search and visualization services of national
249 geographic data and services through its portal at geodata.gov. The adoption of Geospatial Profile
250 practices will increase visibility into and access to available resources of domestic interest.

251 The National Map is a key set of data layers backed by map and data services of national scope
252 that will be managed and advertised using the Geospatial Profile guidance. The NSDI is the umbrella
253 activity that overlies all these geospatial efforts that is realized through coordinated efforts by all
254 participants.

1.4 Overview of Geospatial Capabilities

256 This section provides a high-level overview of geospatial information and services.

1.4.1 What is Geospatial Information?

258 Geospatial information is used in a majority of business settings both inside and outside the
259 government. Geospatial data includes any type of data that has an associated geographic or spatial
260 location or extent. Examples include: building addresses, transportation networks, utility networks,
261 imagery, buildings and facilities, airspaces, and jurisdictional boundaries. Geospatial data may be
262 represented in two or more dimensions, such as a position or extent or region, and may also include
263 dynamics over time, for example the progression of the shape and path of a hurricane.

264 Geospatial information includes not only information that is obvious to most people as
265 geographic in nature, such as elevations, satellite imagery, and global positioning system (GPS)
266 position coordinates, but also includes other types of information that many people may not realize
267 have geospatial or locational characteristics. The geospatial aspects of these other types of data can
268 be enabled by a well-designed architecture and can be used in many different ways to help improve
269 the performance of a government or business organization. For example:

270 ■ Human resources systems capture the office building and room, and home address,
271 for each employee

272 ■ Inventory and asset management systems generally identify the facility or room
273 where a piece of equipment is stored or used

274 ■ Business performance reports often itemize results according to an organization's
275 regions or jurisdictions

276 Section 2.7 of the Geospatial Profile describes how geospatial data and information should be
277 incorporated into each organization's Enterprise Architecture.

278 In addition, in operational and support situations, a moving asset or reported or sensed entity or
279 event may be tracked according to its geographic location. Examples of a moving asset or reported
280 or sensed entity or event include: aircraft, trucks, a vessel suspected of carrying contraband, and
281 individuals on a watch list.

1.4.2 How is Geospatial Information Used?

283 Any information that has an associated location can be subjected to/used for performing
284 geospatial queries, analysis, intelligence, and visualization. Combinations of data sources may be
285 needed to provide users an integrated view over time of events, tracked entities, and their locations to
286 support and coordinate decision-making during operational planning, preparedness, prevention,
287 response, and remediation.

288 Sections 2.3 and 2.4 of the Geospatial Profile describe how geospatial capabilities support the
289 business functions (2.4) and performance metrics (2.3) in each organization's Enterprise
290 Architecture.

291 <mark>[Insert and describe a notional situation map graphic here, a look-ahead to the emergency</mark>
292 <mark>management scenario, just to encourage the visual nature of how users will often use geospatial</mark>
293 <mark>information within their operational contexts, and to initiate the theme of meeting operational user</mark>
294 <mark>needs throughout the profile.]</mark>

1.4.3   What are Geospatial Services?

Geospatial services are well-defined software functions that access locational data to produce specific results such as visualizations, queries, and analyses. Examples of general-purpose geospatial services that may be used by many business applications include:

Determining the geographic coordinates corresponding to a person's address

- Identifying routes for navigating from one location to another
- Creating online or paper maps (operational pictures) for visualizing a situation or event along with relevant geographic features and positions of entities of interest
- Performing a query to retrieve geospatial information based on types, attributes, and geographic regions or political boundaries
- Converting geographic data from one reference datum or projection to another

Geospatial services are often made accessible to users through a web browser, but may also be provided to users and other software applications through a variety web-based applications and desktop client applications.

1.5   Use Case Overview

A use case (with sub-use cases and scenarios) will be used throughout this document to provide examples of concepts and processes within this Geospatial Profile, particularly in section 2. This section will provide an overview of the use case so that when it is encountered it will be understood. For further detail, please see Appendix C.

<mark>To Be Provided.</mark>

1.6   Objectives

The Geospatial Profile intends to inform and thus improve governmental architecture and geospatial community practices by fulfilling the following objectives:

1)   Provide guidance for documenting and integrating geospatial capabilities within each of the FEA reference models (Performance, Business, Service Component, Data, and Technical)

2)   Demonstrate how geospatial capabilities are related across the reference models

3)   Describe how geospatial capabilities apply across business lines and agencies

4)   Provide examples of applying the Geospatial Profile's guidance by using a mission-oriented use case

5)   Discuss how geospatial capabilities may interact with other FEA profiles that are under development

327   6) Provide guidance to architects to help identify and exploit geospatial technologies

328   7) Initiate the establishment of a knowledge base for those applying the Geospatial
329   Profile to their EA efforts

1.7   Audience

331   The Geospatial Profile is intended to inform a range of audiences, ***not*** just architects and
332 geospatial technology professionals. The profile should be useful to the following:

333   ■ ***Business Managers and Sponsors***: those responsible for defining mission and
334   business line needs that rely on geospatial capabilities.

335   ■ ***CIO Office Leadership and Staff***: those responsible for the overall coordination
336   of an organization's IT planning, development, and management activities to
337   support business needs.

338   ■ ***Geospatial Information Officers (GIOs)***: those responsible for planning and
339   managing an organization's geospatial activities, investments, and assets.

340   ■ ***Architects***: those responsible for developing EAs and managing EA programs, and
341   ensuring that geospatial requirements are incorporated within EAs.

342   ■ ***Discipline Practitioners***: organizations and individuals responsible for ensuring
343   that architectures, planned investments, and implementations adequately address
344   needs from the perspective of individual disciplines. Examples of disciplines
345   include: data management, information security, privacy, records management,
346   geospatial, human capital management, and others.

347   ■ ***Portfolio Managers and Capital Planners***: those responsible for planning,
348   budgeting, and justifying portfolios of investment initiatives.

349   ■ ***Solutions Providers and Integrators:*** those organizations providing products and
350   services for delivering integrated solutions to meet or support mission and business
351   line needs

352   ■ ***Geospatial Vendors and Consultants:*** those offering geospatial products and
353   services that may enable the implementation of geospatial capabilities (described in
354   an EA) to support mission and business needs.

355   In particular, the Geospatial Profile portrays the need to interconnect the various views of
356 architecture, including the business and performance-driven perspective and the IT perspective (see
357 section 2.2 for more information on this topic).

1.8   Federal Policies and Drivers

359   The OMB FEA Program Management Office's (PMO) 2005 - 2006 Federal Enterprise
360 Architecture Action Plan (March 2005) includes a strategic initiative, Create a Geospatial Profile,
361 which is described as follows:

362   […] the ability of Federal agencies to create and appropriately manage geospatial
363   information has become increasingly important. The purpose of the President's
364   Geospatial One-Stop Initiative is to provide Federal, State, local and tribal agencies with
365   a single point of access to map-related data enabling consolidation of redundant data.
366   The goal is to improve the ability of the public and government to use geospatial
367   information to support the business of government and improve decision-making.

OMB has issued guidance (i.e., OMB Circulars A-16 and A-11) providing direction for Federal agencies producing, maintaining or using spatial data either directly or indirectly in the fulfillment of their mission. This direction includes general responsibilities for preparing, maintaining, publishing and implementing a strategy for advancing spatial data activities in support of the National Spatial Data Infrastructure (NSDI) strategy. It instructs agencies to use Federal Geographic Data Committee (FGDC) data standards. […]

The FEA PMO is supporting geospatial efforts through its FEA reference models and contribution towards establishing a Geospatial Profile. […] The purpose of this profile is to provide a consistent framework that can be applied within and across agencies to identify the geospatial implications across lines of business. […]

Other drivers from Federal law and policy are provided as Appendix H.

1.9   Authority

The Geospatial Profile was developed by the Geospatial Community of Practice under the direction of the US Chief Information Officers (CIO) Council's Architecture and Infrastructure Committee (AIC) and the FGDC. It was also developed in coordination with the FEA PMO.

1.9.1   Geospatial Community of Practice

The Geospatial Enterprise Architecture Community Of Practice (GEA COP) Working Group was established in 2005 under the auspices of the US CIO Council's Architectural Infrastructure Committee (AIC) and the FGDC to serve as the focal point for the advancement of the Geospatial Profile, consistent with the proven practices of the NSDI.

1.9.2   CIO Council Architecture and Infrastructure Committee

[To be provided]

1.9.3   Federal Geographic Data Committee

The Federal Geographic Data Committee was formed in 1990 by OMB to develop the National Spatial Data Infrastructure (NSDI) in cooperation with organizations from state, local, and tribal governments, the academic community, and the private sector. The NSDI encompasses policies, standards, and procedures for organizations to cooperatively produce, share and use geographic data.

1.9.4   Federal Enterprise Architecture Program Management Office

OMB's FEA PMO provides direction, guidance, and requirements to federal agencies for developing and using EAs and for achieving business-oriented results by implementing EAs. The FEA PMO also works with the CIO Council to facilitate the advancement of federal architecture practices through communities of interest and knowledge sharing.

As noted in Section 1.8, the establishment of the FEA Geospatial Profile is one of the action areas identified in the FEA PMO Action Plan of March 2005.

Section 2.1 provides an overview of the FEA reference models.

2 Geospatial Capabilities and the FEA Reference Models

This chapter is the primary content of the Geospatial Profile. It is organized as a set of views on the elements of the Federal Enterprise Architecture and, thus, an overview is provided for the convenience of the reader. A discussion of the relationship of geospatial to each FEA element in turn is then provided; in each case additional background on the FEA elements is given.

2.1 FEA Overview

This overview text is quoted directly from the FY07 Budget Formulation FEA Consolidated Reference Model Document[2].

The FEA consists of a set of interrelated "reference models" designed to facilitate cross-agency analysis and the identification of duplicative investments, gaps and opportunities for collaboration within and across agencies. Collectively, the reference models comprise a framework for describing important elements of the FEA in a common and consistent way.

Through the use of this common framework and vocabulary, IT portfolios can be better managed and leveraged across the federal government. This section introduces the purposes and structures of the five FEA reference models:

- Performance Reference Model (PRM)
- Business Reference Model (BRM)
- Service Component Reference Model (SRM)
- Technical Reference Model (TRM)
- Data Reference Model (DRM)

2.1.1 Performance Reference Model (PRM)

The PRM is a framework for performance measurement providing common output measurements throughout the federal government. It allows agencies to better manage the business of government at a strategic level, by providing a means for using an agency's EA to measure the success of IT investments and their impact on strategic outcomes. The PRM accomplishes these goals by establishing a common language by which agency EAs can describe the outputs and measures used to achieve program and business objectives. The model articulates the linkage between internal business components and the achievement of business and customer-centric outputs. Most importantly, it facilitates resource-allocation decisions based on comparative determinations of which programs and organizations are more efficient and effective. The PRM focuses on three main objectives:

- Help 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

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[2] http://www.whitehouse.gov/omb/egov/documents/CRM.PDF

439 ■ Identify performance improvement opportunities that span traditional
440 organizational structures and boundaries

441 The PRM structure is designed to clearly express the cause–and-effect relationship between
442 inputs and outputs. This "line of sight" is articulated through the use of the Measurement Area,
443 Category, Grouping, and Indicator hierarchy. Refer to Figure 2 for the PRM structure.

444
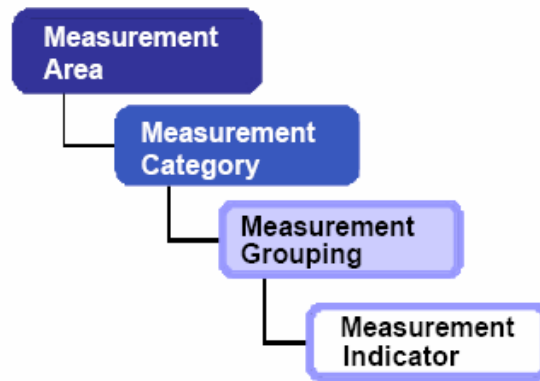
445 **Figure 2: PRM Structure**

446 ### 2.1.2 Business Reference Model (BRM)

447 The BRM provides a framework that facilitates a functional (rather than organizational) view of
448 the federal government's lines of business (LoBs), including its internal operations and its services for
449 citizens, independent of the agencies, bureaus and offices that perform them. The BRM describes the
450 federal government around common business areas instead of through a stove-piped, agency-by-
451 agency view. It thus promotes agency collaboration and serves as the underlying foundation for the
452 FEA and E-Gov strategies.

453 While the BRM does provide an improved way of thinking about government operations, its true
454 utility as a model can only be realized when agencies effectively use it. The functional approach
455 promoted by the BRM will do little to help accomplish the E-Gov strategic goals if it is not
456 incorporated into business-focused enterprise architectures and the management processes of federal
457 agencies and OMB.

458 The BRM is structured into a tiered hierarchy representing the business functions of the federal
459 government. Refer to Figure 3 for the BRM tiered hierarchy.
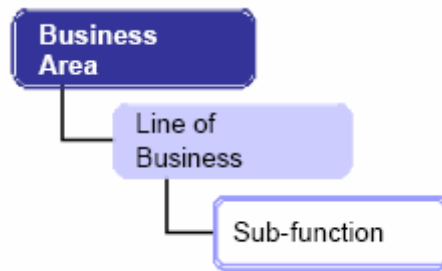
Figure 3: BRM Structure

2.1.3   Service Component Reference Model (SRM)

The SRM is a business-driven, functional framework classifying Service Components according to how they support business and performance objectives. It serves to identify and classify horizontal and vertical Service Components supporting federal agencies and their IT investments and assets. The model aids in recommending service capabilities to support the reuse of business components and services across the federal government.

The SRM is organized across horizontal service areas, independent of the business functions, providing a leverage-able foundation for reuse of applications, application capabilities, components, and business services. It is structured hierarchically as depicted in Figure 4.
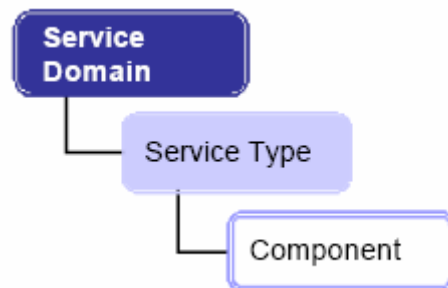
Figure 4: SRM Structure

2.1.4   Technical Reference Model (TRM)

The TRM is a component-driven, technical framework that categorizes the standards and technologies to support and enable the delivery of Service Components and capabilities. It also unifies existing agency TRMs and E-Gov guidance by providing a foundation to advance the reuse and standardization of technology and Service Components from a government-wide perspective.

Aligning agency capital investments to the TRM 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 to support their business functions, mission, and target architecture. The TRM structure is depicted in Figure 5.

Service
Area

Service
Category

Service
Standard
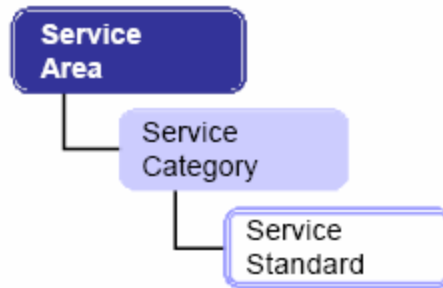
484 **Figure 5: TRM Structure**

2.1.5   Data Reference Model (DRM)

486   The FEA Data Reference Model (DRM) is intended to promote the common identification, use,
487   and appropriate sharing of data/information across the federal government through its
488   standardization of data in the following three areas: data context, data sharing, and data description
489   (refer to Figure 6).

Data Context

Data Sharing

Data
Description

490
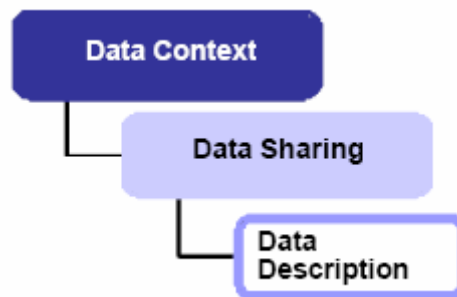
491   **Figure 6: DRM Structure**

492   The current published version of the DRM is undergoing revision. The FEA PMO is
493   collaborating with members of the interagency DRM working group, chartered by the Architecture
494   and Infrastructure Committee (AIC) of the Chief Information Officer (CIO) Council, to further
495   enhance and improve this reference model. The DRM structure presented in Figure 5 is the updated
496   description of the DRM based on the work being done by the FEA PMO and the interagency DRM
497   working group. Because the new version of the DRM has not been completed, the latest published
498   version is provided in this document for reference.

2.2   How Geospatial Interacts with the FEA Reference Models

500   This section provides a synopsis of the way that geospatial interacts with each of the five FEA
501   reference models. For further information, please read the section indicated for each model.

502   ■   Performance Reference Model (PRM, section 2.3)—In the geospatial view of the
503   PBRM, the discussion focuses on providing EAs with metrics that can be used to
504   measure their geospatial maturity.

505   ■   Business Reference Model (BRM, section 2.4)—In the geospatial view of the BRM,
506   the discussion centers around a process and methodology to help EAs identify and
507   describe the geospatial nature of their business activities.

- Service Component Reference Model (SRM, section 2.5)—In the geospatial view of the SRM, the discussion centers on providing the EA with an extension of the FEA SRM to include geospatial specializations of the Service Components as well as some guidance and background to help EAs deal with issues of granularity and other difficult concepts.

- Technical Reference Model (TRM, section 2.6)— In the geospatial view of the TRM, the discussion provides the EA with an extension of the FEA TRM to include geospatial standards [and technologies?].

- Data Reference Model (DRM, section 2.7)— In the geospatial view of the DRM, the discussion provides the EA with a context of how the geospatial community views the elements of the FEA DRM and the mechanisms used by the geospatial community to implement the FEA DRM in practice.

2.3 Geospatial View of the Performance Reference Model (GeoPRM)

> *NOTE: This is a very first draft PRM, not reviewed by any group. It is a very nice initial contribution, but it needs to be noted that only the author (and the Editor) have seen this to date.*

2.3.1 Introduction

The FEA has an interrelated, mutually supportive structure composed of five reference models. Each reference model has several levels ranging from general (upper-most levels) to detailed/specific (lower levels) that describe the elements and information unique to the model. Geospatial information and technologies interact and impact at multiple levels within each reference model.

The performance methodology for the FEA Geospatial Profile begins with the business owner's careful analysis of each reference model to determine the nature, scope, and content of the geo-services to be provided. Information and data are identified using common terms aligned with geospatial objectives, such as interoperability, accuracy, discoverability, and availability, as well as terms that specifically address each business process such as geocoding, visualization, and spatial analysis. This information must then be transformed into quantitative data through a series of relevant questions and answers that assist business owners in understanding the geospatial nature, or elements, of the processes they are designing or reengineering. Whenever new geo-services are established, or an existing service is spatially-enabled, an assessment should be conducted to document the impacts of these initiatives. This methodology can be used by the business owners as well as the stakeholders who participate in the decision-making process.

The **Geospatial Performance Reference Model** (GeoPRM) defines measures of success related to business outcomes. The geo-services within a business process or IT system should be designed to support measures of outcome attainment. Hence, measures will need to be developed for the geospatial technologies, information, and services that can link them to successful business outcomes. Ultimately, performance information obtained from across all of the FEA models builds toward the development and implementation of effective business processes to serve citizens. Interoperability, accuracy, discoverability, and availability attributes and assessment as well as business process goals will be included as critical elements in the performance model, along with the ability to assess improvements based on a maturity model for architecting these technologies and services.

2.3.2 Overview of the FEA Performance Reference Model

The Performance Reference Model (PRM) helps agencies measure the performance of major IT investments and their contribution to agency performance. The objectives of the model are to enhance performance information; improve the alignment and better articulate the contribution of inputs (such as technology), to outputs and outcomes; and identify improvement opportunities that span organizational boundaries.

The model (illustrated in *Figure 1,* below) is comprised of four Measurement Areas.

1) *Mission and business results* – to capture the outcomes that agencies seek to achieve.

2) *Customer results* – to capture how well an agency or specific process within an agency is serving its customers.

3) *Processes and activities* – to capture the outputs that directly result from the processes that IT initiatives support.

4) *Technology* – to capture key performance elements directly associated with IT initiatives.
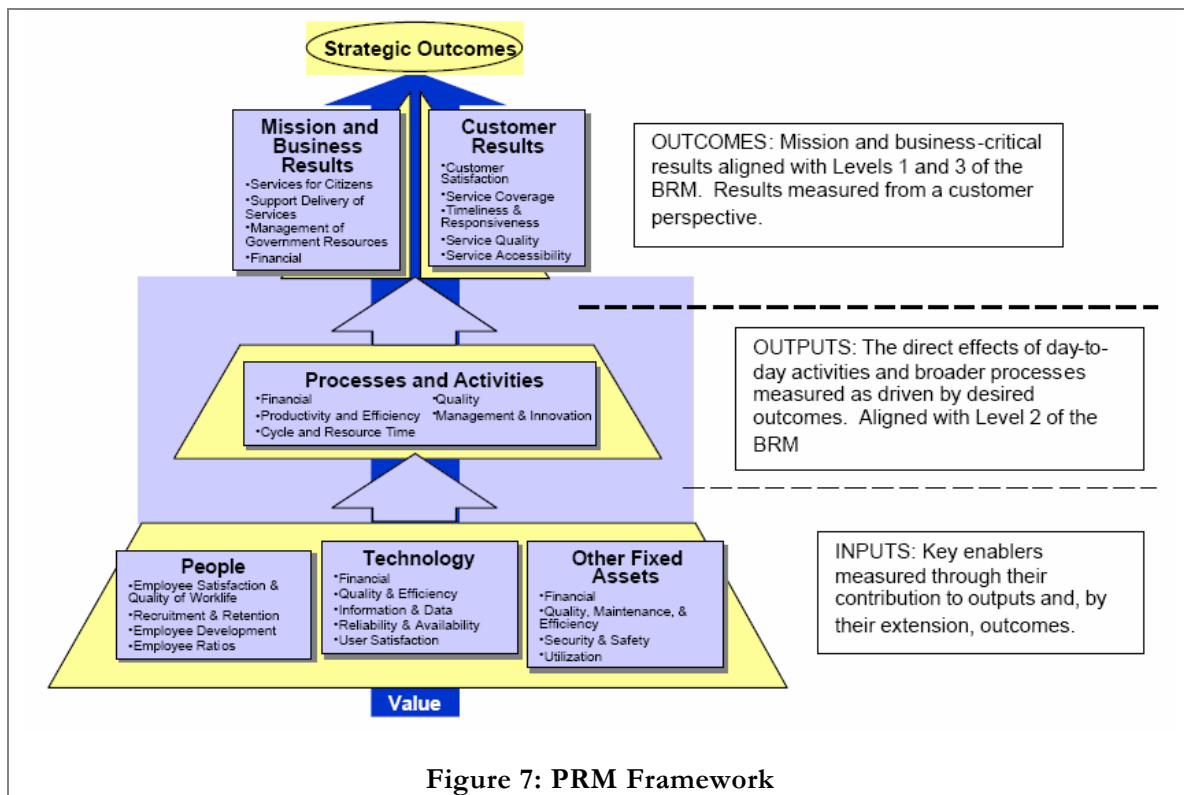
Figure 7: PRM Framework

Each Measurement Area includes Measurement Categories, which are decomposed into generic Measurement Indicators that agencies can tailor to reflect their own environments.

567 *NOTES: New Section: description and layout of geospatial PRM approach mimicking the*
568 *suggested process to use the PRM. This could lead into the Maturity Model section.*

569 *Phase 1—Alignment with PRM*

570 *Phase 2—Explore and Define Improvements*

571 *Phase 3—Measure Progress*

572 *Phase 4—Use Performance Information*

573 **2.3.3   Geospatial Integration Maturity Model**

574 *2.3.3.1   Category Descriptions*

575 *NOTE: Once people are comfortable with the categories (detailed below) then a brief paragraph on*
576 *each will be written for this section.*

577 ■ Coordination—

578 ■ Governance, Management, & Planning—

579 ■ Data Acquisition, Documentation, & Maintenance—

580 ■ Standards & Best Practices—

581 ■ Data Access & Distribution—

582 ■ Policies & Compliance—

583 ■ Enterprise Integration—

584 ■ Training and Skills Development—

585 *2.3.3.2   Maturity Levels*

586 **Level 0—No Program**
587 There is not a documented geospatial integration profile in place at this level of maturity. While
588 geospatial solutions are developed and implemented, this is done with no recognized use of standards
589 or base practices. The organization is completely reliant on the knowledge of independent geospatial
590 specialists.

591 **Level 1—Informal Program**
592 The base geospatial architecture framework and standards have been identified but are typically
593 performed informally. There is general consensus that these steps should be performed, however
594 they may not be followed and are not tracked. Organizations with a geospatial integration profile at
595 this level are still dependant on the knowledge of individual geospatial contributors.

Level 2—Repeatable Program

The base geospatial architecture and standards have been defined and are being tracked and verified along business lines. At this point in the program, geospatial processes are repeatable and reusable templates and components are starting to be developed. The need for product and compliance components to conform to the standards and requirements has been agreed upon, and metrics are being developed and used to track progress toward integration goals and objectives.

Level 3—Well-Defined Program

The geospatial enterprise architecture profile is well defined; using approved standards and/or customized versions of processes or templates. Geospatial processes and services are documented across the organization. Performance metrics are being tracked and monitored in relationship to other general practices and business lines.

Level 4—Managed Program

At this point performance metrics are collected, analyzed and acted upon. The metrics are used to predict performance and provide better understanding of the geospatial processes and capabilities and their impact on the lines of business and the organizations mandated activities.

Level 5—Continuously Improving Vital Program

The geospatial processes are mature; targets have been set for effectiveness and efficiency based on business and technical goals. There is continued diligence on operational aspects of the geospatial integration of the organization but the organization's context within the larger national geospatial framework is understood and pursued. There are ongoing refinements and improvements based on the understanding of the impact that changes in these technologies have on these geospatial processes and programs.

2.3.3.3   Coordination

Level 0

- No Geospatial Coordination is in place. GIT is viewed as a project element and activities are pursued and conducted independently by various individuals, agencies, organizations, and government sectors on a project-by-project basis.

Level 1

- Project-based Coordination wherein independent groups recognize or share a common need where the development of spatial information is a common goal. A vested leader for the group emerges to push the project along and perform the coordination necessary to achieve the desired goal. Once completed, the group dissolves and independence is once more the norm.

Level 2

- Volunteer Coordination relies on an individual to take the lead for the integration of geospatial technologies or where the development of spatial information is a common goal. This leader performs the coordination necessary to move the organization to the desired goal. In many cases this coordination occurs with no predictable pattern or frequency as the volunteer has no time or latitude for such activity.

Level 3

- Unofficial Single Department Coordination: This coordination model can be effective, but it is generally dependent on key individuals who have received their department's blessing to conduct these activities. Being vested within a specific department can also bring perspectives more narrowly defined than are necessary

641 for effective enterprise geospatial coordination. The likelihood that this level of
642 facilitation and coordination will be maintained when that person leaves or when
643 there is a change in leadership within the organization, is very low.

Level 4

- Official Coordination through a Geospatial Information Officer (GIO): This method of coordination has become increasingly popular and is generally most effective. This model provides the greatest assurance that required enterprise coordination work will be identified and completed to the extent granted by the authorizing mandate. Many offices are not always empowered to address all of the required issues so care must be taken in the development of the language establishing its authority.

- Coordination roles and responsibilities may include: Assessing needs and identifying geospatial/GIT investment priorities; Ensuring cost efficient and open access to spatial data and technology resources; Establishing appropriate data standards and ensuring compliance; Establishing appropriate data access and sharing policies; Coordinating data production, maintenance, documentation and delivery; Establishing Mapping Services; Establishing an FGDC compliant Clearinghouse Node (data & metadata); and Coordinating the development of geospatial applications.

Level 5

- Official Coordination through a Geospatial Information Officer (GIO): Coordination roles and responsibilities are reviewed and updated, such functions may include: extended coordination functions outside of the resident agency between federal, state and local agencies; Establishing and maintaining budgetary authority to collect and distribute funds; Establishing and maintaining authority to form partnerships with other levels of government, non-profit organizations, utilities and private organizations; Providing a non-lapsing fund for priority data and system development projects; Providing contractual authority; Offering suitable expertise on technical, management, and policy issues.

2.3.3.4   *Governance, Management, & Planning*

Level 0

- No plans for developing or leveraging the geospatial element of the data with the technologies are in place

Level 1

- Need for geospatial enablement of their information holdings has been identified

- Geospatial activities are informal and unstructured

Level 2

- The organization has begun to develop a vision for how a geospatially enabled database structure and geospatial technologies can enhance support for the organization's business goals and objectives while providing efficiencies in business process workflow.

- The organization has begun to identify geospatial elements, tasks, and related business lines and their associated resource requirements.

- The organization has begun to develop a plan for their geospatial program elements to bring them to the enterprise.

Level 3

686
687 ▪ Geospatial enterprise plans are well-defined and go beyond data retrieval by
688 providing plans for analysis, interpretation, and display of information to observe
689 relationships, patterns, or trends that were not possible to visualize with traditional
690 charts, graphs, and spreadsheets.

691 ▪ Geospatial governance roles and responsibilities have been outlined.

692 ▪ A structured framework and timeline for developing the geospatial enterprise have
693 been established.

694 ▪ Financial and staffing resource requirements have been outlined.

695 ▪ The geospatial enterprise activities are carried out according to the defined plan.

Level 4

696
697 ▪ The geospatial plans are reviewed against business lines and programmatic mandates
698 and changes are incorporated to improve the organization's overall enterprise
699 program.

700 ▪ The organization captures metrics to measure the progress of the plan against the
701 established geospatial goals, objectives, and task elements.

702 ▪ Strategic planning is taking place to set goals for future evolution of the overall
703 Enterprise Architecture Program Plan with the geospatial being an implicit element
704 of those discussions.

Level 5

705
706 ▪ Geospatial action plans are proactively developed and implemented to increase the
707 effectiveness of the overall Enterprise Architecture Program based on captured
708 metrics and opportunities presented among shared business lines.

709 ▪ The organization works with other federal agencies, states, tribes, and local
710 governments to share ideas with a focus on improving the national geospatial profile
711 and framework.

712 *2.3.3.5   Data Acquisition, Documentation, And Maintenance*

Level 0

713
714 ▪ Information development processes and geospatial data are not documented nor are
715 they maintained.

Level 1

716
717 ▪ Geospatial data development processes are ad hoc and informal, processes followed
718 may not be consistent among departments, maintenance processes are ad hoc and
719 informal.

720 ▪ There are no unified processes or geospatial data element standards utilized across
721 the geospatial technologies nor among the organization's lines of business.

Level 2

722
723 ▪ Basic FGDC compliant geospatial metadata is collected and documented.

724 ▪ Data acquisition standards are utilized and processes are planned and tracked for
725 quality assurance and quality control reporting.

726 ▪ The organization is beginning to employ maintenance methods for capturing and
727 providing back-up of time-critical geospatial information elements.

Level 3

- The geospatial data lifecycle processes have been defined and documented for the organization to include stewardship roles and responsibilities as well as archival rules and retention.

- Standardized data acquisition and development processes are being used as the foundation for other agencies, departments, etc. to ensure interoperability.

- FGDC compliant geospatial metadata templates are being used to ensure that the capturing of information is consistent.

Level 4

- The organization routinely captures metrics to measure the effectiveness of the geospatial data development and maintenance processes against business objectives.

- The organization routinely captures metrics to measure the effectiveness of the geospatial data documentation templates against business requirements.

- Corrective action plans are put in place when deficiencies in templates and/or procedures are identified or as geospatial technologies evolve or sunset.

- Intragovernmental meetings are held regularly to review status and goals of the mandated data development activities in relation to the NSDI Framework.

Level 5

- The geospatial lifecycle processes are being followed and have become second-nature within the organization.

- Captured metrics are used to identify inefficiencies in data development or acquisition processes prior to notification of issues.

- Organization shares with other federal, state, tribal, and local governments it's ideas for improvements to geospatial processes and templates.

- Intergovernmental meetings are held regularly to review status and goals of the mandated data development activities in relation to the NSDI Framework.

2.3.3.6   *Standards & Best Practices*

Level 0

- Documentation of business drivers for geospatial technology implementation are unknown.

- Geospatial technology standards and best practices are unknown or not followed.

Level 1

- Documentation of business drivers for geospatial technology implementation are informal.

- Technology standards and best practices utilized are informal and inconsistent.

Level 2

- Business drivers and strategic information related to geospatial elements, technologies, processes, and data have been identified.

- The need for a repository for storage and dissemination of standards and best practices for geospatial information has been identified.

Level 3

- Use of existing geospatial technology standards is consistent within the organization.

770   ■ Documentation of geospatial business drivers and strategic information leads to an
771   inventory of needs related to standards and best practices.

772 **Level 4**
773   ■ Documentation of geospatial aspects of business drivers and strategic information
774   has become a standard operating procedure.

775   ■ Documentation and use of geospatial standards and best practices has become
776   familiar within the organization.

777   ■ The organization captures metrics from the compliance process to identify the need
778   for updates to the geospatial business information, technology change's impacts on
779   protocols, and migration / evolution strategies for implementation planning.

780 **Level 5**
781   ■ Captured business and technology information is reviewed in conjunction with the
782   monitoring of new geospatial technology and business trends to proactively identify
783   those technologies that will improve the national geospatial framework of data,
784   technologies, and information.

785   ■ The organization works with other federal, state, tribal, and local governments to
786   share information regarding best practices.

787   ■ The organization works with other federal, state, tribal, and local governments to
788   share information regarding general approaches to supporting the implementation
789   of new geospatial business and technology trends, standards, and best practices.

790 *2.3.3.7   Data Access & Distribution*

791 **Level 0**
792   ■ Management and departments are not aware of what geospatial data and
793   information is present or the benefits of knowing.

794 **Level 1**
795   ■ The need to create greater awareness about geospatial assets has been identified.

796   ■ Little is known or shared about the geospatial assets or possible distribution
797   methods and improvements.

798 **Level 2**
799   ■ The need for geospatial data discoverability is being communicated to management.

800   ■ Geospatial data awareness and distribution activities are beginning to emerge or be
801   developed.

802 **Level 3**
803   ■ The geospatial data holdings are well defined and their existence communicated.

804   ■ Interagency data sharing and distribution agreements are being formulated.

805   ■ Interdepartmental access and distribution activities are developed.

806 **Level 4**
807   ■ Geospatial data holdings are digitally available and searchable through an FGDC
808   metadata clearinghouse node.

809   ■ Data sharing and distribution agreements are in place to improve the
810   communication and exchange geospatial data.

811   ■ Intergovernmental access and distribution activities are developed.

812 ■ The organization captures metrics to measure the extent and effectiveness of the
813   data discoverability, access, and distribution activities.

814 **Level 5**
815 ■ Metrics are used to proactively identify opportunities for improved data services.

816 ■ Geospatial data holdings are digitally available, searchable, and downloadable
817   through an FGDC data clearinghouse node.

818 ■ Extensive data sharing and distribution agreements are in place to improve the
819   communication and exchange of geospatial data.

820 ■ Intergovernmental access, distribution, and update activities are deployed.

821 ■ The organization works with other federal, state, tribal, and local governments to
822   share ideas for improvements to the national geospatial clearinghouse.

823 *2.3.3.8   Policies & Compliance*

824 **Level 0**
825 ■ No geospatial compliance process exists within the organization. A-16 as an
826   organizational mandate is largely ignored.

827 **Level 1**
828 ■ The need for compliance to geospatial standards has been recognized as outlined in
829   Circular A-16.

830 ■ Compliance is informal and unstructured.

831 ■ Compliance cannot be measured effectively because processes and procedures are
832   not consistent across areas and/or implementations.

833 **Level 2**
834 ■ The organization has begun to organize a compliance process to ensure that all
835   projects and business line implementations utilizing geospatial data and information
836   are consistent with the geospatial standards adopted by the organization and
837   outlined within Circular A-16.

838 **Level 3**
839 ■ A formal geospatial compliance process is well-defined and is an integral part of the
840   geospatial data lifecycle processes.

841 ■ A formal geospatial compliance process is well-defined and is used as a filter for the
842   development and review of proposals for application or data development within
843   the organization.

844 ■ A Business Case is required for variance from the adopted geospatial standards.

845 **Level 4**
846 ■ Compliance to geospatial standards has become common practice throughout the
847   organization.

848 ■ Quality metrics associated with geospatial-related business cases are captured.

849 ■ The geospatial compliance process is continually reviewed and updated as
850   deficiencies or enhancements to the process are identified.

851 **Level 5**
852 ■ Information gathered during the compliance process is used to proactively identify
853   updates to geospatial standards and/or policies.

- Compliance metrics are used to drive continuous process improvements in the Business Cases as well as define opportunities for leveraging activities.

- The organization works with other federal, state, tribal, and local governments to share ideas for improvements to the compliance process as it relates to the geospatial elements and technologies it embodies.

2.3.3.9 *Enterprise Integration*

Level 0
- No program in place for geospatial integration across the enterprise IT environment.

Level 1
- The role that geography or location plays as a central organizing principle in a line of business has been recognized and critical data model elements have been identified.

