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Federal Enterprise Architecture and E-Government: Issues for Information Technology Management

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Summary

Congressional policymakers are concerned about potential inefficiencies and inefficacies in the operation of the federal government, particularly as it relates to decisions regarding information technology (IT) investments. These concerns have increased as federal IT spending has grown to more than $60 billion annually. One approach being implemented to reduce duplicative spending and improve cross-agency collaboration is the use of enterprise architecture (EA) planning across the federal government. An EA serves as a blueprint of the business operations of an organization, and the information and technology needed to carry out these functions.

As an information technology management and planning tool, EA planning represents a business-driven approach to information technology management that emphasizes interoperability and information sharing. The Federal Enterprise Architecture (FEA) was started in 2002 by the Office of Management and Budget (OMB) and continues to be developed today. The FEA is composed of five reference models: Performance, Business, Service, Data, and Technical. Each of the reference models represents specific aspects of the FEA and provides a "common language" for departments and agencies to use in developing shared technology solutions.

To focus efforts on specific areas that may yield savings, OMB has identified several "Lines of Business" (LoB), which represent non-core business functions common to many departments and agencies. Some of the current LoBs include Financial Management, Human Resources Management, Federal Health Architecture, Information Systems Security, and Information Technology Infrastructure Optimization. Within each of the LoB initiatives, the longer term goal is to shift the locus of activity for these non-core business functions from being replicated by each individual department and agency, to consolidated shared service centers, or centers of excellence as they are also referred to, which serve as common service providers for the other departments and agencies. Departments and agencies are selected to serve as centers of excellence through a competitive process managed by OMB.

Some of the congressional oversight issues related to the FEA include, but are not limited to, ongoing updates of the reference models, the status of efforts to align the EAs of individual departments with the FEA, the role of the FEA in developing a second generation of e-government initiatives, and progress and implications of consolidating specific business functions across the federal government. This report will be updated as events warrant

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Background

The federal government spends more than $60 billion annually on information technology (IT) goods and services.[1] The Federal Enterprise Architecture (FEA) has the potential to serve as a critical IT management tool for achieving greater efficiencies and breaking down the so-called "stove pipes" that separate individual departments and agencies. The Office of Management and Budget (OMB) describes the FEA as playing a central role to "ultimately transform the Federal government into a citizen-centered, results-oriented, and market-based organization as set forth in the President's Management Agenda (PMA)."[2] The FEA emphasizes developing interoperable standards, facilitating information sharing, and increasing cross-agency collaboration. The FEA is also expected to play a significant role in the future development of federal e-government[3] and homeland security initiatives. With these activities in mind, OMB describes the three primary objectives, or goals, of the FEA as:

- improving the utilization of information resources to achieve a citizen-centered government, resulting in proactive policy and improved decision-making;
- increasing enterprise architecture practice maturity [experience using enterprise architecture planning techniques to make decisions regarding the procurement and use of information technology] government-wide, resulting in better alignment of IT investments with mission performance; and
- increasing cross-agency, intergovernment, and public-private sector collaboration, resulting in increased common solutions and cost savings.[4]

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[1] Office of Management and Budget, *Analytical Perspectives, Budget of the United States Government, Fiscal Year 2007*, February 2006, p. 151.

[2] Office of Management and Budget, *FY07 Budget Formulation: FEA Consolidated Reference Model Document*, May 2005, p. 4.

[3] As defined in the E-Government Act, e-government refers to the use of information technology, including web-based Internet applications, to deliver government information and services to the public, federal agencies, and other governmental entities (116 Stat. 2809 at 2902).

[4] Office of Management and Budget, *Enabling Citizen-Centered Electronic Government* (continued...)

What is an Enterprise Architecture?

