

Advancing Enterprise Architecture Maturity



Concept Level WHITE PAPER

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1. Introduction

1.1 Purpose

The purpose of this white paper is to facilitate the advancement of Enterprise Architecture maturity within government organizations. Enterprise Architecture efforts are a key factor in the transformation of government to a business-value driven approach. This paper describes key lessons learned from successful Enterprise Architecture programs and the steps they have taken to achieve their success. Specifically, the report: (1) identifies successful Enterprise Architecture practices, and (2) provides recommendations for cross-agency documentation, evolution and where appropriate, sharing of successful practices.

1.2 Scope

In their *Practical Guide to Federal Enterprise Architecture*, the Chief Information Officer (CIO) Council has provided useful guidance to Federal Agencies in initiating, developing, using, and maintaining enterprise architectures (EAs). Additionally, three other guidance documents, listed below and issued under the direction of the Council have served to document and guide various aspects of Federal EAs. These are the *Federal Enterprise Architecture Framework*, the *Architecture Alignment and Assessment Guide*, and the recently issued *E-government Enterprise Architecture Guide and Common Reference Models*.

In their report of February 2002, the General Accounting Office (GAO) identified the need to measure Federal Agency progress in achieving maturity of their Enterprise Architectures. Although GAO has proposed a model for measuring EA maturity based on the core elements of the Practical Guide and other documents, this paper has taken a model-neutral approach to the advancement of EA maturity.

This paper presents a number of practices that have been successful in advancing Federal Government organizations through the Enterprise Architecture process as presented in the Practical Guide. The practices, processes, and product artifacts presented/referenced in this white paper are intended to provide insights gained by IAC Enterprise Architecture practitioners, and to serve as a mechanism for strengthening EA efforts throughout Government. Currently known “successful practices” cover many, but not all, of the activities presented in the above referenced Guidebooks.

1.3 Audience

This paper is intended primarily for Federal, State, or Local Government architects and supporting staffs that are looking for resources to facilitate the advancement of their organization’s Enterprise Architecture maturity. This paper is also intended for architects and other practitioners that have successfully advanced an organization’s Enterprise architecture maturity and have resources to share.

1.4 Related Documents

1. *The Federal Enterprise Architecture Framework*, Chief Information Officers Council, Version 1.1, September 1999.
(<http://www.cio.gov/Documents/fedarch1.pdf>)
2. *Architecture Alignment and Assessment Guide*, Chief Information Officers Council, Version 1.0, October 2000.
(http://www.cio.gov/documents/arch_align_assess_oct_2000.pdf)
3. *A Practical Guide to Federal Enterprise Architecture*, Chief Information Officer Council, Version 1.0, February 2001.
(<http://www.cio.gov/Documents/bpeaguide.pdf>)
4. *E-gov Enterprise Architecture Guidance (Common Reference Models)*, Chief Information Officers Council, Version 2.0, July 2002
(http://www.cio.gov/documents/E-Gov_Guidance_July_25_Final_Draft_2_0a.pdf)
5. *Information Technology: Enterprise Architecture Use across the Federal Government Can Be Improved*, United States General Accounting Office, Report to Congressional Committees, GAO-02-6, February 2002.
(<http://www.gao.gov/new.items/d026.pdf>)
6. *C4ISR Architecture Framework*, Department of Defense, C4ISR Architectures Working Group, Version 2.0, 18 December 1997.
(http://www.c3i.osd.mil/org/cio/i3/AWG_Digital_Library/pdfdocs/fw.pdf)

2. Advancing Enterprise Architecture Maturity

Development and effective implementation of an EA is a major challenge confronting all Federal and other Government departments and agencies today. According to the GAO report entitled “Information Technology: Enterprise Architecture Use across the Federal Government Can Be Improved”, only 5 of the 116 agencies surveyed have successfully developed and/or are using their EAs. In analyzing this situation, the report goes on to say “What accounts for this? Historically, agency executives have not fully understood the value of enterprise architectures; hence, these tools have lacked the executive sponsorship necessary to become a funding priority. In addition, human capital expertise in this area has been scarce. As a result, the risk is heightened that agencies will proceed with systems modernization investment decisions without the benefit of this architectural context and will end up with systems that limit mission performance, often after significant unwise use of taxpayer funds”.

Most Federal agencies follow processes based on, or similar to those recommended by the guides published by the CIO Council in planning their programs and in developing and establishing their EAs. Exhibit 2-1 depicts the cyclical EA development process described in the guidebook.