- Geospatial projects, purchases, and applications are typically developed in isolation resulting in redundant acquisitions, development, and training.

Level 2
- The need for geospatial integration to the overall enterprise architecture effort across lines of business and services has been identified.

- The various touch-points between the geospatial components (technologies, standards, processes, services, analyses, etc.) and lines of business and outcomes have been mapped (however, no details exist as to how the integration will take place).

Level 3
- The geospatial aspects of the organization's architecture program is integrated with strategic planning, as well as review and approval within the budgeting process.

- Touch-points of business lines and processes utilizing geospatial elements and components have been well-defined to enable higher levels of information integration, analysis, and presentation.

Level 4
- The organization's enterprise architecture is used to guide geospatial development and acquisition.

- The organization captures metrics to measure the savings in resources, including time and money, through the leveraged use of geospatial technologies within their data models, applications, and data base systems.

- Costs and benefits of geospatial integration within the IT environment, including benefits across agency boundaries, are considered in identifying projects.

- Geospatial technologies are enhancing decision-making and stream-lining business processes while adding significant analytical capabilities to the enterprise IT environment.

- Geospatial integration procedures are reviewed and processes updated when problems or new functionality is identified.

Level 5

- The organization's enterprise architecture process is fully engaged with geospatial functionality which drives continual evolution of geospatial initiatives throughout the enterprise.

- The organization's lines of business influences the geospatial technology deployed and the geospatial technology influences how and what can be delivered along business lines.

- Captured metrics are used to proactively identify improvements to the geospatial integration processes.

- The organization works with other federal, state, tribal and local governments to share ideas for improved geospatial integration, including the areas of procurement, project management practices, application development, and system administration.

2.3.3.10 Training And Skills Development

Level 0

- There is no program in place for geospatial awareness education.

- Several independent groups or individuals typically work to solve a single geospatial issue.

Level 1

- The organization has identified the need to inform staff throughout the enterprise of the benefits and concepts of a geospatially enabled enterprise architecture.

- Geospatial awareness efforts are informal and inconsistent and may be met with skepticism or indifference.

Level 2

- The organization has begun to develop plans for geospatial training and educational sessions to increase the awareness and understanding of what a spatially enabled enterprise can do for the organization.

- Geospatial concepts and functionalities are beginning to be introduced and more consistently discussed in normal day-to-day meetings.

Level 3

- The geospatial operations of the organization begins to operate as a team, using the defined architecture program and adopted / adapted geospatial standards.

- Management briefings have occurred to inform and create champions for the geospatial integration efforts.

- Both business and technical staff understand and promote the appropriate use of geospatial technologies in addressing needs and requirements for the lines of business mandated by the organization.

Level 4

- Personnel throughout the organization have a good understanding of the geospatial principals and can utilize and develop projects to leverage this aspect of their data across the enterprise.

- The organization captures metrics to measure the awareness, participation, acceptance and satisfaction with the geospatial integration effort.

Level 5

- Cross-agency personnel work together as contributors to the spatially enabled architecture and its shared services.

- The organization uses the captured metrics to proactively create action plans for the further expansion of geospatial applications in the business of the organization.

- The organization cooperates with other federal, state, tribal, and local governments in a peer-to-peer forum to share ideas for creating an atmosphere for active involvement, promotion, and deployment of geospatial education, information, application and service support across the national geospatial enterprise.

2.4   Geospatial View of the Business Reference Model (GeoBRM)

The value of place or location-based analysis is often overlooked when modeling business processes because enterprise architects and program managers typically think of geospatial data only in the context of a map or a remotely sensed image created with GIS applications. The coupling of geospatial data, services and technology with conventional data and technologies are often one of the most significant enablers of improved decision making within business operations and increased performance of key mission requirements across all levels of governments. This section is provided to help managers and architects gain a better understanding of how they can incorporate geospatial data, services and technology as a part of their business processes.

The content of this section is a) a background and purpose of the FEA BRM including an instructive explanation of the geospatial aspects of its elements, b) a description of the business view of the National Spatial Data Infrastructure as an element of the Federal enterprise, and c) a geospatial Business Reference Model development process that supports better inclusion of geospatial concepts in organizational enterprise architectures.

2.4.1   The FEA Business Reference Model

The Business Reference Model (BRM) of the Federal Enterprise Architecture is a function-driven framework for describing the business operations of the Federal Government. It describes the lines of business (LOB) independently of the agencies which perform them and categorizes them into 3 Business Areas. These three business areas are: Service to the Citizen, Support Delivery of Services, and Management of Government Resources (see Figure 8).
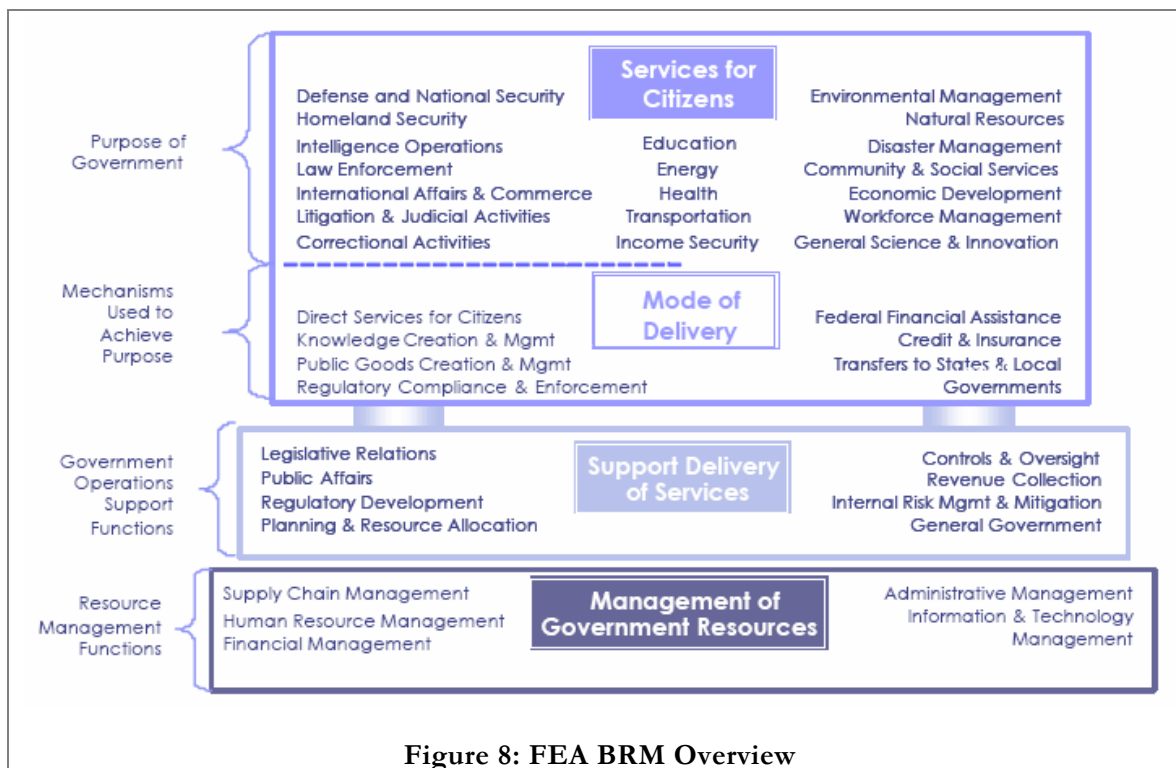
Figure 8: FEA BRM Overview

The FEA BRM Business Areas, Lines of Business, and Sub-functions are all expressed at an agency-independent level of granularity. While a few of the LoBs and Sub-functions (sub-functions are not depicted in Figure 8) may be entirely implemented within a single agency, this is not at all the norm. This means that agencies will need to define business activities that they do perform and then categorize them under the FEA BRM hierarchy so that OMB can appropriately manage these activities in a cross-agency environment. Appendix C contains an analysis of the Lines of Business within the FEA BRM as depicts a) whether the Line of Business can be a primary or secondary creator/user of geospatial data (along with the description of the line of business) and b) provides some examples of the use of geospatial data and technology within that Line of Business. For example, under the "Financial Management" Line of Business we see that the analysis says that this LoB is a secondary user/creator. Further, we can see that geospatial information can be use to track the allocation of grant and/or contract dollars by location of the recipient or the location of the activity funded in the grant/contract. Thus the table in Appendix C should serve as a further illustration of the pervasive nature of geospatial within the Federal enterprise.

The ability to effectively identify the geospatial characteristics of an agency's business activities begins with a thorough analysis of the operational mission of the organization. The development of an accurate description of an organization's business activities (and service chains) and priorities of the business enterprise will help managers and program officials determine the relationship of geospatial to their business functions. This topic will be covered in more detail in section 2.4.3.

2.4.2   The Role of NSDI in BRM Development

TBD.

2.4.3   Geospatial BRM Development Process

In order for the Geospatial BRM to be truly effective, it must relate directly to the BRM for an organization's Enterprise Architecture and it must become part of it or be embedded in it. The primary goal of this Geospatial BRM development process is to provide guidance in the development of the BRM such that geospatial aspects are captured and brought to light so that their benefits are realized in all parts of the Enterprise.

This development process is predicated on the assumption that some business analysis of the enterprise has already been done; that it has generated a series of business activities within the Enterprise; and that these are documented so that further analysis can be conducted. If you do not have a list of business activities, then these will need to be generated as they are the key to developing an enterprise architecture that truly reflects the needs and priorities of the Enterprise.

Our example business activity that we will use in later portions of this document is the "Activate Resources in Response to Incident" activity. The description for this activity is:

Deploy people and equipment that play an active role in responding to any kind of incident. (e.g., emergency response teams, medical surge response, etc.) Includes the resources associated with any organization (Department of Homeland Security (DHS), federal, state, local, tribal, maybe even international).

2.4.3.1   Process

The Geospatial BRM development process is intended to uncover and define the geospatial aspects of any business activity. This process starts with analyzing business activity descriptions to determine if there is a role for placed-based information in the execution of the business activity. The next step then is to determine the function of geospatial data, technology, and services in carrying out those activities. If it is ascertained that there is a locational aspect to the business activity, the next step of the analysis is to develop a business statement for each activity that describes the role of geospatial data and technology in the business activity. This statement will be called a Geospatial Business Statement in this development process. Descriptions of the geospatial data, applications and services needed to support a business process may also be generated during this step of the process.

The following list of geospatial business questions are provided to help the Enterprise Architect assess whether their operations could benefit from a location based approach , determine where and how to incorporate this approach in to the business activity.

 For this process to be most effective, it is recommended that the architect, program managers and Subject Matter Experts involved with the business activity jointly answer these questions for that activity. If Subject Matters Experts are not available or the time with them is extremely limited, it is

1030 recommended that the Enterprise Architect request key strategic and operational documents from
1031 the program managers and subject managers to gain a good grasp of the various components and the
1032 associated information flow. By using these documents, to develop a concise understanding of the
1033 operation of a business activity, the Enterprise Architect can prepare a draft statement for review by
1034 program managers and subject matter experts for their review and acceptance. Regardless of the
1035 steps used, the following questions will be helpful in determining the role of location based
1036 approaches in that activity:

1037   1) Is the activity associated with a place or a location?

1038   2) Does the activity description contain any of the following key words?

1039   Address (physical), address (postal), area, bearing, bearings, city, community,
1040   compass, country, direction, distance, district, domicile, event, facility,
1041   geography, house, household, incident, latitude, locale, locality, locate, location,
1042   longitude, neighborhood, pinpoint, place, point, port, position, post, property,
1043   region, reservation, residence, river reach, scene, site, situation, space, spot,
1044   station, street, suburb, terrain, territory, topography, town, tract, venue, vicinity,
1045   village, watershed, where, whereabouts, zip code, zone

1046   If yes, then further questions should be asked to determine the role of that keyword
1047   in the activity.

1048   3) Does the place/position/location/address have an impact on the way that an
1049   activity is conducted? In other words, does the activity vary by
1050   place/position/location/address or do the characteristics of a
1051   place/position/location/address impact the activity?

1052   If yes, then further questions should be asked to elicit more about how that activity
1053   varies spatially and what geospatial information and services may be relevant to the
1054   activity.

1055   4) Does the activity require the use of a map/aerial photograph/satellite image?

1056   Would a map/aerial photograph/satellite image be helpful in the conduct of the
1057   activity or increase the effectiveness of individuals or groups conducting the
1058   activity?

1059   5) Does the activity require the use of GPS or other location determination
1060   technology?

1061   Would the use of GPS or other location determination technology be helpful in the
1062   conduct of the activity or increase the effectiveness of individuals or groups
1063   conducting the activity?

1064   6) Does the activity require knowing the location of any of the actors in the activity?

1065   Is the location of the actor(s) changing and is ongoing knowledge of the location(s)
1066   useful to the activity?

1067   Does an individual or group conducting the activity need to know their location?

1068   Does an individual or group managing the activity need to know the location of the
1069   individual or group conducting the activity?

1070 7) Is it useful to know the address of the individuals or organizations being served by
1071   or affected by the activity?

1072 8) Would the addition of a "where" component of the business activity enhance the
1073   business operation?

1074 This step of the process should result in written descriptions in language familiar to the
1075 enterprise which identify the use of geospatial capabilities and how they add value to the
1076 accomplishment of the mission associated with each business activity.

1077 Using these descriptions the next step is to prepare Geospatial Business Statements that will
1078 more fully reflect the degree to which geospatial data, applications and services are or should be a
1079 part of a business activity. The following is provided to help the Enterprise Architect prepare
1080 Geospatial Business Statements.

1081 Geospatial Business Statements are written for each Business activity for the purpose of
1082 specifying the geospatial components required to meet the business need. The Geospatial Business
1083 Statements, taken in their totality are used to identify common data, application and services
1084 requirements and to target where the enterprise architecture can focus to provide the greatest
1085 possible business value to the organization. Geospatial Business Statements are written in sentence
1086 form and use the common definitions/descriptions contained in Appendix E : Geospatial Business
1087 Language. The Geospatial Business Language is provided to assist the geospatial community in
1088 adopting common terminology for geospatial terms. Taken in concert with the FEA Glossary and
1089 the Glossary included with this profile (Appendix B), the Geospatial Business Language will enable
1090 Enterprise Architects and business managers to have a directory of common descriptions which can
1091 be a growing community resource.

1092 The Geospatial Business Language is comprised of five basic types of terms:

1093 ■ **Application**—A computer program with a user interface or computer program
1094   component that employs geospatial data and technology; a geospatial business
1095   process or sub-process that is implemented as a software program or program
1096   component.

1097 ■ **Data**—A geospatial information class, type or property.

1098 ■ **Function**—A geoprocessing unit; a geoprocessing user tool; a geospatial service
1099   component.

1100 ■ **Process**—A general business series of actions that employs geospatial data and
1101   technology.

1102 ■ **Technology**—An application of science that generates, displays, manages or
1103   otherwise processes geospatial data. (Excluding general-purpose Information
1104   Technology.)

1105 Appendix E provides an initial list of Geospatial Business Language elements for use by
1106 Enterprise Architects. It should be recognized that many more elements are possible. These
1107 additional elements can be added to this listing however, care should be taken limit the number of
1108 new Geospatial Business Language elements generated as part of this BRM process.

1109   Service Components (and in our case Geospatial Service Components) are often identified over
1110 the course of analyzing business activities and they are elements that show up over and over in the
1111 course of writing Geospatial Business Statements. When these common components are identified,
1112 the Enterprise Architect can return to past Geospatial Business Statements and rewrite them based
1113 on the Geospatial Service Component(s) that have been identified. This iterative process has the
1114 great benefit of improving reuse within the business analysis write-up.

1115   The Geospatial Service Component Reference Model (see section 2.5) contains the background
1116 and reference to an initial list of Geospatial Service Components (Appendix G) for use by Enterprise
1117 Architects, however, it should be recognized that many more are possible and that some care should
1118 be taken to generate or identify new Geospatial Service Component as this process is being used.

1119 *2.4.3.2   Example of a Geospatial Business Statement using Geospatial Business Language*

1120   For example, an analysis of the "Activate Resources in Response to Incident" activity referenced
1121 in 2.4.3 might yield the following Geospatial Business Statement among many other possibilities
1122 (note the Geospatial Business Language elements in our example are listed in italics):

1123   ■ *Route* emergency personnel and apparatus to *incident location.*

1124   For the "Activate Resources in Response to Incident" activity, a Geospatial Service Components
1125 might be:

1126   ■ *Route Service.* Description: Able to determine (or fetch a predetermined) *route* and
1127   *navigation information* for autonomous or semi-autonomous *navigation* between two or
1128   more *points* on a *network.*

1129   As previously stated, the process described in this section is iterative because, as analysis
1130 continues, new elements of the Geospatial Business Language and new Geospatial Service
1131 Components will emerge that will then need to be re-introduced into past Geospatial Business
1132 Statements. This feedback and improvement characteristic is highly important to the overall process
1133 and, if patiently applied, will prove to be useful fruit later in the architecture development.

1134 *2.4.3.3   Summary*

1135   The Geospatial Business Reference Model Development Process is all about getting agencies to
1136 think in terms of their businesses and services and how they can be delivered to citizens and
1137 managed more effectively using the geospatial information associated with them. It starts from the
1138 business the organization is trying to execute, by analyzing it and finding the common services
1139 components needed define to carry out those business functions, what data they operate on and the
1140 standards to implement them. If done correctly, an organization now has a way of articulating why it
1141 needs a piece of technology and tying it back to the business requirement. This process helps those
1142 doing the business analysis, to get a better understanding of the way geospatial information and
1143 technology can enhance business processes. It aids them in describing those geospatial needs
1144 through Geospatial Business Statements using terminology which relates geospatial concepts related
1145 to the business.

2.5   Geospatial View of the Service Component Reference Model (GeoSRM)

1146

2.5.1   Scope and Purpose

1147

1148   The Federal Enterprise Architecture (FEA) Program Management Office (PMO) has developed
1149 a Service Component Reference Model (SRM) as a baseline for categorizing and aligning federal

business applications into common, reusable Service Components, which are categorized into appropriate service domains and service types. The FEA PMO has stated that "Aligning the layers of the SRM to agency technology, business, and application architectures enables the categorization of an agency's IT investments, assets and infrastructure by the common definition and purpose of the Service Components in the SRM." Classifying Service Components according to the SRM framework decreases software maintenance and development costs through the systematic identification and elimination of redundant systems. Additionally, classifying systems furthers the development of a Component-Based Architecture, a key goal of e-government.

In line with the goals and objectives of FEA, and more specifically with the FEA SRM, this part of the FEA Geospatial Profile, hereafter referred to as the GeoSRM, serves to:

- Build upon and extend the FEA SRM by defining, classifying, categorizing and recommending common, reusable geospatial "building blocks" – Geospatial Service Components – for reuse in federal, state, local and tribal computing environments.

- Provide guidance to agencies concerning GeoSRM implementation and use, aligning with and leveraging existing federal guidance, FEA PMO and Federal CIO Council recommendations, and harmony with other significant Federal interoperability and resource sharing initiatives, such as the National Information Exchange Model.

2.5.2 Key Terms

The successful adoption and use of the GeoSRM will depend on achieving consensus about consistent, well-known and well-understood business language. This starts with terms defined by the FEA-PMO, Federal CIO Council and other Federal initiatives. It continues with efforts to define a common geospatial business language that unambiguously distinguishes common Geospatial Service Components in terms of purpose and role (what business function(s) they perform), how they are described, and the nature of the interfaces and applicable standards (in the companion TRM). Consensus will not be easy unless this information is consistent, well-known and well-understood, i.e., the semantics regarding all aspects of the Components are known and agreed upon. As with the other parts of the FEA, the business language of the GeoSRM must be clearly stated and understood by all stakeholders.

Some key terms are defined here. Other terms are defined in Appendix B (: Terminology (Glossary)) and Appendix E (: Geospatial Business Language).

Geospatial – 1) Referring to location relative to the Earth's surface. "Geospatial" is more precise in many geospatial information contexts than "geographic," because geospatial information is often used in ways that do not involve a graphic representation, or map, of the information. [Source: OGC]; also 2) Refers to the broad set of information and technology involved in measuring, modeling and exploiting the earth, natural and manmade features and other earth phenomena. [DHS]

Service Component – 1) Modularized service-based applications that package and process together service interfaces with associated business logic into a single cohesive conceptual module. Aim of a Service Component is to raise the level of abstraction in software services by modularizing synthesized service functionality and by facilitating service reuse, service extension, specialization and service inheritance [CIO Council, FEA PMO]; 2) A Component; 3) A bundling of one or more closely related Services. Within the context of the FEA SRM, a low-level software object/class does not qualify as a Service Component. A Service Component in the SRM has a clear functional business role and should be a shared resource for many enterprise users.

2.5.3 FEA SRM

2.5.3.1 Introduction and Overview[3]

The FEA SRM is a business-driven, functional framework classifying Service Components with respect to how they support business and performance objectives. It serves to identify and classify Service Components that support federal agencies and their IT investments and assets. The model aids in recommending service capabilities to support the reuse of business components and services across the federal government.

The FEA SRM, constructed hierarchically, is structured across horizontal service areas that, independent of the business functions, can provide a leverage-able foundation for reuse of applications, application capabilities, Components, and business services. The SRM is structured around Service Domains, Types, and Components.

The FEA SRM Service Domains provide a high-level view of the services and capabilities that support enterprise and organizational processes and applications. They are differentiated by their business-oriented capability, and include:

- Customer Services
- Process Automation
- Business Management Services
- Digital Asset Services
- Business Analytical Services
- Back Office Services
- Support Services

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[3] The information in this section is taken directly from the FEA Consolidated Reference Model.

1214   Service Domains are comprised of Service Types that further categorize and define the
1215   capabilities of each Domain. As illustrated in the figure below, each Service Domain is classified into
1216   one or more Service Types that group similar capabilities in support of the domain. Service Types
1217   provide an additional layer of categorization that defines the business context of a specific
1218   component within a given domain. Finally, each Service Type includes one or more Service
1219   Components that provide the "building blocks' to deliver the Component capability to the business.
1220   A Component is defined as "a self contained business process or service with predetermined
1221   functionality that may be exposed through a business or technology interface."

Figure 9: FEA SRM Overview

1222   *2.5.3.2   Introduction to Components[4]*

1223   The term "component" can represent many things to many people. It can describe a complete
1224   business line such as U.S. Treasury's PAY.GOV, a service supporting the validation of a Social
1225   Security Number, an application to support Content Management, or a capability that may be
1226   accessed through a technology or business interface. With multiple types of components available in

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[4] The information in this section is taken from the white paper entitled Service Component-Based Architectures, developed by the Federal CIO Council, Architecture and Infrastructure Committee, in collaboration with the FEA-PMO and the Industry Advisory Council. The purpose of this white paper is to inform agencies' thinking on development and use of enterprise architecture, in a manner consistent with Component sharing and reuse, and the objectives of the FEA.

1227   industry and across governments, it became critical to the success of the SRM to define
1228   "Component" and to clarify the level of granularity that will reside within the SRM.

1229   **Component Definition**
1230   A Component is defined as "*a self contained business process or service with predetermined functionality that*
1231   *may be exposed through a business or technology interface*."

1232   **Component Granularity[5]**
1233   As illustrated in the following table, there are three levels of Service Component granularity that
1234   are viable for the SRM.

1235

Table 1: SRM Component Granularity Levels

Level	Definition	ROI
Business Component System	A set of cooperating business components assembled together to deliver a solution to a business problem. Can be expressed as an IT 300 exhibit.	High
Business Component	Represents the implementation of an autonomous business concept, business service, or business process. It consists of all the technology elements (i.e., software, hardware, data) necessary to express, implement, and deploy a given business concept as an autonomous, reusable element of a large information system. It is a unifying concept across the development lifecycle and the distribution tiers. Normally not expressed as an IT 300 exhibit, but as a sub-component of a larger business component system.	Medium
Distributed Component	The lowest level of SRM component granularity. It is a software element that can be called at run-time with a clear interface and a clear separation between interface and implementation. It is autonomously deployable. Normally not ex-pressed as an IT 300 exhibit. A distributed component provides low ROI for capital planning purposes.	Low
Language Class (n/a)	A class in an object-oriented programming language to build distributed components. This is **NOT** considered an SRM component. Normally not expressed as an IT 300 exhibit. A language class provides very low ROI for capital planning purposes.	Very Low

1236

1237   *2.5.3.3   The Role of Geospatial in the FEA SRM*

1238   Version 1.0 of the FEA SRM contains only one reference to geospatial. It aggregates all
1239   geospatial-related Components under the *Business Analytical Services Domain, Visualization Service Type*,
1240   and a Component identified as "*Mapping, geospatial (GIS), elevation, GPS*". Clearly, not all geospatial-

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[5] The notion of component granularity is expanded to include return on investment (ROI).

related capabilities can exist in a single functional business component. As will be presented in the next section, the role of Geospatial Service Components is much broader than described in FEA SRM.

> *Note: The FEA SRM greatly oversimplifies the role of geospatial in the Federal enterprise. We may want to propose basic changes after we've had a chance to do a more thorough job fleshing out and vetting the FEA Geoprofile. For the time being, the approach is to merely map as best we can to the existing SRM, effectively extending the SRM with a level of detail. In a few instances, we recommend changes to the FEA SRM. A goal of the GeoSRM is to much more clearly and accurately match the business and technology realities concerning the role of geospatial in a Federal, State, local and tribal enterprise.*

2.5.4 Geospatial Service Components

The GeoSRM identifies and defines a set of common Service Components that either geospatially extend those already identified in the FEA SRM or are entirely new entirely geospatially-oriented Service Components.

> *Note: The goal is to categorize the new and/or Extended Service Components into the framework of the FEA SRM, Figure 1. However, it is possible that we could identify new Service Domains and/or Service Types that would augment the FEA SRM. The primary initial sources for Service Components include the list that FGDC created for the GSA and the DHS Geospatial Enterprise Architecture.*

The table in Appendix G contains Geospatial Service Components that are mapped to the FEA SRM. The first three columns represent the service categories, type and Components represented in the FEA SRM. The last three columns identify and describe the Geospatial Service Components. The description includes the level of service component granularity as defined in Section 2.5.3.2, where BCS represents *Business Component System*, BC represents *Business Component* and DC represents *Distributed Component*. Again, this distinction is important because it reflects ROI, which is important in IT Exhibit 300 formulation.

> *Note: We expect the distinction between Component levels may be somewhat grey, at first, until the GeoSRM is more mature. For example, one Agency's idea of an appropriate bundling of services as a Business Component, may not exactly mesh with another Agency. For this reason, it is probably reasonable to expect initially that there will be greater consensus at the lower level (Distributed Components) rather than at the higher levels where business needs are more subtle and specialized. The exception to this will be broadly appealing general-purpose systems, such as a robust Geographic Information System (GIS), as an Enterprise-wide Business Component System.*
>
> *Note: We use an asterisk (*) on a Geospatial Service Component to indicate that there are more than one entry for this component. This is done for cases in which the Geospatial Service Component does not fit neatly under the FEA SRM taxonomy of Service Components [2]. There are also instances where we have created new, recommended FEA Service Components.*

2.5.5 Agency GeoSRM Development Guidance

The GeoBRM provides guidance for Agency BRM development that will result in the identification of Service Components that are Agency-specific and geospatially-enabled. The guidance in this section will match that guidance and will flesh it out further as required to support the development of effective, business-driven Agency SRMs.

2.5.5.1 Guidance Concerning Component Granularity[6]

The effective identification, assembly, and usage of Service Components allows for aggregate business services to be shared across agencies and governments. These business services provide the functionality and execution of business processes, which in turn sustain the FEA Business Reference Model (BRM) sub-functions. Service Component aggregation will enable rapid building and implementation of Components to support a given initiative or investment. The figure below illustrates the concept of aggregate services where multiple Service Components can support a business sub-function.
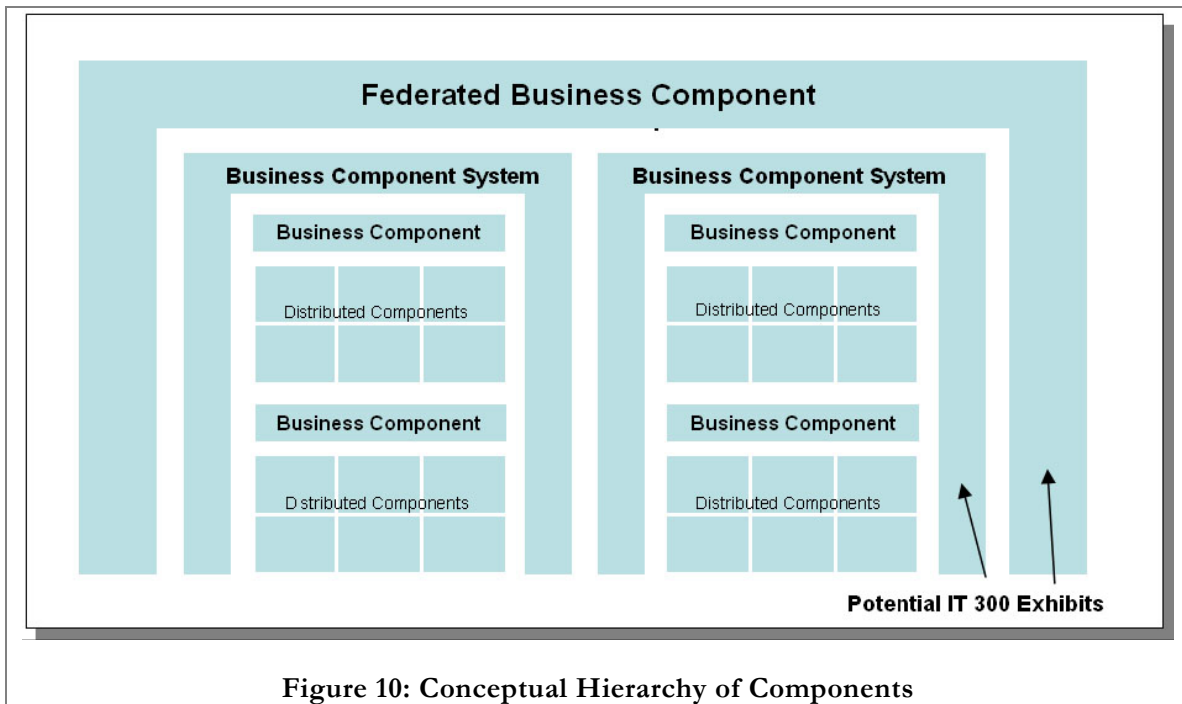
Figure 10: Conceptual Hierarchy of Components

The SRM is decomposed into lower levels of granularity beginning from the process and application levels to the software and component and module levels. This level of decomposition provides various perspectives for stakeholders and solution architects to support the adoption of components and services within an IT initiative, asset, or investment.

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[6] *Service Component-Based Architectures* [3].

2.5.5.2 Desired Features of a Service Component[7]

1297

1298 An important consideration regarding the success of the FEA SRM is to have strong
1299 participation by the entire stakeholder community to ensure that the right Service Components are
1300 chosen and verified. The Federal CIO Council, in cooperation with the FEA-PMO, developed the
1301 following list of desired features to assist agencies in successfully defining Service Components,
1302 which we have taken the liberty of slightly altering for geospatial audiences.

1303 *Note: It is our view that this list of Component features is solid and if strictly adhered to provides a*
1304 *sound set of guidelines for further developing the GeoSRM. Thus stated, Component definition is*
1305 *not a science, and it will take several iterations and the efforts of many to produce wholesome*
1306 *content for favorable impacts to Agency planning and review processes.*

1307 A successful service component-based architecture requires the application of sound architecture
1308 principles to the definition and composition of components. The components in the architecture
1309 should exhibit the following basic features:

1310 *Encapsulation* - A component should clearly separate the definition of the services
1311 that it provides from its implementation of those services. This implies that the
1312 internals of a "well-behaved" service component are hidden behind a contract and
1313 agreed upon interface specifications (standards) between the component and the
1314 outside world.

1315 *Consumability* - A Component that is designated as the provider of certain services
1316 should be able to provide those services in a coherent and consistent manner to
1317 another software or business process. To the extent that is possible, Components
1318 should provide services without impeding the operations of users. A Component
1319 should be independently developed, delivered, and installed without complex
1320 interdependencies on other external components (i.e., keep interfaces functionally
1321 simple).

1322 *Extensibility* - A well-behaved Service Component should be extensible in both the
1323 services it provides and the way those services are provided within the Component
1324 itself. A well-behaved Component should be extensible to adapt to changes in the
1325 business and data while at the same time preserving services provided to existing
1326 consumers.

1327 *Standards-Based* - The value of a Component increases in conjunction with the
1328 number of places the Component is used. Standards, both technical and domain, affect
1329 this applicability in a number of ways. First, by basing the interface of a component on
1330 industry standard practices and technologies, the Component is more likely to be
1331 reused. As an example, if a component is built using Cobol, re-use of that Component
1332 in a .NET environment is relatively difficult and therefore is unlikely to occur. On the
1333 other hand, if a technology standard, such as WSDL, is used to create an interface for
1334 the Component, it can then be used from either Java or .NET with equal ease and will
1335 therefore see greater ROI. Further, if the interface is based on a domain industry
1336 standard such as GML or NIEM, even greater ROI is likely since a consortium of

---

[7] *Service Component-Based Architectures* [3].

organizations have "pre-agreed" to adhere to the standard. The second reason standards help Component reuse is that Components need a compatible execution environment. This means that the implementation also benefits from being standards based. For example, if a component is written to Web Services Interface Standards, such as many OGC specifications, then it can be deployed in a fairly broad set of execution environments and therefore is more likely to be compatible.

Industry Best Practices and Patterns - A software Component should embody industry "best practices" and patterns. Patterns are simply common solutions to recurring problems or issues faced in the software life cycle. Patterns typically reflect industry best practices—the convergence of approaches to solving problems. The use of (technology) patterns (and E-business Patterns) in Components facilitates the understanding and consumption of the Components.

Well Documented - A software Component should be well documented to promote understanding of its capabilities and encourage its consumption. The documentation should permit architects, designers, and integrators to evaluate and consume the Component. The documentation should include models (preferably in UML; for example, use cases, class diagrams, and sequence diagrams) depicting the process and data capabilities of the Component, user guides, functional over-views, and installation guides, as well as API documentation. A Test Harness should be delivered with the Component to allow the consumer of the Component to test each of the services or methods offered by it prior to consuming the Component. If appropriate, the Component should include the source code (for "white box" Components) and a "management application" if the data managed by the Component must be entered or updated independent of the consuming application. Finally, a Component should be delivered with samples of consumption of the Component to indicate how the Component operates within an application environment.

Cohesive Set of Services - Components should be factored in such a way that they provide a cohesive set of services. Proper "packaging" of services makes the services easier to find and use. System developers and integrators are able to use just the right Component for the need. Using Components that offer too broad an array of services leads to bloated software and can result in bugs due to in-advertent use of features that are not appropriate. As an example, suppose an Image Processing Component included a complex array of image processing and data management functions for a certain type of imagery and its intended uses. While this might work well for an immediate community of specialized imagery analysts, further reuse would likely be limited. Creating appropriately factored service offerings will significantly increase the breadth of opportunities for reuse of a Component.

Well-Defined and Broadly Available Licensing or SLA - A software Component should be accompanied by a well-defined license or service-level agreement (SLA). The license or SLA defines the user's rights and responsibilities with respect to the Component. In particular, the license or SLA should clearly articulate the intellectual property ownership for the Component, the scope of usage permitted, the extent of any rights granted to modify the Component or produce derived works, and the extent of any rights granted to redistribute the Component. For COTS Components, the copyright will usually reside with the original author of the Component, but the rights to use, modify, and redistribute can vary widely. To promote reuse of the Component, the license or SLA terms should be sufficiently broad as to allow the Component to be reused in contexts other than its first intended usage without having to renegotiate

1385 licensing terms. So, for example, a site- or organization-wide license would be more
1386 appropriate than a single-processor license.

2.6 Geospatial View of the Technical Reference Model (GeoTRM)

2.6.1 Introduction

1389
> *NOTE: We plan to add technologies (product categories) in the TRM over the next weeks.*

2.6.1.1 Purpose

1391 As a key element of the FEA, the GeoTRM establishes the basic guidance necessary to help
1392 ensure that proposed IT solutions which have or desire a geospatial location component are in
1393 compliance with industry standards, and therefore are likely to integrate efficiently into a multi-
1394 agency information sharing and processing environment. Specifically, the GeoTRM is intended to
1395 describe elements of proposed solutions using a standard vocabulary and categorization scheme to
1396 allow them to be compared to identify overlaps and gaps.

2.6.1.2 Goals

1398 Establishing and institutionalizing the GeoTRM will provide the guidance and direction the
1399 federal government needs to function as an integrated enterprise capable of accomplishing all of the
1400 missions for which it is, or will be, responsible. The goals of the GeoTRM are as follows:

1401 ■ Promote vendor independence through the use of standards-based products and
1402 interchangeable services and components,

1403 ■ Improve interoperability, reuse, and information sharing across operational entities,

1404 ■ Improve operational effectiveness and efficiency through the use of common
1405 concepts and tools,

1406 ■ Improve security through the identification of common security services and
1407 standards, and

1408 ■ Improve development and integration efficiency and responsiveness through the
1409 identification of a common infrastructure for applications.