In the mid-1980s, John Zachman, a business planning consultant, developed the Zachman Framework, which was designed to serve as a blueprint, or an architecture, to facilitate the integration of IT systems.[5] The "enterprise," for which an architecture is created, refers to either a "single organization or mission area that transcends more than one organizational boundary (e.g., financial management, homeland security)."[6] The architecture represents a "big picture" view of how the enterprise operates and carries out its responsibilities. An enterprise architecture (EA) serves as a blueprint of the business operations of an organization, and the information and technology needed to carry out these operations, both currently and prospectively. As such, it is an information technology management and planning tool. It is designed to be comprehensive and scalable, to account for future growth needs. EA planning represents a business-driven approach to IT management that emphasizes interoperability and information sharing.

Since the development of the Zachman Framework, various parts of the federal government have attempted to work with EAs. For example, the Clinger-Cohen Act (P.L. 104-106), passed in 1996, tasked agency chief information officers (CIOs) with, among other responsibilities, "developing, maintaining, and facilitating the implementation of a sound and integrated information technology architecture for the executive agency."[7] The Clinger-Cohen Act defined information technology architecture as

> an integrated framework for evolving or maintaining existing information technology and acquiring new information technology to achieve the agency's strategic goals and information resources management goals.[8]

In September 1999, the Federal Chief Information Officers (CIO) Council[9] issued its FEA Framework, which was described as a "conceptual model that begins to define a documented and coordinated structure for cross-cutting businesses and

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[4] (...continued)
2005-2006 FEA PMO Action Plan, March 2005, p. 17.

[5] J.A. Zachman, "A Framework for Information Systems Architecture," *IBM Systems Journal*, vol. 26, no. 3, 1987.

[6] U.S. General Accounting Office, *Information Technology: The Federal Enterprise Architecture and Agencies' Enterprise Architectures are Still Maturing*, GAO Testimony GAO-04-798T, May 19, 2004, p. 4.

[7] 110 STAT. 685.

[8] 110 STAT. 686.

[9] Originally created by Executive Order 13011 and later codified into law by the E-Government Act of 2002 (P.L. 107-347), the CIO Council serves as the "principal interagency forum for improving agency practices related to the design, acquisition, development, modernization, use, operation, sharing, and performance of Federal Government information resources."

design developments in the Government."[10] In the glossary of the document, the FEA itself is defined as

> A strategic information asset base, which defines the business, the information necessary to operate the business, the technologies necessary to support the business operations, and the transitional processes necessary for implementing new technologies in response to the changing business needs. It is a representation or blueprint.[11]

The E-Government Act (P.L. 107-347), passed in 2002, tasks the Administrator of the Office of E-Government with overseeing the development of EAs, both within and across agencies. The act defined enterprise architecture as

> (A) means — (I) a strategic information asset base, which defines the mission; (ii) the information necessary to perform the mission; (iii) the technologies necessary to perform the mission; and (iv) the transitional processes for implementing new technologies in response to changing mission needs; and (B) includes — (I) a baseline architecture; (ii) a target architecture; and (iii) a sequencing plan.[12]

What is the Federal Enterprise Architecture?

The FEA is a planning and management tool used to guide federal information technology investments, with a specific focus on improving efficiency and identifying common applications that can be used government-wide. It is designed to ensure that IT investments support the functions of government, rather than allowing technology choices determine how the government carries out its operations.[13] OMB Circular A-11, *Preparation and Submission of Budget Estimates*, last updated in November 2005, requires federal departments and agencies to demonstrate that their information technology investments align with FEA standards and guidelines in order to receive OMB approval.[14] As a whole, the FEA is intended to "enable the federal government to identify opportunities to leverage technology to

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[10] Chief Information Officers Council, *Federal Enterprise Architecture Framework, Version 1.1* September 1999 p. 2.

[11] Ibid., p. C-5

[12] 116 STAT. 2902.

[13] State governments are also active in developing their own enterprise architectures. The National Association of State Chief Information Officers (NASCIO) released the third version of its Enterprise Architecture Development Tool-Kit in October 2004, to serve as a guide for state and local government agencies. NASCIO's Adaptive Enterprise Architecture Development Program has received funding from the Department of Justice to support state EA efforts, with a particular emphasis on facilitating the development of state information sharing capabilities. See [http://www.nascio.org/hotissues/EA/].