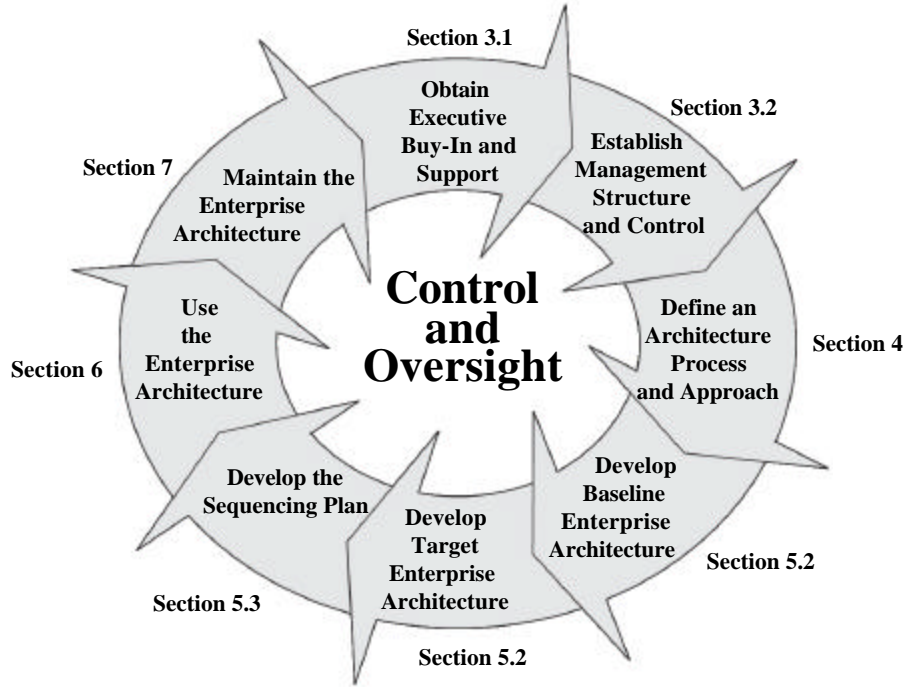


Exhibit 2-1 The Practical Guide Enterprise Architecture Process

The process consists of an orderly sequence of steps recommended for EA development, and the guide provides approaches for carrying out each step. Exhibit 2-2 lists selected practices highlighted in this paper and their mapping to steps in the EA development process depicted in Exhibit 2-1.

EA Process Step	Practice
Obtain Executive Buy-in and Support	Provide Sponsorship
Define an Architecture Process and Approach	Plan the EA Program Develop a Marketing and Communications Plan Develop EA/Business Metrics
Develop Target Enterprise Architecture	Recognize and Leverage Thought Leadership
Develop the Sequencing Plan	Tie Architecture into Capital Planning Investment Control (CPIC) Process
Maintain the Enterprise Architecture	Manage EA Change
Cross-Cutting Process Steps	Obtain Organizational Buy-in
	Conduct Independent Verification and Validation (IV&V)

Exhibit 2-2 White Paper Activity Areas and Corresponding EA Process Steps

The practices addressed herein are not intended to be comprehensive in their coverage of all of the steps in Exhibit 2-1.

3. Successful Practices for Developing Enterprise Architectures

This section describes some practices from various agencies that, in the experience of IAC members, have worked well in enabling these agencies to successfully execute the EA guidance and to progress in developing and using their enterprise architectures.

3.1 Provide Sponsorship

3.1.1 Introduction and purpose

Development of a successful EA requires active participation by both the agency business units and Information Management/Information Technology (IM/IT) organizations. An effective, visible executive sponsorship of the EA program goes a long way towards ensuring that an agency commits the right level and type of resources to conduct a successful Enterprise Architecture program.

3.1.2 Successful practices

Two key EA sponsorship practices that have been observed in successful agencies are:

3.1.2.1 Demonstrate Commitment

The Practical Guide clearly identifies the need for agency EA sponsorship by the agency head. For example, at the IRS, the Commissioner was the visible sponsor of the EA program. Similarly on the DoD Financial Management Modernization Program (FMMP), which will modernize financial management operations throughout the Department of Defense, the Secretary of Defense has clearly and consistently articulated a strong message of organizational commitment for the development of the Financial Management Enterprise Architecture (FMEA). Within the Department's top ten programs, development of the FMEA falls only one below Homeland Security. At the Department of Veterans Affairs (VA), the Secretary has vocally articulated both the reasons for, and the vision to use, the EA as the transformational mechanism to achieve the goal of "One VA". Slight variations of this approach have been shown to work as well. At the Department of Energy (DOE), the Deputy Secretary, as the agency COO, was directly involved.

In all of these instances and others, the need to drive the technology plans from the EA have been understood and articulated by these leaders. In every case this also translates into ensuring that the business units participate, contributing the appropriate expertise to ensure that the business models are accurate and sufficiently detailed.

It should be added that the agency head or the other senior executive sponsor (like the Deputy Secretary as the COO) needs to reiterate his/her commitment periodically throughout the life-cycle of the EA program. This can be done in a number of ways, but most effectively it is accomplished by ensuring that the EA is a visible component of the senior leadership's strategic and/or annual plans.

While sponsorship by the agency head is necessary, it is also important that the sponsorship translate into budget commitment commensurate with the size, scope and complexity of the agency's EA program. For the FMEA program, DoD created a separate budget line item in order to get support and approval for funding of the initiative by OMB, the President, and the Congress. The budget resources provided the funding for all needed elements of the FMEA architecture program, including the Program Management Office as well as contractor support for FMEA architecture development. This was also the case at the DOE where a multi-year Corporate Systems Modernization budget line item has been created and approved by the Congress. It includes monies for architecture, planning, business process redesign and technology acquisition, design and implementation.

At the INS, sponsorship by the agency leadership, in the form of a memo from the commissioner, enabled the dedication of resources across the agency committed to the fulfillment of the EA project. The INS EA initiative received funding appropriate for the complexity of the project, and a cross agency commitment of personnel representing the business areas to provide ongoing support related to internal processes, critical cross agency information, and future direction.