2.6.1.3 Audience

1411 This profile of the TRM is intended for use by IT managers, procurement officials, program and
1412 project sponsors, technical and systems architects, software developers and maintainers, IT
1413 operations management and staff, security personnel, enterprise infrastructure staff, systems
1414 integrators, vendors, and service providers. Strategic Planners, Investment Managers, and enterprise
1415 architects will also use it to guide the planning process, and to guide the creation and evolution of
1416 enterprise technical and systems architectures.

2.6.1.4 Intended Uses

1418 The GeoTRM is intended to support three principal uses in conjunction with standards profiles:

1419   ■   Ensuring interoperability among DHS systems and with external systems and users,

1420   ■   Guiding the design of system and technical architectures, and

1421   ■   Providing the basis for assessing architectural compliance for technical solutions.

1422 Interoperability is the primary concern. This profile of the TRM adopts the organizational
1423 scheme of the Federal EA (FEA) TRM to ensure interoperability with Service Components outside
1424 the geospatial domain.

1425 The GeoTRM provides a technology-focused, vendor-independent view of the hardware and
1426 software services that will support the enterprise. It is intended to be used by systems architects,
1427 engineers, developers, vendors, service providers, and others involved in defining and creating new
1428 systems and modifying existing systems. This view identifies the technical services and capabilities
1429 provided by a common IT infrastructure that system and application architects and engineers must
1430 consider when defining new systems or modifying existing systems.

2.6.2 Standards Profile

1432 The implementation of the GeoTRM is accomplished through definition of a Standards Profile.
1433 The initial Geospatial Standards Profile is at the end of this document.

2.6.3 Relationship to the Service Component Reference Model (SRM) Geospatial Profile

1436 The GeoTRM must be viewed within the context of the SRM-Geospatial Profile. The
1437 functionally-oriented capabilities described in the SRM-Geospatial Profile in terms of "Service
1438 Components" are enabled by technical services described in this document. It is assumed that, as the
1439 SRM-Geospatial Profile matures, the GeoTRM will change in response.

2.6.4 Terminology

1441 The following terms and intended usage are presented to aid the reader.

1442   ■   **Application**—an automated business process or portion thereof. It is composed of
1443   components unique to the application as well as shared components.

1444   ■   **Business Logic**—the portion of an application that is concerned with the encoding
1445   of business rules specific to the application.

1446   ■   **Channel**—a mode of application access and delivery consisting of an end-point
1447   device, interface software, and a communications path to the application logic. An
1448   example is a Web browser executing on a Personal Digital Assistant (PDA) using a
1449   wireless protocol to access application on the Internet.

1450   ■   **Data Store**—a logical data "container." An implementation of a data store may be
1451   a relational Database Management System (DBMS), a spatial data store (for
1452   geographic information system support), an indexed file system, a flat file system, an
1453   associative data store, or any other viable storage model.

1454   ■   **End-user Device**—any device and associated operating system or other run-time
1455   software that is used to connect an end-user with an application. Examples are
1456   PDAs, cellular phones, printers, plotters, and desktop and laptop computers.

1457   ■   **End-user**—a human interacting with a computer-based application.

- **Infrastructure Services**—software components that provide common-use functionality to applications and/or to other services and are application-neutral; that is the services can and are expected to be used by any arbitrary application. Examples are a Web portal and an application server.

- **Service Component**—as defined by the FEA Service Component Reference Model (SRM), a *service component* is the most granular level of the SRM framework. Service components are combined to provide specific business services organized by *service type* and *service layer* in the SRM. Examples are Data Access Services and Directory Services.

- **Service Framework**—a specific configuration of technical services, protocols, and interfaces grouped by similar functionality into conceptual layers.

- **Service Platforms**—application-neutral computing, storage, and communications devices and software that provide the technical environment required by the Service Framework. These are the computers, operating systems, storage subsystems, and networks that comprise the physical level of the DHS IT infrastructure.

- **Technical Component**—in contrast to the functional capability provided by a *service component,* a technical component is the software or hardware implementation of a specific technical function. A technical component may be custom developed or acquired from a vendor, through open source channels, or from other appropriate sources.

- **Technical Service**—in this document, a technical service is a technical component that provides functionality to applications and other technical services through well-defined and published interfaces.

2.6.5 Approach

1482   The FEA TRM provides a view of technical services, protocols and interfaces that are primarily
1483 concerned with supporting the implementation of Service Components, as defined in the FEA SRM.
1484 Geospatial technology is in many ways a special case of database technology, and therefore the
1485 architectural concerns of database technologies usually account for geospatial as well. For example,
1486 there is no need to account separately for geospatial in the high-level TRM category of **Service**
1487 **Access and Delivery**.
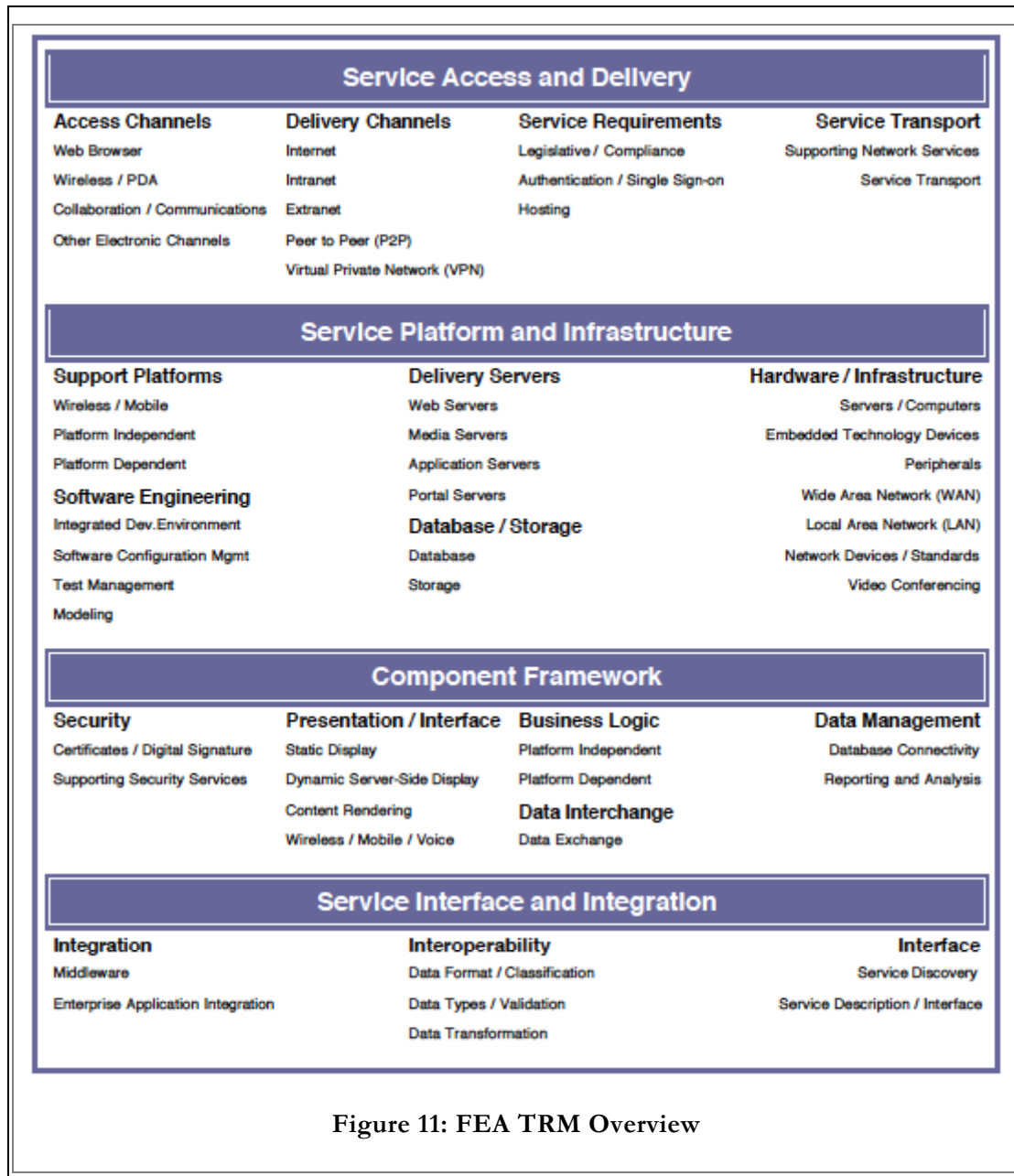
Figure 11: FEA TRM Overview

1488   At the **Service Platform and Infrastructure**, **Component Framework** and **Service Interface**
1489 **and Integration** levels, however, the geospatial industry has defined a number of specialized systems
1490 and standards.

1491 ## 2.6.6 Service Platform and Infrastructure

1492 ### *2.6.6.1 Database / Storage*

1493 Database / Storage refers to a collection of programs that enables storage, modification, and
1494 extraction of information from a database, and various techniques and devices for storing large
1495 amounts of data.

1496 **Database**
1497 Refers to a collection of information organized in such a way that a computer program can
1498 quickly select desired pieces of data. A database management system (DBMS) is a software
1499 application providing management, administration, performance, and analysis tools for databases.

1500 Geospatial database support at a minimum means that the database software has:

1501 - a specialized compact geospatial data **format**

1502 - geospatial **indexing**

1503 - geospatial data access and processing **functions**

1504 Less common is geospatial database support for advanced functions such as replication, long
1505 transactions, atomic transactions, etc. This level of geospatial awareness is usually present only in
1506 products with native geospatial support.

1507 Notable databases with native geospatial support:

1508 - IBM DB2

1509 - MySQL

1510 - Oracle

1511 - PostgreSQL

1512 Databases with geospatial support via 3rd-party products:

1513 - IBM DB2

1514 - Microsoft SQL Server

1515 - MySQL

1516 - Oracle

1517 - PostgreSQL

1518 - Sybase

1519 ## 2.6.7 Component Framework

1520 The Component Framework consists of the design of application or system software that
1521 incorporates interfaces for interacting with other programs and for future flexibility and
1522 expandability. This includes, but is not limited to, modules that are designed to interoperate with
1523 each other at runtime. Components can be large or small, written by different programmers using
1524 different development environments and may be platform independent. Components can be
1525 executed on standalone machines, a LAN, Intranet or the Internet.

2.6.7.1   Security

1527   Security defines the methods of protecting information and information systems from
1528   unauthorized access, use, disclosure, disruption, modification, or destruction in order to provide
1529   integrity, confidentiality and availability.

1530   *NOTE: GeoDRM special b/c certain inherently spatial characteristics are accounted for in*
1531   *GeoDRM that would not be part of any other security regime. No specs here yet – how to*
1532   *mention??*

1533   *2.6.7.2   Presentation / Interface*

1534   This defines the connection between the user and the software, consisting of the presentation
1535   that is physically represented on the screen.

1536   **Content Rendering**
1537   This defines the software and protocols used for transforming data for presentation in a
1538   graphical user interface.

1539   *Relevant standards:*
1540   ▪ OGC Styled Layer Descriptor (SLD)

1541   ▪ https://portal.opengeospatial.org/files/?artifact_id=1188

1542   SLD is an XML encoding for how the Web Mapping Service (WMS)
1543   specification can be extended to allow user-defined symbolization of feature
1544   data.

1545   ▪ OGC Web Map Service Implementation Specification (WMS)

1546   ▪ http://portal.opengeospatial.org/files/?artifact_id=5316

1547   Provides three operations (GetCapabilities, GetMap, and GetFeatureInfo)
1548   in support of the creation and display of registered and superimposed map-
1549   like views of information that come simultaneously from multiple sources
1550   that are both remote and heterogeneous.

1551   ▪ ISO Geographic Information – Portrayal (ISO 19117:2005)

1552   This is an abstract document and is not intended for direct implementation.
1553   It gives general guidelines to the application developers about the
1554   mechanism that shall be used to portray the feature instances of a dataset.
1555   The portrayal mechanism described makes it possible to have general rules
1556   valid for the whole dataset, and at the same time rules valid for a specific
1557   value of a feature attribute only.

1558   **Wireless / Mobile / Voice**
1559   This consists of the software and protocols used for wireless and voice enabled presentation
1560   devices.

1561   *Relevant standards:*
1562   ▪ OpenGIS Location Service OpenLS: Core Services

1563 ■ http://portal.opengeospatial.org/files/?artifact_id=8836

1564 The primary objective of OpenLS is to define access to the Core Services
1565 and Abstract Data Types (ADT) that comprise the "GeoMobility" Server,
1566 an open location services platform. The GeoMobility Server provides
1567 content such as maps, routes, addresses, points of interest, traffic, etc. It
1568 can also access other local content databases via the Internet.

1569 *2.6.7.3 Data Interchange*

1570 Define the methods in which data is transferred and represented in and between software
1571 applications.

1572 **Data Exchange**
1573 Data Exchange is concerned with the sending of data over a communications network and the
1574 definition of data communicated from one application to another. Data Exchange provides the
1575 communications common denominator between disparate systems.

1576 *Relevant standards:*
1577 ■ OGC Web Feature Service (WFS)

1578 ■ https://portal.opengeospatial.org/files/?artifact_id=8339

1579 The OGC Web Feature Service allows a client to retrieve and update
1580 geospatial data encoded in Geography Markup Language (GML) from
1581 multiple Web Feature Services. The requirements for a Web Feature Service
1582 are: 1. The interfaces must be defined in XML. 2. GML must be used to
1583 express features within the interface. 3. At a minimum a WFS must be able
1584 to present features using GML. 4. The predicate or filter language will be
1585 defined in XML and be derived from CQL as defined in the OpenGIS
1586 Catalogue Interface Implementation Specification. 5. The datastore used to
1587 store geographic features should be opaque to client applications and their
1588 only view of the data should be through the WFS interface. The use of a
1589 subset of XPath expressions for referencing properties.

1590 ■ ISO Geographic Information - Web Feature Service (ISO 19142)

1591 This standard is a direct adoption of the OGC WFS specification.

1592 ■ OGC Web Coverage Service (WCS)

1593 ■ https://portal.opengeospatial.org/files/?artifact_id=3837

1594 Extends the OGC Web Mapping Service (WMS) interface to allow access
1595 to whole or portions of geospatial "coverages"—regularly varying *gridded*
1596 data sets such as aerial imagery.

1597 ■ Filter Encoding (Filter)

1598 ■ http://portal.opengeospatial.org/files/?artifact_id=8340

1599 This document defines an XML encoding for filter expressions based on
1600 the BNF definition of the OpenGIS Common Catalog Query Language as
1601 described in the OpenGIS Catalog Interface Implementation Specification,
1602 Version 1.0

1603   ■   ISO Geographic Information - Filter Encoding (ISO 19143)

1604   This standard is a direct adoption of the OGC Filter Encoding
1605   specification.

1606   ■   Coordinate Transformation Services

1607   ■   http://portal.opengeospatial.org/files/?artifact_id=999

1608   To minimize errors associated with projecting a 3D surface (the earth) into
1609   a 2D plane, different earth *projections* are used by various state, local and
1610   federal agencies. This makes it crucial to have the ability to transform data
1611   from one projection to another as needed.

1612   ■   Spatial Data Transfer Standard (SDTS): FGDC-STD-002

1613   ■   http://mcmcweb.er.usgs.gov/sdts/

1614   The SDTS was designed by a group of people representing government
1615   agencies, universities, and private companies that saw a requirement for a
1616   robust way of transferring earth-referenced spatial data between dissimilar
1617   computer systems with the potential for no information loss. The SDTS is a
1618   standard for data transfer, as opposed to a standard for data processing.
1619   SDTS does not replace existing Geographic Information System (GIS)
1620   processing formats.

1621   NOTE: a modified version was adopted as ANSI INCITS 320:1998, which
1622   is undergoing periodic review through INCITS Technical Committee L1.

1623   ■   SDTS Part 5: Raster Profile and Extensions: FGDC-STD-002.5

1624   ■   http://www.fgdc.gov/standards/status/sub4_1.html

1625   Description needed.

1626   ■   SDTS Part 6: Point Profile: FGDC-STD-002.6

1627   ■   http://www.fgdc.gov/standards/status/sub2_3.html

1628   Description needed.

1629   ■   SDTS Part 7: Computer-Aided Design and Drafting (CADD) Profile: FGDC-STD-
1630   002.7-2000

1631   ■   http://www.fgdc.gov/standards/status/sub3_2.html

1632   Description needed.

1633   2.6.8   Service Interface and Integration

1634   *2.6.8.1   Integration*

1635   Integration defines the software services enabling elements of distributed business applications
1636 to interoperate. These elements can share function, content, and communications across
1637 heterogeneous computing environments. In particular, service integration offers a set of architecture
1638 services such as platform and service location transparency, transaction management, basic
1639 messaging between two points, and guaranteed message delivery.

Middleware

Middleware increases the flexibility, interoperability, and portability of existing infrastructure by linking or "gluing" two otherwise separate applications.

Relevant standards:

- Information technology -- Database languages -- SQL multimedia and application packages -- Part 3: Spatial: ISO 13249-3:2003

    ==Description needed.==

- Simple Features for SQL

    - http://portal.opengeospatial.org/files/?artifact_id=829

        The Simple Feature Specification application programming interfaces (APIs) provide for publishing, storage, access, and simple operations on Simple Features (point, line, polygon, multi-point, etc). This specification describes a SQL implementation of Simple Features.

- Simple Features for CORBA

    - http://portal.opengeospatial.org/files/?artifact_id=834

        This specification describes a CORBA implementation of Simple Features.

- Simple Features for OLE/COM

    - http://portal.opengeospatial.org/files/?artifact_id=830

        This specification describes an OLE/COM implementation of Simple Features.

2.6.8.2   Interoperability

Data Format / Classification

Defines the structure of a file. There are hundreds of formats, and every application has many different variations (database, word processing, graphics, executable program, etc.). Each format defines its own layout of the data. The file format for text is the simplest.

Relevant standards:

- OGC Geography Markup Language Encoding Specification (GML)

    - http://portal.opengeospatial.org/files/?artifact_id=4700

        The Geography Markup Language (GML) is an XML encoding for the transport and storage of geographic information, including both the geometry and properties of geographic features.

- OGC Web Map Context Implementation Specification (Context)

    - https://portal.opengeospatial.org/files/?artifact_id=8618

        This document is a companion specification to the OGC Web Map Service Interface Implementation Specification version 1.1.1, hereinafter "WMS 1.1.1." WMS 1.1.1 specifies how individual map servers describe and provide their map content. The present Context specification states how a specific grouping of one or more maps from one or more map servers can be described in a portable, platform-independent format for storage in a

1679	repository or for transmission between clients. This description is known as
1680	a "Web Map Context Document," or simply a "Context." Presently, context
1681	documents are primarily designed for WMS bindings. However,
1682	extensibility is envisioned for binding to other services. A Context
1683	document includes information about the server(s) providing layer(s) in the
1684	overall map, the bounding box and map projection shared by all the maps,
1685	sufficient operational metadata for Client software to reproduce the map,
1686	and ancillary metadata used to annotate or describe the maps and their
1687	provenance for the benefit of human viewers. A Context document is
1688	structured using eXtensible Markup Language (XML). Annex A of this
1689	specification contains the XML Schema against which Context XML can be
1690	validated.

1691 ■ ESRI Shapefile Technical Description

1692 ■ http://www.esri.com/library/whitepapers/pdfs/shapefile.pdf

1693	A shapefile stores nontopological geometry and attribute information for
1694	the spatial features in a data set. The geometry for a feature is stored as a
1695	shape comprising a set of vector coordinates. This document provides all
1696	the technical information necessary for writing a computer program to
1697	create shapefiles without the use of ESRI® software for organizations that
1698	want to write their own data translators.

Data Types / Validation
1699
1700 Refers to standards used in identifying and affirming common structures and processing rules.
1701 This technique is referenced and abstracted from the content document or source data.

1702 *Relevant standards:*

1703 ■ Content Standard for Digital Geospatial Metadata (version 2.0):
1704 FGDC-STD-001-1998

1705 ■ http://www.fgdc.gov/metadata/contstan.html

1706	The objectives of the standard are to provide a common set of terminology
1707	and definitions for the documentation of digital geospatial data. The
1708	standard establishes the names of data elements and compound elements
1709	(groups of data elements) to be used for these purposes, the definitions of
1710	these compound elements and data elements, and information about the
1711	values that are to be provided for the data elements. ISO harmonization
1712	efforts are underway.

1713 ■ ISO Geographic Information – Metadata (ISO 19115:2003)

1714	This document defines the schema required for describing geographic
1715	information and services. It provides information about the identification,
1716	the extent, the quality, the spatial and temporal schema, spatial reference,
1717	and distribution of digital geographic data.

1718 ■ ISO Geographic information -- Metadata -- Part 2: Extensions for imagery and
1719 gridded data (ISO 19115-2)

1720 Description needed.

1721 ■ Content Standard for Digital Geospatial Metadata, Part 1: Biological Data Profile:
1722 FGDC-STD-001.1-1999

1723 ■ http://www.fgdc.gov/standards/status/sub5_2.html
1724 Description needed.

1725 ■ Content Standard for Digital Geospatial Metadata: Extensions for Remote Sensing
1726 Metadata: FGDC-STD-012-2002

1727 ■ http://www.fgdc.gov/standards/status/csdgm_rs_ex.html
1728 Description needed.

1729 ■ Metadata Profile for Shoreline Data: FGDC-STD-001.2-2001

1730 ■ http://www.fgdc.gov/standards/status/sub5_6.html
1731 Description needed.

1732 ■ Cadastral Data Content Standard: FGDC-STD-003

1733 ■ http://www.fgdc.gov/standards/status/sub3_5.html
1734 Description needed.

1735 ■ Classification of Wetlands and Deepwater Habitats of the United States: FGDC-
1736 STD-004

1737 ■ http://www.fgdc.gov/standards/status/sub3_4.html
1738 Description needed.

1739 ■ Vegetation Classification Standard: FGDC-STD-005

1740 ■ http://www.fgdc.gov/standards/status/sub2_1.html
1741 Description needed.

1742 ■ Soil Geographic Data Standard: FGDC-STD-006

1743 ■ http://www.fgdc.gov/standards/status/sub2_2.html
1744 Description needed.

1745 ■ Content Standard for Digital Orthoimagery: FGDC-STD-008-1999

1746 ■ http://www.fgdc.gov/standards/status/sub3_6.html
1747 Description needed.

1748 ■ Content Standard for Remote Sensing Swath Data: FGDC-STD-009-1999

1749 ■ http://www.fgdc.gov/standards/status/sub4_4.html
1750 Description needed.

1751 ■ Utilities Data Content Standard: FGDC-STD-010-2000

1752 ■ http://www.fgdc.gov/standards/status/sub3_1.html
1753 Description needed.

Data Transformation

Data Transformation consists of the protocols and languages that change the presentation of data within a graphical user interface or application.

Relevant standards:
- OGC Styled Layer Descriptor (SLD)

  - https://portal.opengeospatial.org/files/?artifact_id=1188

    SLD is an XML encoding for how the Web Mapping Service (WMS) specification can be extended to allow user-defined symbolization of feature data.

- OGC Web Map Service Implementation Specification (WMS)

  - http://portal.opengeospatial.org/files/?artifact_id=5316

    Provides three operations (GetCapabilities, GetMap, and GetFeatureInfo) in support of the creation and display of registered and superimposed map-like views of information that come simultaneously from multiple sources that are both remote and heterogeneous.

2.6.8.3 Interface

Interface defines the capabilities of communicating, transporting and exchanging information through a common dialog or method. Delivery Channels provide the information to reach the intended destination, whereas Interfaces allow the interaction to occur based on a predetermined framework.

Service Discovery

Defines the method in which applications, systems or web services are registered and discovered.

Relevant standards:
- OGC Catalogue Implementation Specification (Catalogue)

  - http://portal.opengeospatial.org/files/?artifact_id=5929&version=1

    Defines a common interface that enables diverse but conformant applications to perform discovery, browse and query operations against distributed and potentially heterogeneous catalog servers.

Service Description / Interface

Defines the method for publishing the way in which web services or applications can be used.

OGC has done work in this area. Services may use WSDL as a way to describe endpoint bindings. More information is usually available by invoking a given service's *GetCapabilities* operation. This operation provides the calling application with more detailed, service domain-specific information. For example, in the case of the OGC Web Mapping Service, the *GetCapabilities* operation catalogs such features as available data layers and supported image formats.

Relevant standards:
- OGC Reference Model (ORM)

  - http://www.opengeospatial.org/specs/?page=orm

The ORM describes a framework for the ongoing work of the Open Geospatial Consortium and our specifications and implementing interoperable solutions and applications for geospatial services, data, and applications.

- OGC Web Service Common Implementation Specification (OGC Common)

    - https://portal.opengeospatial.org/files/?artifact_id=8798

        This document specifies many of the aspects that are, or should be, common to all or multiple OWS interface Implementation Specifications. Those specifications currently include the Web Map Service (WMS), Web Feature Service (WFS), and Web Coverage Service (WCS). These common aspects include: operation request and response contents; parameters included in operation requests and responses; and encoding of operation requests and responses.

2.7 Geospatial View of the Data Reference Model (GeoDRM)

2.7.1 Scope and Purpose

This guidance applies only to the domain as bounded by ones enterprise for those information resources that are geospatial.

[Sidebar definition of geospatial: Geospatial (Spatial, Geographical, and Locational) Data (Information): Any data or information that is referenced to a place on the earth.]

The purpose of this section is to provide:

- Guidance to EA authors regarding geospatial data and metadata
- Guidance on alignment with FEA DRM while preserving the investment made by the geospatial community over many years

2.7.2 Geospatial DRM Introduction and Overview

The FEA Data Reference Model (DRM) is intended to promote the common identification, use, and appropriate sharing of data/information across the federal government through its standardized characterization of data and information resources. The Geospatial DRM is intended to develop a standardized method to representing the locational aspect of that data. In keeping with the FEA DRM approach, the following three areas can be described as:

Data Context—A standard approach to representing taxonomies that an agency uses to categorize its data. The geospatial data context should reference locational and thematic taxonomies developed by the geospatial community. Place codes represent a spatial taxonomy.

Data Sharing—A standard approach to describing the characteristics and requirements of interagency data exchanges, including data sources. This defines a standard message structure known as an Information Exchange Package. Standard geospatial data exchange models such as Framework Data (developed by FGDC and standardized through ANSI), the Open Geospatial Consortium (OGC) specifications, the National Information Exchange Model (NIEM) community-based model, and standard encoding methods of locational information will be reviewed and reconciled.

Data Description—A standard approach to describing an agency's data resources. This is achieved through the application of the geospatial metadata standard, the Content Standard for

1832 Digital Geospatial Metadata (CSDGM, 1998) to describe data sets and collections. The definition of
1833 standardized geospatial data elements and constructs is also required for interoperability.

2.7.3   National Spatial Data Infrastructure (NSDI) Introduction and Overview

1835 The NSDI is the technology, policies, standards, human resources, and related activities
1836 necessary to acquire, process, distribute, use, maintain, and preserve spatial data.

2.7.4   Geospatial support for the DRM

1838 The practices of the NSDI directly support the three standardization goals of the FEA DRM.
1839 The geospatial community has been careful in its data management approach to re-use practices from
1840 the library and bibliographic community, thereby ensuring interoperability with that wealth of
1841 information.

2.7.4.1   Data Context

1843 In the FEA DRM guidance, data context is supported through formalized categorization of data
1844 resources. In the geospatial realm, information resources can be classified using standardized
1845 conventions based on location and thematic content.

1846 Data resources that have a geographic context, location, or coverage can be identified in one of
1847 two ways – by their approximate geographic extent or by an address in the context of a specific
1848 addressing system. The international standard for describing geographic information (metadata),
1849 known as ISO 19115, specifies an "Extent" to hold these geographic properties of an information
1850 resource. Extent allows one to describe a bounding area (polygon), a geographic bounding box
1851 (rectangle in latitude and longitude that encloses a resource of interest), or a geographic identifier
1852 such as a geographic place code for an information resource. Geographic identifiers can be used to
1853 categorize data spatially in the context of a published list of place name codes, and in some cases can
1854 even be used to navigate place name hierarchies. Although geometric or geographic coordinates do
1855 not specify broad taxonomies for geographic data, Extent properties and their schemas provide a
1856 context in which information resources can easily be found within a given geographic context.

1857 The second main style of geographic or locational property is that of address. Although there
1858 may be many specialized uses for address (census, emergency response, routing, delivery, defining
1859 relative location or proximity) standardized constituent elements of a street address can support
1860 multiple use cases. ISO 19115, and its serialization in XML (ISO 19139), describe a contact address
1861 for geographic metadata that embodies these fundamental elements. Footnote? A draft National
1862 Address Content Standard is under review and reconciliation by the FGDC and its partner
1863 organization, the Urban and Regional Information Systems Association (URISA) to develop a multi-
1864 purpose address solution for use nationwide.

1865 Geographic data are also categorized using a set of Topic Categories from ISO 19115 that help
1866 to organize the content of the information resource by thematic or application domain. The use of
1867 Topic Category is compulsory in metadata records produced according to ISO 19115. These
1868 nineteen categories are expressed using a name and/or numeric code. Data may be classified in more
1869 than one category.

2.7.4.2   Data Sharing

1871 How organizations structure their data holding should enable various data partners to share
1872 information based on place or location. Organizing data to be accessed by location enables data sets

1873 to be reusable and geographically referenced. The effective benefits of sharing data in this manner
1874 include:

1875   ▪   Improving the ability to fuse disparate data types and providing a more
1876   comprehensive and holistic view of a particular problem set.

1877   ▪   Improving the ability to make connections and relationships based strictly on
1878   "where it is" and "what else is in the area."

1879   ▪   Enabling interoperability.

1880   ▪   Increasing communication and collaboration.

1881   ▪   Increasing productivity, saving time and money.

1882   ▪   Improving access to government.

1883 Geospatial information from different sources should be easy to integrate, combine, or use in
1884 spatial displays, even when sources contain dissimilar types of data (raster, vector, coverage, etc.) or
1885 data with disparate data element name schemas. For exactly this reason, the geospatial community
1886 has developed data sharing interface specifications that standardize on the data that is exchanged at
1887 the service itself, such as Web Map Service (WMS), Web Feature Service (WFS), and other Open
1888 Geospatial Consortium (OGC) specifications. By adhering to these guidelines, special displays and
1889 visualizations, for specific audiences and purposes, can be generated, even when many types of data
1890 and sources are required, all without the full extent of the data model being known.

1891 It is important here to make the distinction between the need to access primarily geospatial data
1892 for display or visualization purposes, versus data that must be exchanged and fully integrated with
1893 other well-defined data structures, such as relational database systems. In this case, well defined
1894 schema representations are needed. The framework data standard establishes common requirements
1895 for data exchange for seven themes of geospatial data that are of critical importance to the National
1896 Spatial Data Infrastructure (NSDI), as they are fundamental to many different Geographic
1897 Information Systems (GIS) applications. The seven geospatial data themes are: **geodetic control**,
1898 **elevation**, **orthoimagery**, **hydrography**, **transportation**, **cadastral**, and **governmental unit**
1899 **boundaries**. Framework data standards specify a minimal level of data content that data producers,
1900 consumers, and vendors are expected to use for the interchange of framework data, including
1901 through Web services.

1902 Business data, often in a tabular form, may have a relatively small spatial component, but is
1903 equally important in the need to ensure its exchange is accomplished in a standardized manner.
1904 Whenever the Federal Government standardizes on a common reference to describe an address,
1905 location or geographic theme, business data components must be reconciled with geospatial practices
1906 and the standards referenced within this profile.

1907 *2.7.4.3   Data Description*

1908 The most important concept to keep in mind when discussing the definition and use of data
1909 element standards is predictability. Adhering to common geospatial data standards, agencies will be
1910 able to: collect data once and use it often; warehouse geospatial data more effectively for various
1911 needs; and, better protect the privacy of individuals while improving access to non-restricted
1912 information.

1913 The expected benefits of developing geospatial data element definitions include:

1914 ■ Enabling effective sharing of information between collaborating partners -
1915   improving communication that, in turn, improves collections.

1916 ■ Reducing the amount of manual intervention in information processing and
1917   integration, which increases productivity and can reduce costs.

1918 ■ Providing a means for publishing the geospatial data element standards for the
1919   benefit of information exchange partners.

1920 ■ Streamlining access to geospatial information to improve knowledge-worker
1921   workflow.

1922 ■ Improving the quality, consistency, and interoperability of enterprise geospatial data
1923   assets and information.

1924 ■ Supporting the ongoing adoption of the use of standard geospatial data elements in
1925   coordination with any kind of application or system modernization.

1926 ■ Promoting the migration to a location-based services architecture, which will
1927   simplify the process for improving and extending production systems.

1928   This area includes two major components. The first is a standard approach to describing and
1929 documenting an agency's geospatial data resources. The second component is the actual definition of
1930 standardized geospatial data elements and constructs that is required for interoperability.

1931   The documentation of an agency's geospatial data resources has been achieved through the
1932 application of a geospatial metadata standard, the Content Standard for Digital Geospatial Metadata
1933 (CSDGM, 1998). In July 2003, ISO announced the approval and publication of ISO 19115,
1934 Geographic information - Metadata. Metadata is a term that refers to data about data. This standard
1935 establishes a common framework for communicating information about geospatial data sets. The
1936 standard includes mandatory elements as well as recommended or optional elements. This
1937 information includes: identification of sources and stewards; details about the data's organization
1938 including number and type of features, spatial reference, and attributes including description of each
1939 attribute and definitions of acceptable ranges of values; descriptions of data quality; use constraints;
1940 as well as information needed to successfully access, transfer and process the data. Adopting a
1941 uniform standard for metadata allows all users of geospatial data to locate and evaluate that data with
1942 a predefined set of criteria. Creating and using geospatial metadata provides: information about an
1943 organization's data holdings to data catalogues and clearinghouses; information needed to process
1944 and interpret data; and the descriptive information to allow an end user to choose the most
1945 applicable data set for their needs

1946   All federal government agencies are required to the extent practical to provide geospatial
1947 metadata that conform to this standard. Most state and many local governments have already
1948 adopted the FGDC metadata standard or a modified version of it. Also, nearly all state and federal
1949 geospatial data and metadata are publicly available. Utilizing this geospatial metadata standard allows
1950 developers to incorporate metadata components into their enterprise applications. This helps to
1951 facilitate the intergovernmental exchange of geospatial data and provides the information necessary
1952 to search for, assess, understand, and use geospatial data.

1953   The second component, Data Element Definition, addresses the need for high-quality,
1954 consistent data in support of the business functions of government. The life cycle of data begins with
1955 data definition and entry, continues through transactional, operational and decision support, and
1956 ends with obsolescence and/or archival of data. Structuring and controlling the definition of
1957 geospatial data elements as well as the geospatial components of other data will ensure consistent use
1958 in and across government. The mechanism for achieving this goal is predefined, meaningful,
1959 geospatial data elements that are clearly understood by all information systems. This would include

1960 spatial elements such as address, location, projection, linear reference system, and geographic areas
1961 such as counties, block groups, and legislative areas. This will reduce the difficulty of exchanging data
1962 and information including data designs, reduce re-training requirements, and foster a common
1963 approach to Data Management within government. By promoting the concept of federated data,
1964 government will benefit in the areas of reuse, accuracy, security and currency thus making the data
1965 more shareable than the historic model.

2.7.5 Example use of the GeoDRM

This sidebar will need to be updated to refer to the Wildfire scenario that is under development for all example sidebars.

This section outlines the use of the guidance in this GeoDRM in the context of the hurricane scenario in Appendix C. In order to support situational awareness and other operational planning, preparation, mitigation, response and recovery requirements, a certain amount of base map information is required. This base map information includes at least some of the following list of data:

- Ortho-rectified aerial photography or satellite imagery (both historical and current)

- Transportation networks (primarily road and rail networks, but also public transportation and inland waterway information)

- Utility networks—above-ground electric transmission lines, gas and water pipelines, storm and wastewater sewers

- Vegetation/Land Cover—vegetation type, structural type, sand/beach, etc.

- Demographics—population distribution (day and night-time distribution, if possible), socio-economic data (such as property values)

- Weather—hurricane track and intensity information (relates to predictive rainfall, wind speed, and storm surge information)

- Facilities of interest—Hospitals, fire stations, police stations, emergency operations facilities, sheltering locations (such as public buildings, schools, churches), and other critical infrastructure facilities (such as wastewater treatment, power generation/transmission facilities, hazardous material handling/usage)

- Response assets on the ground—emergency response personnel, emergency response apparatus (trucks, earth moving equipment, etc), command posts locations, fire stations, police stations, emergency operations facilities, etc.

- Alert or warning information—weather alerts and warnings, road condition alert (to include debris obstruction, damage, or destruction/failure information), etc.