[14] See Section 53 of OMB Circular A-11 at [http://www.whitehouse.gov/omb/circulars/a11/current_year/s53.pdf].

- reduce redundancy;
- facilitate horizontal (cross-federal) and vertical (federal, state, and local) information sharing;
- establish a direct relationship between IT and mission/program performance to support citizen-centered, customer-focused government; and
- maximize IT investments to better achieve mission outcomes."[15]

Chief Architects Forum (CAF)

To facilitate ongoing enterprise architecture efforts across the federal government, the Architecture and Infrastructure Committee of the federal CIO Council created the Chief Architects Forum (CAF) in April 2004.[16] The members of the CAF include the chief architects from federal departments and agencies. These individuals are responsible for ensuring that the technical infrastructures of their agencies are able to fully support the operational needs of their agencies. While this requires a strong understanding of the business functions of their agencies, enterprise architects are primarily focused just on building and maintaining the technology (hardware and software). In contrast, CIOs are generally responsible for both operational and technological issues and serve at a higher, executive-level capacity. Also, while the department-level CIO position and responsibilities are statutorily defined by the Clinger-Cohen Act (P.L. 104-106), individuals serving as chief architects may be doing so in addition to other assigned responsibilities. The CAF meets quarterly and, similar to the CIO Council, serves as a means for sharing information and identifying solutions to common problems.

Reference Models

The FEA is composed of five reference models: Performance, Business, Service, Data, and Technical. Each of the reference models represents specific aspects of the FEA, and provides a framework, or a shared language, for departments and agencies to develop technology solutions that can be used by the federal government collectively. The reference models are updated as needed to reflect changes in applications and services. Brief descriptions of the five reference models, drawn from the EA website, are as follows:

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[15] Office of Management and Budget, *Expanding E-Government: Improved Service Delivery for the American People Using Information Technology*, December 2005, p. 2; Office of Management and Budget, *Analytical Perspectives, Budget of the United States Government, Fiscal Year 2006*, February 2005, p. 178.

[16] The CAF website is available at [http://colab.cim3.net/cgi-bin/wiki.pl?ChiefArchitectsForum%20].

- **Performance Reference Model** — a framework for measuring the output of major information technology investments and their contributions toward achieving organizational goals.[17]

- **Business Reference Model** — a framework for describing the federal government business operations independent of the agencies that perform them.[18]

- **Service Component Reference Model** — a framework for identifying information technology service components (applications) used to support government business functions.[19]

- **Data Reference Model** — a framework that, at an aggregate level, describes the data and information used to support government program delivery and business operations.[20]

- **Technical Reference Model** — a framework for describing the standards, specifications, and technologies used to support and facilitate the delivery of service components (applications).[21]

The OMB developed the FEA reference models through its FEA Program Management Office, in conjunction with the Federal CIO Council and the General Services Administration (GSA), for federal agencies and departments to use in their IT budget and planning process.[22] The Performance Reference Model (PRM) provides a standardized framework for measuring the contribution of major IT initiatives that fulfill existing legislatively-mandated management processes. The processes that the PRM emphasizes are drawn primarily from the E-Government Act of 2002, the Clinger-Cohen Act of 1996, and the Government Performance and Results Act (GPRA) of 1993.[23] The current version of the PRM (version 1.0) was last updated September 2003.

While the *PRM* emphasizes government performance goals applicable to nearly all executive branch agencies, OMB describes the Business Reference Model (BRM)

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[17] For more detail, see [http://www.whitehouse.gov/omb/egov/a-2-prm.html].

[18] For more detail, see [http://www.whitehouse.gov/omb/egov/a-3-brm.html].

[19] For more detail, see [http://www.whitehouse.gov/omb/egov/a-4-srm.html].