The highest-level executive sponsorship of EA translates into a key success factor. This sponsorship then permeates throughout the rest of the organization.

3.1.2.2 Build a Sponsorship Network

Sponsorship by the agency head needs to be cascaded and reinforced through the organization in order for the EA program to receive the degree of cooperation from and participation by all needed stakeholders, or at a minimum, from the influential business units. Thus, it is important that an agency develop a sponsorship network consisting of agency senior managers who keep the EA program on the "radar screen" of key agency participants. As an example, on the IRS EA program, the sponsorship network included the Chief Operating Officer (COO) and the executives responsible for governance and execution of key modernization programs.

At the sub-agency level within DOE, sponsorship networks were developed through an iterative planning and project development process. By addressing immediate initiatives the EA teams were able to provide proofs of concept related to the enterprise perspective. When planning IT projects, EA teams were able to confirm that EA was a vehicle for achieving savings and leveraging investments. After identifying the first viable business sponsor and demonstrating the benefits of a broader perspective, other business area initiatives were folded into the EA migration process with willing sponsors.

3.1.3 Pitfalls to avoid

It is important that the sponsorship declarations both from the agency head as well as from the sponsorship network be made at the very outset of the EA program, and reiterated periodically throughout the duration of the program. Common pitfalls are that the sponsorship is provided after the EA program is underway, or is provided only in passing to a few senior managers with no further reiteration of the message. This can

happen by virtue of administration change or just by the change out of executive leadership at the top of the agency. There are ways to mitigate against this happening, the most important of which is to ensure that there are sufficient different ways the EA is integrated into the fabric of each agency's management policies, procedures and structures.

3.2 Plan the EA Program

The development of the formalized program plan for the EA is a demonstrated key success factor.

3.2.1 Introduction and Purpose

Planning an Enterprise Architecture program requires building a foundation that focuses on implementation of roles and responsibilities, defining the scope of the architecture effort, and providing the necessary resources to effectively develop the architecture products. Activities for planning an Enterprise Architecture program are discussed in detail in the Practical Guide (Section 3, Initiate Enterprise Architecture Program; and Section 4, Define an Architecture Process and Approach). There are also means of getting copies of other agencies program plans that can be very helpful in planning EA. The DOE has a web page that contains early EA program documents that describe the scope and map out the deliverables over multiple years. A number of the U.S. Customs Services EA program planning artifacts are highlighted in the Architecture Alignment and Assessment Guide, as Revised, August 2001.

3.2.2 Successful practices

Four important planning activities are discussed here with examples of successful practices from active Enterprise Architecture programs. The planning activities are:

- Establish the Management Structure
- Specify Enterprise Architecture Scope
- Specify the Enterprise Architecture Framework
- Select Tools and Program Support Resources

3.2.2.1 Establish the Management Structure

A key to having an effective and business-aligned EA effort is to provide a governance structure that ensures and maintains visibility into the EA process across leadership and management functions. Business area management oversight of the EA process ensures alignment with the mission, vision, and business strategy of the agency.

If an appropriate governance structure does not exist, then oversight boards and steering committees, with executive participation, should be implemented. This approach was used at the DOE sub-agency level, resulting in on-going sponsorship throughout the organization for the EA process. The approach to establishment of the governance bodies as implemented at the U.S. Customs Service is also described in the Alignment and Assessment Guide.

3.2.2.2 Specify Enterprise Architecture Scope

Although overall goals and objectives of the Enterprise Architecture effort are typically established very early in the program, some additional scoping is often important as part of the planning phase. Specifically, scope definition considerations should cover the following:

- Relative emphasis on Business and Technology aspects
- Relationship between Business and Technology drivers
- Scope and depth of “as-is” architecture definition
- Scope and breadth of “to-be” architecture definition
- Scope and depth of architecture transition plans and how such will be translated into the CPIC portfolio

Depending on an organization’s unique requirements, different emphasis may be needed between business and technology (data, applications or service components and infrastructure) aspects of the architecture. For example, technology considerations may not require as much initial emphasis in an organization requiring significant business transformation (e.g., it may not be necessary to develop a fully-attributed logical data model to adequately describe the business model for the enterprise, or to develop a physical data model where significant system architecture effort is required in a later lifecycle phase). Similarly, the effort required for documenting the “as-is” system must be considered in terms of its value in a business-transformation driven architecture effort. In this example, it may be more appropriate to defer extensive “as-is” documentation to a transition phase to ensure appropriate emphasis and resources are applied to the transformed business definition in the Enterprise Architecture development phase.

As an example of a successful practice, DoD has consistently emphasized the business transformation focus of their architecture, with technology being an enabling component. DoD has also explicitly required definition of the FMEA business and technology views in terms of ‘as-is’, ‘to-be’ and the supporting transition process. To avoid excessive resource commitment to the “as-is” analysis, the DoD required the Enterprise Architecture contractor to develop a recommendation of the level of detail required for the “as-is” product specification. If much of the installed base of technology will be replaced as an end result of an EA, then documentation of it in excruciating detail is certainly a waste.