In all of the above cases, both the data description and the data sharing mechanism must be known. The schema of the data elements (the data element definition) and the possible valid values of the individual schema elements must be known in order to facilitate understanding and use. Where possible, the data should be made available via content standards, such as the Content Standard for Digital Orthoimagery (FGDC-STD-008-1999), Vegetation Classification Standard (FGDC-STD-005), Utilities Data Content Standard (FGDC-STD-010-2000), or the emerging FGDC Framework Data Content standards. The alert and warning information should be made available using the OASIS Common Alerting Protocol version 1.0. In some of the above cases, content standards do not exist or they may not adequately cover the geospatial aspects of the data (for example, in the case

2002 of the location of emergency apparatus and personnel). These should be considered gaps and they
2003 should be filled by effort at the Federal, state, and local levels.

2004 Further, we should recognize that this information can come from many sources and that the
2005 data must be documented with appropriate metadata (as defined in the section on data description)
2006 using the Content Standard for Digital Geospatial Metadata (version 2.0), FGDC-STD-001-1998.
2007 Included in the metadata for the data should be documentation of online mechanisms for data
2008 sharing (such as availability as a web map or as feature data via common standard protocols like
2009 WMS, WFS, or even FTP). The metadata should be published into the NSDI via the mechanism
2010 described in Use Case 2, Scenario 2.1 (via the NSDI and specifically Geospatial One-Stop Portal, or,
2011 if the data is For Official Use Only, via some NSDI-compliant but secure information channel like
2012 the Homeland Security Information Network (HSIN)).

Appendix A: References

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[2] FEA Consolidated Reference Model Document, FEA PMO, May, 2005. http://www.whitehouse.gov/omb/egov/documents/CRM.PDF

[3] Service Component-Based Architectures, Version 2.0, Federal CIO Council, Architecture and Infrastructure Committee, June, 2004. http://www.cio.gov/documents/CIOC_AIC_Service%20Component%20Based%20Architectures%20_2.0_FINAL.pdf

[4] Enterprise Architecture Assessment v1.0 Frequently Asked Questions (FAQs), OMB FEA PMO, May, 2004. http://www.whitehouse.gov/omb/egov/documents/EA_Assessment_FAQs.PDF

[5] United States Department of Energy, Office of Management, Budget and Evaluation (OMBE); Enterprise Architecture: APPLICATION LAYER, December 30, 2003. http://www.mbe.doe.gov/ME2-5/I-MANAGE/OMBApplicationLayer.doc

[6] National Information Exchange Model (NIEM), a joint DOJ/DHS initiative. http://niem.gov/default.php

Appendix B: Terminology (Glossary)

2032 *NOTE: Thus far, only the SRM has contributed to this glossary. We need to gather the inputs to*
2033 *this glossary from the BRM, PRM, DRM, and TRM over the next weeks*

2034 *Some of these glossary entries will find their way into the FEA glossary (some even came from that*
2035 *source) or will be harmonized with those terms. Some will stay.*

2036 **Component** – 1) Independently deployable unit of software that exposes its functionality
2037 through a set of services accessed via well-defined interfaces. A component is based on a component
2038 standard, is described by a specification, and has an implementation. Components can be assembled
2039 to create applications or larger-grained components. [Source: CIO Council, FEA PMO]; 2) A self
2040 contained business process or service with predetermined functionality that may be exposed through
2041 a business or technology interface. [CIO Council, FEA PMO] (See Service Component)

2042 **Coverage** – 1) A coverage associates positions within a bounded space to a continuum of
2043 feature attribute values. Examples include a raster image or a digital elevation surface. [FGDC]; 2) A
2044 feature that associates positions within a bounded space (its spatiotemporal domain) to feature
2045 attribute values (its range). Geospatial coverages (including the special case of Earth images) are two-
2046 (and sometimes higher-) dimensional metaphors for phenomena found on or near a portion of the
2047 Earth's surface. A coverage can consist of a set of features or Feature Collections. Earth images are
2048 seen as Grid Coverages that contain features whose geometries are of type "set of cells" or "set of
2049 pixels" (surfaces). [OGC] (See Feature)

2050 **E-Business Patterns** – Patterns for e-business are a group of proven reusable assets that can be
2051 used to increase the speed of developing and deploying net-centric applications, like Web-based
2052 applications. [CIO Council, FEA PMO] (See Patterns)

2053 **Feature** – 1) The conceptual representation of a geographic entity, e.g., city, temperature, tree,
2054 bridge. [FGDC]; 2) The starting point for modeling of geographic information. Abstraction of a real
2055 world phenomenon. A digital representation of a real world entity or an abstraction of the real world.
2056 It has a spatial domain, a temporal domain, or a spatial/temporal domain as one of its attributes.
2057 Examples of features include almost anything that can be placed in time and space, including desks,
2058 buildings, cities, trees, forest stands, ecosystems, delivery vehicles, snow removal routes, oil wells, oil
2059 pipelines, oil spill, and so on. Features are usually managed in groups as feature collections. The
2060 terms feature and object are often used synonymously. The terms feature, feature collection and
2061 coverage are defined in line with OpenGIS. [OGC]

2062 **Geospatial** – 1) Referring to location relative to the Earth's surface. "Geospatial" is more precise
2063 in many geospatial information contexts than "geographic," because geospatial information is often
2064 used in ways that do not involve a graphic representation, or map, of the information. [Source:
2065 OGC]; also 2) Refers to the broad set of information and technology involved in measuring,
2066 modeling and exploiting the earth, natural and manmade features and other earth phenomena. [DHS]

2067 **Geospatial Service** – A Service that has geospatial data or information as a primary input
2068 and/or output. (See Geospatial Service Component)

2069   **Geospatial Service Component** – A Service Component (Component or Service) that has
2070   geospatial data or information as a primary input and/or output. (See Component and Geospatial
2071   Service)

2072   **Shared Service** – Architectural elements (business processes and/or technology components)
2073   that are used by multiple organizations within the enterprise. [FEA PMO] (See Service)

2074   **Service** – 1) Discrete unit of functionality that can be requested (provided a set of preconditions
2075   is met), performs one or more operations (typically applying business rules and accessing a data-
2076   base), and returns a set of results to the requester. Completion of a service always leaves business and
2077   data integrity intact. [CIO Council, FEA PMO]; 2) A computation performed by a software entity on
2078   one side of an interface in response to a request made by a software entity on the other side of the
2079   interface. A collection of operations, accessible through an interface, that allows a user to evoke a
2080   behavior of value to the user. [ISO]

2081   **Service Component** – 1) Modularized service-based applications that package and process
2082   together service interfaces with associated business logic into a single cohesive conceptual module.
2083   Aim of a Service Component is to raise the level of abstraction in software services by modularizing
2084   synthesized service functionality and by facilitating service reuse, service extension, specialization and
2085   service inheritance [CIO Council, FEA PMO]; 2) A Component; 3) One or more closely related
2086   Services. Within the context of the FEA SRM, a low-level software object/class does not qualify as a
2087   Service Component. A Service Component in the SRM has a clear functional business role and
2088   should be a shared resource for many enterprise users. (See Component and Service)

2089   **Service-Oriented Architecture (SOA)** – Architecture that provides for reuse of existing
2090   business services and rapid deployment of new business capabilities based on existing capital assets.
2091   [CIO Council, FEA PMO]

2092   **Pattern** - Frequently occurring combination of business and technical elements that can be used
2093   to deliver re-useable business services across the enterprise.

2094

Appendix C: Use Case

Scope and Purpose

One of the primary goals in developing the Federal Enterprise Architecture is to design information systems that work well together, leading to better, quicker decision making at lower cost. This section provides business and functional context to the FEA Geospatial Profile by introducing a set use cases and scenarios that illustrate how this profile, when properly implemented, can support interoperability and data re-use across agencies and levels of government.

NOTE: The other sections of this profile will utilize the material provided here as a borrowing ground for examples and should also provide input back to this section in ways that the use cases can more directly support the documentation requirements of the other sections.

Definitions

*"In software engineering, a **use case** is a technique for capturing the potential requirements of a new system or software change. Each use case provides one or more **scenarios** that convey how the system should interact with the end user or another system to achieve a specific business goal. Use cases typically avoid technical jargon, preferring instead the language of the end user or domain expert. Use cases are often co-authored by software developers and end users[8]."*

In the FEA Geospatial Profile, we will adopt the basic definition above with the following adjustments:

Master Use Case—an abstract, high-level use case that is intended to provide a business requirements context for the use cases that will be used in the FEA Geospatial Profile.

Use Case—a more concrete use case that is intended to provide a functional requirements content for the FEA Geospatial Profile effort by looking at a hypothetical system within the Master Use Case business context.

Scenario—an element of a use case that conveys how a hypothetical system should interact with the end user or another system to achieve a specific use case sub-functional goal.

Master Use Case

This section provides a complete description of the Master Use Case for the FEA Geospatial Profile. It includes background on the following lines of business and then outlines use cases in an industry-standard fashion:

The Disaster Management Line of Business and the Emergency Response sub-function and then proceeds to outline the use case in industry-standard use case fashion.

Background—Scenario Lines of Business

The following descriptions of Lines of Business from the FEA BRM are provided for immediate context:

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[8] Wikipedia, http://en.wikipedia.org/wiki/Use_case, July 2005

"Disaster Management—involves the activities required to prepare for, mitigate, respond to, and repair the effects of all disasters, whether natural or manmade.

- **Disaster Monitoring and Prediction** *involves the actions taken to predict when and where a disaster may take place and communicate that information to affected parties. Note: Weather forecasting, while central to Disaster Monitoring and Prediction, is more closely aligned with the "Environmental Monitoring and Forecasting" sub-function in the Environmental Management Line of Business.*

- **Disaster Preparedness and Planning** *involves the development of response programs to be used in case of a disaster as well as pre-disaster mitigation efforts to minimize the potential for loss of life and property. This involves the development of emergency management programs and activities as well as staffing and equipping regional response centers, and mitigation focused construction and preparation.*

- **Disaster Repair and Restore** *involves the cleanup and restoration activities that take place after a disaster. This involves the cleanup and rebuilding of homes, buildings, roads, environmental resources, or infrastructure that may be damaged due to a disaster.*

- **Emergency Response** *involves the immediate actions taken to respond to a disaster. These actions include, but are not limited to, providing mobile telecommunications, operational support, power generation, search and rescue, and medical life-saving actions.*[9]*"*

"Community and Social Services—includes all activities aimed at creating, expanding, or improving community and social development, social relationships, and social services in the United States.

- **Community and Regional Development** *involves activities designed to assist communities in preventing and eliminating blight and deterioration, assist economically distressed communities, and encourage and foster economic development through improved public facilities and resources..*

"Health—involves federal programs and activities to ensure and provide for the health and wellbeing of the public. This includes the direct provision of health care services and immunizations as well as the monitoring and tracking of public health indicators for the detection of trends and identification of widespread illnesses/diseases. It also includes both earned and unearned health care benefit programs.

- **Health Care Research and Practitioner Education** *fosters advancement in health discovery and knowledge. This includes developing new strategies to handle diseases; promoting health knowledge advancement; identifying new means for delivery of services, methods, decision models and practices; making strides in quality improvement; managing clinical trials and research quality; and providing for practitioner education."*

In the Master Use Case for the FEA Geospatial Profile, we will focus on the Disaster Preparedness and Planning and Emergency Response sub-functions. These sub-functions are strong Master Use Case candidates because:

- Disaster preparedness, disaster planning, and emergency response often requires multi-level, multi-agency, multi-jurisdictional collaboration and support and thus provides excellent business and functional context for the information sharing and interoperability in a geospatial context.

- Emergency response has a heavy command and coordination element and thus provides excellent business and functional context for a situational awareness capability to deliver a

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[9] OMB, *FY07 Budget Formulation: FEA Consolidated Reference Model Document*, May, 2005.

2170 location-based understanding of response resources including their disposition and
2171 movements.

2172 • Disaster preparedness, disaster planning, and emergency response often depends on
2173 understanding the interaction of disaster-related phenomena and the natural and built
2174 environment and thus requires a comprehensive, geospatially-enabled understanding of both
2175 of these elements. This provides excellent functional and business context for the use of
2176 science-based models as they relate to the event at hand.

2177 • Disaster preparedness, disaster planning, and emergency response is covered by a vast and
2178 well-known body of lessons learned and standard operating procedures, including the
2179 National Incident Management System (NIMS) and the National Response Plan (NRP), that
2180 provide an excellent framework of documentation that we can reuse in our use cases.

2181 While the focus will be on Disaster Preparedness, full understanding of the architecture's
2182 significance requires looking beyond this one Line of Business. In this scenario we look at the
2183 community in which the event occurs to see how Community and Regional Development efforts are
2184 informed and enhanced, and we look at Health Care Research to examine how information from a
2185 disaster should make its way into research databases.

Background—Catastrophic Incidents

2187 A catastrophic incident, as defined by the NRP, is any natural or manmade incident, including
2188 terrorism, which results in extraordinary levels of mass casualties, damage, or disruption severely
2189 affecting the population, infrastructure, environment, economy, national morale, and/or government
2190 functions. A catastrophic incident could result in sustained national impacts over a prolonged period
2191 of time; almost immediately exceeds resources normally available to State, local, tribal, and private-
2192 sector authorities in the impacted area; and significantly interrupts governmental operations and
2193 emergency services to such an extent that national security could be threatened. All catastrophic
2194 incidents are Incidents of National Significance. These factors drive the urgency for coordinated
2195 national planning to ensure accelerated Federal/national assistance.

2196 The Catastrophic Incident Annex to the National Response Plan (NRP-CIA) establishes the
2197 context and overarching strategy for implementing and coordinating an accelerated, proactive
2198 national response to a catastrophic incident.

2199 The NRP-CIS provides a list of the specific actions that are initiated upon activation of the
2200 NRP-CIA. The following Federal departments and agencies and other organizations are assigned
2201 specific responsibilities as cooperating agencies:

2202 • Department of Agriculture

2203 • Department of Defense

2204 • Department of Energy

2205 • Department of Health and Human Services

2206 • Department of Homeland Security

2207 • Department of Transportation

2208 • Department of Veterans Affairs

2209 • Environmental Protection Agency

2210   •   American Red Cross

2211   Departments and agencies assigned primary responsibility for one or more functional response
2212 areas under the NRP-CIS appendixes are identified below.

2213   •   **Mass Care:** American Red Cross

2214   •   **Search and Rescue:** Department of Homeland Security

2215   •   **Decontamination:** Department of Homeland Security, Environmental Protection Agency,
2216   and Department of Health and Human Services

2217   •   **Public Health and Medical Support:** Department of Health and Human Services

2218   •   **Medical Equipment and Supplies:** Department of Health and Human Services

2219   •   **Patient Movement:** Department of Health and Human Services and Department of
2220   Defense

2221   •   **Mass Fatality:** Department of Health and Human Services

2222   •   **Housing:** Department of Homeland Security

2223   •   **Public and Incident Communications:** Department of Homeland Security

2224   •   **Transportation:** Department of Transportation

2225   •   **Private-Sector Support:** Department of Homeland Security

2226   •   **Logistics:** Department of Homeland Security

2227 **Background—Command and Coordination Hierarchy and Function**

2228   Figure 12 depicts the elements and function of the command and coordination hierarchy from
2229 the National Response Plan. The elements in blue are activated in the event of an Incident of
2230 National Significance, like a Catastrophic Incident. The white elements are activated when the
2231 complexity of the incident and incident management span-of-control considerations so dictate.
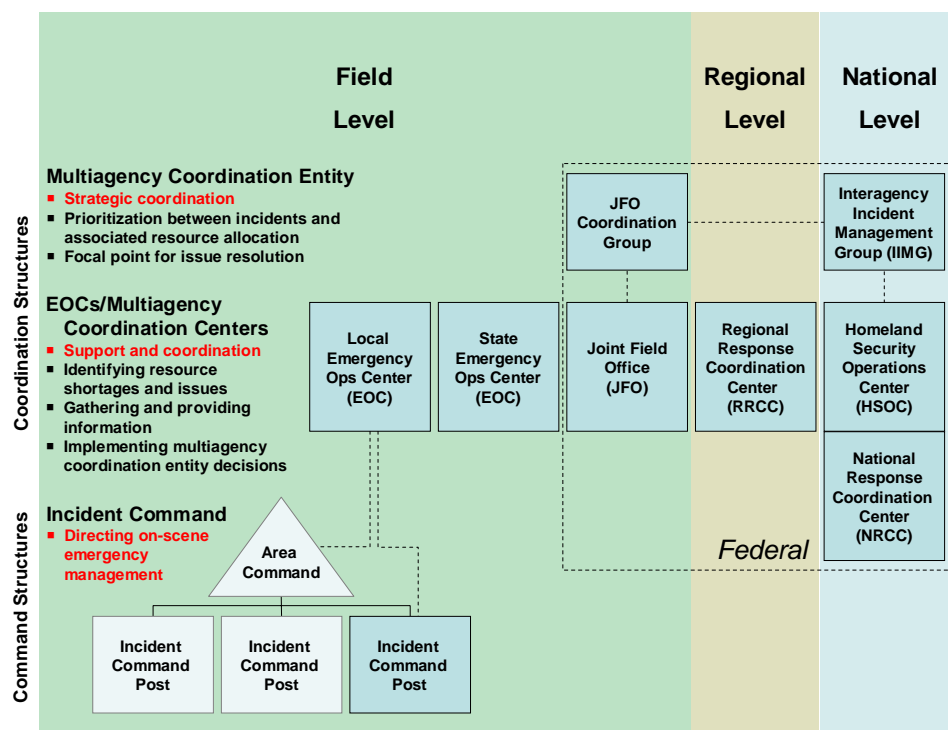
Figure 12: Command and Coordination Hierarchy[10]

Master Use Case

Name:

Disaster preparedness, disaster planning, and emergency response

Description

This Master Use Case brings together several use cases that might contribute to an overall view of the planning and preparation for and response to a major hurricane event. It is intended only for illustrative purposes within this geospatial profile and thus does not consider all possible use cases.

Pre-condition

This use case contemplates the following pre-conditions:

- A National Spatial Data Infrastructure exists that includes the ability to find and access geospatial data holdings (public and FOUO) of all Federal, State, Local, and Tribal government entities.

- A Situational Awareness System is in place and is deployed and/or deployable with all elements of the command and coordination hierarchy.

- Advanced location determination technology is deployed with emergency response personnel and apparatus.

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[10] DHS NIMS Integration Center, *National Incident Management System Overview Briefing*, May 2005

2250   • A hurricane event, Hurricane Doug, is occurring that threatens life and property in the
2251   already saturated and thus flood prone mid-Atlantic region of the United States.

2252   • Others TBD

Basic Course of Events

2253

2254   • Use Case 1—Provide Situational Awareness

2255   o Scenario 1.1—Connect with local sources of situational data

2256   o Scenario 1.2—Provide current disposition of emergency response apparatus

2257   • Use Case 2—Provide Base map and other required Geospatial Information

2258   o Scenario 2.1—Publish metadata holdings into the NSDI

2259   • Use Case 3—Provide Location-based Services

2260   o Scenario 3.1—Route Response Resources

2261   • Use Case 4—Wrap-up activities

2262   o Scenario 4.1—Record and archive data about the event

2263   o Scenario 4.2—Monitor ongoing environmental factors

2264   • Use Case 5—Redevelopment and Recovery

2265   o Scenario 5.1—Target stricken areas for redevelopment

2266   o Scenario 5.2—Apply to aid programs

2267   o Scenario 5.3—Track recovery success

Alternate Paths

2268

2269   None.

Post-condition

2270

2271

2272   **Post-condition**

Use Case 1—Provide Situational Awareness

2274   **Background**

2275   **Use Case**

2276   *Name:*

2277   *Description*

2278   *Pre-condition*

2279   *Basic Course of Events*

2280   *Alternate Paths*

2281   *Post-condition*

Use Case 2—Provide Base map and other required Geospatial Information

2283   **Background**

2284   **Use Case**

2285   *Name:*

2286   *Description*

2287   *Pre-condition*

2288   *Basic Course of Events*

2289   *Alternate Paths*

2290   *Post-condition*

Use Case 3—Provide Location-based Services

2292   **Background**

2293   **Use Case**

2294   *Name:*

2295   *Description*

2296   *Pre-condition*

2297   *Basic Course of Events*

2298   *Alternate Paths*

2299   *Post-condition*

Use Case 4— Wrap-up activities

2301   **Background**

2302   **Use Case**

2303   *Name:*

2304   *Description*

2305   *Pre-condition*

2306   *Basic Course of Events*

2307   *Alternate Paths*

2308   *Post-condition*

Use Case 5— Redevelopment and Recovery

2310   **Background**

2311   **Use Case**

2312   *Name:*

2313   *Description*

2314   *Pre-condition*

2315   *Basic Course of Events*

2316   *Alternate Paths*

2317   *Post-condition*

2318

2319

Appendix D: Geospatial Activity Examples for FEA BRM Lines of Business

> NOTE: *This table is a very preliminary draft and has not been vetted by the BRM Team.*

Business Area	Lines of Business	Currently use or create Geospatial Data or Services as a Primary or Secondary Element	Use of Geospatial data and applications
Services for Citizens	Homeland Security	Primary—protecting the nation against terrorist attacks. This includes analyzing threats and intelligence, guarding borders and airports, protecting critical infrastructure, and coordinating responses to emergencies	Entirely Geospatial based in its activities. Relies on foundation data from other agencies and creates its own data to be used in conjunction with the foundation data to plan and conduct operations. Much of the planning and conduct is improved buy direct use of geospatial tools such as digital maps displays, GIS, satellite and airborne imagery processing, GPS locations, etc.
Services for Citizens	Intelligence Operations	Primary—collecting and analyzing information to meet the national security challenges of the U.S. by processing reliable, accurate foreign intelligence, and disseminating intelligence products to policymakers, military commanders, and other consumers	Entirely Geospatial based in its activities. Creates its own foundation data and uses data from other to plan and conduct operations. Much of the planning and conduct is improved buy direct use of geospatial tools such as digital map displays, GIS, satellite and airborne imagery processing, GPS locations, etc.
Services for Citizens	Defense & National Security	Primary—involves information to understand the needs for where to establish national and multinational military objectives; sequence initiatives; define limits and assess risks for the use of military and other instruments of national power; developing global plans or theater war plans to achieve these objectives.	Entirely Geospatial based in its activities. Creates its own foundation data and has multiple agreements to procure it from other countries and agencies all used to plan and conduct operations. Much of the planning and conduct is improved buy direct use of geospatial tools such as GIS, satellite and airborne imagery processing, GPS locations.

Services for Citizens	International Affairs and Commerce	Primary - the non-military activities that promote U.S. policies and interests beyond our national borders, including the negotiation of conflict resolution, treaties, and agreements. Also includes: foreign economic development and social/political development; diplomatic relations with other nations; humanitarian, technical and other developmental assistance to key nations; and global trade	Entirely Geospatial based in its activities: If it is not somewhere else it is not international. But much of the 'geospatial' is handled manually and does not require either digital data or applications. Used commonly in conflict resolution, foreign economic development and social / political development. Typically depends on other sources for its foundation data, but may create its own where none exists. Planning and conduct is often improved by direct use of geospatial tools such as GIS, satellite and airborne imagery processing, GPS locations.
Services for Citizens	Disaster Management	Primary—involves information to conduct the activities required to prepare for, mitigate, respond to, and repair the effects of all disasters, whether natural or manmade regardless of where the threat may come from or the disaster may occur.	Entirely Geospatial based in its activities. Relies on other agencies and levels of government for some of its foundation data, but also creates some itself where not otherwise available. Much of the planning and conduct is improved buy direct use of geospatial tools such as digital map displays, GIS, satellite and airborne imagery processing, GPS locations, etc. Routing, damage prediction, asset allocation are common uses.
Services for Citizens	Law Enforcement	Primary—activities to protect people, places, and things from criminal activity resulting from non-compliance with U.S. laws. This includes patrols, undercover operations, response to emergency calls, as well as arrests, raids, and seizures of property.	Geospatial based in that law enforcement is organized according to governmental unit boundaries, but much is handled without the need for digital data or applications. Crime tracking and prediction is gaining significance as is routing for the dispatch of emergency vehicles.
Services for Citizens	Education	Primary—Activities for all government programs that promote the education of the public, including formal school, college, university or other training program at any location.	Primarily non geospatial – management is usually divided by geographic district, but tracking of results and tailoring of programs based on that can be done without digital data or tools. Geospatial tools such as GIS may be used to determine catchment boundaries for schools and routing for school buses. Typically

			makes its own data, but could easily transition to dependence on others for foundation data – creating its own my geolocating data that it already has (addresses for instance)
Services for Citizens	Energy	Primary—all actions performed by the government to ensure the procurement and management of energy resources, including the production, sale and distribution of energy, as well as the management of spent fuel resources.	Primarily non geospatial – though many things they do depend entirely on location whether it is siting of man made facilities such as powerplants and the location of natural resources such as coal, oil, and natural gas deposits. At the highest levels digital data and tools are useful for presentations, but at the working level they are necessary to best conduct there work: a coal seam 100 miles from the nearest railroad is harder to mine than one 5 miles from a railroad.
Services for Citizens	Environmental Management	Primary—all functions required to monitor the environment and weather, determine proper environmental standards and ensure their compliance, and address environmental hazards and contamination.	Entirely geospatial based – depends on others for some of its foundation data, but creates its own data for the bulk of its work – connecting its data to geographic locations and then using that interaction in its work. Heavy user of digital data and tools including GIS, remotely sensed imagery, GPS and 'location' of other sensors such as water temperature and turbidity, atmospheric pollutants, etc.
Services for Citizens	Health	Primary—federal programs and activities to ensure and provide for the health and wellbeing of the public including the direct provision of health care services and immunizations as well as the monitoring and tracking of public health indicators for the detection of trends and identification of widespread illnesses/diseases	Primarily non geospatial, though learned that it does care recently with the shortage of flu vaccine – how did it get allocated to where? In edition epidemiology is using location to track and 'manage' disease itself. . Typically makes its own data, but could easily transition to dependence on others for foundation data – creating its own my geolocating data that it already has (addresses for instance)
Services for Citizens	Natural Resources	Primary—all activities involved in conservation planning, land management, and national park/monument tourism that affect the nation's	Entirely geospatial based – depends on others for some of its foundation data, but creates its own data for the bulk of its work – connecting its data to

		natural and recreational resources, both private and federal	geographic locations and then using that interaction in its work. Heavy user of digital data and tools including GIS, remotely sensed imagery, GPS and 'location' of other sensors such as water temperature and turbidity, atmospheric pollutants, etc.
Services for Citizens	Community and Social Services	Primary—information about location for activities aimed at creating, expanding, or improving community and social development, social relationships, and social services in a community in the United States. This includes all activities aimed at locality-specific or nationwide social development and general social services.	Primarily non geospatial, though it does analyze some of its functions by location. Typically buys its data and adds from its own database such things as addresses. Light user of digital data and tools.
Services for Citizens	Economic Development	Primary—information to know where to promote commercial/industrial development and to regulate the American financial industry to protect investors nationally. It also includes the management and control of the domestic economy and the money supply, and the protection of intellectual property and innovation across the nation.	Rural Development needs to incorporate geospatial technologies and data into its business processes to respond and recover from natural disasters or terrorist activity. In the event of one of these occurrences responders need current, accurate, and easily accessible information to ensure the readiness of Rural Development to respond. Geospatial information is also an important component in strategy development, the mapping and analysis of funded assets at risk, and agency resources. During response and recovery, geospatial information is used to provide a dynamic common operating picture, coordinate and track emergency assets, understand event impacts, accurately estimate damage, locate safety zones, and facilitate recovery.

Rural Development also needs to incorporate geospatial technologies and data into its business processes to better serve its customers. Publishing Rural Development geospatial resources on results |

			from programs and projects to enhance rural investment and avoid redundant expenditures of time, effort, and effort by applicants and borrowers."
Services for Citizens	General Science and Innovation	Secondary—all federal activities to meet the national need to advance knowledge in general research and technology programs, space exploration activities, and other research and technology programs that have diverse goal	Non geospatial agency that uses 'location' more as an allocation mechanism for its work than for the work itself.
Services for Citizens	Correctional Activities	Secondary—federal activities that ensure the effective incarceration and rehabilitation of convicted criminals	Non geospatial agency that uses digital data and tools to site future facilities.
Services for Citizens	Litigation and Judicial Activities	Secondary—activities relating to determining an issue of fact and reaching a decision based on that evidence, determining a legal question or matter or attempting to prove guilt/responsibility	Non geospatial agency that could provide digital data to law enforcement: where did the convicted person come from?
Services for Citizens	Income Security	Secondary—activities designed to ensure that members of the public are provided with the necessary means – both financial and otherwise – to sustain an adequate level of existence. This includes all benefit programs, hat promote these goals for members of the public	
Services for Citizens	Workforce Management	Secondary—those activities that promote the welfare of the nation's workforce by improving their working conditions, advancing opportunities for profitable employment, and strengthening free collective bargaining	
Services for Citizens	Transportation	Primary—all federally supported activities related to the safe passage, conveyance, or transportation of goods and/or people including air, ground, water and space operations	Entirely geospatial in its work, though much can be done without digital data or tools. Allocation of funds by state or congressional district does not require geospatial data, but evaluation of a proposed roadway would. Depends on others for some of its

			foundation data, but creates its own data for the bulk of its work – connecting its data to geographic locations and then using that interaction in its work. Heavy user of digital data and tools including GIS, remotely sensed imagery, GPS and 'location' of other sensors such as traffic load.
Support Delivery of Services	Legislative Relations	Secondary—activities aimed at the development, tracking, and amendment of public laws through the legislative branch of the federal government	Codification of objective criteria for needed geographic distribution of assistance
Support Delivery of Services	Regulatory Development	Secondary—involves activities associated with developing regulations, policies, and guidance to implement laws	Determination of program funding eligible areas.
Support Delivery of Services	Public Affairs	Secondary—the exchange of information and communication between the federal government, citizens and stakeholders in direct support of citizen services, public policy, and/or national interest	Outreach to potential applicants for assistance in underserved areas or among populations.
Support Delivery of Services	Planning and Resource Allocation	Secondary—the activities of determining strategic direction, formulating and executing budgets, identifying and establishing programs for defining and allocating the organizational workforce and technology requirements among those programs and processes	Targeting of funding decisions to maximize their effectiveness, planning for deployment of emergency assistance resources
Support Delivery of Services	Revenue Collection	Primary—includes the collection of government income from all sources. Except for tax collection which is accounted for in General Government	Evaluation of any patterns of loan delinquencies
Support Delivery of Services	Internal Risk Management and Mitigation	Primary—all activities relating to the processes of analyzing exposure to risk in the event of a catastrophic or damaging event and determining appropriate countermeasures	Assessment of risk from environmental or economic hazards in specific areas or of specific projects
Support Delivery of	Controls & Oversight	Primary—operations and programs of the federal government and its external business partners	Discovery and response to geographic patterns of fraud or identification of waste or fraud by a single

Services		determine the effectiveness of and the extent to which they comply with applicable laws and regulations and prevent waste, fraud, and abuse	entity across similar geographic areas.
Support Delivery of Services	General Government	Primary—general overhead costs of the federal government, including legislative and executive activities; provision of central fiscal, personnel, and property activities; and the provision of services that cannot reasonably be classified in any other Line of Business. Includes Tax Collection	Tracking, geocoding, and real-time internet mapping of agency facilities and resources so that the data can be added to other internet mapping applications for emergency preparedness or disaster response.
Management of Government Resources	Financial Management	Secondary—The use of financial information to measure, operate and predict the effectiveness and efficiency of an entity's activities in relation to its objectives. The ability to obtain and use such information is usually characterized by having in place policies, practices, standards, and a system of controls that reliably capture and report activity in a consistent manner	Tracking and allocation of grants and/or contract dollars
Management of Government Resources	Human Resource/Resource Management	Secondary—all activities associated with the recruitment and management of personnel	Locations of academic centers of excellence for targeted recruitment in relationship to recruiting personnel.
Management of Government Resources	Administrative Management	Primary—the day-to-day management and maintenance of the internal infrastructure. Includes the maintenance and operation of office buildings, fleets, machinery, and other capital assets; the physical protection of an organization's personnel, assets, and facilities and business related travel for an organization's employees	Phone/network/cubicle management; personnel rosters by facility for emergency evacuation purposes
Management of Government Resources	Information and Technology Management	Secondary—involves the coordination of information and technology resources and systems required to support or provide a service	Facility/personnel locations in planning network/bandwidth leasing

Management of Government Resources	Supply Chain Management	Primary—the purchasing, tracking, and overall management of goods and services	Tracking shipments of sensitive cargo; manifest tracking/management.

2322

2323   Appendix E: Geospatial Business Language

2324   The *Geospatial Business Language* defined herein consists of the key terminology used to define the role of geospatial in the Federal Enterprise
2325 Architecture (FEA) context. These terms are intended as a starting place for agencies to use in defining their enterprise architectures and specifically
2326 their Business Functions (see Enterprise Architecture Glossary of Terms). More than a glossary, these definitions form the basis for a consistent
2327 language, a *lingua franca* for describing the role of geospatial in all Business Functions. Further, these terms are used to construct the *Geospatial Business*
2328 *Statements*, which describe the role of geospatial for each of the Business Functions (See GeoBRM).

2329   The *Geospatial Business Language* is comprised of five basic types of terms:

2330   ■ **Application** – A computer program with a user interface or computer program component that employs geospatial data and
2331   technology; a geospatial business process or sub-process that is implemented as a software program or program component.

2332   ■ **Data** – A geospatial information class, type or property.

2333   ■ **Function** – A geoprocessing unit; a geoprocessing user tool; a geospatial service component.

2334   ■ **Process** – A general business series of actions that employs geospatial data and technology.

2335   ■ **Technology** – An application of science that generates, displays, manages or otherwise processes geospatial data. (Excluding general-
2336   purpose Information Technology.)

Geospatial Term	Type	Definition/Description
Absolute Location	Data	Specifies a precise position on the earth. Defined by an address, position, feature geometry (e.g., point, line or polygon), or Place of Interest. A subtype of Location Object.
Activity	Data	Any current, historical or planned event of interest with geospatial context (location/time, extent, geographic, national), or a temporal series of actions with a series of geospatial contexts.
Activity	Process	An agency business activity. A process or sub-process involving one or more elements of the agency enterprise architecture.
Activity Report	Data	Reports that contain the geospatial-temporal context of any agency function. Reports contain interlinked, multi-media data that characterize the nature, context and status of the function.
Activity Report Service	Technology	Able to generate an Activity Report for any location-based function.
Address	Data	Specifies street location, postal location or street intersection as used in navigation and locating parties and facilities. Address consists of a street address (or intersection), place name (e.g., country, municipality, etc.), postal code, street locator, building locator, and supplemental address information. Addresses are the means of referencing primarily residences and buildings (of all types).
After Action Report	Data	The geospatial-temporal context of post-incident/event lessons learned in location-based account form. Based upon understanding of the root cause, status of recovery and recommended actions. Detailed accounts (reports) contain interlinked, multi-media data that adequately characterize the nature and context of the incident/event. Detailed accounts (reports) may contain references to plans, maps and other reports.
After Action Report Service	Technology	Able to generate a detailed account (After Action Report) with the geospatial context of the root cause, status and recommendations pertaining to post-incident recovery operations.
Alert	Data	A communication message with geospatial and temporal context that is triggered by any suspicious or threatening event. Can be determined by evaluating observed or calculated conditions through a "watch" function, an output from a modeling and simulation activity, by correlating incidents, occurrences and/or intelligence and predicting a potential threat or threat condition. Example: A sensor alert that results from one or more observations that meet predefined 'threat detection' conditions. Alerts may lead to false alarms or develop into Warnings (as determined by a qualified party).
Alert-Warning Report Service	Technology	Able to generate a communication message with a detailed account (Alert-Warning Report) containing information about location-based alert or warning messages.
Area of Interest (AOI)	Data	A defined parameter (circle, bounding box, or polygon representing a region of concern. Generally, any area of interest within the mission. Used as a search parameter or can be displayed. A designated area of interest in an application.
Assessment	Data	Generally, the results of analysis pertaining to a topic of interest, such as a threat, threat consequence, risk, vulnerability, etc. The geospatial-temporal context of geospatial analysis results, which includes supporting facts, interpretations, hypotheses and projections. May consist of maps, annotated images, reports, plans, etc.
Asset	Data	A valuable item that is owned. Generally, any equity used in agency operations.