[20] For more detail, see [http://www.whitehouse.gov/omb/egov/a-5-drm.html].

[21] For more detail, see [http://www.whitehouse.gov/omb/egov/a-6-trm.html].

[22] Office of Management and Budget, *Enabling Citizen-Centered Electronic Government*, March 31, 2005, p. 6, available at [http://www.whitehouse.gov/omb/egov/documents/2005_NDU.pdf].

[23] Office of Management and Budget, Federal Enterprise Architecture Program Management Office, *The Performance Reference Model Version 1.0*, p. 11, available on the OMB website at [http://www.whitehouse.gov/omb/egov/documents/fea-prm1.PDF].

as the foundation of the FEA itself.[24] The *BRM* is based on a functional view of government operations, rather than an organizational view. This orientation reflects the business-focused nature of enterprise architecture IT management. The current version of the *BRM* (version 2.0) was last updated June 2003.

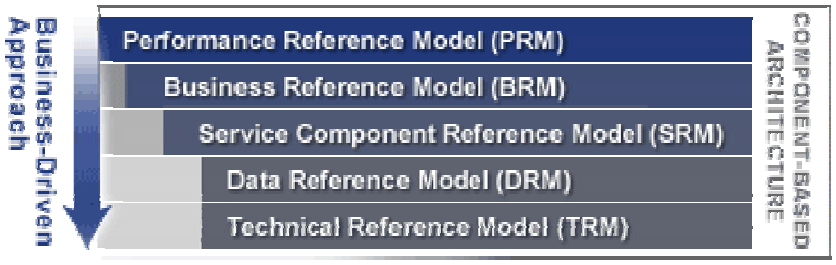
The Service Component Reference Model (SRM), in turn, is intended to identify applications and components that, independent of their business function, can provide a foundation of technologies that are reusable government-wide. The current version of the *SRM* (version 1.0) was last updated June 2003.

The Data Reference Model (DRM) identifies standards for harmonizing how data is described, categorized, and shared across the federal government, with an emphasis on information sharing and data reuse by applications in the *SRM*.[25] The current version of the *DRM* (version 2.0) was last updated November 2005.

The Technical Reference Model (TRM) identifies the core technologies and standards for facilitating the reuse of applications and components in the *SRM*, with an emphasis on interoperability and security. The current version of the *TRM* (version 1.1) was last updated August 2003.

A graphical representation of the relationship of the five reference models to each other, as it appears in various OMB documents and presentations, is included below.

Figure 1. The Federal Enterprise Architecture



Source: [http://www.whitehouse.gov/omb/egov/a-1-fea.html].

[24] See [http://www.whitehouse.gov/omb/egov/a-1-fea.html].

[25] Office of Management and Budget, *FY07 Budget Formulation: FEA Consolidated Reference Model Document*, May 2005, pp. 5-6.

Lines of Business Initiatives

The first generation of e-government initiatives, sometimes referred to as the Quicksilver projects, were proposed in 2001.[26] Since that time, these initiatives have been mostly successful in achieving various project-specific milestones and objectives, although collectively attempts to attain full cross-agency collaboration have been somewhat limited.[27] The OMB has expressed an interest in having the next generation of e-government projects have a broader government-wide character. To that end, in spring 2004, after reviewing data collected from agencies for the development of the FEA (particularly as it related to the Business Reference Model), and formulating the annual federal budget, OMB identified "five major collaborative initiatives" that represent non-core business functions common to many departments and agencies. These five so-called "Lines of Business" (LoBs) initiatives include Financial Management, Human Resources Management, Grants Management, Case Management, and Federal Health Architecture. OMB anticipates that these initiatives will create $5 billion in savings over 10 years.[28] In March 2005, OMB established a task force for a sixth project, the Information Systems Security LoB initiative.[29]

Within each of the LoB initiatives, the longer-term goal is to shift the locus of activity for these non-core business functions from each individual department and agency, to consolidated shared service centers. These shared service centers, also referred to as centers of excellence, function as common service providers for other departments and agencies. Departments and agencies can choose to apply to serve as centers of excellence through a competitive process managed by OMB. After OMB selects how many and which agencies will be designated as centers of excellence, all of the other departments and agencies are then required to negotiate individual service agreements with one of the centers of excellence, who compete against each other for business.