3.2.2.3 Specify the Enterprise Architecture Framework

A number of suitable Frameworks are available (e.g., FEAF, TEAF, C4ISR) to provide guidance in the development of an organization’s Enterprise Architecture. While an excellent discussion related to the evaluation and selection of a Framework is provided in the Practical Guide, it is important to recognize that these Frameworks are guidance only and sometimes should be tailored to the specific requirements of an organization. For example, the organization should determine, as part of the planning process, if all suggested Framework products are appropriate, if products are appropriate for different views (“as-is” and “to-be”), and what attributes are required to be populated for each product. Also, these frameworks have been evolving and growing as they and the

architecture field have matured. This maturity has expanded the focus and the potential artifacts recommended by each. In addition, the advent of the five FEA reference models will affect each of these frameworks, which will have to be modified to accommodate them.

The C4ISR Architecture Framework (soon to be renamed the DoD Architecture Framework) has been established and promulgated as policy for all EA initiatives within DoD. For DoD FMEA, conformance to the DoD EA framework has been incorporated as a requirement in all planning and contractual documents. The C4ISR Architecture Framework includes an Integrated Dictionary product that provides for the identification, specification, and definition of all C4ISR recommended products to be delivered as part of an Architecture initiative. For the DoD FMEA project, DoD required the Enterprise Architecture contractor to prepare the Integrated Dictionary to identify and define the products to be delivered for both the “as-is” and “to-be” views of the architecture.

3.2.2.4 Select Tools and EA Support Resources

Enterprise Architectures can be complex and require the use of sophisticated automated tools to effectively develop, maintain, and communicate the Architecture. There are many useful tools available and their evaluation and selection based on relative needs may be important to provide the necessary capabilities to the architecture team. Often, one tool will not meet all needs of a particular project, so consideration of factors such as tool interoperability is important. Once there is sufficient understanding of tool requirements, often fairly early in an architecture program, a careful tool selection can be made. In some higher-level architecture efforts and most initial business modeling sophisticated tools are not initially needed. The initial work can be done with common tools like word processors and spreadsheets. The information from these can later be exported into most tools.

For DoD FMEA, an automated tools evaluation and recommendation task was conducted in parallel with the project’s initial planning task. DoD identified a broad set of requirements that dictated evaluation not only of basic tool features and functions, but also interoperability among various tools. To support a large Enterprise Architecture development team and Department-wide stakeholders, DoD identified the need for tools to support: Enterprise Architecture development conforming to the C4ISR Architecture Framework, requirements management, configuration management, web portal, content management, and synchronous and asynchronous collaboration. A suite of automated tools was acquired and implemented at Government direction and made available to support the architecture team as their tasks began. Vendor training on their tools was provided at the start of the Architecture development phase.

In addition, there are other resources that may be required in EA programs such as team rooms, audiovisual, write-on/printing white boards, computers and other equipment. It is advisable to treat the EA just as any other important project with appropriate support facilities and staff.

3.2.3 Pitfalls to avoid

- Do not try to make technology the driver for business transformation. Technology is an enabler.
- Don't assume that all members of an architecture team and key stakeholders understand the architecture scope and products the same. Some terms have multiple interpretations. Standardization, training, and reinforcement are vital during the planning phase. Communicate, communicate, communicate!
- Don't commit to so much detail that you get lost in the weeds.
- Don't scope the architecture definition at such a high level that there is limited or no value to the results.
- Don't assume that tool integration is going to be as easy as the vendor or vendor literature suggests. Provide for vendor support to work out sticky details that aren't intuitive.

3.3 Develop a Marketing and Communications Plan

3.3.1 Introduction and purpose

The Practical Guide describes the purpose of the marketing strategy and communications plan to “..keep senior executives and business units continually informed, and to disseminate EA information to management teams”. Successful Marketing and Communications Plans can go beyond disseminating information; they can provide agencies with powerful two-way communications vehicles for soliciting and disseminating feedback from agency EA teams, and fostering the development of a unified, agency-wide EA team that feels a strong sense of ownership. This can go a long way towards reinforcing the commitment of program participants and stakeholders, thereby enhancing the likelihood of success.

3.3.2 Successful practices

Successful Communications and Marketing plans include the following practices:

3.3.2.1 Promote/publish successes

Effective communications plans should emphasize promoting and publishing success stories throughout the organization. This is particularly important during the startup phase of an EA program, when participants struggle to find direction, make progress, and above all, to see results. Early successes build team confidence in the EA program and accelerate buy-in and support by team members. Achieving upper management approval and support, as well as getting the team formed and holding the initial meetings, should be recognized and promoted as successes. Each event along the detailed schedule should be scrutinized as to its value towards communicating progress.

3.3.2.2 Solicit feedback and act on recommendations

EA team members who are actually doing the work develop excellent insights into what is working and what is not. Soliciting feedback from team members typically allows EA program management to tap into this reservoir of insight. Furthermore, team morale and

enthusiasm increases when management responds to the feedback and publishes both the feedback and the response in the communications vehicles. Often this approach works equally well for other agency staff outside the EA team, at least in the form of questions and answers. Many staff in the agency will be curious about what the actual outcomes or results of the EA may be and how it could affect them. Allowing these kinds of questions up front and directly addressing them helps to ensure that the EA is not seen as something other than what it is.