Asset Inventory	Data	The management data associated with equities (Assets).
Asset Inventory Management	Application	Enterprise-level application(s) that is used to manage fixed and mobile equities (Assets). In particular, to monitor and track the location/time/identity/activity/status for a set of equities (Assets).
Audit Trail	Data	A history of significant geoprocessing operations. e.g., Records of geospatial database update operations (what, when, where).
Auxiliary Data	Data	Any geospatial information of value to the mission that are not available as Framework Data, but are directly accessible to the Enterprise Architecture through sharable external resources. Information (data) used in support of the agency mission that are available from all possible sources. Collection is triggered by significant incidents. Information (data) may not have been merged or integrated in order to conform to or be consistent with any National standards.
Background Check (Records)	Data	The geospatial context associated with historical analysis, examination or exploration.
Base	Data	The foundational data required for generating multi-purpose maps and other geospatial products. The data that comprise a Base Map. May consist of one or more features and/or coverages. All Base data should be registered to a common coordinate reference system.
Base Map	Data	A multi-purpose representation of the earth (or portion thereof) that conveys general geospatial context, as depicted by predominant geographic features.
Benefit (Records)	Data	The compensation for a party. Privileges that are granted or provided by the government. Also medical compensation (Benefits), including medical care and crisis counseling, and relief compensation (Benefits), including assistance to victims and their families for emergency relief.
Biographical	Data	The geospatial vita for persons (e.g., physical address, place of birth, citizenship, person/organization affiliations, residence history, travel history, etc).
Biographical Analysis	Application	The means to examine a person (records) in conjunction with other geospatial data, including events, person/organization affiliations, incidents, threats and intelligence data.
Capital Asset	Data	Capital assets are land, structures, equipment, and intellectual property (including software) that are used by the Federal Government and have an estimated useful life of two years or more. Examples include: easements, rights of way, buildings, facilities, and other structures. The geospatial records describing these assets.
Cargo (Records)	Data	Current, historical, and predicted location/time/identity/activity/status (e.g., tracked location, route, speed, direction, conveyance, etc.) of payload/freight/shipment/goods and their containers. Includes geospatial context of shipping manifest records (i.e., identification of organization/place of manufacture, place of shipping origin, destination, shipping route, etc.) Includes identity, location, time and status for seized cargo. Cargo locations may relate to mobile conveyances or fixed locations (cargo may be in a warehouse, pier, wharf, etc.)
Case (Records)	Data	Generally, all information (records) associated with an investigation. As used here, specifically the geospatial context (location/time/identity/activity/status) pertaining to an investigation. Current, historical, and predicted geospatial context (tracking) for persons, organizations, incidents, occurrences, conveyances, cargo, etc., as associated with an investigative case. Includes location/time/identity/activity/status for related confiscation and seizures of goods, assets, conveyances, etc., and current and

		historical locations associated with evidence. May reference conveyance, risk (threat), event (incident, occurrence, Event), or party (person or organization) records.
Case Analysis	Application	Generally the evaluation of all information (records) associated with an investigation. The means to (data) mine, integrate, and correlate varied types of case-related data for the purpose of extrapolating, analyzing and deriving geospatial data in the form of profiles, patterns, trends, networks, tendencies, indicators, hypotheses, and conclusions, as it pertains to case understanding. Source data include, but are not limited to, intelligence, incidents, occurrences, criminal and suspicious activities, financial transactions, persons, organizations, goods, cargo, hazmat, conveyances, etc. May also involve geoparsing and geocoding functions to scan and annotate associated textual data for geographic and temporal references.
Catalog Service	Technology	The Catalog Service defines common information models and standard operations that allow applications and services to interact with registry instances, regardless of their role or content, in order to discover, access and manage geospatial resources (data and services). Specialized Catalog Services may exist for specific data classes, e.g., an Image Catalog Service (ICS).
Change detection	Function(s)	The assessment of alterations to features or coverages over time to support geospatial/intelligence analysis. This is often accomplished using a time-series of imagery to identify areas or features where any detected change may have occurred. Change is characterized in the spatial-temporal domain. Change may be represented as an alteration in location, identity, activity or status.
Citizenship	Data (Property)	A person's country of origin or home country, as established through naturalization.
Collaboration	Function	The means to share information and interact with common resources (data, services and applications). [More than merely sharing data.] Involves timely dissemination of the right actionable information to actors in an operational setting, and thus depends upon interoperable communications to all parties (cross-jurisdictional) and to all operational nodes, including the field. Effective collaboration functions are optimized in terms of the duplication/distribution of shared, collaborative resources.
Collaboration (Geospatial)	Process	(Geospatial) collaboration refers to the process of sharing and interacting with common resources that are based on geospatial data, service and application (business) standards, supporting interoperations across all levels of government and private institutions. Collaboration is enabled by collaborative technologies that are based upon common standards for geospatial data, services and applications.
Collection Plan	Data	The planned schedule, tasking and resource allocations pertaining to a given assemblage asset, asset mission and set of assemblage requirements for geospatial data, imagery or intelligence.
Collection Requirements	Data	Requests for geospatial data (including remote sensing) and intelligence, including location and geospatial extent of collection area of interest, observables and required geospatial attributes or properties, which can then be converted into data requests for known collection methods and systems.
Communication	Data	Correspondence, outreach content, warnings or alerts.
Community of Interest (COI)	Data	A group of enterprise users who share common data, services and/or business processes. Communities of Interest (COIs) defines the semantics for sharing enterprise resources. These semantics (ontology) form the basis for achieving autonomous, robust interoperability throughout the enterprise.
Containment Area	Data	The geospatial extent of a target geospatial boundary to contain an incident, and the impact and consequences of the incident.

Contingency Plan	Data	A program of action designed for handling possible future circumstances or events. Geospatial and temporal context for contingency plans associated with any plan or operation.
Conveyance (Records)	Data	A vehicle, vessel, boat, aircraft, truck, or other mode of transportation that is able to transport cargo or passengers. The records for description, tracking and monitoring of conveyances (aircraft, marine vessels, motor vehicles, trains). Includes identity (digital records of credentials, owner's address, etc.) and other tracking and monitoring information. Tracking and monitoring of conveyances produces current, historical and future (planned or projected) location/time/identity/activity/status data. These records may include travel history, travel itinerary, shipping manifest and license/permit information. May reference events (occurrences, incidents, events), cases, persons and organizations.
Coordinate Reference System	Data	A function that associates locations in space to geometries of coordinate tuples in a mathematical space, usually a real valued coordinate vector space, and conversely associates coordinate values and geometries to locations in the real world, e.g., geographic coordinates (latitude, longitude) and Universal Transverse Mercator (UTM) (projected coordinates).
Coordinate (and Unit) Transformation Service	Technology	The ability to convert geospatial data between different coordinate reference systems, datums and units. Support map re-projections on-the-fly for map viewing, as well as permanent coordinate conversions that result in a converted output data set.
Common Operating Picture (COP)	Data/ Technology	The collective set of time-sensitive, mission-critical, shared resources (data and services). Contains geospatial context (a composite of Framework Data and Auxiliary Data), the disposition and nature of threat(s), friendly personnel and assets, as well as incidents, events, observations, related intelligence, and other relevant agency operations data. A COP represents a collaborative workspace for interoperations between all distributed actors in support of time-sensitive, mission-critical agency operations. It is not practical to consider a COP as merely a common data view. Rather, many possible views may be generated on the fly for a given mission and/or user (depending on associated services, available data and application context). Related to the COP, MSOP is a collaborative workspace comprised of the subset of shared COP resources that are required for a mission, with additional resources that are unique to the mission. The User-Specific Operating Picture (USOP) is an actionable data view of the MSOP that is specialized for a user, in a specific role, on a specific device.
COP Collaboration Server	Technology	A Collaboration Server is a computer connected to clients via a network used for hosting, managing, and monitoring shared COP/MSOP/USOP resources and the cooperative exchange of geospatial data.
COP Manager	Application	The means to direct or control the scope and resources associated with a COP and MSOP. The scope is defined in terms of geospatial extent (area of interest), timeframe, subject of interest (e.g., threat(s), case, monitor cargo, etc), operations objectives (e.g., respond to incident, recover from disaster, etc), the data required to support the execution of operations (e.g., support threat modeling & analysis, case analysis, cargo tracking, etc), and other operations parameters (e.g., constraints, mission features, etc). Resources may include physical entities (e.g., personnel, assets, conveyances, technology, etc) and logical entities (e.g., business components and processes, data, services). The COP Manager provides the means to select and allocate resources, manage and monitor collaboration activities, monitor status and performance of resources, and monitor and manage external communications. The distinction between the COP Manager and other operations-related applications is that the COP Manager is managing the big picture (COP), and subsets of the COP (MSOPs), whereas other agencyapplications focus on USOP in user-specific operations activities.
COP Manager Client	Technology	COP Manager provides the means to direct or control the scope and resources associated with a COP, select and allocate resources, direct and monitor collaboration activities, monitor status and performance of resources, and monitor and control external communications. The distinction between the COP Manager and other operations applications is that the COP Manager is managing

		the big picture (COP), and subsets of the COP (MSOPs).
Correlation (geospatial)	Process	The process of relating data through geospatial-temporal properties.
Coverage	Data	A two- (and sometimes three or higher) dimensional geographic representation of earth phenomena. A subtype of Feature. Common examples include imagery and digital terrain models.
Coverage Portrayal Service	Technology	Coverage Portrayal Service is chained to a Web Coverage Service (WCS) to convert geospatial coverage data (grid/image) to a map. The resultant map can be overlaid with data fetched from other servers for reference and orientation.
Critical Asset	Data	Critical infrastructures are those physical and cyber-based systems essential to the minimum operations of the economy and government. They include, but are not limited to, telecommunications, energy, banking and finance, transportation, water systems and emergency services, both governmental and private.
Critical Infrastructure Inventory Management	Application	The means to keep track of and report on the location and status of critical assets and key assets. To generate reports and maps conveying this information.
Custody (Records)	Data	The custody records for a person.
Damage Assessment	Application	The means to analyze and determine the extent and nature of destruction, harm, injury, and loss of value caused by a threat or natural hazard through the use of imagery and other sensor and human observations. Includes loss estimations. To generate reports and maps conveying this information.
Damage Assessment	Data	A map, image and/or related report that characterizes the location, extent and severity of destruction, harm, injury, and loss of value caused by a threat or hazard.
Data Acquisition/Generation	Application	Generally, the means to acquire, collect, process and/or generate new information (data) for the enterprise. There are many such specialized applications and tools for collecting, reformatting, verifying, editing, integrating and transforming new information (data) for the enterprise. e.g., Supervisory Control and Data Acquisition (SCADA).
Data Collection Management	Application	The means to submit new information (data) gathering requirements and administer these requests through fulfillment or obsolescence. Includes the means to manage requirements for human/sensor collection activities.
Data Collection Planning	Application	The means to devise, schedule and allocate requests for new information (data) to gather assets; to develop assembly plans that convey schedule, tasking and resource allocation for collection assets.
Data Correlation	Function	The family of functions for determining the spatio-temporal interrelationships and statistical correlation between data sets, and elements and properties within these sets. Correlation functions include intersection (AND, AND NOT), union (OR, NOT), proximity, statistical correlation (as it relates to accuracy and precision), pairings, regression, etc. Also the functions that determine the meanings of geospatial-temporal correlations.
(Geospatial) Data Dictionary	Data	A repository for well-known data terms (classes, elements, types, properties, relationships) for all data that are to be shared within a COI. The names, definition, schema fragments (format/syntax), legal values/value ranges for these terms.
Data Discovery Service	Technology	Able to search for and locate desired data through open, standard publish-find mechanisms. Search requests may be defined in terms of geospatial-temporal, mathematical and statistical filters for discovering data and data relationships, and optionally storing the

		metadata results as a new data set.
(Geospatial) Data Mining	Function	The family of search and retrieval functions that employ search filters with Boolean, mathematical (geometric and topological) and statistical operators for discovering patterns, trends, tendencies, etc. in geospatial data.
Decision Support Aids	Data	Artifacts used to assist in judgments. Broadly, decision support data that have geospatial properties or are defined as geospatial entity subtypes. Consists of plans, reports and maps with geospatial content.
Deployment Plan	Data	The procedures to bring forces, material, people, systems into operation. Geospatial and temporal context for deployment plans associated with any operation. Depicts terrain, objectives, threats, (blue & white) assets, etc.
Digital Rights Management Services	Technology	DRM is the use of a range of techniques to control copyright material and the terms and conditions on which it is made available to users. Digital Rights Management Services provide secure, controlled access to geospatial data provided by private providers/stewards for mission-critical agency business activities.
Direction	Data (Property)	The relationship by which the alignment or orientation of any position with respect to any other position is established.
Disaster Assistance	Application	The means to support hazard/disaster related benefits processing. To share hazards and related assessments [e.g., Digital Flood Insurance Rate Maps (DFIRMs) for lending institutions and flood insurance purposes (Human Services – Individual Assistance & Public Assistance), post disaster Housing Habitability data (individual structures and public infrastructure) for rebuilding purposes, etc.]
Distance	Data (Property)	A linear extent of space between two points. The travel distance between two places.
Electronic Navigation	Application	The use of computerized systems to track movements/shipments/conveyances/aeronautics. The means to determine, verify and simulate navigation guidance for mobile assets. To produce navigation instructions and guidance data for use in computer-assisted navigation. These need to be uploaded to conveyances (for navigation) and simulators (for mission rehearsal). Employ navigation technologies such as Long Range Radio Aid to Navigation (LORAN), Global Positioning System (GPS), digital nautical charts (National Oceanic & Atmospheric Administration (NOAA)), and flight planning and management software with digital aeronautical charts (Federal Aviation Aviation (FAA)), automatic vehicle locator (AVL) and in-vehicle navigation systems, and inertial navigation systems (INS).
Emergency Declaration	Data	The geospatial extent and nature of a serious situation or occurrence that happens unexpectedly and demands immediate action, portrayed in map and/or report form.
Emergency Declaration Report Service	Technology	Able to generate an Emergency Declaration Report with the geospatial extent and nature of an emergency.
Emergency Reporting	Application	The means to document and account in detail the nature and geospatial-temporal context of a serious situation or occurrence to proper authorities; to declare state and federal emergencies. Reference threats, threat consequence assessments, warnings, alerts and other location-based content germane to the emergency.
Emergency Report	Data	The geospatial-temporal context of a disaster/incident/danger/accident. A location-based detailed-account pertaining to a state or federal emergency. Reports may reference maps, mission plans, incidents, occurrences, parties, threat intelligence,

		risks/threats/vulnerabilities and associated assessments, etc. Reports contain interlinked, multi-media data that adequately characterize the nature and context of the emergency.
Environmental Impact Assessments	Data	The analysis of environmental data for a recovery site(s) and the examination of the impact on the external conditions and surroundings. Analysis of the effectiveness of recovery plans and operations as they pertain to safety and health concerns in a post-incident environment.
Evacuation Plan	Data	The documented process of departure of people from a particular location, usually due to an emergency or natural disaster. The geospatial-temporal context of the evacuation plan, which includes maps and reports that convey plan objectives, schedules and details, which includes: estimated population densities, threat locations, threat consequences, evacuation routes, mutual aid support facilities, etc.
Evacuation Planning & Management	Application	The means to produce and implement plans that convey the details pertaining to evacuation of a current or planned disaster/threat area. Produces Evacuation Plans.
Event Analysis	Application	The means to (data) mine, integrate, and correlate varied types of events (occurrences, incidents, activities) for the purpose of extrapolating, analyzing and deriving geospatial data in the form of patterns (e.g., cluster), densities, trends, networks, tendencies, indicators, hypotheses, and conclusions, as it pertains to event understanding. Source data include, but are not limited to, intelligence, incidents, occurrences, case, criminal and suspicious activities, financial transactions, persons, organizations, goods, cargo, hazmat, conveyances, etc. May also involve geoparsing and geocoding functions to scan and annotate associated textual data with geospatial-temporal references.
Event Plan	Data	The documented process of an organized occurrence. The results of Event Planning & Analysis for major events. The geospatial-temporal context of the event plan, which includes maps and reports that convey plan objectives, schedules and details which includes: event venue (location/time/activity), facilities, assets, personnel, security plans, evacuation plans, mutual aid support plans, etc.
Event Planning & Analysis	Application	The means to produce Event Plans for major events, and to examine the potential threats and vulnerabilities in context with event venue (location/time/activity), facilities, assets, personnel, security plans, evacuation plans, mutual aid support plans, etc.
Event (Records)	Data	Any event (incident, occurrence, or event) of interest with geospatial and temporal context.
Event Venue	Data	A schedule of planned activities and locations for a major event. A subtype of Event Plan.
Evidence	Data	The current and historical location/time/identity/status associated with the collection of individual pieces of data or artifacts associated with a case, and locations of evidence storage to ensure chain of custody. (Also see Case.)
Exercise Planning	Application	The means to produce accounts that convey the details pertaining to training drills for simulated threat(s) for a given area/facility/event. Produces Exercise Plans.
Exercise Plan	Data	The document process for drills related to training and preparation. The results of training exercise planning. The geospatial-temporal context of the plan, which includes maps and reports that convey objectives and situation context for the exercise, including: area/facility/event location detail, simulated threats, threat consequences, response objectives, asset locations, population densities, evacuation routes, mutual aid support facilities, etc.
Facilities	Data	Geospatial representations of surface, above surface and sub-surface structures, and installed Heating, Ventilation & Air Conditioning

		(HVAC), plumbing, electrical, security systems, and other installed infrastructure for any facility identified as an asset. Also, associated real property (e.g., rights of way, easements, etc)
Facility Mapping & Management	Application	The means to create and maintain detailed geospatial records of structure(s) for the purpose of managing the structure(s) and related land and infrastructure. Used in planning, construction, security and maintenance. Used to produce facility Maps, Plans and Reports. Assure compliance with all applicable laws regulating the development, use or transfer of property. These include National Environmental Policy Act (NEPA), Americans with Disabilities Act (ADA), Clean Water Act (CWA), Occupational Safety and Health Act (OSHA), Superfund Act, state and local permitting, and so on. Any planned construction activity at federally owned/operated facilities requires compliance with these laws. Used to manage space utilization of existing facilities to assure that space, furniture and equipment are adequate to support current and future mission requirements.
Feature	Data	An abstraction of a real world phenomenon. A geographic entity with a location relative to the earth. Usually represented by vector data (points, lines and polygons) with geometry, topology and descriptive properties (attributes).
Foundation Data	Data	Base features or coverages that can be used as a common underlay for more specific mission or project data.
Framework Data	Data	The core types of geospatial data required in support of the agency mission. Meets National geospatial data standards. All Framework Data are registered to a common coordinate reference system.
Fusion	Process	The process of merging data by exploiting their geospatial-temporal properties. To combine geospatial data. To combine any agency enterprise data on the basis of their geospatial-temporal properties.
Gateway Service	Technology	The Gateway Service is a technology used to determine the geospatial position of a known mobile terminal from a wireless network. Position is expressed in geographic coordinates. Mobile terminals (cell phones, Personal Data Assistant (PDAs), etc) must be equipped with GPS or some other position determination technology. An important service used in Location-Based Services (LBS), in the wireless realm.
Gazetteer	Data	An authoritative source of geographic names with coordiante locations (see Geographic Names and Geonames).
Gazetteer Service	Function	The ability to determine the geospatial coordinates for a place, given place name and/or attributes. This function accesses a database of geographic place names, together with their geographic locations and other descriptive information.
Gazetteer Service	Technology	Able to access a Gazetteer, which is a directory of well-known places and their locations. It generally consists of point features. A Gazetteer Service is a network-accessible service that retrieves one or more features, given a query (filter) request. This filter request must support selection by well-known feature properties. Queryable feature properties include, but are not limited to, feature type, feature name, authority, or identification code. Each instance of a Gazetteer Service has an associated vocabulary of identifiers. Thus, a Gazetteer Service may apply to a given region, such as a country, or some other specialized grouping of features. The returned features will include one or more geometries expressed in a well-known Coordinate Reference System.
Geocode	Function	The ability to determine geospatial coordinates, given an address.
Geodetic Control	Data	Points of known precise location on the earth (latitude, longitude, elevation) as established through surveying or photogrammetric methods. Control points that are expressed in a common coordinate reference system (e.g., World Geodetic System 1984 (WGS – 84)). Geodetic control is required to accurately register spatial data. The National Spatial Reference System is the fundamental geodetic control for the United States.

Geographic Affiliation	Data (Property)	Relates a person, good or asset to a physical location related to the earth (relative or absolute). These geospatial-temporal properties are stored in agency Framework Data under Party (Person or Organization), Goods or Asset Records.
Geographic Information System (GIS)	Technology	An integrated system of computer hardware, software, and set of procedures designed to create, store, query, display and analyze geospatial data and related attributes.
Geographic Names	Data (Property)	An authoritative source of geographic names with locations. E.g., Trafalgar Square, White House, Washington, D.C. Typically available through an online Gazetteer or Location-based Directory. (See Gazetteer and Geonames).
GIS Client	Technology	A general-purpose client, either thick or thin, that provides visualization and interaction with geospatial data.
GIS Server	Technology	The GIS server is comprised of bundled services that support the generation, revision, management, processing, and output of geospatial data. Consists of the server-side components comprising a GIS.
Geocoder/Reverse Geocoder Services	Technology	Able to determine geospatial coordinates, given an address (Geocoder), or determine address, given geospatial coordinates (Reverse Geocoder). A Geocoder transforms a description of a feature location, such as a place name, street address or postal code, into a normalized description of the location, which includes coordinates. A Geocoder Service receives a description of a feature location as input and provides a normalized address with coordinates as output. The feature location descriptions are any terms, codes or phrases that describe the features, and that are well known to the Geocoder Service, such as a street addressing or postal coding scheme.
Geolink	Data (Property)	A geo-enabled hyperlink (URI). This link may reference any geospatial-temporal resource (data/service). e.g., A geolink may reference a Location Object or a particular Feature on a given map. Geolinks provide the means to link between digital text/voice terms and the geospatial realm.
Geolocate	Function	The means to determine a geospatial position (the coordinates in a geographic coordinate reference system, a.k.a. position determination), or more generally, a location, for an object of interest (e.g., person, asset, conveyance, goods, cargo, device, etc.)
Geolocate Service	Technology	The means to determine a location for a fixed or Mobile Object of interest (e.g., geospatial feature, person, asset, conveyance, goods, cargo, device, etc.) Mobile Objects must be equipped with GPS, Radio Frequency Identification Device (RFID), and/or other position determination technologies.
Geometry (Geospatial)	Data (Property)	The geometric properties of geospatial data.
Geoname	Data (Property)	The designation/identifier (name) associated with a specific geographic location/place. A place name. E.g., Trafalgar Square, White House, Washington, D.C. Typically available through an online Gazetteer or Location-based Directory.
Geoparse	Function	The means to decompose text data in order to pinpoint geospatial and temporal terms. Optionally, also the means to geocode the terms and establish geospatial hyperlinks to geospatial-temporal resources (e.g., Location on a particular Map).
Geoparser Service	Technology	Geoparsing refers to the capability to scan and decompose a textual document, identifying key words and phrases that have geospatial-temporal context. A Geoparser Service works in the context of two bodies of information: a reserved vocabulary (a dictionary of place names, a gazetteer or a directory of Points of Interest (POIs) and a text source (e.g., a newspaper or cable.) The Geoparser returns all occurrences of the use (in the text source) of any term in the reserved vocabulary. Each occasion establishes a geolinks

		(geospatial/temporal-aware hyperlink) between text terms and the geospatial location associated with the reserved word. That result is an annotated text document with geolinks.
Geoprocessing	Process	The process of creating, updating, analyzing, modeling, rendering and otherwise utilizing geospatial data.
Georeferenced	Data	Any geospatial data. Earth associated data employing a geographic coordinate reference system.
Geosecurity	Data	The means to control and manage access on the basis of geospatial properties.
Geospatial Analysis	Data	The information products (data) that results from geospatial analysis. An Assessment.
Geospatial Analysis	Process	The process of mining, integrating, correlating, extrapolating, or otherwise analyzing geospatial data to determine geospatial-temporal patterns (e.g., cluster), densities, trends, networks, line of sight, tendencies, indicators, hypotheses and conclusions. See Threat Analysis, Threat Consequence Analysis, Vulnerability Analysis, Case Analysis, Damage Assessment, Event Analysis, Mitigation Planning & Analysis, Performance Planning & Analysis, and Screening and Risk Analysis.
Geospatial Application Components	Technology	Specialized Geospatial Applications may have one or more server-side Geospatial Application Components. These server-side components contain geospatial business logic and reference Geospatial Enterprise Services, which are common geospatial services that are available throughout the enterprise.
Geospatial Context	Data	Broadly, the geospatial characterization (classes, types and properties) of agency data.
Geospatial Coordinate	Data (Property)	The coordinates of a geospatial position expressed in a geospatial coordinate reference system, e.g., geographic – latitude, longitude, and elevation.
Geospatial Data	Data	Broadly, agency data that have geospatial properties or are defined as geospatial entity subtypes. agency geospatial entity subtypes include: Location Object, Feature, Coverage, Observation, Route, Mobile Object and Structure. Agencies require standards for common exchange of all geospatial entity subtypes embedded in any network messages, e.g., an Observation encoded in Geography Markup Language (GML).
Geospatial Data Format Conversion, Import/Export Services	Technology	Able to import/export, manipulate and convert geospatial data, through standard services. Formats include GML, MapInfo, ESRI, Intergraph, etc.
Geospatial Data Rollup (GDR)	Process	The means by which geospatial data are "rolled up" from data producer/steward nodes to common higher-level enterprise nodes, and then replicated as necessary. GDR is made possible by standards that are strictly and rigorously enforced between all nodes involved in rollup operations. Strict rules and guidelines for data creation and update transactions and reporting must also be followed. The objective of GDR is to optimize automation of the process so that all operational elements involved in the agency mission always have the best data.
Geospatial Data Standards	Data	The accepted models of authority associated with geospatial information (data). A type of standard under the Mandate subcategory of the Governance category.
Geospatial Data Transfer	Application	The means to move, copy, or exchange geospatial data between enterprise database nodes, which cuts across the agency enterprise. Includes operations to support periodic synchronizations of databases based upon update transactions to the master database. Used to

		accomplish replication operations between redundant nodes to support continuous 24/7 assured mission operations. Used to accomplish data rollup operations for Framework Data (synchronize data up the local-state-federal chain). Includes the required management tools. Produces Transaction Reports and Audit Trails.
Geospatial Data Transfer Standard	Data	Geospatial data format specifications to facilitate the exchange of geospatial data between organizations in a common data format. A type of standard under the Mandate subcategory of the Governance category.
Geospatial Entity Type	Data	The basic data type for agency geospatial data that are used in geospatial services. Includes the subtypes: Location Object, Feature, Coverage, Observation, Route, Mobile Object and Structure.
Geospatial Extent	Data	The area of a geospatial entity type, as defined by a minimum bounding rectangle or polygon.
Geospatial Information Technology (GIT)	Technology	Broadly applies to all geospatial information processing technologies. e.g., Position determination (GPS, etc.), GIS, Remote sensing (sensors and observations), Surveying, LBS, Location-Based Tag & Track, Telematics, AVL, Modeling & Simulation, Image Processing, Terrain Visualization, AM/FM and SCADA.
Geospatial Infrastructure	Technology	The underlying base or foundation geospatial technologies required for the agency enterprise.
Geospatial Integration Broker	Technology	A key component used in moving geospatial data between systems.
Geospatial Integration & Test Tools	Application	Tools that support examining and uniting of geospatial component services and applications. Consists of geospatial standards registry, reference implementations and test tools (including simulations and modeling for threat scenarios).
Geospatial Metadata	Data	Data about geospatial data. Any metadata that has geospatial properties.
Geospatial Model	Data	Data that define a geospatial schema.
Geospatial One-Stop Portal	Technology	An e-government initiative designed to facilitate the sharing and dissemination of geospatial data and resources over the Internet. A Web-based Portal for one-stop access to maps, data and other geospatial services.
Geospatial Processing Workstation	Technology	A Geospatial Processing Workstation is a high-end computer dedicated to GIS, Image Processing and other demanding geospatial processing tasks. Geospatial Processing workstations may be Unix or Windows based. They typically are characterized by large memory, large screen video, and massive disk storage.
Geospatial Product	Data	Broadly, any agency 'product' (i.e. artifact, data, map, widget, etc.) that have geospatial properties or are defined as geospatial entities. Any geospatial information that are published in accordance with standards for consumption by agency users, government officials and the public. Includes maps, imagery, location-based reports, assessments, analyses, plans, aids, profiles and so forth that characterize the earth and also the geospatial-temporal context of risks, threats, vulnerabilities, facilities, intelligence, events, hazards, plans, etc.
Geospatial Property	Data (Property)	The spatial geometry or attributes (including references) that define position on the earth (or location).
Geospatial Information Dissemination Protocols	Data	The standard procedures for passing geospatial content on a network (geospatial data and intelligence reporting and dissemination).
Geospatial Service	Data	The conventions associated with geospatial service components.

(Component) Standards		
Geospatial Standards	Data	Generally, the accepted and widely recognized models of authority or excellence that apply to agency geospatial capabilities. Consists of standards for geospatial services, data and communication protocols.
Global Positioning System (GPS)	Technology	A radio navigation system consisting of 24 earth-orbiting satellites that enable users to determine accurate geospatial position, velocity and time using a GPS receiver and associated computational capabilities. Determines geographic coordinates expressed in World Geodetic System 1984 (WGS - 84. Key technology for positioning, navigation and timing (PNT) in support of the agency mission. Useful for tracking and monitoring of assets, goods, cargos, persons and conveyances, especially for real-time operations.
Goods (Record)	Data	Assets being transported by Conveyance. The records for description (including a digital record of credentials), tracking and monitoring of assets (e.g., place of manufacture, shipping history in geospatial context – location/time/identity/status), and including money. May reference location, case, conveyance, risk, event (incident, occurrence, Event) or Party (person or organization) records. Subcategories include Cargo, parcels/packages, evidence, money, Hazmat and any other types of goods/things of interest.
Graphics Viewer Plug-in	Technology	The means to visualize and interact with 2D and 3D geospatial data in pictoral representation, where the user may interact/change geospatial elements. Provides tools to select geospatial features/locations/structures/routes/observations/mobile-objects for viewing, set view window, display chosen view, measure and pinpoint, navigate through view with pan and zoom, etc. Optionally choose symbology, graphics display template or select previous views.
Hazard	Data	A risk/danger (i.e., hazard) assessment in geospatial-temporal context, e.g., the floodplain for 100 year flood. May be Geospatial Data or Geospatial Product.
Hazard Map	Data	A graphic representation that conveys a risk/danger (i.e., hazard) assessment in geospatial-temporal context. A type of assessment, under the subcategory Assessment, under the Geospatial Product category.
Hazard Modeling, Analysis & Mapping	Application	The means to create, represent, break down, simulate and maintain detailed geospatial records of hazards for the purpose of characterizing and managing the threats (risks) associated with the hazard. Used in emergency preparedness, response and recovery planning and operations. Used to produce Hazard Maps and related Reports.
Hazmat (Records)	Data	The records for description (including a digital record of credentials), tracking and monitoring of hazardous materials, e.g., place of manufacture, or current, historical and scheduled location/time/identity/activity/status (shipping history). May reference location, case, conveyance, risk, event (incident, occurrence, Event), Party (person or organization), or case records.
Health & Safety Monitoring	Application	The means to track the locations of Notice of Violations (NOV) and reported incidents to assess problem work sites or otherwise dangerous conditions. Perform pre-deployment environmental health and safety evaluations of potential work sites, such as Disaster Field Offices (DFOs) or other temporary work environments.
Hydraulic-Hydrographic Modeling	Application	The means to create, control, display and store the results of hydraulic and hydrographic models, e.g., Hydrologic Engineering Center 2 (HEC2), Better Assessment Science Integrating Point and Non-point Sources (BASINS), and others.
Hyper-spectral Scanners	Technology	Any device that is specialized for measuring radian energy using contiguous bands of spectral data across a broad range of electromagnetic spectra. The resulting image can be visualized as a 3-dimensional dataset with two spatial and one spectral dimension, which is often referred to as an image cube.

Identity (Records)	Data	The current descriptive geospatial information about a person, organization, or goods that defines their identity. For persons, can include place of birth, citizenship, current address(es), etc. Descriptive geospatial and identity information about goods, like place of manufacture, address, etc. Includes digital records of credentials.
Image Processing Client	Technology	A desktop client, either thick or thin, that provides visualization and interaction with geospatial imagery data. Many specialized geospatial imagery applications may exist within the agency EA.
Image Processing Server (IPS)	Technology	The IPS server is comprised of bundled services that support the generation, revision, management, processing, and output of geospatial image data. Consists of the server-side components comprising an IPS.
Image Viewer Plug-in	Technology	The means to visualize and interact with geospatial images (rectified or unrectified). Provides tools to select image and optional graphics overlays for viewing (geospatial features/locations/structures/routes/observations/mobile-objects), set view window, display chosen view, measure and pinpoint, navigate through view with pan and zoom, etc. Optionally choose symbology, image display template or select previous views.
Image(ry)	Data	A graphic representation of an object or scene, typically produced by an optical or digital electronic device. May be in still or motion format. Common examples include remotely sensed data (e.g., satellite data and airborne data), scanned data, aerial photographs, motion imagery, and photographs. An image is normally stored as a raster data set of binary or integer values that represent the intensity of reflected light, heat, or other range of values on the electromagnetic spectrum.
Imagery Analysis	Process	The process of examining (analyzing) and interpreting remotely sensed imagery in order to discern spatial patterns or features of interest.
Incident	Data	A specific instance of carrying out a threat that may or may not result in harm to a party or asset. It requires a response above and beyond the normal daily operations. Current and historical geospatial and temporal context associated with any type of incident, whether natural or man-made. Incidents may be occurrences of an instance of a single threat type, or include combinations of occurrences of multiple threats (e.g., high explosive combined with radiological-dirty bomb; hurricane or typhoon with flooding, etc). Incident data provide a complete historical geospatial and temporal context for all activities associated with the incident (preparation, mitigation, response, recovery), and may link to intelligence, maps, reports, analyses (risk, threat, vulnerability), plans (mitigation, preparation, response, recovery, etc.), consequence modeling outputs, assessments, and tracking of assets, parties, conveyances, goods, etc. associated with the incident. Includes location/time/identity/activity/status for all occurrences and activities associated with the incident.
Incident (/Event) Management	Application	The means to support command and control for an occurrence or event, including situation awareness, monitoring threats and threat assessments, coordinating and monitoring response activities, assets, personnel, etc., and reporting status to persons in the command and control chain (see incident reporting). Create and manage incident/event data. Generate and disseminate alerts and warnings. Support pertinent communications. Reference relevant weather and other supporting geospatial data. Determine containment areas, logistics and deployment plans and ingress/egress routes for incidents. Update incident/event records to reflect response results.
Incident Reporting	Application	The means to generate detailed accounts about occurrences for proper authorities.
Incident Report	Data	The geospatial-temporal context of occurrences in detailed account form(i.e., reports). Reports contain interlinked, multi-media data that adequately characterize the nature and context of the incident. Reports may contain references to plans, maps and other reports.

Incident Report Service	Technology	Able to generate an Incident Report (detailed account of an occurrence) with information about a location-based incident message.
Integration	Process	The process of relating two or more physical data sets by exploiting geospatial-temporal properties, creating a virtual whole. To cross-reference related geospatial data. To integrate any agency enterprise data on the basis of their geospatial-temporal properties.
Intelligence	Data	Knowledge concerning threats and potential threats as it applies to the broad agency mission.
Interferometric SAR	Technology	Interferometric Synthetic Aperture Radar (InSAR) is a technique that enables measurement of very small movements of the earth's surface, as subtle as centimeters or less. The SAR interferometry technique acquires a pair of images from two radar measurements, taken from two marginally displaced coherent observations of the surface. For each pixel corresponding to the same ground area in both images, phase values are differenced to produce an interferogram, which, using the orbit parameters, is subsequently used to produce a Digital Elevation Model (DEM).
Interoperability (Geospatial)	Process	Ability of different processors, middleware, software and networks to interface and communicate with each other in order to share geospatial data and/or services.
Interview (Records)	Data	The geospatial context associated with conversations conducted to elicit specific information (i.e., interviews).
Intervisibility	Function	The means to determine whether or not there is clear visibility between two locations, or from an observation point/platform to an observation area. See line-of-sight.
Itinerary (Records)	Data	The detailed account(s) pertaining to a person's planned travel. The location/time/identity/planned-activities/status of places, persons and organizations to be visited. May include the means of transit, route(s), and travel guidance.
Key Asset	Data	Individual equities whose destruction would not endanger vital systems, but could create local disaster or profoundly damage our Nation's morale or confidence. Key assets include symbols or historical attractions, such as prominent national, state, or local monuments and icons. Key assets also include individual or localized facilities that deserve special protection because of their destructive potential or their value to the local community. Examples include: National Icons, Monuments, and Marine Resources.
Law Enforcement Assets	Data	A law enforcement officer's equipment: gun, munitions, baton, etc. These may be tracked by Asset Inventory Management and may or may not have geospatial context.
License/Permit (Records)	Data	The geospatial-temporal context associated with documented official or legal permissions.
Light Detection and Ranging (LiDAR)	Technology	The Light Detection and Ranging (LiDAR) is an active remote sensing system that can be operated in either a profiling or scanning mode using pulses of light to illuminate the terrain. By accurately measuring the round trip travel time of the laser pulse from the aircraft to the ground, a highly accurate spot elevation and topology can be calculated.
Line-of-Sight	Function	The means to determine whether or not there is intervisibility (visual line-of-sight) between two or more points in space, e.g., from a viewpoint to a target, between a point and an area or line, or between a line (e.g., flight path) and a point(s), line(s) or area(s). Also, the means to determine electronic line-of-sight for a signal.
Locate	Process	The ability to determine the position of a person, thing, or phenomenon.
Location	Data	A broadly used term that refers to any place of interest on the earth.