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[26] Pursuant to the July 18, 2001 OMB Memorandum M-01-28, an E-Government Task Force was established to create a strategy for achieving the Bush Administration's e-government goals. In doing so, the Task Force identified 23 interagency initiatives designed to better integrate agency operations and information technology investments. A twenty-fourth initiative, a government-wide payroll process project, was subsequently added by the President's Management Council. These initiatives are sometimes referred to as the Quicksilver projects. A list of the projects is available at [http://www.gpoaccess.gov/usbudget/fy06/pdf/ap_cd_rom/9_3.pdf].

[27] U.S. General Accounting Office, *Electronic Government: Potential Exists for Enhancing Collaboration on Four Initiatives*, GAO Report GAO-04-6, October 2003.

[28] Office of Management and Budget, *Enabling Citizen-Centered Electronic Government 2005-2006 FEA PMO Action Plan*, March 2005, pp. 11-12.

[29] This initiative is also sometimes referred to as the IT Security Line of Business.

As of December 2005, the first five LoB initiatives were in their operational phases, while the Information Systems Security initiative was in its planning phase.[30] The OMB describes the initiatives and their primary objectives as:

- **Financial Management** — to develop a government-wide financial management solution that is efficient and improves business performance while ensuring integrity in accountability, financial controls, and mission effectiveness.[31]

- **Human Resource Management** — to develop government-wide, modern, cost-effective, standardized, and interoperable human resource solutions providing common core functionality to support the strategic management of human capital.[32]

- **Grants Management** — to develop a government-wide solution to support end-to-end grants management activities that promote citizen access, customer service, and agency financial and technical stewardship.[33]

- **Case Management** — to facilitate the management and sharing of information between federal and local law enforcement agencies, and with citizens, using common solutions and data standards.[34]

- **Federal Health Architecture** — to improve the health and safety of citizens through access to reliable health-related information and services, and through greater interoperability of health information and technology between medical providers.[35]

- **Information Systems Security** — to develop an information security program that enables agencies' mission objectives through a comprehensive and consistently implemented set of risk-based,

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[30] Dick Burk, *Updates on the Latest Enterprise Architecture Guidance in Government*, December 1, 2005, available at [http://www.whitehouse.gov/omb/egov/documents/2005_IT_EA_in_Govt.pdf].

[31] For more detailed information, see [http://www.whitehouse.gov/omb/egov/c-6-2-financial.html].

[32] For more detailed information, see [http://www.whitehouse.gov/omb/egov/c-6-4-human.html].

[33] For more detailed information, see [http://www.whitehouse.gov/omb/egov/c-6-3-grants.html].

[34] For more detailed information, see [http://www.whitehouse.gov/omb/egov/c-6-1-case.html].

[35] For more detailed information, see [http://www.whitehouse.gov/omb/egov/c-6-5-federal.html].

cost-effective controls and measures that adequately protects information contained in federal information systems.[36]

In February 2006, the Bush Administration announced the creation of three additional LoBs. They include IT Infrastructure Optimization, Geospatial Systems, and Budget Formulation and Execution. Plans for these three LoBs are in the earliest stages of development. In April 2006 the General Services Administration (GSA) issued requests for information (RFI) for each of the three new LoBs. The RFIs seek "strategies, alternatives, and experiences in developing and implementing programs and innovative practices."[37] Responses to the RFIs were due in early May 2006. During FY2006, an interagency task force is expected to be established for each new LoB to assess current circumstances, and identify opportunities for consolidation to be proposed during the FY2008 budget review.