3.3.2.3 Set realistic expectations for the stakeholders, and manage them through the EA life-cycle

Since the need for developing an EA is a relatively recent requirement in the Federal Government, the purpose for it and the outcomes and impact of an EA are not usually well understood within most agencies. As a result, stakeholder expectations can vary widely across the organization. Successful communications and marketing plans can help set realistic stakeholder expectations, and ensure that the expectations are managed, particularly with respect to the impact on individual business units.

3.3.2.4 Tie EA to impact on employee opportunities

An EA program may result in many changes to an agency, including new or optimized processes and implementation of enabling technologies. Often these changes can translate into career opportunities for employees, and EA management can energize them by publishing articles on the changes and the opportunities that are opened up, particularly when coupled to training opportunities. For example, the implementation of physical plant security cameras may require a new function to manage the processes associated with indexing and storage of the various recordings and their collation to and cross checking with other security records. This could be a new position created as a by-product of the EA process, something like “video guard”.

3.3.2.5 Periodically review and update the Marketing and Communications Plan as the EA program evolves

The communications needs of an EA program evolve and change throughout the life of the program. During the startup phase, EA messages are aimed at explaining the program purpose and scope, the expected outcomes, providing examples of EA programs at other agencies, and, above all, answering questions. As the program evolves, EA marketing and communications focuses increasingly on progress achieved, issues encountered, soliciting feedback from participants, reporting on positive impacts on business units, and discussion of process and technology changes, as well as associated training opportunities. Marketing and Communications plans should evolve to provide for these changing requirements, and use the appropriate media to disseminate the resulting messages.

3.3.3 Pitfalls to avoid

There are two major pitfalls in developing and deploying Marketing and Communications plans. One is the use of new communications media that employees do not know well or do not use commonly, and/or the use of media that require employees to find (“pull”) information on their own, e.g., by visiting a web site, instead of being sent a

pointer to the information (e.g., a URL) in a weekly email. A second common pitfall is over-dependence on written messages without adequate face-to-face communications from the executive sponsor, the champions and the team leader, EA Program Manager or Chief Architect. This has the effect of allowing questions that may not get answered in a timely manner to fester and often create a counter current or drag of rumors and false expectations.

3.4 Develop EA and Business Metrics Early

3.4.1 Introduction and Purpose

The importance of identifying specific EA and Business related metrics early on cannot be overstated. As the EA progresses there will be a need to quantify the impacts and results. Establishing the formulae for attribution of various business results to the EA and its implementation is critical to the long term success and ability of the EA to actually transform the Agency's business.

3.4.2 Successful practices

3.4.2.1 Establish Complementary IT and Business Metrics

The EA will begin to spin off specific transition plans and projects aimed at consolidating, improving or making various business functions more efficient or effective. It is critical that the metrics related to both the IT and the business process be established early on and that the relationships between the two are understood. This will enable the tracking and recording of the data required to report results and that later will be used to determine if the ROI or cost/benefits have, are or will soon be achieved. It is too late to start thinking about establishing metrics after the investment has been made, installed and is either being tested or is in production. Examples of this are found in many transaction-based implementations where the relationships between transaction efficiencies and frequencies are directly translatable to bottom line calculations. While these are typically found in private sector models, like situations can be established in the public sector to demonstrate cost avoidance. The IRS implementation of online forms is an example. The development of on-line applications for many processes, approvals, licenses and subscriptions would be similar.

3.4.2.2 Establish EA Program Metrics

The EA Program itself should have metrics for its various components and parts. For example, the Architecture information repository should track the use of the information, by whom and when. These uses can be translated into things like opportunity and cost avoidance. The reuse of the functional business model for reorganizations and various management analyses is another example. The data model and its planned reuse of data objects and the consolidations associated with reuse is another component of the Architecture where direct cost avoidance can be measured and established. The ability to produce these metrics may prove critical to maintain EA program momentum and substantiate progress and impacts.

3.4.3 Pitfalls to avoid

It is important to avoid the following pitfalls:

- Failing to identify and collect the data that can substantiate the impact of the EA on the enterprise and its business processes.
- Collecting cycle time and statistics relative to the supporting technologies but not making it relevant to the business improvements. Establishing relevancy may take a bit of translation and often the relationships are not explicit. This is particularly true with IT infrastructure and the associated metrics.
- Not providing anecdotal evidence required to ensure the proper understanding and translation of various IT metrics. For example network outages on a weekend may go unnoticed until that happens during the mass transfer of timesheet data to a pay service provider who cannot cut the checks because of the outage. The fact that often this transfer happens on weekends during non peak times makes the network outage statistics for 7 days a week relevant.
- Not making sure that all metrics are understood, translatable to the business and appropriate for showing the effects of the EA.
- Establishing cost savings before an analysis is done to appropriately establish reasoned and achievable targets, over reasonable timeframes.

3.5 Obtain Organizational Buy-in

3.5.1 Introduction and Purpose

Implementing an EA in any but the smallest organizations will require the support and buy-in of many organizational units and sub-units. Most Federal agencies are composed of many semi-autonomous groups, each of which has at least its own current architecture. Some may have started planning and developing an EA, or may have identified functional or business drivers. All will be stakeholders in the agency-wide EA implementation process. A successful EA development and implementation process must recognize and accommodate the disparate and heterogeneous organizational units at all levels of the organizational hierarchy.