Location Object	Data	Any place or site on the earth of interest in the agency mission. A position with geospatial coordinates. Generally, as used in agency business, a place or point of interest. Also, the location of a person, thing or any other phenomenon referenced to the earth. Includes Absolute Location and Relative Location. As defined by OGC (Location), the extensible, abstract data type for all expressions of location that can be used by geospatial applications and services to specify the location of a target, asset, conveyance, person, etc. As used in LBS, a Location is the root of a semantic tree that includes a Point, Position, Address, and Point of Interest as its subtypes.
Location-Based Messaging Client	Technology	The means to visualize location-based messages (communications with embedded geospatial elements). Example messages include alerts, warnings, emergency declarations, location report and situation reports.
Location-Based Messaging Service	Technology	The means to represent location-based messages (communications with embedded geospatial elements). Location-based messages include alerts, after action reports, warnings, emergency declarations, location reports, situation reports and other event Reports.
		The Location Organizer Folder (LOF) is a standard message container model for capturing multi-media data in a geospatial context. It is based upon XML (Extensible Markup Language) and GML.
Location-Based Services (LBS)	Technology	Location-Based Services combine Web, wireless and geospatial technologies to provide the means to exploit positional information anywhere, anytime, and on any device. Generally, any services involving a mobile terminal (e.g., cell phone, PDA or notebook) and mobile users.
Location-Based Tag & Track	Technology	Technology for designating and following assets, equipment, goods, cargos, conveyances, and persons. e.g., GPS with RFID.
(Location) Directory Service	Technology	The (Location) Directory Service provides access to online lists (databases) of persons, places, products and/or services (e.g., Yellow/White/Green/Blue Pages, Restaurant/Travel/Entertainment Guides, Community Services, etc). This service is ordinarily used to find the location of a specific or nearest person, place, product and/or service. It is an important service used in LBS.
Location Reference	Data	Any means for representing location. A direct or indirect association to a physical location. Examples include an address, census block, geoname, coordinates, etc. Comprised of the standard geospatial elements/properties associated with any 'geospatial data' (i.e., any data which are captured, stored and managed within the agency enterprise as geospatial data), or with any 'non-geospatial data', which are any agency business data that are predominantly non-geospatial, and yet they have geospatial elements/properties that can be exploited through geospatial services.
Location Search & Reporting	Application	The means to search person, case, event, facility and property records using geospatial-temporal criteria, and then generate Location Reports conveying query results.
Location Report	Data	The query results pertaining to a person, case, event, facility or property expressed in location-based report form (detailed positional account). Reports contain interlinked, multi-media geospatial data.
Location (Site) Report Service	Technology	Able to generate a Location Report (detailed positional account) with information about an agency data object's location, related entities, and geospatial context. Example objects include geospatial feature, person, asset, conveyance, goods, cargo, device, etc.
Logistics Plan	Data	The documented management of the details of an operation. The geospatial-temporal context of an logistics plan, which includes maps and reports that convey objectives, schedules, deployments and contingencies concerning the distribution and use of goods (materials and supplies), assets, conveyances and related personnel in meeting the needs of emergencies.
Logistics Planning	Application	The means to produce logistics plans that convey the movement and deployments of goods, cargo, conveyances, assets and related

		personnel, for agency operations.
Manifest	Data	A list of passengers and cargo carried on a truck, ship, or other passenger or cargo conveying vehicle.
Map (and Charts)	Data	Generally, an annotated, symbolized graphical representation of select geospatial-temporal data for an intended purpose. Also, a map created by an orthorectified image. May contain annotations and marginalia. May be in hardcopy or softcopy form. May reference a Report or Plan. May be referenced by or embedded in a Report or Plan.
Map Publication	Application	The means to produce finished softcopy and hardcopy maps for use in agency operations. Includes the assembly and integration of data, symbolization, annotation, legend/marginalia generation and placement, and cartographic finishing. This capability is required throughout the agency enterprise.
Map Publication Service	Technology	Able to automatically generate and broadcast Maps of interest for inclusion in a plan, report, or other Geospatial Product, with select content and symbolization (map template). To produce a Map for inclusion in a word or graphic document.
Map Viewer Plug-in	Technology	The means to visualize and interact with geospatial data in rendered map form. Provides tools to select base map/image data for viewing, select optional graphics overlays (geospatial features, locations, structures, routes, observations, mobile-objects), set view window, display chosen view, measure and pinpoint, navigate through view with pan and zoom, etc. Optionally choose symbology, map display template or select previous views.
Metafeature	Data	An entity (feature) that synoptically represents and/or references other features. A complex or compound feature.
Mission Feature	Data	A geospatial entity that represents a pursuant target (object) or constraint in some agency operational context. Types of Mission Features include: At Risk Location (typically an area), Containment Area, Boundary Zone, Observation Area/Point, etc. Also see AOI, POI, and Place of Interest.
Mission-Specific Operating Picture (MSOP)	Data/ Technology	The collective set of time-sensitive, mission-critical, shared resources (data and services) associated with an area and subject of interest that conveys situational context for a mission. Contains geospatial context (a composite of Framework Data and Auxiliary Data), the disposition and nature of threat(s), friendly personnel and assets, as well as incidents, events, observations, related intelligence, and other relevant mission data. A MSOP draws upon the shared resources of the COP.
Mission Plan	Data	The scheme designed to reach specific objectives or assignments. The geospatial-temporal context of a mission plan, which includes maps and reports that convey objectives, threats, deployment/route details, contingencies and situation context for the mission, as well as the navigation instructions and guidance data to support electronic navigation.
Mission Planning	Application	The means to scheme, program, schedule and allocate assets to a mission; to develop data collection plans that convey schedule, tasking and resource allocation for collection assets.
Mission Rehearsal	Application	The means to verify and simulate pre-planned missions involving navigation guidance for mobile assets. Employs Mission Rehearsal Models. Input to these models consists of terrain, threats, threat avoidance constraints, features, weather, other environmental conditions, planned/predicted navigation guidance, asset operating constraints, etc. Outputs consist of 4D, simulated rehearsals, in their projected operating environments.
Mission Rehearsal Models	Data	Schematics that characterize the behaviors of mobile/dynamic mission (plan of action) assets and the effects of these assets in a mission rehearsal context. These models are associated with simulations of mission assets in their projected operating environments.

Mitigation Plan	Data	The scheme designed to minimize and alleviate riks, hazards, emergencies or general occurrences. The geospatial-temporal context of a mitigation plan, which includes maps and reports that convey the planning, scheduling and allocation of all resources required to contain and minimize the impact of a disaster.
Mitigation Planning & Analysis	Application	The means to determine and assess impact of the root cause of an incident/event and to produce mitigation plans and supporting Geospatial Products (assessments, maps, reports, etc) for natural and human induced threats, hazards and disasters, in order to support future emergency response and recovery efforts for impending or possible disasters. Also, the means to analyze post-disaster response effectiveness (post mission assessments and after action reports) and create mitigation plans and supporting Geospatial Products to enhance future planning, safety, preparations, response and recovery operations, countermeasures and training for cases, threats, hazards and disasters.
Mobile Object	Data	Any entity (object) of interest that is in motion, or is otherwise dynamic, and is monitored and/or tracked. A person, good, conveyance or asset. Mobile objects have location, time, identity, activity, status, and optionally speed and direction of motion. Historical records of location/time/identity/activity/status/speed/direction may be recorded for tracking purposes.
Model	Data	The schematic description of data that accounts for its properties and characteristics. Geospatial-oriented model to support simulation and autonomous operations. Models have a data perspective (model input and output parameters) and a behavior perspective (software).
Modeling & Simulation	Process	The means to predict aspects of the behavior of some system by creating an approximate (mathematical) model of it. Modeling in space and time through a special-purpose software package, or a more general simulation package aimed at a representation of the attributes of a system.
Monitor	Process	The ability to systematically observe and report on a location (place/area/point of interest), feature (e.g., building), person, goods, assets, conveyances etc. with the purpose of collecting information about location/time/identity/activity/status.
Monitor Assets	Application	A program that observes, supervises, manages, or controls the equities or items of value. The means to monitor Assets for change in location/activity/status. To determine and record the current and historical location/time/identity/activity/status of mobile assets, including capital assets, key assets, law enforcement assets, and operational materials and equipment, through observation, tracking and analysis. To perform situation awareness. May lead to reporting of occurrences (e.g., Suspicious Activity Reporting), alerts or Situation Reports.
Monitor Conveyances	Application	A program that observes, supervises, manages, or controls transports. The means to monitor Conveyances for change in location/activity/status. To determine and record the current and historical location/time/identity/activity/status of conveyances through observation, tracking and analysis. To perform situation awareness. May lead to reporting of occurrences (e.g., Suspicious Activity Reporting), alerts or Situation Reports.
Monitor Goods & Cargo	Application	A program that observes, supervises, manages, or controls freight, merchandise, payload, or equities. The means to monitor Goods and Cargo for change in location/activity/status. To determine and record the current and historical location/time/identity/status of goods and cargo through observation, tracking and analysis. To perform situation awareness. May lead to reporting of occurrences (e.g., Suspicious Activity Reporting), alerts or Situation Reports.
Monitor Locations	Application	A program that observes, supervises, manages, or controls places, sites, positions, streets, neighborhoods, venues, localities, etc. The means to monitor Locations for change in activity/status. To determine and record the current and historical time/activity/status at a

		location through observation and analysis. To perform situation awareness. May lead to reporting of occurrences (e.g., Suspicious Activity Reporting), alerts or Situation Reports.
Monitor Parties	Application	A program that observes, supervises, manages, or controls people, persons, citizens, crowds, etc. The means to monitor Parties (Persons or Organization) for change in location/activity/status. To determine and record the current and historical location/time/identity/activity/status of persons in geospatial context and cyberspace, through observation, tracking and analysis. To perform situation awareness. May lead to reporting of occurrences (e.g., Suspicious Activity Reporting), alerts or Situation Reports.
Monitor Recovery	Application	A program that observes, supervises, manages, or controls cleanup, decontamination and restoration. The means to monitor incident locations for change in activity/status pertaining to cleanup, decontamination and restoration. Employ recovery plans to support recovery operations. Determine and record the current and historical time/activity/status at recovery locations through observation and analysis for subsequent analysis and legal implications. Produce location-based After Action Reports that contain recovery progress, and environmental impact assessments.
Monitoring Service	Technology	Able to determine (or fetch a predetermined) location/time/identity/status/activity series for a Location.
Multi-spectral Scanners	Technology	Any device that is specialized for measuring radian energy of the earth's surface using discrete bands of spectral data ranging from the blue to the near-infrared portions of the electromagnetic spectrum.
Mutual Aid Support Plan	Data	May result from certain planning and analysis activities for major events, emergency preparations/response/recovery, etc. The geospatial-temporal context of the mutual aid support plan, which includes maps and reports that convey plan objectives (deployment sites, logistics, etc), schedules and activities in geospatial context.
National Affiliation	Data (Property)	Relates a person, good or asset to a nation.
(The) National Map (TNM)	Data	A seamless, continuously maintained set of Base data for the U.S., consisting of both feature and coverage data that meet consistent National standards. The National Map (TNM) will serve as the central portal for the sharing and dissemination of critical geospatial information. The 'Base Map' for agency operations.
National Spatial Data Infrastructure	Data, Technology	Provides a consistent means to share geographic data among all users. This includes all technologies, policies, and people necessary to promote sharing of geospatial data throughout all levels of government, the private and non-profit sectors, and the academic community.
Native Spatial DBMS	Technology	The Enterprise Database Management System (DBMS) should provide native support for storing and managing all types of geospatial data. Capabilities should include geospatial indexing, open Structured Query Language (SQL) query support with geometry and topology operators, geospatial analytics, geospatial data mining, coordinate transformation and linear referencing.
Nautical Navigation	Data	Data which pertains to nautical navigation, like waterways, ports, harbors, bridges, navigation aids, traffic, traffic control, (electronic) navigation guidance, fixed hazards and dynamic hazards.
Navigation	Process	The guidance of conveyances or persons from place to place. The act of navigating; the act of passing on water in ships or other vessels or in the air in aircraft; the state of being navigable.
Navigation Guidance	Data	The navigation instructions and directional data for use in computer-assisted navigation (e.g., Notice to Mariners).

Navigation Service	Technology	An enhanced version of the Route Service, which determines routes between two or more points with enhanced navigation information. An important service used in Location-Based Services (LBS).
Network	Data	A complex interconnected group or system. Includes the following type (of networks): terrorist, hostile interest affiliation, road transportation (road, air, rail, and sea), logistical, energy distribution, communications, water supply, food distribution, emergency response, financial, sociological, etc.
Network Analysis	Function	The examination of a complex interconnected group or system. The means to analyze transportation, telecommunications, energy supply, water supply and any other networks in geospatial context. The means to determine a Route.
Notice	Data	Alert information or messaging (notification) between operational actors containing geospatial and temporal context.
Observation	Data	Data derived from sensor measurement, human detection, and other sensing and measurement techniques.
Observation Point	Data	A location from which observations (detecting, viewing, sensing) are made by human and/or sensors for monitoring or tracking purposes. A type of Mission Feature.
Observation Area	Data	An area under observation (detection, surveillance, supervision) by human and/or sensors for monitoring or tracking purposes. A type of Mission Feature.
Occurrence	Data	An activity (routine transaction) that is of interest in the agency mission. Can be something that happens at a specific point in time or over a period of time. It requires an expected response as part of normal operations. The geospatial-temporal context of current and historical locations of any suspicious, criminal, terrorist activities of interest, including arrests, offenses, confiscations and seizures. May reference multi-media geo-referenced data (e.g., maps, reports, motion video, still images, etc.) Defines the identity/location/time/activity/status for any activity of interest.
Operational Plan	Data	A documented process for a particular method of efficient, productive activity. The geospatial-temporal context of an operations plan, which specifies the allocation of funds, activities and resources by organization and geographic area (congressional district, state, territory, county, reservations, and cities). May also include maps and reports that convey objectives, schedules, deployments, contingencies and the situation context for projected operations, including: threat disposition, blue force disposition, contingency deployments, environmental constraints, etc. Plans may also include standard operating procedures for geospatial data acquisition, management and sharing, as well as the geospatial management and investment plans for all levels of government, developed in cooperation with private and public sector entities.
Operational Planning	Application	A program designed to document the process for a particular method of efficient, productive activity. The means to scheme, schedule and allocate personnel and assets for emergency operations. To develop Operational Plans.
Organization (Records)	Data	An administrative or functional entity established formally or informally to represent interests or issues or to conduct an activity, as opposed to an individual or person representing oneself. The records for describing and monitoring organizations of interest. Description includes relevant geospatial locations. Monitoring produces current and historical location/time/identity/activity/status data. May reference events (occurrences, incidents), alerts, cases, assets, conveyances, persons, and affiliations with hostile interests.
Party	Data	A unique individual (living or dead). Can be characterized or identified by historical, biographic, and biometric information. A person or organization of interest in the agency mission for which geospatial-temporal context is required.

Patrol	Process	Moving about an area or along a border for the purpose of observation and inspection. Includes engaging adversaries, suspected threats, and perpetrators.
Performance Criteria	Data	The rules or standards for assessing system accomplishment (performance) based upon geospatial considerations.
Performance Model	Data	Schemas (models) that characterize the key performance indicators of agency systems. These models are associated with system performance simulations that are used in performance analyses. Input to these models consists of performance criteria and geospatial performance factors (incidents, events, districts, etc), i.e., geospatial entities of interest for performance monitoring purposes. Model output consists of performance measures by geographic entity/locations.
Performance Plan	Data	The planned/projected/predicted performance of a system or system resources based upon geospatial factors and criteria.
Performance Planning & Analysis	Application	The means to determine system performance based upon geospatial-temporal factors and criteria. Track and report on Events, incidents, key assets, vulnerabilities, grants, expenses and funding by geospatial areas (congressional district, state, territory, county, reservations, and cities) for agency activities. Create and evaluate performance criteria and annual performance plans (including accountability reports).
Person (Record)	Data	The records for description, tracking and monitoring of persons. Includes identity (digital records of credentials, place of birth, citizenship, address) and other biographical information including travel history, geographical/national affiliations, etc. Tracking and monitoring of persons produces current, historical and future (planned or projected) location/time/identity/activity/status data. Person records may include subcategories of other business data including records containing background check, interview, custody, travel, history, itinerary, and license/permit information. May reference events (occurrences, incidents, events), cases, conveyances and organizations, employment, activity, asset, and risk.
Personal Map Software	Technology	Personal Map Software includes a variety of tools for viewing, annotating and manipulating map data. Typically include map data for standalone operations. Often includes GPS capability for mobile applications. Commercial software for desktop or PDA.
Photogrammetric Cameras	Technology	Cameras that are specialized for the remote capture and measurement of panchromatic (350-1100 nm) data of the earth's surface. These units are typically mounted on airborne craft and produce photographs that can be transformed into a geo-registered image product using specialized photogrammetric software applications.
Place of Birth	Data	Location associated with a person's birth.
Place of Destination	Data	Shipping or travel destination.
Place of Interest	Data	May be represented as a point (i.e., point of interest) or an area (i.e., area of interest).
Place of Manufacture	Data	Place where a good is manufactured.
Place of Origin	Data	Shipping or travel origin.
Plan	Data	A documented course of action to be taken in order to achieve a specified goal or objective that is officially designated as a Plan. The results of planning pertaining to a topic of interest, such as an exercise, mission, recovery, etc. The geospatial-temporal context of a Plan. Plans include supporting facts, objectives and projections. May reference one or more Reports, Plans or Maps.

Point of Interest (POI)	Data	A place or entity with a fixed position that may be used as a reference point or a target. Generally, any point of interest within the mission. A location of interest represented as a point in a known coordinate reference system, with metadata describing the location. May also contain name, type, category, address, phone number and other information about a place.
Position	Data	Any observed or calculated position, in the broad semantic context of the use of the term. Primarily contains a geographic position and quality of position. The geospatial coordinates, accuracy and precision of a point or vertices of a line or polygon.
Post Mission Analysis	Application	The means to assess the performance of a mission and assess effectiveness of mission, event, preparation, logistics, response, deployment, evacuation, search & rescue, security, countermeasures, (training) exercise and recovery plans, and the effectiveness of mission operations (assess incident and situation reports). The ability to compare plans with mission operations details and determine lessons learned. The means to produce post mission assessments that convey analysis results (maps and location-based reports), and to produce and after action reports.
Post Mission Assessments	Data	The analysis output from Post Mission Analysis. Assessments of the effectiveness of plans, operations and training in response to an incident/event/case.
Preparation Plan	Data	The geospatial-temporal context of an emergency preparedness plan, which includes maps and reports that convey preparation objectives, schedules, deployments, contingencies and geospatial-temporal situation context for planned operations.
Preparation Planning	Application	The means to preplan, schedule and allocate personnel and assets to a potential disaster/threat; to develop operations plans that convey schedule, tasking and resource allocation for preplanned operations, in a geospatial-temporal context. The means to produce deployment and contingency plans.
(Threat) Profile	Data	A geospatial-temporal pattern, trend, network, tendency or indicator that characterizes threat and risk behaviors. Used in determining location, identity, severity and probability of the risk/threat. [Note: Other types of location-based profile may be defined for the agency mission.]
Profiling	Function	To detect or calculate a geospatial-temporal pattern, trend, network, tendency or indicator by evaluating a set of geospatial entities and/or a set of agency business data with geospatial properties. Used for detecting new risks and threats. e.g., Detect a visitation pattern by analyzing immigration data for suspected terrorists and their associates.
Program Plan	Data	The geospatial-temporal context of a program plan, which includes maps and reports that convey program objectives, schedules and geospatial-temporal situation context for planned activities.
Program Planning	Application	The means to preplan, schedule, and allocate personnel and assets for an agency activity; to develop activity plans that convey schedule, tasking and resource allocation for preplanned activities, in a geospatial-temporal context. The means to produce Program Plans.
Public Information Outreach	Application	The means to inform the public on the basis of location. Portray maps (e.g., NFIP (National Flood Plain Insurance Program) floodplain maps) and location-based information reports, alerts, warnings and emergency declarations concerning threats, threat consequences, response and recovery status, mitigation and situation reports, and benefits locations through public information (media) channels. Allow the public to interact through these channels (e.g., explore what's happening in their area of interest). Support electronic registration (geocoding) for the application of benefits. Numerous types of geospatial products produced by geospatial applications across the enterprise may be distributed through public information channels.

Raster	Data	An abstraction of the real world where spatial data is expressed as a matrix of cells or pixels, with spatial position implicit in the ordering of the pixels. Unlike vector data, there are no implicit topological relationships. Coverages are often represented in raster form. e.g., imagery.
Recovery Plan	Data	The geospatial-temporal context of an emergency recovery plan, which includes maps and reports that convey recovery objectives, schedules, resource deployments, contingencies and geospatial-temporal situation context for planned recovery operations.
Recovery Planning	Application	The means to preplan/plan, schedule, and allocate personnel and assets for incident recovery; to develop recovery (operations) plans that convey schedule, tasking and resource allocation for recovery operations, sharing amongst government and non-government relief organizations. Publish locations and route directions to crisis counseling, housing and other recovery centers; share with public.
Reference Architecture (Geospatial)	Technology	Consists of reference implementations of key geospatial components and applications with standard interfaces. Also consists of a registry of associated geospatial standards and conformance test tools.
Relative Location	Data	A location stated as a relative position with respect to an Absolute Location (i.e., address, position, feature geometry, e.g., point, or Place of Interest).
Report	Data	A location-enabled, multimedia report. The results of reporting pertaining to a topic of interest, such as an emergency, incident, suspicious activity, etc. The report has geospatial-temporal context, which includes supporting data like locations, features, imagery, etc. May reference one or more Reports, Plans or Maps.
Response Plan	Data	The geospatial-temporal context of an emergency response plan, which includes maps and reports that convey response objectives, schedules, resource deployments, contingencies and the geospatial-temporal situation context for planned response operations.
Response Planning	Application	The means to preplan/plan, schedule and allocate personnel and assets to a disaster/threat/incidents/events, given possible risks, public safety considerations and potential affected locations, facilities, key or critical assets, etc.; to develop response operations plans that convey schedule, tasking and resource allocation for response operations, in a geospatial-temporal context. The means to produce Response Plans.
Reverse Geocode	Function	The ability to determine an Address from geospatial coordinates.
Risk	Data	The nature of the risk associated with a threat, vulnerability or weapon. Risks correlate threats with vulnerabilities. The geospatial context of a risk is defined in a Risk Assessment.
Risk Analysis	Application	The means to determine and assign risks and risk assessments for key assets, critical assets, key persons or conveyances. To analyze associated geospatial risk factors, in conjunction with related threat, vulnerability, threat intelligence and other intelligence. Consists of mapping and correlating threats to vulnerabilities. Means of analysis may consist of: (data) mine, integrate, correlate, extrapolate, and analyze data for patterns, densities, trends, networks, line of sight, tendencies, indicators, hypotheses, and conclusions, as it pertains or may pertain to risks. May also involve geoparsing and geocoding functions to scan and annotate textual risk, risk assessment, threat, threat assessment, vulnerability, vulnerability assessment, person, conveyance, threat intelligence and other all-source intelligence for geographic and temporal references.
Risk Assessment	Data	The modeling and analysis output from Risk Analysis. May consist of maps and/or reports.

Route	Data	The representation of a route for navigation purposes. The route's overall characteristics, such as its start point, waypoints, end point, transportation type, total distance, travel time and bounding box. Route geometry is defined as a list of geographic positions along the route, ordered in the sequence of planned travel, starting with the position of the route's origin and ending with the position of the route's destination, including waypoints. Also, a list of travel instructions consisting of turn-by-turn directions and advisories along the route, ordered in sequence of their occurrence. Routes are derived from navigable transportation networks.
Route Service	Technology	Able to determine (or fetch a predetermined) route and navigation information for autonomous or semi-autonomous navigation between two or more points on a network. An important service used in LBS, in the wireless realm.
Screening & Risk Analysis	Application	The means to determine and assign risks and risk assessments for parties (persons or organizations) and goods, and to screen accordingly. Analyze geospatial risk factors (e.g., physical address, place of birth, citizenship, travel history, travel itineraries, geographic/national affiliations, etc. for persons and organizations, and place of origin, place of manufacture, shipping route and place of destination for goods) in conjunction with party and goods records and related intelligence. Data mining and correlation applies here. May also involve geoparsing and geocoding functions to scan and annotate associated textual data for geographic and temporal references.
Search & Rescue Plan	Data	The geospatial-temporal context of search and rescue plan, which includes maps and reports that convey search & recovery objectives, schedules, resource deployments, contingencies and geospatial-temporal situation context for planned search & rescue operations.
Search & Rescue Planning	Application	The means to preplan/plan, schedule and allocate personnel and assets for search and rescue missions. The means to develop Search & Rescue Plans that convey schedule, tasking and resource allocation for search & rescue operations, in a geospatial-temporal context. Create and manage related incident/event data. Generate alerts and warnings, as needed. Support pertinent communications.
Search & Rescue Response	Application	The means to support command and control for an incident or event that requires search and rescue. Involves creating and managing situation awareness, monitoring threats and threat assessments, coordinating and monitoring response activities/assets/personnel, communicating with response personnel, etc., and reporting status to persons in the command and control chain (Situation Reports). Create pertinent communications. Update incident/event records to reflect response results.
Security Planning	Application	The means to determine and document the security plans, in geospatial context, to secure and protect fixed and mobile assets, persons, goods, conveyances, etc.
Security Plan	Data	Documents the security measures for protecting persons, assets, goods, conveyances, etc., in map and report form (e.g., Where to place barriers, guard posts, sensors, etc.). Includes details concerning sensor deployments.
Security Protection & Management	Application	The means to secure and protect fixed and mobile assets, persons, goods, conveyances, etc. (in geospatial context). (e.g., Where to place barriers, guard posts, sensors, etc. Where are the guards, sensor alerts, etc.). Includes integration with sensors and other security monitoring tools and the means to process and display observations. May lead to reporting of events or alerts.
Semantic Business Profiles (SBP)	Data	Business semantic schemas that define the common semantic framework (terms and their meanings within the enterprise environment) associated with shared geospatial business processes and procedures. SBPs are exposed through registry services. Defined by COI.
Semantic Data Profiles (SDP)	Data	Data semantic schemas that define the common semantic framework (terms and their meanings) associated with shared geospatial data description and access. SDPs are exposed through registry services. Defined by Communities of Interest.

Semantic Interoperability Services	Technology	Fully autonomous business, service and data interoperability is only possible when clients can locate and access business, service and data on-the-fly through publish-find-bind-orchestration patterns that subscribe to well-known business, service and data semantics.
Semantic Service Profiles (SSP)	Data	Service semantic schemas that define the common semantic framework (terms and their meanings) associated with shared geospatial service description and access. SSPs are exposed through registry services. Defined by Communities of Interest.
Sensor	Data	The description and parameters associated with a sensor for the purpose of sensor management and the exploitation of observations from the sensor.
Sensor	Technology	An electronic device that is used for detection and monitoring through signature and pattern recognition.
Sensor Alert Service	Technology	The Sensor Alert Service produce alert messages when given observation conditions are met by a sensor. Provides the means for client services/users to specify and register user profiles that contain user information, applicable sensors/observations, alert conditions (e.g., maximum/minimum values), and alert actions (what happens if conditions are met). Also, the means for client services/users to update user profiles. Clients are able to control the nature of alerts. For example, a client is able to activate/deactivate an alert capability. Also provides the means to support push/pull capabilities, e.g., to wait for observation input from associated sensors (for on/off sensors like a detector), or to actively poll for (current/historical/predicted) sensor observations.
Sensor Management	Application	The means to manage sensor assets and the allocation of data collection requirements and tasks to sensors.
Sensor Collection Service	Technology	A service by which a client can obtain observations from one or more sensors/platforms (can be mixed types). Clients can also obtain information that describes the associated sensors and platforms.
Sensor Planning Service	Technology	A service by which a client can determine sensor collection feasibility for a desired set of collection requests for one or more mobile sensors/platforms, or the client may submit collection requests directly to these sensors/platforms.
Service Discovery Service	Technology	Able to search for and locate desired services through open, standard publish-find mechanisms. Search requests may be defined in terms of filters for discovering services and service-data relationships, and optionally storing the metadata results as a new data set.
Share	Process	The means for two or more actors in a system to access and utilize the same resources (data, services, devices, etc.). Commonly refers to sharing data between federal, state, local, tribal and private users through network-accessible, standards-based services.
Site Modeling & Analysis	Application	The means to analyze, model and delineate areas based upon site characteristics (e.g., to locate ideal sites for a facility). To produce Site Plans.
Site Plan	Data	The results of site planning. The geospatial-temporal context of the plan, which includes maps and reports that convey site objectives/schedules, activity locations and the situation context for the site (e.g., facility/infrastructure locations, other key features, current imagery, etc.).
Situation Awareness	Data	A coherent representation of data for an area of interest that conveys geospatial situational context, disposition and behaviors of threat(s), friendly personnel and assets, incidents, events, observations and related intelligence and agency Framework Data. Closely related to a COP, MSOP, or a specialized view of the COP/MSOP, a.k.a. USOP.
Situation Awareness	Application	The means to combine varied sources of data to create the situational context associated with threats, vulnerabilities and friendly forces for the purpose of understanding their nature and disposition and to support decision making for threat response and mitigation. In

		particular, view near-real time threat disposition, related observations, and friendly force disposition in geospatial context, with the appropriate level of detail. Leads to a shared, collaborative COP, MSOP, or specialized views of the COP/MSOP that convey actionable information, a.k.a. USOP. The means to generate Situation Reports.
Situation Reports	Data	Reports that contain relevant geospatial-temporal situation context for any activity/event/incident/occurrence for command and control purposes.
Situation Report Service	Technology	Able to generate a Situation Report with the geospatial extent and nature of an operational situation.
Spatial Reference System	Data (Property)	A function that associates locations in space to geometries of coordinate tuples in a mathematical space, usually a real valued coordinate vector space, and conversely associates coordinate values and geometries to locations in the real world, e.g., coordinate reference systems, linear reference systems.
Spatial Relationship	Data (Property)	The relationship between two objects as described in geospatial terms (distance, coordinates, etc). Also topological relationships, e.g., adjacent, connected, surrounded by, etc.
Specialized Geospatial Clients (Various)	Technology	A desktop client, either thick or thin, that provides visualization and interaction with geospatial data. Also provides access to underlying Application Components and Geospatial Services. Many specialized geospatial applications will exist within the agency EA, each which may have a Geospatial Client and one or more Application Components and/or Geospatial Services.
Speed (velocity)	Data (Property)	The rate of motion or a measure of the rate of motion. Distance traveled over an interval of time. Often represented by a vector(s) indicating direction of motion.
Structure	Data	The geospatial representation of a man-made structure, e.g., building or bridge.
Style Management Service (SMS)	Technology	The means to create, update and manage styles and symbols. The SMS must manage distinct objects that represent styles and symbols and provide the means to discover, query, insert, update, and delete these objects. Styles provide the mapping from feature types and feature properties and constraints to parameterized Symbols used in drawing maps. Symbols are bundles of predefined graphical parameters and predefined fixed graphic "images".
Suspicious Activity	Data	Represents any suspicious activity or occurrence of interest (identity/activity/status) that poses a risk (threat or vulnerability) or potential risk, with geospatial context (location/time, extent, geographic, national), or a series of suspicious activities/occurrences with geospatial-temporal contexts.
Suspicious Activity Report	Data	The geospatial-temporal context of suspicious activities captured in report form. May reference maps, incidents, occurrences, parties, threat intelligence, risks/threats/vulnerabilities, etc. Reports contain interlinked, multi-media data that adequately characterize the nature and context of the activity.
Suspicious Activity Report Service	Technology	Able to generate a Suspicious Activity Report for a location-based suspicious activity.
Suspicious Activity Reporting	Application	The means to analyze and report suspicious/criminal/terrorist activities to proper authorities (e.g., indications of a threat, notifications of suspected criminal activities, etc).
Surveillance	Process	Observing activities in an area of interest or at a point of interest through visual/listen inspection or sensors.

Synthetic Aperture Radar (SAR)	Technology	A microwave instrument that transmits radar pulses very rapidly. In fact, SAR is generally able to transmit several hundred pulses while the platform passes over a particular object. Many backscattered radar responses are therefore obtained for that object, which can be manipulated such that the resulting image looks like the data were obtained from a big, stationary antenna. In general, the synthetic aperture is the distance traveled by the spacecraft while the radar antenna collected information about the object.
Tariff Management	Application	The means to manage tariffs for goods, in a geospatial context.
Temporal Reference System	Data (Property)	A function that associates time to a coordinate (usually one dimensional points and intervals) and conversely associates coordinate geometries to real world time.
Temporal Relationship	Data (Property)	The relationship between two events with respect to time; or pertaining to a specified period of time.
Test Model	Data	The test models (data and encoded procedures) to support simulations and modeling to test how geospatial data and technology will perform in local conditions and in different attack scenarios.
Threat	Data	An intended or unintended indication of imminent danger, harm, evil, etc. Includes infestation of a commodity by living pest. The geospatial context of a Threat is defined in a Threat Assessment.
Threat Analysis	Application	The means to define threats and threat assessments. For terrorism, the means to (data) mine, integrate, and correlate varied types of geospatial data for the purpose of extrapolating, modeling, analyzing and deriving geospatial data in the form of patterns (e.g., cluster), densities, trends, networks, line of sight, tendencies, indicators, hypotheses, and conclusions, as it pertains to threats and the understanding of threat behaviors in their environment, in order to minimize the risks associated with the threat. Source data include, but are not limited to, intelligence, incidents, events, criminal and suspicious activities, financial transactions, persons, organizations, goods, etc. For terrorism and natural hazards, this includes the means to conduct Threat Consequence Assessments and Hazard Modeling, Analysis & Mapping. May also involve geoparsing and geocoding functions to scan and annotate associated textual data for geographic and temporal references.
Threat Assessment	Data	The modeling and analysis output from Threat Analysis. For natural hazards, this includes floodplains and areas of high susceptibility from tidal storm surge, hurricane, tornado, landslide, earthquake, fire, tsunami, volcanic events, high winds and other types of natural disasters.
Threat Consequence Assessment	Application	The means to understand the consequences of terrorist and natural threats as determined by modeling/simulation and analysis (e.g., Consequence Assessment Tool Set (CATS)). The means to produce Threat Consequence Assessments for threats to key assets, critical assets, key persons or conveyances (and associated routes). Means of analysis may consist of: (data) mine, integrate, correlate, extrapolate, and analyze data for patterns, densities, trends, networks, tendencies, indicators, hypotheses and conclusions, which pertains or may pertain to threats. May also involve geoparsing and geocoding functions to scan and annotate associated textual data for geographic and temporal references.
Threat Consequence Assessment	Data	The modeling and analysis output from Threat Consequence Assessment.
Threat Detection	Application	The means to detect chemical and biological threats in air and water through the employment of sensors. The means to access sensors as network resources to meet rapid response and risk mitigation requirements. Detect threats through screening and analysis of sensor

		observations. Create, reference and share alerts.
Threat Intelligence	Data	Intelligence data that pertains to a threat and the associated risks that the threat poses.
Threat/Vulnerability Mitigation Strategy	Data	Generally, the geospatial-temporal context of a threat/vulnerability mitigation strategy. Specifically: Security Plans, Countermeasures or Mission Plans.
Threat Prediction	Data	The predicted location/time/identity/activity/status information for a threat.
Threat Models	Data	Models that characterize threats and threat behaviors in a specified environment, under specified conditions/constraints. Behaviors are represented by operational constraints/patterns/preferences/ tendencies/etc. (e.g., for attack, deployment, etc.), threat consequences, etc.
Threat Warnings & Alerts	Data	A Warning or Alert pertaining to a threat. Determined by observation, modeling or analysis, and correlation with one or more incident(s), occurrence(s) or observation(s).
Topology Services	Technology	Able to detect topology errors (e.g., overshoots and undershoots of common linear and polygonal features within a definable tolerance), automatically correct errors, if possible, and define topological relationships between connected/collocated linear, polygon, and point features.
Track	Data	A sequence of observations and/or predictions concerning the location/time/identity/activity/status for persons, goods, assets, conveyances or any other mobile objects for a given period of time (current, historical and planned/projected). Optionally, to also represent speed and direction of motion.
Tracking	Function	The means to observe or otherwise determine the location/time/identity/activity/status for persons, goods, assets, conveyances or any other mobile objects for a given period of time (current, historical and planned/projected).
Tracking Service	Technology	Able to determine (or fetch a predetermined) location/time/velocity/identity/status/activity series (track) for a Mobile Object (e.g., persons, goods, assets, devices, etc.)
Traffic Service	Technology	The means to access traffic information regarding incidents and/or conditions for a specified area of interest, road, or road segment, for a specified time period. Also, the means to access traffic information regarding incidents and/or conditions for a designated route (that has been determined by a Route Service or Navigation Service) for a specified time period.
Training Aids	Data	The means to produce geospatial training aids in support training exercises, and in the form of maps, reports and plans.
Training Exercise Simulation	Application	Provide training simulations capabilities to support training exercises. The simulations employ geospatial data and technology to simulate different attack scenarios. Uses training models and supporting databases.
Training Models	Data	The training models (data and encoded procedures) to support training simulations in order to test how geospatial data and technology is going to perform in local conditions and in different attack scenarios.
Training Planning & Support	Application	The means to plan training exercises and produce geospatial training aids in the form of maps, reports and plans.