As described in the President's FY2007 budget proposal,[38] the primary objectives of the three new LoBs include:

- **IT Infrastructure Optimization** — to further refine the opportunities for IT infrastructure consolidation and optimization and develop Government-wide common solutions. This includes establishing best practices, performance measures, and common standards for commodity infrastructures, such as computer help desk services, data centers, and telecommunications.

- **Geospatial Systems** — to identify opportunities for optimizing and consolidating federal geospatial-related investments to reduce costs and improve services to citizens through business performance improvements. This includes continuing support for efforts by the Federal Geographic Data Committee to develop the National Spatial Data Infrastructure (NSDI). The NSDI is defined in Executive Order 12906 as "the technology, policies, standards, and human resources necessary to acquire, process, store, distribute, and improve utilization of geospatial data."[39]

- **Budget Formulation and Execution** — to build toward a ''budget of the future'' by employing standards and technologies for electronic information exchange to link budget, execution,

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[36] For more detail, see [http://www.whitehouse.gov/omb/egov/c-6-6-its.html].

[37] The RFIs are available at IT Infrastructure Optimization [http://www.estrategy.gov/lineofbusiness/docs/ioi_rfi.doc], Geospatial Systems [http://www.estrategy.gov/lineofbusiness/docs/geospatial_rfi.doc], and Budget Formulation and Execution [http://www.estrategy.gov/lineofbusiness/docs/budgeting_rfi.doc].

[38] Office of Management and Budget, *Analytical Perspectives, Budget of the United States Government, Fiscal Year 2007*, February 2006, p. 153.

[39] A copy of Executive Order 12906 is available at [http://www.archives.gov/federal-register/executive-orders/pdf/12906.pdf].

performance, and financial information throughout all phases of the annual budget formulation and execution cycle.

As OMB continues to collect and analyze information from the departments and agencies, it will be able to further develop the FEA. In turn, OMB is likely to identify additional opportunities for e-government initiatives based around the LoBs.

Oversight Issues for Congress

As the federal enterprise architecture initiative continues to evolve, Congress may decide to consider several issues related to implementation and oversight. These issues include, but are not limited to, the following:

- the overall effectiveness of the federal enterprise architecture at improving federal IT management and reducing IT spending;
- the progress of ongoing efforts to update and enhance the five reference models, and how effective they are at identifying cross-agency redundancies;
- how well the enterprise architectures of the individual departments and agencies align with the federal enterprise architecture;
- how OMB is using the FEA to evaluate the IT business cases submitted by agencies with their yearly budget requests and how much money has been saved through this process;
- how the federal enterprise architecture is being used to address federal information security problems;
- how the federal enterprise architecture is facilitating and benefitting large-scale IT projects such as agency-level technology modernization efforts, the federal government's adoption of Internet Protocol version 6 (IPv6), the 24 Quicksilver e-government initiatives, and government-wide information sharing;
- the development and performance of the next generation of collaborative e-government initiatives based on the Lines of Business;
- whether current funding arrangements and interagency procurement regulations will constrain the ability of the centers of excellence to make necessary upgrades over time and to compete effectively in public-private competitive sourcing situations; and
- potential collaboration opportunities and/or lessons to be learned from state government EA efforts.

For Further Reading

Chief Information Officers Council, *Federal Enterprise Architecture Framework, Version 1.1*, September 1999, available at [https://secure.cio.noaa.gov/hpcc/docita/files/federal_enterprise_arch_framework.pdf].

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Office of Management and Budget, Federal Enterprise Architecture Program Management Office, *The Service Component Reference Model (SRM) Version 1.0*, June 2003 available at [http://www.feapmo.gov/resources/fea_srm_release_document_rev_1.pdf].

Office of Management and Budget, Federal Enterprise Architecture Program Management Office, *The Technical Reference Model (TRM) Version 1.1*, August 2003, available at [http://feapmo.gov/resources/fea_trm_release_document_rev_1.1.pdf].