Obtaining organizational buy-in may be facilitated by four practices:

- Recognizing the hierarchical structure of the organization and aligning the EA scope to it
- Establishing a policy that defines the relationships among the organizational levels and the EA and subsidiary architectures
- Developing a modular EA that allows choice or substitution of components
- Offering assistance to groups implementing the EA

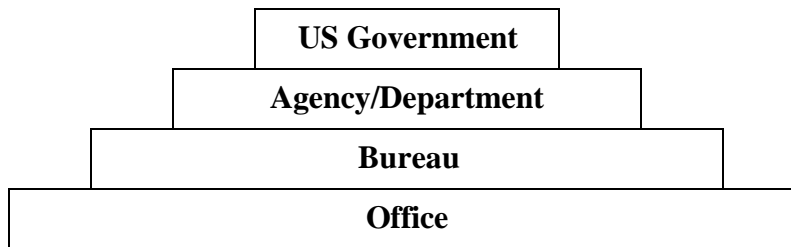
These practices are discussed below. They primarily apply to the EA development phase, but may be extended to all phases of the EA lifecycle.

3.5.2 Successful practices

Successful EA development and implementation programs have used the following practices to obtain organizational buy-in:

3.5.2.1 Recognize the Hierarchical Structure of the Organization

A simplified organizational hierarchy representation of the Federal environment might include the organizational hierarchy levels shown below.



The architecture selected for the EA must identify aspects or components to be implemented at each level of the organizational hierarchy. It must recognize and accommodate the likely existence of an EA above or below the level where the EA is targeted. Often early recognition of this fact and accounting for it in the scoping can avoid later potential clashes and confusion.

An EA developed at the agency level may allow bureaus to develop EAs that are suitable for their environment. An EA developed by a bureau, where the agency has not yet begun development of an EA must be able to accommodate the eventual development of an agency-level EA. The EA for any level of the hierarchy must balance the need for a consistent architecture in all organizational units below that level with allowing each subunit to develop an EA at their level that recognizes their business needs. With the advent of the Federal Business Reference Model and the other reference models (Performance, Service Components, Data and Technology), the requirements for alignment of agency EAs at the Federal cross government level is increasingly expected.

For example, an EA developed for the Department of Health and Human Services (DHHS) must provide a common architecture for all of DHHS and still allow the National Institutes of Health (NIH) and the Centers of Disease Control and Prevention (CDC) to develop aspects that will address their specific needs which are not common with the rest of the enterprise. The architecture for NIH and CDC must allow each Center and Institute to customize the architecture to support unique business needs while remaining consistent with the overall architecture.

This level of flexibility is necessary to achieve the buy-in of organizational subunits. Each subunit must be involved during the EA development phase. This includes the business and functional elements as well as the IT elements of each subunit. Early in the EA process, achieving organizational buy-in requires that each subunit be contacted, invited, and involved. Each subunit must be assured on how the development of the EA can benefit them, and how they are to participate.

3.5.2.2 Design for the Organizational Structure

The architecture must be designed to be modular, so that organizational subunits may implement the pieces that they require yet within the overall governing reference models of higher-level architectures. In some cases, this may mean allowing the use of

competing products, provided that they use common, compatible or interoperable technical standards. Subunits will be unlikely to buy into an architecture that does not allow them to choose the components that they feel they legitimately need to satisfy business process capabilities. An EA that is not designed to allow some choices or substitution of components is unlikely to succeed in a large, diverse agency, although it may be the best option for a smaller agency. This is beginning to change and some interesting experiments are now underway in several large agencies wherein limited desk tops, servers and related operating systems and software are being constrained. In at least one major cabinet department the decision to move to an “open” software solution set, for over a hundred thousand seats could, if it succeeded, seriously impact this approach by demonstrating feasibility and cost effectiveness.

For another example, all parts of an organization may be unlikely to buy into a technology architecture that permits the use of only one database product, or one messaging system. However, an architecture that specified a large database system and a small database system, specifying how they would interoperate, is more likely to succeed.

3.5.2.3 Recognize the Hierarchical Structure of the Organization

The EA must be designed from the start to consider what is allowed in the way of multiple, occasionally competing technologies and business practices within a specified range. Typically this is after an assessment of which module would be most appropriate for a specific circumstance. An example is where there may be a personnel management module of the EA that could be used by an organizational unit of less than a few hundred employees, and a module that could be used by a unit of more than several thousand. The EA would define these options and ensure compatibility, interoperability, and facilitate the possible future move to combined personnel management architecture for the entire organization. This will facilitate the growth and evolution of the EA over time, as products and technologies change. It will also increase the ease of obtaining the buy-in of sub-organizations, as each subunit will be able to see how and where it will be able to insert component modules that are most appropriate for them, within the broader reference models and bounds of the overall agency-wide EA.