Training Plan	Data	The results of training planning and support. The geospatial-temporal context of the resulting training plan, which includes maps and reports that convey objectives/schedules, activity locations and situation context for the (training) exercise, including: potential threat locations, threat consequences, asset locations, population densities, evacuation routes, mutual aid support facilities, etc.
Transaction Report	Data	Reports that summarize geospatial transactions for specified time periods.
Transshipment Point	Data	An intermediate location (waypoint) in a shipping route for goods and cargo where the means of conveyance changes. A subtype of Route.
Travel History (Records)	Data	The record(s) pertaining to a person's or conveyance's past travel. The location/time/identity/activity/status of places, persons, organizations that are visited. Includes the means of transit.
Travel Planning	Application	The means to plan secure and safe travel for individuals. Produces itineraries.
User-Specific Operating Picture	Data	The User Specific Operating Picture (USOP) is an actionable data view of an MSOP that is specialized for a user, in a specific role, on a specific device. USOPs are application-dependent data views that are created through the COP and MSOP collaborative workspaces, and are dependent upon the specific user/application context. USOPs will vary from activity to activity and from individual/device to individual/device. [Thus, each agency activity/application will have to be evaluated to consider collaboration needs and the scope of each USOP.]
Vector	Data	An abstraction of the real world where positional data is represented in the form of coordinates. The basic units of spatial information are points, lines and polygons, where each is composed as a series of one or more coordinate points. Features are generally represented by vector geometry.
Verification Event (Records)	Data	The records of identity verification events associated with a Person or Good.
Visualization	Process	The rendering of geospatial data into a product or medium which allows an analyst or user to review, visually assess and draw conclusions about the underlying information.
Vulnerability	Data	Potential targets where the United States and its interests are open to attack by armed forces, terrorists, etc. The geospatial context of a vulnerability is defined in a Vulnerability Assessment.
Vulnerability Analysis	Application	The means to determine and assign vulnerabilities and vulnerability assessments for key assets, critical assets, key persons or conveyances (and associated routes). Means of analysis may consist of: (data) mine, integrate, correlate, extrapolate, and analyze data for patterns, densities, trends, networks, tendencies, indicators, hypotheses and conclusions, which pertains or may pertain to vulnerabilities. May also involve geoparsing and geocoding functions to scan and annotate associated textual data for geographic and temporal references.
Vulnerability Assessments	Data	The modeling and analysis results from Vulnerability Analysis, as it pertains to key and critical assets.
Warning	Data	An expression of threat to those who need to know. A (warning) message that is indicative of a current or predicted threat, based upon modeling, analysis, and/or correlation with one or more incident(s), occurrence(s) or observation(s).
Warning/Alert Management	Application	The monitoring and processing of Alerts in a geospatial-temporal context. The means to generate Warnings.

Watch	Function	A function that determines Alerts, which are triggered by any suspicious or threatening event with geospatial and temporal context, as determined by evaluating observed or computed conditions.
Watch	Data	A "lookout" notice for a person, goods, conveyance, activity, etc. of interest that contains geospatial and temporal context for a Watch Area.
Waterway Management	Application	The means to perform waterways management to provide a safe, efficient and navigable waterway system to support domestic commerce, international trade and military sealift. Provide long-range and short-range aids to navigation (buoys/sensors/breaking ice), electronic charting and tide/current/pilotage information through Notices to Mariners services, weather services, vessel traffic services, technical assistance and advice, vessel safety standards and inspection, and bridge administration standards and inspections.
Weather	Data	Weather conditions at specified locations. Hindcasts, nowcasts, forecasts and climate data.
Weather Alerts & Warnings	Data	A warning or alert message that is indicative of a current or predicted storm threat, based upon modeling, analysis, and/or correlation with one or more incident(s), occurrence(s) or observation(s).
Weather Model	Data	Models that characterize the behaviors of weather systems and the effects of these systems. These models are associated with weather simulations that are influenced by terrain and features. Input to these models consists of terrain and feature data, meteorological sensor observations and model control parameters. Outputs consist of hindcast, nowcast and forecast weather conditions and climate at specified locations.
Weather Modeling & Analysis	Application	The means to model/simulate and analyze weather conditions at specified locations. The means to determine hindcasts, nowcasts and forecasts for a location and share this information with agency users. The means to generate and disseminate Weather Alerts & Warnings.
Weather Service	Technology	The means to access weather conditions for an area of interest or location for a specified time period.
Web Annotation Service	Technology	The Web Annotation Service is a specialized WFS that accesses map/image annotations. It is based upon the XML for Image and Map Annotation (XIMA), which defines an XML vocabulary to encode annotations on imagery, maps, and other geospatial data. This vocabulary draws on the GML to express the positions of these annotations in geographic (real world) or image-pixel coordinates, and to associate each annotation with the geospatial resource(s) it describes. The XIMA encoding is useful for any activity that requires linking or tagging geospatial data in order to present and discuss it with others, to make joint decisions, or to communicate spatially.
Web Coverage Service (WCS)	Technology	Able to access geospatial coverage data (e.g., imagery and Digital Terrain Model (DTM)). WCS supports the networked interchange of geospatial data as "coverages" containing values or properties of geographic locations. Unlike the Web Map Service (WMS), which filters and portrays spatial data to return static maps (server-rendered as pictures), the WCS provides access to intact (unrendered) geospatial information, as needed for client-side rendering, multi-valued coverages (such as multi-spectral images and terrain models), and input into scientific models and other clients beyond simple viewers.
Web Feature Service (WFS)	Technology	The WFS supports the query and discovery of geographic features (represented in vector form). In a typical Web access scenario, Web Feature Service (WFS) delivers Geography Markup Language (GML) representations of geospatial features. Clients (service requestors/consumers) access geographic feature data through a WFS by submitting a query for just those features that are needed for an application. The client generates a request and posts it to a WFS server on the Web. The WFS instance executes the request, returning the resulting geographic features to the client encoded in GML. A GML-enabled client can manipulate or operate on the

		returned geographic features.
Web Map Service (WMS)	Technology	A WMS is able to access vector and raster data and render it 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 model or images), the WMS produces an image of the data that can be directly viewed in a web browser or other picture-viewing software. A WMS labels its data as one or more "Layers," each of which is available in one or more "Styles." Upon request a WMS makes an image of the requested Layer(s), in either the specified or default rendering Style(s). Typical output formats include Portable Network Graphics (PNG), Graphics Interchange Format (GIF), Joint Photographic Expert Group format (JPEG), and Tagged Image File Format (TIFF).
Web Notification Service	Technology	A service by which a client may conduct a dialog with one or more other services. This service is useful when many collaborating services are required to satisfy a client request, and/or when significant delays are involved is satisfying the request, which is often the case in the geoprocessing realm.
Web Registry Service (WRS)	Technology	The WRS provides a common mechanism to classify, register, describe, search, maintain and access information about geospatial resources available on a network. Resources are network addressable instances of typed data or services. Types of registries are differentiated by their role such as registries for cataloging geospatial resource types (e.g., types of geographic features, coverages, sensors, symbols, services, etc), online data instances (e.g., geospatial and image datasets and repositories, application schema, and symbol-style libraries), and online instances of services.
Web Terrain Service (WTS)	Technology	The WTS extends the WMS interface to allow the access and portrayal of three dimensional geospatial data. This service can be exploited to perform tasks such as terrain analysis, mission planning, and fly-throughs.

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Appendix F: Geospatial Standards Profile

Source	Document Code	Specification Title	Description
OGC	ORM	OGC Reference Model	The ORM describes a framework for the ongoing work of the Open Geospatial Consortium and our specifications and implementing interoperable solutions and applications for geospatial services, data, and applications
OGC	OGCCommon	OGC Web Services Common	Specifies many of the aspects that are, or should be, common to all or multiple OWS interface Implementation Specifications. Those specifications currently include the Web Map Service (WMS), Web Feature Service (WFS), and Web Coverage Service (WCS). These common aspects include: operation request and response contents; parameters included in operation requests and responses; and encoding of operation requests and responses.
OGC	WFS	Web Feature Service	The OGC Web Map Service allows a client to overlay map images for display served from multiple Web Map Services on the Internet. In a similar fashion, the OGC Web Feature Service allows a client to retrieve and update geospatial data encoded in Geography Markup Language (GML) from multiple Web Feature Services. The requirements for a Web Feature Service are: 1. The interfaces must be defined in XML. 2. GML must be used to express features within the interface. 3. At a minimum a WFS must be able to present features using GML. 4. The predicate or filter language will be defined in XML and be derived from CQL as defined in the OpenGIS Catalogue Interface Implementation Specification. 5. The datastore used to store geographic features should be opaque to client applications and their only view of the data should be through the WFS interface. The use of a subset of XPath expressions for referencing properties.
OGC	Filter	Filter Encoding	Filter Encoding (Filter): defines an XML encoding for filter expressions based on the BNF definition of the OpenGIS Common Catalog Query Language as described in the OpenGIS Catalog Interface Implementation Specification, Version 1.0 [2].
OGC	WMC	Web Map Context Documents	A companion specification to the OGC Web Map Service Interface Implementation

				Specification version 1.1.1 [4], hereinafter "WMS 1.1.1." WMS 1.1.1 specifies how individual map servers describe and provide their map content. The present Context specification states how a specific grouping of one or more maps from one or more map servers can be described in a portable, platform-independent format for storage in a repository or for transmission between clients. This description is known as a "Web Map Context Document," or simply a "Context." Presently, context documents are primarily designed for WMS bindings. However, extensibility is envisioned for binding to other services. A Context document includes information about the server(s) providing layer(s) in the overall map, the bounding box and map projection shared by all the maps, sufficient operational metadata for Client software to reproduce the map, and ancillary metadata used to annotate or describe the maps and their provenance for the benefit of human viewers. A Context document is structured using eXtensible Markup Language (XML). Annex A of this specification contains the XML Schema against which Context XML can be validated
OGC	OpenLS		OpenGIS Location Services	This OpenGIS Implementation Specification describes OpenGIS Location Services (OpenLS): Core Services, Parts 1-5, also known as the GeoMobility Server (GMS), an open platform for location-based application services. It also outlines the scope and relationship of OpenLS with respect to other specifications and standardization activities. The primary objective of OpenLS is to define access to the Core Services and Abstract Data Types (ADT) that comprise the GeoMobility Server, an open location services platform.
OGC	CSW		Catalog Interface	Catalog Interface: Defines a common interface that enables diverse but conformant applications to perform discovery, browse and query operations against distributed and potentially heterogeneous catalog servers.
OGC	WMS		Web Mapping Service	Provides three operations (GetCapabilities, GetMap, and GetFeatureInfo) in support of the creation and display of registered and superimposed map-like views of information that come simultaneously from multiple sources that are both remote and heterogeneous.
OGC	WCS		Web Coverage Service	Extends the Web Map Server (WMS) interface to allow access to geospatial "coverages" that represent values or properties of geographic locations, rather than WMS generated maps (pictures).
OGC	GML		Geography Markup Language	The Geography Markup Language (GML) is an XML encoding for the transport and

			storage of geographic information, including both the geometry and properties of geographic features.
OGC	SLD	Styled Layer Descriptor	The SLD is an encoding for how the Web Map Server (WMS 1.0 & 1.1) specification can be extended to allow user-defined symbolization of feature data.
OGC	Grid	Grid Coverages	This specification was designed to promote interoperability between software implementations by data vendors and software vendors providing grid analysis and processing capabilities.
OGC	CTS	Coordinate Transformation Services	Provides interfaces for general positioning, coordinate systems, and coordinate transformations.
OGC	SF	Simple Features - SQL, CORBA, OLE/COM	The Simple Feature Specification application programming interfaces (APIs) provide for publishing, storage, access, and simple operations on Simple Features (point, line, polygon, multi-point, etc).
OGC	SML	Sensor Model Language for In-situ and Remote Sensors	The Sensor Model Language work proposes an XML schema for describing the geometric, dynamic, and observational characteristics of sensor types and instances.
OGC	UoM	Units of Measure Recommendation	Common semantic for units of measurement to be used across all OGC specifications.
OGC	WTS	Web Terrain Service	This document is a companion specification to the OpenGIS Web Map Service Interface Implementation Specification version 1.1.1 [4], hereinafter "WMS 1.1.1." WMS 1.1.1 specifies how individual map servers describe and provide their map content. The present Web Terrain Service specification describes a new operation, GetView, and extended Capabilities which allow a 3D terrain view image to be requested, given a map composition, a terrain model on which to drape the map, and a 3D viewpoint from which to render the terrain view. A simple attempt is also made to reconcile 2D and 3D viewpoints by allowing the requested 3D area of view to be approximated with a WMS 1.1.1 bounding box.
FGDC	FGDC-STD-001-1998	Content Standard for Digital Geospatial Metadata (version 2.0)	http://www.fgdc.gov/metadata/contstan.html
FGDC	FGDC-STD-001.1-1999	Content Standard for Digital Geospatial Metadata, Part 1:	http://www.fgdc.gov/standards/status/sub5_2.html

		Biological Data Profile	
FGDC	FGDC-STD-012-2002	Content Standard for Digital Geospatial Metadata: Extensions for Remote Sensing Metadata	http://www.fgdc.gov/standards/status/csdgm_rs_ex.html
FGDC	FGDC-STD-001.2-2001	Metadata Profile for Shoreline Data	http://www.fgdc.gov/standards/status/sub5_6.html
FGDC	FGDC-STD-002	Spatial Data Transfer Standard (SDTS)	http://mcmcweb.er.usgs.gov/sdts/ (a modified version was adopted as ANSI INCITS 320:1998, which is undergoing periodic review through INCITS Technical Committee L1)
FGDC	FGDC-STD-002.5	SDTS Part 5: Raster Profile and Extensions	http://www.fgdc.gov/standards/status/sub4_1.html
FGDC	FGDC-STD-002.6	SDTS Part 6: Point Profile	http://www.fgdc.gov/standards/status/sub2_3.html
FGDC	FGDC-STD-002.7-2000	SDTS Part 7: Computer-Aided Design and Drafting (CADD) Profile	http://www.fgdc.gov/standards/status/sub3_2.html
FGDC	FGDC-STD-003	Cadastral Data Content Standard	http://www.fgdc.gov/standards/status/sub3_5.html
FGDC	FGDC-STD-004	Classification of Wetlands and Deepwater Habitats of the United States	http://www.fgdc.gov/standards/status/sub3_4.html
FGDC	FGDC-STD-005	Vegetation Classification Standard	http://www.fgdc.gov/standards/status/sub2_1.html
FGDC	FGDC-STD-006	Soil Geographic Data Standard	http://www.fgdc.gov/standards/status/sub2_2.html

FGDC	FGDC-STD-007	Geospatial Positioning Accuracy Standard, Part 3, National Standard for Spatial Data Accuracy	http://www.fgdc.gov/standards/status/sub1_1.html
FGDC	FGDC-STD-008-1999	Content Standard for Digital Orthoimagery	http://www.fgdc.gov/standards/status/sub3_6.html
FGDC	FGDC-STD-009-1999	Content Standard for Remote Sensing Swath Data	http://www.fgdc.gov/standards/status/sub4_4.html
FGDC	FGDC-STD-010-2000	Utilities Data Content Standard	http://www.fgdc.gov/standards/status/sub3_1.html
FGDC	FGDC-STD-011-2001	U.S. National Grid	http://www.fgdc.gov/standards/status/usng.html
ISO	13249-3:2003	Information technology -- Database languages -- SQL multimedia and application packages -- Part 3: Spatial	
ISO	17572	Intelligent Transport Systems (ITS) -- Location Referencing for Geographic Databases	
ISO	18026	Information technology -- Spatial Reference Model (SRM)	
ISO	18042-4	Information technology -- Computer graphics and image processing -- Spatial reference model language bindings -- Part 4: C	
ISO	19101:2002	Geographic Information - Reference Model	

ISO	19101-2	Geographic information -- Reference model -- Part 2: Imagery	
ISO	19103	Geographic information -- Conceptual schema language	
ISO	19104	Geographic information -- Terminology	
ISO	19105:2000	Geographic Information - Conformance and testing	
ISO	19106:2004	Geographic Information - Profiles	
ISO	19107:2003	Geographic Information - Spatial schema	
ISO	19108:2002	Geographic Information - Temporal Schema	
ISO	19109:2005	Geographic Information - Rules for application schema	
ISO	19110:2005	Geographic Information - Methodology for feature cataloguing	
ISO	19111:2003	Geographic Information - Spatial referencing by coordinates	
ISO	19112:2003	Geographic Information - Spatial referencing by geographic identifiers	
ISO	19113:2002	Geographic Information - Quality Principles	

ISO	19114:2003	Geographic Information - Quality evaluation procedures	
ISO	19115:2003	Geographic Information - Metadata	defines the schema required for describing geographic information and services. It provides information about the identification, the extent, the quality, the spatial and temporal schema, spatial reference, and distribution of digital geographic data.
ISO	19115-2	Geographic information -- Metadata -- Part 2: Extensions for imagery and gridded data	
ISO	19116:2004	Geographic Information - Positioning services	
ISO	19117:2005	Geographic Information - Portrayal	
ISO	19118	Geographic Information - Encoding	
ISO	19119:2005	Geographic Information - Services	
ISO	19120:2001	Geographic information -- Functional standards	
ISO	19121:2000	Geographic information -- Imagery and gridded data	
ISO	19123	Geographic Information - Schema for coverage geometry and functions	
ISO	19125-1:2005	Geographic Information - Simple feature access -- Part 1: Common architecture	
ISO	19125-2:2004	Geographic Information - Simple feature access -- Part 2:	

		SQL option	
ISO	19127:2005	Geographic information -- Geodetic codes and parameters	
ISO	19128	Geographic information -- Web Map Server interface	
ISO	19130	Geographic information -- Sensor and data models for imagery and gridded data	
ISO	19131	Geographic information -- Data product specification	
ISO	19132	Geographic information -- Reference model -- Location based services framework	
ISO	19133	Geographic information -- Location-based services -- Tracking and navigation	
ISO	19134	Geographic information -- Location based services -- Multimodal routing and navigation	
ISO	19135	Geographic information -- Procedures for item registration	
ISO	19136	Geographic information -- Geography Markup Language	

ISO	19137	Geographic information -- Generally used profiles of the spatial schema and of similar important other schemas	
ISO	19138	Geographic information -- Data quality measures	
ISO	19139	Geographic information -- Metadata -- XML schema implementation	
ISO	19141	Geographic information -- Schema for moving features	
ISO	19142	Geographic Information - Web Feature Service	
ISO	19143	Geographic Information - Filter encoding	
ISO	6709:1983	Standard representation of latitude, longitude and altitude for geographic point locations	
ANSI	320-1998 (R2003)	Information technology - Spatial Data Transfer	
ANSI	353-2004	Information Technology - Geographical Information Systems - Spatial Data Standard for Facilities, Infrastructure, and Environment (SDSFIE)	
ANSI	61-1986 (R2002)	Geographic Point Locations for Information Interchange, Representation of (formerly	

		ANSI X3.61-1986 (R1997))	
INCITS	BSR INCITS PN-1574-D-200x	Information technology - Geographic Information Framework Data Content Standards	
OASIS	CAP	Common Alerting Protocol v 1.0	http://www.oasis-open.org/committees/download.php/6334/oasis-200402-cap-core-1.0.pdf

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Appendix G: Geospatial Service Components

FEA Service Domain	FEA Service Type	FEA Service-Component	FEA Service Component Description	Geospatial Service Component (* - multiple entries)	Geospatial Service Component Description	Component Granularity Level
Back Office Services Domain	Assets - Materials Management	Asset Cataloging - Identification	Asset Cataloging / Identification - defines the set of capabilities that support the listing and specification of available assets.			
Back Office Services Domain	Assets - Materials Management	Asset Transfer, Allocation, and Maintenance	Defines the set of capabilities that support the movement, assignment, and replacement of assets.			
Back Office Services Domain	Assets - Materials Management	Computers - Automation Management	Computers / Automation Management - defines the set of capabilities that support the identification, upgrade, allocation and replacement of physical devices, including servers and desktops, used to facilitate production and process-driven activities.			
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.	BCS
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.	BCS
Back Office Services Domain	Data Management	Data Classification	Defines the set of capabilities that allow the classification of data.			
Back Office Services	Data Management	Data Cleansing	Defines the set of capabilities that support the removal of incorrect or			

Domain			unnecessary characters and data from a data source.			
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 transformation services. Services to transform geospatial data schemas between disparate systems.	DC
				Coordinate Transformation Service	The ability to transform geospatial data between different coordinate reference systems, datums and units. Support map re-projections on-the-fly for map viewing, as well as permanent coordinate transformations that result in a transformed output data set.	DC
				Geospatial Information Broker	A key component used in moving geospatial data between systems. Involved in data sharing and collaboration operations. Involved in Geospatial Data Rollup/Rolldown (GDRR) Operations.	BC
Back Office Services Domain	Data Management	Data Mart	Defines the set of capabilities that support a subset of a data warehouse for a single department or function within an organization.			
Back Office Services Domain	Data Management	Data Recovery	Defines the set of capabilities that support the restoration and stabilization of data sets to a consistent, desired state.			
Back Office Services Domain	Data Management	Data Warehouse	Defines the set of capabilities that support the archiving and storage of large volumes of data.			
Back Office Services Domain	Data Management	Extraction and Transformation	Defines the set of capabilities that support the manipulation and change of data.			
				Feature Update	An application and supporting services for	BC

				Service	selection, browsing, extraction, transformation, integration and update of a feature database. Assures that requestor credentials are sufficient for requested changes and that changes requested do not violate validation rules.	
				Coverage Update Service	An application and supporting services for selection, browsing, transformation, integration and update of a coverage (e.g., imagery) database. Assures that requestor credentials are sufficient for requested changes and that changes requested do not violate validation rules.	BC
				Gazetteer Update Service	An application and supporting services to support browsing, data entry, transformation, integration and update of a gazetteer database. Supports adding, changing, and deleting gazetteer records. Assures that requestor credentials are sufficient for requested changes and that changes requested do not violate validation rules.	BC
				Geospatial Resource Metadata (Catalog) Update Service	An application and supporting services for browsing, data entry, transformation, integration and update of the metadata for geospatial resources, and optionally, update of associated geospatial resource records. (Geospatial resources include maps and data from which maps may be derived, and may include ancillary products and services. A Geospatial Catalog includes various ways by which geospatial resources are characterized and associated.) Assures that requestor credentials are sufficient for requested changes and that changes requested do not violate validation rules. Accesses one or more Resource Catalog Servers.	BC
				Geospatial Service Metadata (Catalog) Update Service	An application and supporting services for browsing, data entry, integration and update of the metadata for geospatial services. Assures that requestor credentials are sufficient for requested changes and that changes requested do not violate validation rules. Accesses one or more Service Catalog Servers.	BC

Back Office Services Domain	Data Management	Loading and Archiving	Defines the set of capabilities that support the population of a data source with external data.			
Back Office Services Domain	Data Management	Meta Data Management	Defines the set of capabilities that support the maintenance and administration of data that describes data.			
Back Office Services Domain	Data Management	Geographic Data Management (GIS) [NEW Service Component]11	A general-purpose set of capabilities for extracting, loading, transforming, integrating, storing, archiving and managing geospatial information and related metadata.			
				Geographical Information System*	An integrated system for collecting, storing, accessing, sharing, disseminating, integrating, manipulating, visualizing, analyzing and otherwise exploiting Geospatial Information. GIS focuses on producing and exploiting "digital maps" that convey Geospatial Information in graphical form. It is used widely in government, education and business. Also, a general-purpose collection of tools for processing geospatial data. Normally consists of one or more applications with one or more databases. May be configured as a desktop application and/or as a collection of client and server Components.	BCS
				GIS Server*	Comprised of one or more bundled geospatial processing services that support the generation, revision, management, processing, and output of geospatial data. Server-based GIS.	DC
				Native Geospatial	The capabilities for an Enterprise DBMS to provide native support for storing and managing	DC

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11 A complex Business Component System such as a GIS, featured here, does not fit neatly under the FEA SRM taxonomy [2]. GIS cuts across many FEA Service Domains and Types. We have created a new Geospatial Service Component, GIS, here and elsewhere, to reflect the predominant role of GIS in an enterprise.

				DBMS Server	all types of geospatial data. Capabilities should include geospatial indexing, open SQL query support with geometry and topology operators, geospatial analytics, geospatial data mining, coordinate transformation and linear referencing.	
Back Office Services Domain	Data Management	Imagery Data Management (GIS) [NEW Service Component]12	A general-purpose set of capabilities for extracting, loading, transforming, integrating, storing, archiving and managing geospatial imagery and related metadata.			
				Imagery Processing System (IPS)*	An integrated system for collecting, storing, accessing, sharing, disseminating, integrating, manipulating, visualizing, analyzing and otherwise exploiting Geospatial Imagery. IPS focuses on producing and exploiting "digital orthoimagery" that conveys Geospatial Information in raster image form. It is used widely in government, education and business. Also, a general-purpose collection of tools for processing geospatial imagery. Normally consists of one or more applications with one or more databases. May be configured as a desktop application and/or as a collection of client and server Components.	BCS
				Geospatial Imagery Processing Server*	Comprised of one or more bundled geospatial imagery processing services that support the generation, revision, management, processing, and output of geospatial imagery. Server-based Imagery Processing System.	DC
Back Office Services Domain	Development and Integration	Data Integration	Defines the set of capabilities that support the organization of data from separate data sources into a single source using middleware or application integration and the modification of system data models to capture new			

12 Likewise, a complex Business Component System such as an Imagery Processing System (IPS), featured here, does not fit neatly under the FEA SRM taxonomy [2]. IPS cuts across many FEA Service Domains and Types. We have created a new Geospatial Service Component, IPS, here and elsewhere, to reflect the predominant role of IPS in an enterprise.

			information within a single system.			
Back Office Services Domain	Development and Integration	Enterprise Application Integration	Defines the set of capabilities that support the redesigning of disparate information systems into one system that uses a common set of data structures and rules.			
Back Office Services Domain	Development and Integration	Instrumentation and Testing	Defines the set of capabilities that support the validation of application or system capabilities and requirements.			
Back Office Services Domain	Development and Integration	Legacy Integration	Defines the set of capabilities that support the communication between newer generation hardware-software applications and the previous, major generation of hardware-software applications.			
Back Office Services Domain	Development and Integration	Software Development	Defines the set of capabilities that support the creation of both graphical and process application or system software.			
Back Office Services Domain	Financial Management	Credit - Charge	Defines the set of capabilities that support the use of credit cards or electronic funds transfers for payment and collection of products or services.			
Back Office Services Domain	Financial Management	Activity-Based Management	Defines the set of capabilities that support a defined, specific set of finance-related tasks for a given objective.			
Back Office Services Domain	Financial Management	Auditing	Defines the set of capabilities that support the examination and verification of records for accuracy.			
Back Office Services Domain	Financial Management	Billing and Accounting	Defines the set of capabilities that support the charging, collection and reporting of an organization's accounts.			
Back Office Services Domain	Financial Management	Currency Translation	Defines the set of capabilities that support the calculations and difference between multiple mediums of			

			exchange.			
Back Office Services Domain	Financial Management	Debt Collection	Defines the set of capabilities that support the process of accounts receivable.			
Back Office Services Domain	Financial Management	Expense Management	Defines the set of capabilities that support the management and reimbursement of costs paid by employees or an organization.			
Back Office Services Domain	Financial Management	Internal Controls	Support the methods and procedures used by the organization to safeguard its assets, produce accurate accounting data and reports, contribute to efficient operations, and encourage staff to adhere to management policies and mission requirements			
Back Office Services Domain	Financial Management	Payment - Settlement	Defines the set of capabilities that support the process of accounts payable.			
Back Office Services Domain	Financial Management	Payroll	Defines the set of capabilities that involve the administration and determination of employees compensation.			
Back Office Services Domain	Financial Management	Revenue Management	Defines the set of capabilities that support the allocation and re-investment of earned net credit or capital within an organization.			
Back Office Services Domain	Human Capital - Workforce Management	Contingent Workforce Management	Defines the set of capabilities that support the continuity of operations for an organization's business through the identification of alternative organization personnel.			
Back Office Services Domain	Human Capital - Workforce Management	Resource Planning and Allocation	Support the determination of strategic direction, the identification and establishment of programs and processes, and the allocation of resources (capital and labor) among those programs and processes			

Back Office Services Domain	Human Capital - Workforce Management	Skills Management	Defines the set of capabilities that support the proficiency of employees in the delivery of an organization's products or services.			
Back Office Services Domain	Human Capital - Workforce Management	Team - Org Management	Defines the set of capabilities that support the hierarchy structure and identification of employees within the various sub-groups of an organization.			
Back Office Services Domain	Human Capital - Workforce Management	Workforce Acquisition - Optimization	Defines the set of capabilities that support the hiring and re-structuring of employees and their roles within an organization.			
Back Office Services Domain	Human Capital - Workforce Management	Workforce Directory - Locator	Defines the set of capabilities that support the listing of employees and their whereabouts.			
Back Office Services Domain	Human Resources	Awards Management	Defines the set of capabilities that support the recognition of achievement among employees of an organization.			
Back Office Services Domain	Human Resources	Benefit Management	Defines the set of capabilities that support the enrollment and participation in an organization's compensation and benefits programs.			
Back Office Services Domain	Human Resources	Career Development and Retention	Defines the set of capabilities that support the monitoring of performance as well as the professional growth, advancement, and retention of an organization's employees.			
Back Office Services Domain	Human Resources	Education - Training	Defines the set of capabilities that support the active building of employee capacities.			
Back Office Services Domain	Human Resources	Health and Safety	Defines the set of capabilities that support the security and physical well-being of an organization's employees.			
Back Office Services Domain	Human Resources	Personnel Administration	Defines the set of capabilities that support the matching between an organization's employees and potential			

			opportunities as well as the modification, addition and general upkeep of an organization's employee-specific information.			
Back Office Services Domain	Human Resources	Recruiting	Defines the set of capabilities that support the identification and hiring of employees for an organization.			
Back Office Services Domain	Human Resources	Resume Management	Defines the set of capabilities that support the maintenance and administration of one's professional or work experience and qualifications.			
Back Office Services Domain	Human Resources	Retirement Management	Defines the set of capabilities that support the payment of benefits to retirees.			
Back Office Services Domain	Human Resources	Time Reporting	Defines the set of capabilities that support the submission, approval and adjustment of an employee's hours.			
Back Office Services Domain	Human Resources	Travel Management	Defines the set of capabilities that support the transit and mobility of an organization's employees for business purposes.			
Business Analytical Services Domain	Analysis and Statistics	Forensics	Defines the set of capabilities that support the analysis of physical elements using science and technology for investigative and legal purposes.			
Business Analytical Services Domain	Analysis and Statistics	Mathematical	Support the formulation and mathematical analysis of probabilistic models for random phenomena and the development and investigation of methods and principles for statistical inference			
Business Analytical Services Domain	Analysis and Statistics	Radiological	Defines the set of capabilities that support the use of radiation and x-ray technologies for analysis and scientific examination.			
Business	Analysis and	Structural -	Defines the set of capabilities that			

Analytical Services Domain	Statistics	Thermal	support the use of data flow and data modeling diagrams for applying systematic analysis of data.			
Business Analytical Services Domain	Analysis and Statistics	Geographic Analysis (GIS) [NEW Service Component]13	A general-purpose set of capabilities for analyzing and processing geospatial data.			
				Geographical Information System*	An integrated system for collecting, storing, accessing, sharing, disseminating, integrating, manipulating, visualizing, analyzing and otherwise exploiting Geospatial Information. GIS focuses on producing and exploiting "digital maps" that convey Geospatial Information in graphical form. It is used widely in government, education and business. Also, a general-purpose collection of tools for processing geospatial data. Normally consists of one or more applications with one or more databases. May be configured as a desktop application and/or as a collection of client and server Components.	BCS
				GIS Server*	Comprised of one or more bundled geospatial processing services that support the generation, revision, management, processing, and output of geospatial data. Server-based GIS.	DC
				Geocoder/ Reverse Geocoder Service	Able to determine geospatial coordinates, given an address (Geocoder), or determine address, given geospatial coordinates (Reverse Geocoder). A Geocoder transforms a description of a feature location, such as a place name, street address or postal code, into a normalized description of the location, which includes coordinates. A Geocoder Service receives a description of a feature location as input and provides a normalized address with coordinates as output.	DC

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					The feature location descriptions are any terms, codes or phrases that describe the features, and that are well-known to the Geocoder Service, such as a street addressing or postal coding scheme. These services are very important across many enterprises, as they enable enterprise users to exploit the geospatial-temporal context of the wide diversity of business data that contain Location References, such as address, building name, census tract, etc. They are also key to correlating, integrating and fusing dissimilar data on the basis of geospatial-temporal characteristics.	
				Geolocate Service	The capability to use GPS or some other means to determine a geospatial location for a fixed or mobile object of interest (e.g., geospatial feature, person, asset, conveyance, goods, cargo, device, etc.) Mobile Objects must be equipped with GPS, Radio Frequency ID (RFID), and/or other position determination technologies.	DC
				Gateway Service	Determines the geospatial position of a known mobile terminal from a wireless network. Position is expressed in geographic coordinates. Mobile terminals (cell phones, PDAs, etc) must be equipped with GPS or some other position determination technology. An important service used in LBS, in the wireless realm.	DC
				Route Service	Able to determine (or fetch a predetermined) route and navigation information for autonomous or semi-autonomous navigation between two or more points on a network. An important service used in LBS, in the wireless realm.	DC
				Navigation Service	An enhanced version of the Route Service, which determines routes between two or more points with enhanced navigation information. An important service used in LBS.	DC
				Monitoring Service	Able to determine (or fetch a predetermined) location/time/identity/ status/ activity series for	DC

					a Location.	
				Tracking Service	Able to determine (or fetch a predetermined) location/time/velocity/identity/status/activity series (track) for a mobile object (e.g., persons, goods, assets, devices, etc.)	DC
				Weather Service	The means to access weather conditions for an area of interest or location for a specified time period.	DC
				Traffic Service	The means to access traffic information regarding incidents and/or conditions for a specified area of interest, road, or road segment, for a specified time period. Also, the means to access traffic information regarding incidents and/or conditions for a designated route (that has been determined by a Route Service or Navigation Service) for a specified time period.	DC
				Model Service	Able to determine and access the extent and nature of a geospatial model (e.g., Toxic Dispersion Model -- plume for a chemical or biological event in air or water). The model output is characterized by features. "Toxic Dispersion" refers to the effects of introducing a chemical, radioactive or biological agent into the atmosphere or a water supply at a point source. Simulation is employed to understand the effects of a toxic agent within its medium. The objective of the simulation is to ascertain contamination levels in a geospatial-temporal context, and thus, to understand the nature of toxic plumes, danger zones, warning zones, and related features, and to be able to view or analyze the output from a simulation run in conjunction with any other geospatial data, e.g., as plumes or danger/warning zones within a geospatial decision support tool. Also, the ability to determine and access weather, hydrographic and other environmental parameters through environmental simulation. The simulation output is characterized by observations.	DC

				Geoparser Service	Geoparsing refers to the capability to scan and parse a textual document, identifying key words and phrases that have geospatial-temporal context. A Geoparser Service works in the context of two bodies of information: a reserved vocabulary (a dictionary of place names, a gazetteer or a directory of points of interest (POIs) and a text source (e.g., a newspaper or cable.). The Geoparser returns all occurrences of the use (in the text source) of any term in the reserved vocabulary. Each occasion establishes a geolinks (geospatial/temporal-aware hyperlink) between text terms and the geospatial location associated with the reserved word. That result is an annotated text document with geolinks.	DC
				Sensor Planning Service	A service by which a client14 can determine sensor collection feasibility for a desired set of collection requests for one or more mobile sensors/platforms, or the client may submit collection requests directly to these sensors/platforms.	DC
				Sensor Observation Service	A service by which a client can obtain observations from one or more sensors/platforms (can be mixed types). Clients can also obtain information that describes the associated sensors and platforms.	DC
				Sensor Alert Service	The SASs produce alert messages when given observation conditions are met by a sensor. Provides the means for client services/users to specify and register user profiles that contain user information, applicable sensors/observations, alert conditions (e.g., maximum/minimum values), and alert actions (what happens if conditions are met). Also, the means for client services/users to update user profiles. Clients are able to control the nature of alerts. For example,	DC

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14 Client, as used here, means any software component or application that invokes a service.

					a client is able to activate/deactivate an alert capability. Also provides the means to support push/pull capabilities, e.g., to wait for observation input from associated sensors (for on/off sensors like a detector), or to actively poll for (current/historical/predicted) sensor observations.	
				Topology Service	The ability to detect topology errors (e.g., overshoots and undershoots of common linear and polygonal features within a definable tolerance), automatically correct errors, if possible, and define topological relationships between connected/collocated linear, polygon, and point features.	DC
Business Analytical Services Domain	Analysis and Statistics	Imagery Analysis (IPS) [NEW Service Component]15	A general-purpose set of capabilities for analyzing and processing geospatial imagery and related metadata.			
				Imagery Processing System (IPS)*	An integrated system for collecting, storing, accessing, sharing, disseminating, integrating, manipulating, visualizing, analyzing and otherwise exploiting Geospatial Imagery. IPS focuses on producing and exploiting "digital orthoimagery" that conveys Geospatial Information in raster image form. It is used widely in government, education and business. Also, a general-purpose collection of tools for processing geospatial imagery. Normally consists of one or more applications with one or more databases. May be configured as a desktop application and/or as a collection of client and server Components.	BCS
				Geospatial Imagery Processing	Comprised of one or more bundled geospatial imagery processing services that support the generation, revision, management, processing,	DC

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15 Likewise, a complex Business Component System such as an Imagery Processing System (IPS), featured here, does not fit neatly under the FEA SRM taxonomy [2]. IPS cuts across many FEA Service Domains and Types. We have created a new Geospatial Service Component, IPS, here and elsewhere, to reflect the predominant role of IPS in an enterprise.