3.5.2.4 Provide Implementation Support and Assistance

Organizational subunits are more likely to buy into a demonstrated architecture when the “owner” of the EA implementation, such as the EA Program Management Office (PMO), provides implementation assistance. Demonstrating the feasibility of the EA may require a test bed, where the components can be shown operating as intended and where unique components of subunits architectures can be tested with the common solution set. This test bed can provide a training ground for technical and business process professionals who will be implementing the EA in the subunits. Implementation assistance such as this can increase the level of buy-in throughout the organization dramatically. Of course, direct funding for EA implementation (by the EA group PMO or sponsor) will help increase organizational willingness to adopt the architecture, but can be expensive. Other forms of assistance that can be provided to subunits include:

- On-site training in new products

- Business, data, applications, and technical working groups to develop common solutions
- A technical reference model, showing a baseline configuration of all components
- Template project management plans, schedules, and resource estimates for EA implementation in subunits or business areas
- Sample or reference models for unified business practices, including documentation such as personnel management information manuals or system security plans that conform to the EA model.
- Organization-wide quantity purchasing discounts
- Centralized implementation but shared management paid through a revolving charge back account managed by the central IT organization or contractor providing the services.

3.5.3 Pitfalls to avoid

There are some common pitfalls that often prevent all or some parts of an organization from buying into and supporting an EA.

- Do not assume that the CIO, agency head, or other top official can force an EA onto a large agency. Buy-in from all (or most) levels and organizational subunits is necessary.
- Do not develop an EA that is a “one size fits all” approach, or not until sufficient analysis and consultation shows it is feasible, not just technically but also business wise and politically. For many elements of the EA you may want to offer choices like a “large, medium, and/or small size” solution or a high/low service level.
- Avoid offering so many choices that your EA does not bring the benefits of standardization and common practices.
- Do not presume that an EA that is technically acceptable to all organizational subunits will be fully accepted. You must show that it is operationally compatible and achieve the buy-in from each subunit’s management.
- Recognize the wide diversity in a large organization, and ensure that the EA can accommodate it.
- Consider having some of the more respected and influential subunits implement the EA first, and then assist other subunits.

3.6 Recognize and Leverage Thought Leadership

3.6.1 Introduction and Purpose

Developing an EA is greatly facilitated by a “thought leader”. This is a person or people with the vision to understand the overall purpose and needs of the enterprise and who can envision a way to embody it in a practical, working architecture.

3.6.2 Successful practices

Successful EA (development and implementation) programs have used the following thought leadership practices:

3.6.2.1 Identify the Thought Leader(s)

The thought leader may be the CIO, or organizational head, but often those people are not able to devote the amount of time and attention required. The thought leader may be the project manager, technical team lead, or the chief architect on the project. Or, a thought leader may emerge from unexpected places within the project. Since this is not an appointed position by that title, an agency should be prepared to recognize and nurture a thought leader (or leaders) when they emerge.

Most thought leaders are able to explain the vision and purpose of the EA to all levels of stakeholders, and “sell” the concept. A successful thought leader will understand the technical as well as business needs of all elements of the organization, often through long years of experiences within the agency. This person or people often have the ability to keep track of the myriad of details that a comprehensive EA incorporates, without losing track of the big picture. A thought leader is often someone who is respected throughout the organization for their leadership abilities, and who becomes the “go-to person” for explanations or problems. EA thought leaders are often created or identified by products of a previous architecture effort either at a lower level within the agency or at another agency.

Identifying a thought leader is not always a simple task or a matter of deciding to appoint someone to the position, it may require allowing one to emerge. Developing an EA can succeed without a thought leader, but the presence of one will often greatly increase the chances of success.

3.6.2.2 Provide Appropriate Training

Thought leadership is not something that is easily taught. However, training can be provided that shows how to recognize emerging thought leaders, nurture their development, and utilize their talents. This may be included as part of project management training, personnel leadership training, or other suitable forums. Currently, there is no formal certification for thought leaders, so managers may need to be given other tools to identify them. There are a number of tests, like Myers–Briggs, that may help identify thought leaders that typically come from a narrow set of personality types and profiles.

3.6.3 Pitfalls to avoid

Some of the common pitfalls related to thought leadership that should be considered and avoided if possible include:

- Do not assume that the thought leadership must or will come from the CIO or agency head. Often it will come from someone more fully involved with the project or even someone from an involved business unit.
- Do not fail to recognize a thought leader when one begins to emerge. Often the thought leader is not a vocal or aggressive person, and must be encouraged and nurtured.

- Allow the thought leader to be more than one person, if necessary. If a group or committee is developing a common vision, then no individual leader may be required.
- Do not initially try to assign a thought leader. Unless someone has previous experience and has previously shown visionary skills, asking or assigning them to act as a thought leader or lead architect may not produce the desired result.
- Do not believe that thought leadership is too nebulous to define or recognize.

3.7 Tie the Enterprise Architecture Sequencing Plan into the Capital Planning Investment Control (CPIC) process

3.7.1 Introduction and Purpose

The EA will result in a number of investments that are from the program or that are driven by the various architectures - data, applications or technology. The requirement that all proposed investments travel through specific governance committees or review boards that ensure there are both business and technical alignments as a prerequisite to being included into the investment portfolio is a critical step. This integration into the Capital Planning Investment Control process is described in the Architecture Alignment and Assessment Guide. The added value concept is using a specific automated process and decision support to record reviews of the investment 300s and to assign a score for each against a specific set of criteria.

3.7.2 Successful practices

3.7.2.1 Establish a well documented and automation-supported review and evaluation process

The Department of Energy established a process where every investment form 300, when received by the CIO, is distributed among a number of reviewers. Reviewers read and score each submission using common criteria for various attributes, such as: goodness, accuracy, completeness, was the actual topic or issue addressed at all? Scores are then tallied and a threshold for passing is established. Further review takes place in a decision support environment where the ranges of scores are presented. The architectural alignment criteria are included with the other criteria and are explicit. Investments which fail are returned to the creating offices with guidance as to how to correct deficiencies. Architectural deficiencies may require missing a budget cycle to fix.