				Server*	and output of geospatial imagery. Server-based Imagery Processing System.	
Business Analytical Services Domain	Business Intelligence	Balanced Scorecard	Defines the set of capabilities that support the listing and analyzing of both positive and negative impacts associated with a decision.			
Business Analytical Services Domain	Business Intelligence	Decision Support and Planning	Defines the set of capabilities that support the analyze information and predict the impact of decisions before they are made.			
Business Analytical Services Domain	Business Intelligence	Demand Forecasting - Mgmt	Defines the set of capabilities that facilitate the prediction of sufficient production to meet an organization's sales of a product or service.			
Business Analytical Services Domain	Knowledge Discovery	Data Mining	Defines the set of capabilities that support the exploring and analyzing of detailed business transactions to uncover patterns and relationships within the business activity and history.			
Business Analytical Services Domain	Knowledge Discovery	Modeling	Defines the set of capabilities that support the simulating of conditions or activities by performing a set of equations on a set of data.			
Business Analytical Services Domain	Knowledge Discovery	Simulation	Defines the set of capabilities that support the representation of the interaction between real-world objects.			
				Terrain Simulator	The application and supporting services for viewing 3D geospatial information. Many specialized types of this service. Accesses one or more Terrain Servers.	BC
Business Analytical Services Domain	Reporting	Ad-Hoc	Ad Hoc - defines the set of capabilities that support the use of dynamic reports on an as needed basis.			
				Location	The application and supporting services for	BC

				Report Generator*	composing a report based upon location-based (geospatial) information. Many specialized types of this service, e.g., situation reports, after action reports, alert/warning reports, incident reports, activity reports, etc.	
Business Analytical Services Domain	Reporting	OLAP	Defines the set of capabilities that support the analysis of information that has been summarized into multidimensional views and hierarchies.			
Business Analytical Services Domain	Reporting	Standardized - Canned	Defines the set of capabilities that support the use of pre-conceived or pre-written reports.			
				Location Report Generator*	The application and supporting services for composing a report based upon location-based (geospatial) information. Many specialized types of this service, e.g., situation reports, after action reports, alert/warning reports, incident reports, activity reports, etc.	BC
Business Analytical Services Domain	Visualization	CAD	CAD - defines the set of capabilities that support the design of products with computers.			
Business Analytical Services Domain	Visualization	Graphing - Charting	Defines the set of capabilities that support the presentation of information in the form of diagrams or tables.			
Business Analytical Services Domain	Visualization	Imagery	Defines the set of capabilities that support the creation of film or electronic images from pictures, paper forms or graphics for static or dynamic use.			
				Coverage Client*	An application that provides the means to visualize and interact with Coverages (e.g.,	BC16

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[16] May come bundled with one or more Coverage Servers, and/or may be more open-ended and integrate with one or more Distributed Component Coverage Servers.

					geospatial imagery and raster data). Provides tools to select Coverage data for viewing, enhancement, annotation layer control, setting view window, display chosen view, coordinate transformation, measure and pinpoint, navigate through view with pan and zoom, etc. Usually associated with one or more Coverage Servers.	
				Annotation Service*	A service that accesses map/image annotations. Annotations are useful for any activity that requires linking or tagging geospatial data in order to present and discuss it with others, to make joint decisions, collaborate or to communicate spatially.	DC
Business Analytical Services Domain	Visualization	<mark>Mapping, geospatial (GIS), elevation, GPS17</mark>	<mark>Provide for the representation of position information through the use of attributes such as elevation, latitude, and longitude coordinates</mark>			
				Map(ping) Client	An application that provides the means to visualize and interact with geospatial data in rendered map form. Provides tools to select base map/image data for viewing, layer control (e.g., Features, locations, structures, routes, observations, and mobile-objects), set view window, display chosen view, coordinate transformation, measure and pinpoint, navigate through view with pan and zoom, etc. Optionally choose symbology, map display template or select previous views. Usually associated with one or more Map Servers.	BC18
				Situation Awareness	An application and associated services for viewing an area of interest, incident or event in a geospatial context. May include related geospatial services for selection, analysis, manipulation,	BC

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[17] This is the only reference having to do with geospatial in the entire FEA SRM, version 1.0. Recommend that this FEA Service Component be changed to "Geospatial Visualization", described as "Provide for the representation of geospatial information."

[18] May come bundled with one or more Map Servers, and/or may be more open-ended and integrate with one or more Distributed Component Map Servers.

					reporting, collaboration, etc.	
				Coverage Client*	An application that provides the means to visualize and interact with Coverages (e.g., geospatial imagery and raster data). Provides tools to select Coverage data for viewing, enhancement, annotation layer control, setting view window, display chosen view, coordinate transformation, measure and pinpoint, navigate through view with pan and zoom, etc. Usually associated with one or more Coverage Servers.	BC19
				Feature Client	Sends requests to one or more Feature Servers for detailed information pertaining to a particular feature within a map. Provides the means to visualize Feature information. Provides tools to query Feature data, display chosen view, and designate target coordinate transformation system. Often combined with Map Client.	BC20
				Personal Map Software	Personal Map Software includes a variety of tools for viewing, annotating and manipulating map data. Typically include map data for standalone operations. Often includes Global Positioning System (GPS) capability for mobile applications. Commercial map software for desktop or Personal Digital Assistant (PDA).	BC
				Geospatial Client	An application that provides the means to visualize and interact with a variety of geospatial data, including Maps, Features and Coverages. Provides tools to select data for viewing, enhancement, annotation layer control, setting view window, display chosen view, coordinate transformation, measure and pinpoint, navigate through view with pan and zoom, etc. Usually associated with one or more geospatial data servers.	BC21

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[19] May come bundled with one or more Coverage Servers, and/or may be more open-ended and integrate with one or more Distributed Component Coverage Servers.

[20] May come bundled with one or more Feature Servers, and/or may be more open-ended and integrate with one or more Distributed Component Feature Servers.

				Specialized Geospatial Business Components (Various)	Geospatial-based business applications and associated services that provides visualization and interaction with geospatial data. Provides access to underlying Business Components and Geospatial Services. Many such Specialized Geospatial Business Components will exist within enterprises, each which may have a client application and one or more Business Components and/or Geospatial Services. **Error! Reference source not found.** lists of some of the possible Specialized Geospatial Business Components.	BC22
				Location Client*	Sends requests to one or more Location Servers for a) geo-coding an address, yielding a coordinate; b) reverse geo-coding a coordinate, returning an address; c) routing from a start point to and end point (perhaps with intervening via points); d) a point of interest given a coordinate or an address (either precisely or within a proximity). Provides the means to visualize location information. Provides tools to query location data and display chosen view, often on a map. Normally implemented as wireless, Location-based Services (LBS).	BC23
				Gazetteer Client	Sends requests to one or more Gazetteer Servers a for place names by a given location or for locations by a given place name. Provides the means to visualize gazetteer information. Provides tools to query gazetteer data and display chosen view. Often combined with other clients.	BC24

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[21] May come bundled with one or more geospatial data servers, and/or may be more open-ended and integrate with one or more Distributed Component servers.

[22] May come bundled with one or more geospatial data servers, and/or may be more open-ended and integrate with one or more Distributed Component servers.

[23] May come bundled with one or more Location Servers, and/or may be more open-ended and integrate with one or more Distributed Component servers.

[24] May come bundled with one or more Gazetteer Servers, and/or may be more open-ended and integrate with one or more Distributed Component servers.

				Style Management Service (SMS)	The means to create, update and manage styles and symbols. The SMS must manage distinct objects that represent styles and symbols and provide the means to discover, query, insert, update, and delete these objects. Styles provide the mapping from feature types and feature properties and constraints to parameterized Symbols used in drawing maps. Symbols are bundles of predefined graphical parameters and predefined fixed graphic "images".	BC
				Annotation Service*	A service that accesses map/image annotations. Annotations are useful for any activity that requires linking or tagging geospatial data in order to present and discuss it with others, to make joint decisions, collaborate or to communicate spatially.	DC
Business Analytical Services Domain	Visualization	Multimedia	Defines the set of capabilities that support the representation of information in more than one form to include text, audio, graphics, animated graphics and full motion video.			
Business Management Services Domain	Investment Management	Performance Management	Defines the set of capabilities for measuring the effectiveness of an organization's financial assets and capital.			
Business Management Services Domain	Investment Management	Portfolio Management	Defines the set of capabilities that support the administration of a group of investments held by an organization.			
Business Management Services Domain	Investment Management	Strategic Planning & Mgmt	Defines the set of capabilities that support the determination of long-term goals and the identification of the best approach for achieving those goals.			
Business Management Services Domain	Management of Process	Business Rule Management	Defines the set of capabilities for the management of the enterprise processes that support an organization and its policies.			

Business Management Services Domain	Management of Process	Change Management	Defines the set of capabilities that control the process for updates or modifications to the existing documents, software or business processes of an organization.			
Business Management Services Domain	Management of Process	Configuration Management	Defines the set of capabilities that control the hardware and software environments, as well as documents of an organization.			
Business Management Services Domain	Management of Process	Governance - Policy Management	Defines the set of capabilities intended to influence and determine decisions, actions, business rules and other matters within an organization.			
Business Management Services Domain	Management of Process	Program - Project Management	Defines the set of capabilities for the management and control of a particular effort of an organization.			
Business Management Services Domain	Management of Process	Quality Management	Defines the set of capabilities intended to help determine the level that a product or service satisfies certain requirements.			
Business Management Services Domain	Management of Process	Requirements Management	Defines the set of capabilities for gathering, analyzing and fulfilling the needs and prerequisites of an organization's efforts.			
Business Management Services Domain	Management of Process	Risk Management	Defines the set of capabilities that support the identification and probabilities or chances of hazards as they relate to a task, decision or long-term goal.			
Business Management Services Domain	Organizational Management	Network Management	Defines the set of capabilities involved in monitoring and maintaining a communications network in order to diagnose problems, gather statistics and provide general usage.			
Business	Organizational	Workgroup -	Defines the set of capabilities that			

Management Services Domain	Management	Groupware	support multiple users working on related tasks.			
Business Management Services Domain	Supply Chain Management	Storefront - Shopping Cart	Defines the set of capabilities that support the online equivalent of the supermarket cart, where orders and merchandise are placed.			
Business Management Services Domain	Supply Chain Management	Returns Management	Defines the set of capabilities for collecting, analyzing, and resolving product returns or service cancellations.			
Business Management Services Domain	Supply Chain Management	Catalog Management	Defines the set of capabilities that support the listing of available products or services that an organization offers.			
				Services Catalog Client	An application that sends requests to one or more Service Catalog Servers for geospatial service catalog records. Includes tools to select and view this information.	BC
				Resources Catalog Client	An application that sends requests to one or more Resource Catalog Servers for geospatial resource catalog records. Includes tools to select and view this information. (Geospatial resources include maps and data from which maps may be derived, and may include ancillary products and services. A geospatial catalog includes various ways by which geospatial resources are characterized and associated.)	BC
				Location Client*	Sends requests to one or more Location Servers for information about a point of interest (e.g., store) and associated products and services. Provides capabilities to support a) geo-coding an address, yielding a coordinate; b) reverse geo-coding a coordinate, returning an address; c) routing from a start point to and end point (perhaps with intervening via points); d) a point of interest given a coordinate or an address (either precisely or within a proximity). Provides	BC

				the means to visualize point of interest information. Provides tools to query point of interest data and display chosen view, often on a map. Normally implemented as wireless, Location-based Services (LBS).	
Business Management Services Domain	Supply Chain Management	Inventory Management	Provide for the balancing of customer service levels with inventory investment		
Business Management Services Domain	Supply Chain Management	Invoice - Requisition Tracking and Approval	Defines the set of capabilities that support the identification of where a shipment or delivery is within the business cycle.		
Business Management Services Domain	Supply Chain Management	Logistics and Transportation	Provide for efficient freight and traffic management		
Business Management Services Domain	Supply Chain Management	Ordering - Purchasing	Defines the set of capabilities that allow the placement of request for a product.		
Business Management Services Domain	Supply Chain Management	Procurement	Defines the set of capabilities that support the ordering and purchasing of products and services.		
Business Management Services Domain	Supply Chain Management	Sourcing Management	Defines the set of capabilities that support the supply of goods or services as well as the tracking and analysis of costs for these goods.		
Business Management Services Domain	Supply Chain Management	Warehouse Management	Provide for the storage and movement of materials within a warehouse, including these processes: material receipt, order picking, packaging, labeling and shipping		
Customer Services Domain	Customer Initiated Assistance	Self-Service	Defines the set of capabilities that allow an organization's customers to sign up for a particular service at their own		

			initiative.		
Customer Services Domain	Customer Initiated Assistance	Reservations - Registration	Defines the set of capabilities that allow electronic enrollment and confirmations for services.		
Customer Services Domain	Customer Initiated Assistance	Online Tutorials	Defines the set of capabilities that provide an electronic interface to educate and assist customers.		
Customer Services Domain	Customer Initiated Assistance	Online Help	Defines the set of capabilities that provide an electronic interface to customer assistance.		
Customer Services Domain	Customer Initiated Assistance	Assistance Request	Defines the set of capabilities that support the solicitation of support from a customer.		
Customer Services Domain	Customer Initiated Assistance	Multi-Lingual Support	Defines the set of capabilities that allow access to data and information in multiple languages.		
Customer Services Domain	Customer Initiated Assistance	Scheduling	Defines the set of capabilities that support the plan for performing work or service to meet the needs of an organization's customers.		
Customer Services Domain	Customer Preferences	Alerts and Notifications	Defines the set of capabilities that allow a customer to be contacted in relation to a subscription or service of interest.		
Customer Services Domain	Customer Preferences	Personalization	Defines the set of capabilities to change a user interface and how data is displayed.		
Customer Services Domain	Customer Preferences	Subscriptions	Defines the set of capabilities that allow a customer to join a forum, listserv, or mailing list.		
Customer Services Domain	Customer Relationship Management	Sales and Marketing	Defines the set of capabilities that facilitate the promotion of a product or service and capture of new business.		
Customer Services Domain	Customer Relationship Management	Customer Feedback	Defines the set of capabilities that are used to collect, analyze and handle comments and feedback from an		

			organization's customers.			
Customer Services Domain	Customer Relationship Management	Call Center Management	Define the set of capabilities that handle telephone sales and-or service to the end customer.			
Customer Services Domain	Customer Relationship Management	Brand Management	Defines the set of capabilities that support the application of a trade name to a product or service as well as developing an awareness for the name.			
Customer Services Domain	Customer Relationship Management	Contact and Profile Management	Provide a comprehensive view of all customer interactions, including calls, email, correspondence and meetings; also provide for the maintenance of a customer's account, business and personal			
Customer Services Domain	Customer Relationship Management	Customer - Account Management	Define the set of capabilities that support the retention and delivery of a service or product to an organization's clients.			
Customer Services Domain	Customer Relationship Management	Customer Analytics	Defines the set of capabilities that allow for the analysis of an organization's customers as well as the scoring of third party information as it relates to an organization's customers.			
Customer Services Domain	Customer Relationship Management	Partner Relationship Management	Provide a framework to promote the effective collaboration between an organization and its business partners, particularly members of the distribution chain (e.g., channel and alliance partners, resellers, agents, brokers, and dealers) and other third parties that support operations and service delivery to an organization's customers; includes performance evaluation of partners, if necessary.			
Customer Services Domain	Customer Relationship Management	Product Management	Defines the set of capabilities that facilitate the creation and maintenance of products and services.			

Customer Services Domain	Customer Relationship Management	Surveys	Defines the set of capabilities that are used to collect useful information from an organization's customers.			
Digital Asset Services Domain	Content Management	Content Authoring	Defines the capabilities that allow for the creation of tutorials, CBT courseware, Web sites, CD-ROMs and other interactive programs.			
Digital Asset Services Domain	Content Management	Content Publishing and Delivery	Defines the set of capabilities that allow for the propagation of interactive programs.			
Digital Asset Services Domain	Content Management	Content Review and Approval	Defines the capabilities that allow for the approval of interactive programs.			
Digital Asset Services Domain	Content Management	Syndication Management	Defines the set of capabilities that control and regulate an organization's brand.			
Digital Asset Services Domain	Content Management	Tagging and Aggregation	Defines the set of capabilities that support the identification of specific content within a larger set of content for collection and summarization.			
Digital Asset Services Domain	Content Management	Map Production (GIS) [NEW Service Component]25	A general-purpose set of capabilities for authoring, publishing and sharing softcopy and hardcopy digital map data.			
				Geographical Information System*	An integrated system for collecting, storing, accessing, sharing, disseminating, integrating, manipulating, visualizing, analyzing and otherwise exploiting Geospatial Information. GIS focuses on producing and exploiting "digital maps" that convey Geospatial Information in graphical form. It is used widely in government, education and business.	BCS

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[25] A complex Business Component System such as a GIS, featured here, does not fit neatly under the FEA SRM taxonomy [2]. GIS cuts across many Service Domains and Types. We have created a new Geospatial Service Component, GIS, here and elsewhere, to reflect the predominant role of GIS in an enterprise.

					Also, a general-purpose collection of tools for processing geospatial data. Normally consists of one or more applications with one or more databases. May be configured as a desktop application and/or as a collection of client and server Components.	
				Map Publication Service	A lightweight application for publishing maps. Able to automatically generate and publish Maps of interest for inclusion in a plan, report, or other document, with select content and symbolization (map template). E.g. To produce a Map for inclusion in a word or graphic document.	BC
				GIS Server*	Comprised of one or more bundled geospatial processing services that support the generation, revision, management, processing, and output of geospatial data. Server-based GIS.	DC
Digital Asset Services Domain	Content Management	Imagery Production (IPS) [NEW Service Component]26	A general-purpose set of capabilities for authoring, publishing and sharing softcopy and hardcopy geospatial imagery data.			
				Imagery Processing System (IPS)*	An integrated system for collecting, storing, accessing, sharing, disseminating, integrating, manipulating, visualizing, analyzing and otherwise exploiting Geospatial Imagery. IPS focuses on producing and exploiting "digital orthoimagery" that conveys Geospatial Information in raster image form. It is used widely in government, education and business. Also, a general-purpose collection of tools for processing geospatial imagery. Normally consists of one or more applications with one or more databases. May be configured as a desktop application and/or as a collection of client and server Components.	BCS

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26 Likewise, a complex Business Component System such as an Imagery Processing System (IPS), featured here, does not fit neatly under the FEA SRM taxonomy [2]. IPS cuts across many FEA Service Domains and Types. We have created a new Geospatial Service Component, IPS, here and elsewhere, to reflect the predominant role of IPS in an enterprise.

				Geospatial Imagery Processing Server*	Comprised of one or more bundled geospatial imagery processing services that support the generation, revision, management, processing, and output of geospatial imagery. Server-based Imagery Processing System.	DC
Digital Asset Services Domain	Document Management	Classification (Documents)				
Digital Asset Services Domain	Document Management	Document Conversion	Defines the set of capabilities that support the changing of files from one type of format to another.			
Digital Asset Services Domain	Document Management	Document Imaging and OCR	Defines the set of capabilities that support the scanning of physical documents for use electronically.			
Digital Asset Services Domain	Document Management	Document Referencing	Defines the set of capabilities that support the redirection to other documents and information for related content.			
Digital Asset Services Domain	Document Management	Document Review and Approval	Defines the set of capabilities that support the editing and commendation of documents before releasing them.			
Digital Asset Services Domain	Document Management	Document Revisions	Defines the set of capabilities that support the versioning and editing of content and documents.			
Digital Asset Services Domain	Document Management	Indexing	Defines the set of capabilities that support the rapid retrieval of documents through a structured numbering construct.			
Digital Asset Services Domain	Document Management	Library - Storage	Defines the set of capabilities that support document and data warehousing and archiving.			
Digital Asset Services Domain	Knowledge Management	Knowledge Distribution and Delivery	Defines the set of capabilities that support the transfer of knowledge to the end customer.			
Digital Asset	Knowledge	Categorization	Defines the set of capabilities that allow			

Services Domain	Management		classification of data and information into specific layers or types to support an organization.			
Digital Asset Services Domain	Knowledge Management	Information Mapping - Taxonomy	Defines the set of capabilities that support the creation and maintenance of relationships between data entities, naming standards and categorization.			
Digital Asset Services Domain	Knowledge Management	Information Retrieval	Defines the set of capabilities that allow access to data and information for use by an organization and its stakeholders.			
Digital Asset Services Domain	Knowledge Management	Information Sharing	Defines the set of capabilities that support the use of documents and data in a multi-user environment for use by an organization and its stakeholders.			
				Feature Server	Responds to requests from a feature client for detailed information pertaining to a particular feature within a map. Optionally supports coordinate transformation from a source coordinate reference system to a target coordinate reference system.	DC
				Coverage Server	Responds to requests from a coverage client to deliver a rendered orthoimage/map. Optionally supports coordinate transformation from a source coordinate reference system to a target coordinate reference system. May act as a proxy to multiple remote coverage services to return a single composite orthoimage/map.	DC
				Map(ping) Server	The means to render 2D views of geospatial data. Responds to requests from a map client to deliver a rendered map. Supports coordinate transformation from a source coordinate reference system to a target coordinate reference system. Supports the specification of remote layer styles. May act as a proxy to multiple remote map services to return a single composite map.	DC
				Terrain Server	The means to render 3D views of geospatial data. Responds to requests from a Terrain Simulator to deliver a rendered 3D data. Supports coordinate	DC

					transformation from a source coordinate reference system to a target coordinate reference system. Supports the specification of layer styles. May act as a proxy to multiple remote terrain services to return a single composite view.	
				Gazetteer Server	Responds to Gazetteer Client requests for place names by a given location or for locations by a given place name.	DC
				Location Server	A service with multiple functions that responds to Location Client requests for a) geo-coding an address, yielding a coordinate; b) reverse geo-coding a coordinate, returning an address; c) routing from a start point to and end point (perhaps with intervening via points); d) a point of interest given a coordinate or an address (either precisely or within a proximity). Normally implemented as wireless, Location-based Services (LBS).	DC
				Resource Catalog Server* (aka Registry Service)	Responds to client requests for geospatial resource metadata. (Geospatial resources include maps and data from which maps may be derived, and may include ancillary products and services. A geospatial catalog includes various ways by which geospatial resources are characterized and associated.)	DC
				Service Catalog Server*	Responds to client requests for geospatial service metadata.	DC
Digital Asset Services Domain	Knowledge Management	Knowledge Capture	Defines the set of capabilities that facilitate collection of data and information.			
Digital Asset Services Domain	Knowledge Management	Knowledge Discovery	Defines the set of capabilities that facilitate the identification of useful information from data.			
Digital Asset Services Domain	Knowledge Management	Knowledge Engineering	Defines the set of capabilities that support the translation of knowledge from an expert into the knowledge base of an expert system.			

Digital Asset Services Domain	Knowledge Management	Smart Documents	Support the interaction of information and process (business logic) rules between users of the document. (i.e. the logic and use of the document is embedded within the document itself and is managed within the document parameters)			
Digital Asset Services Domain	Records Management	Digital Rights Management	Defines the set of capabilities that support the claim and ownership of intellectual capital and artifacts belonging to an organization.			
Digital Asset Services Domain	Records Management	Document Classification	Defines the set of capabilities that support the categorization of documents and artifacts, both electronic and physical.			
Digital Asset Services Domain	Records Management	Document Retirement	Defines the set of capabilities that support the termination or cancellation of documents and artifacts used by an organization and its stakeholders.			
Digital Asset Services Domain	Records Management	Record Linking - Association	Defines the set of capabilities that support the correlation between logical data and information sets.			
Process Automation Services Domain	Routing and Scheduling	Inbound Correspondence Management	Defines the set of capabilities for the management of externally initiated communication between an organization and its stakeholders.			
Process Automation Services Domain	Routing and Scheduling	Outbound Correspondence Management	Defines the set of capabilities for the management of internally initiated communication between an organization and its stakeholders.			
Process Automation Services Domain	Tracking and Workflow	Case Management	Defines the set of capabilities for managing the life cycle of a particular claim or investigation within an organization to include creating, routing, tracing, assignment and closing of a case as well as collaboration among case handlers.			

Process Automation Services Domain	Tracking and Workflow	Conflict Resolution	Defines the set of capabilities that support the conclusion of contention or differences within the business cycle.			
Process Automation Services Domain	Tracking and Workflow	Process Tracking	Defines the set of capabilities to allow the monitoring of activities within the business cycle.			
Support Services Domain	Collaboration	Document Library	Defines the set of capabilities that support the grouping and archiving of files and records on a server.			
Support Services Domain	Collaboration	Email	Defines the set of capabilities that support the transmission of memos and messages over a network.			
Support Services Domain	Collaboration	Shared Calendaring	Defines the set of capabilities that allow an entire team as well as individuals to view, add and modify each other's schedules, meetings and activities.			
Support Services Domain	Collaboration	Task Management	Defines the set of capabilities that support a specific undertaking or function assigned to an employee.			
Support Services Domain	Collaboration	Threaded Discussions	Defines the set of capabilities that support the running log of remarks and opinions about a given topic or subject.			
Support Services Domain	Communications	Audio Conferencing	Defines the set of capabilities that support audio communications sessions among people who are geographically dispersed.			
Support Services Domain	Communications	Community Management	Defines the set of capabilities that support the administration of online groups that share common interests.			
Support Services Domain	Communications	Computer - Telephony Integration	Computer / Telephony Integration - defines the set of capabilities that support the connectivity between server hardware, software and telecommunications equipment into a			

			single logical system.			
Support Services Domain	Communications	Event - News Management	Defines the set of capabilities that monitor servers, workstations and network devices for routine and non-routine events.			
Support Services Domain	Communications	Instant Messaging	Defines the set of capabilities that support keyboard conferencing over a Local Area Network or the internet between two or more people.			
Support Services Domain	Communications	Real-Time - Chat	Defines the set of capabilities that support the conferencing capability between two or more users on a local area network or the internet.			
Support Services Domain	Communications	Video Conferencing	Defines the set of capabilities that support video communications sessions among people who are geographically dispersed.			
Support Services Domain	Communications	Voice Communications	Provide telephony or other voice communications.			
Support Services Domain	Forms Management	Forms Creation	Defines the set of capabilities that support the design and generation of electronic or physical forms and templates for use within the business cycle by an organization and its stakeholders.			
Support Services Domain	Forms Management	Forms Modification	Defines the set of capabilities that support the maintenance of electronic or physical forms, templates and their respective elements and fields.			
Support Services Domain	Search	Query	Defines the set of capabilities that support retrieval of records that satisfy specific query selection criteria.			
Support Services Domain	Search	Classification (Search)	Defines the set of capabilities that support selection and retrieval of records organized by shared			

			characteristics in content or context.			
Support Services Domain	Search	Pattern Matching	Defines the set of capabilities that support retrieval of records generated from a data source by imputing characteristics based on patterns in the content or context.			
Support Services Domain	Search	Precision - Recall Ranking	Defines the set of capabilities that support selection and retrieval of records ranked to optimize precision against recall.			
Support Services Domain	Security Management	Audit Trail Capture and Analysis	Defines the set of capabilities that support the identification and monitoring of activities within an application or system.			
Support Services Domain	Security Management	Verification	Defines the set of capabilities that support the confirmation of authority to enter a computer system, application or network.			
Support Services Domain	Security Management	Role - Privilege Management	Defines the set of capabilities that support the granting of abilities to users or groups of users of a computer, application or network.			
Support Services Domain	Security Management	Identification and Authentication	Defines the set of capabilities that support obtaining information about those parties attempting to log on to a system or application for security purposes and the validation of those users.			
Support Services Domain	Security Management	Access Control	Defines the set of capabilities that support the management of permissions for logging onto a computer or network.			
Support Services Domain	Security Management	Digital Signature	Defines the set of capabilities that guarantee the unaltered state of a file.			
Support	Security	Encryption	Defines the set of capabilities that			

Services Domain	Management		support the encoding of data for security purposes.			
Support Services Domain	Security Management	Intrusion Detection	Defines the set of capabilities that support the detection of illegal entrance into a computer system.			
Support Services Domain	Security Management	User Management	Defines the set of capabilities that support the administration of computer, application and network accounts within an organization.			
Support Services Domain	Systems Management	License Management	Defines the set of capabilities that support the purchase, upgrade and tracking of legal usage contracts for system software and applications.			
Support Services Domain	Systems Management	Remote Systems Control	Defines the set of capabilities that support the monitoring, administration and usage of applications and enterprise systems from locations outside of the immediate system environment.			
Support Services Domain	Systems Management	Software Distribution	Defines the set of capabilities that support the propagation, installation and upgrade of written computer programs, applications and components.			
Support Services Domain	Systems Management	System Resource Monitoring	Defines the set of capabilities that support the balance and allocation of memory, usage, disk space and performance on computers and their applications.			
Support Services Domain	Systems Management	Issue Tracking	Receive and track user-reported issues and problems in using IT systems, including help desk calls.			

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Appendix H: Excerpts from U.S. Federal Law and Policy

This appendix contains some relevant excerpts from U.S. Federal Law and Policy.

U.S. Federal Law

The purposes of Section 216 [27] of the E-Government Act (Common Protocols for Geographic Information Systems) are to: "reduce redundant data collection and information; and promote collaboration and use of standards for government geographic information."

In Section 216, the term `geographic information' means information systems that involve locational data, such as maps or other geospatial information resources." [28]

Section 216 assigns responsibilities for "the development of common protocols for the development, acquisition, maintenance, distribution, and application of geographic information".

The Federal Geographic Data Committee (FGDC) has a central role in this work, in concert with "private sector experts, State, local, and tribal governments, commercial and international standards groups, and other interested parties".

Section 216 states: "The common protocols shall be designed to:

(1) maximize the degree to which unclassified geographic information from various sources can be made electronically compatible and accessible; and

(2) promote the development of interoperable geographic information systems technologies that shall--

(A) allow widespread, low-cost use and sharing of geographic data by Federal agencies, State, local, and tribal governments, and the public; and

(B) enable the enhancement of services using geographic data."

U.S. Federal Policy

OMB Circular A-16 [29] "establishes a coordinated approach to electronically develop the National Spatial Data Infrastructure" (NSDI).

The NSDI is described as "the technology, policies, standards, human resources, and related activities necessary to acquire, process, distribute, use, maintain, and preserve spatial data." (In Circular A-16: "Spatial data refers to information about places or geography, and has traditionally been shown on maps." [2])

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[27] Section 216 ("Common Protocols for Geographic Information Systems", Public Law 44 USC Ch 36) is part of the E-Government Act of 2002, available at http://thomas.loc.gov/cgi-bin/query/z?c107:H.R.2458.ENR:
[28] In U.S. Federal law and policy, the terms "spatial", "geospatial", "geographic", "mapping", and "locational" when linked with the terms "data" or "information", and/or the terms "system" or "resource", are used interchangeably unless noted otherwise.
[29] OMB Circular A-16 (as revised in 2002) is available on the Internet at http://www.whitehouse.gov/omb/circulars/a016/a016_rev.html

2371   Interoperability is a key focus of Circular A-16:

2372   "The NSDI assures that spatial data from multiple sources (federal, state, local, and tribal
2373   governments, academia, and the private sector) are available and easily integrated to enhance the
2374   understanding of our physical and cultural world."

2375   Among the components of the NSDI are standards, metadata, and the National Spatial Data
2376   Clearinghouse.

2377   "NSDI is made possible by the universal use of standards and protocols for data development,
2378   documentation, exchange, and geospatial services. [...] NSDI standards are developed and
2379   promulgated by the FGDC in accordance with OMB Circular A-119 using an established process
2380   determined by the FGDC with input from a broad range of data users and providers. [...] To broaden
2381   the global use of federal data and services, international standards and protocols must be used."

2382   Circular A-16 states that reliable metadata, structured in a standardized manner, facilitates search
2383   for, access to, and use of geospatial data or services.

2384   Circular A-16 addresses the requirement for a National Spatial Data Clearinghouse acting as an
2385   electronic service for access to documented spatial data and metadata from distributed data sources.

2386   Circular A-16 mandates that "Agencies will provide or develop the required technology and
2387   services required to enable and provide access to NSDI data and information." Accordingly, Circular
2388   A-16 "provides direction for federal agencies that produce, maintain or use spatial data either directly
2389   or indirectly".

2390   Circular A-16 directs agencies, "both internally and through their activities involving partners,
2391   grants, and contracts" to:

2392   "(1) Prepare, maintain, publish, and implement a strategy for advancing geographic information
2393   and related spatial data activities appropriate to their mission, in support of the NSDI Strategy. [...]

2394   "(2) Collect, maintain, disseminate, and preserve spatial information such that the resulting data,
2395   information, or products can be readily shared with other federal agencies and non-federal users, and
2396   promote data integration between all sources. [...]

2397   "(4) Use FGDC data standards, FGDC Content Standards for Digital Geospatial Metadata, and
2398   other appropriate standards, documenting spatial data with the relevant metadata, and making
2399   metadata available online through a registered NSDI-compatible Clearinghouse node.

2400   "(5) Coordinate and work in partnership with federal, state, tribal and local government agencies,
2401   academia and the private sector to efficiently and cost-effectively collect, integrate, maintain,
2402   disseminate, and preserve spatial data, building upon local data wherever possible.

2403   "(6) Use spatial information to enhance electronic government initiatives, to make federal spatial
2404   information and services more useful to citizens, to enhance operations, to support decisionmaking,
2405   and to enhance reporting to the public and to the Congress. [...]

2406   "(10) Search all sources, including the National Spatial Data Clearinghouse, to determine if
2407   existing federal, state, local or private data meets agency needs before expending funds for data
2408   collection. [...]"

Appendix I: Acronym List

> *NOTE: The following acronyms are incomplete and come (mostly) from Appendix E.*

Acronym	Definition
ADA	Americans with Disabilities Act of 1990
AOI	Area of Interest
AVL	Automatic Vehicle Locator
BASINS	Better Assessment Science Integrating Point and Nonpoint Sources
CATS	Consequences Assessment Tool Set
COI	Community of Interest
COP	Common Operating Picture
CWA	Clean Water Act
DBMS	Database Management System
DEM	Digital Elevation Model
DFIRM	Digital Flood Insurance Rate Map
DFO	Disaster Field Office
DTM	Digital Terrain Model
EA	Enterprise Architecture
ESRI	Environmental Systems Research Institute
FAA	Federal Aviation Administration
GDR	Geospatial Data Rollup
GIF	Graphics Interchange Format
GIS	Geographic Information System
GIT	Geospatial Information Technology
GML	Geography Markup Language
GMO	Geospatial Management Office
GPS	Global Positioning System
HEC2	Hydrologic Engineering Center 2
HVAC	Heating, Ventilation & Air Conditioning
ICS	Image Catalog Service
INS	Inertial Navigation System

InSAR	Interferometric Synthetic Aperture Radar
IPS	Image Processing System
JPEG	Joint Photographic Expert Group
LBS	Location-Based Service
LiDAR	Light Detection and Ranging
LOF	Location Organizer Folder
LORAN	Long Range Radio Aid to Navigation
MSOP	Mission-Specific Operating Picture
NEPA	National Environmental Policy Act
NFIP	National Flood Insurance Program
NOAA	National Oceanic & Atmospheric Administration
NOV	Notice of Violation
OGC	Open GIS Consortium
OSHA	Occupational Safety and Health Act of 1970
PDA	Personal Digital Assistant
PDD	Presidential Decision Directive
PNG	Portable Network Graphics
PNT	Positioning Navigation Targeting
POI	Point of Interest
RFID	**Radio Frequency Identification Device**
SAR	Synthetic Aperture Radar
SBP	Semantic Business Profiles
SCADA	Supervisory Control and Data Acquisition
SDP	Semantic Data Profiles
SMS	Style Management Service
SQL	Structured Query Language
SSP	Semantic Service Profiles
TIFF	Tagged Image File Format
TNM	The National Map
URI	Uniform Resource Identifier
USGS	US Coast Guard
USGS	U.S. Geological Survey
USOP	User-Specific Operating Picture
WCS	Web Coverage Service

WFS	Web Feature Service
WGS	World Geodetic System
WMS	Web Map Service
WRS	Web Registry Service
WTS	Web Terrain Server
XIMA	Image and Map Annotation
XML	Extensible Markup Language

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