3.7.2.2 Assess the Final Implementations and Architectural Updates

As the various investments and projects from the EA based sequencing plans are implemented, it is important that they are assessed and that any requisite changes to the architecture are rolled back into the baseline and other relevant parts of the Architecture. The process described above facilitates this by creating a detailed record of rationale and discussions that enable the highlighting of specific updates and changes.

3.7.3 Pitfalls to avoid

The following pitfalls should be avoided:

- Establishing too complex a set of criteria or too broad of a grading criteria for the business cases.
- Not carrying through with or following up on 300s after reviews.
- Not asking relevant questions during the review process and not normalizing the ranges of grades given through facilitation or arbitration.
- Not conducting these reviews outside the current environment. These review meetings take significant focus which needs to be uninterrupted by outside or competing office priorities.
- Not using a team qualified to facilitate a decision support approach to review and resolve grading/pass/fail issues.
- Not allowing sufficient time for reading, review and evaluation of the 300s and the related documents (the EA) in order to do the grading and it be actual and relevant. Not ensuring this is a quick way to undermine this whole process approach.

3.8 Manage EA Change

3.8.1 Introduction and Purpose

Once completed and verified, the EA represents a comprehensive source of information about the entire organization. That structure should be protected by adequate security and change management controls so that it continues as a valued source of agency business, mission, application, data, and technology information.

Proposed changes to the verified, EA structure should be reviewed and approved by a formal agency committee to ensure continued value. It must be recognized that once the EA is functional it represents a cross functional picture of the entire agency and is not the responsibility of a single organizational element even as it may be stewarded by the CIO or CTO.

3.8.2 Description of Successful Practices

An underlying component for governance, budgetary and technical control in any properly managed repeatable process is a functioning change management program. A formalized change management committee must represent various technical program and management levels within the organization as well as headquarters and field organizations. It is the responsibility of the committee to review and either approve or reject proposed EA modifications. The implications and process steps associated with either of these decision outcomes should be integrated into the overall CPIC process. An essential function of the organization is to respond quickly and efficiently to changes in the four layers of the EA – Business, Data, Application and Technology. The committee should be considered the focal point for technology consequence, standardization and integration. This committee could be the investment and management control board that makes technical decisions, as well as setting capital planning strategies. However, in larger agencies, it has often proven wise to segregate these governance steps and views. It is, however, also important to ensure they are coordinated and that information flows between these functions. Again the Architecture Alignment and Assessment Guide and the Practical Guide both speak to the EA governance body issues and requirements.

3.8.3 Pitfalls to avoid

All too often organizational elements do not formally meet to discuss or integrate critical programmatic changes. IT support elements independently initiate infrastructure or technology improvement initiatives without coordinating directions with program or business concerns. Conversely, program/business elements tend to implement major application requirements without proper consideration for associated impacts on supporting IT applications or technology support structures. As a result IT structures tend to be independently designed and segmented rather than integrated and comprehensive systems. This is the model for the distributed IT approaches of the past and is not compatible with an Enterprise Architecture approach.

3.9 Conduct Independent Verification and Validation (IV&V)

3.9.1 Introduction and Purpose

An EA, when implemented properly to satisfy E-Government and other core mission initiatives, will create a foundation of organizational processes, procedures, best practices, technology deployments, and working standards that will guide the agency programs and leverage technology to satisfy ever-expanding complex business imperatives. The completed EA should guide and govern the design, development and implementation of technology components to enable the agency to effectively and efficiently integrate technical functions or capabilities with business requirements. In order to implement such design objectives properly, a quality assurance program including independent verification and validation (IV&V) processes must be incorporated into the EA model as early as the initial planning stage. The criteria for goodness and quality should be understood as well as the targeted deliverables, models, repositories and artifacts. Reviewing these ultimately will be the means for IV&V of the architecture.

3.9.2 Description of Successful Practices

Just as a quality IT applications system design and development program under a repeatable standards program depends upon a quality information assurance capability, the concept is also critical for an enterprise information management model like EA. It provides checkpoints to ensure that desired requirements are actually modeled and fully tested according to a repeatable process guaranteeing to the organization that what is implemented is indeed the model desired. For example, within the INS/IRM organization under a systems management and integration program, this process is carried out most efficiently. Design criteria and business function specifications for the EA model were carefully assembled, coordinated among service organizations and agreed upon before implementation began. Contractors in a formal quality assurance role utilized these requirements to ensure that the EA model incorporated all design objectives. The effort initially consumed more development time and resources than anticipated. Results now recognize this IV&V approach as a successful practice.

3.9.3 Pitfalls to avoid

There is a tendency to develop a common technology infrastructure, but not to pursue common data, business, or applications requirements. This is true particularly for those

agencies that adapt a model structure developed by another federal or private industry organization. Such efforts are prone to design failures and initial model faults unless the implementing EA architect completes an agency focused requirements design, incorporates that set of requirements into the IV&V effort and tests the model against the agreed upon design criteria. Repeatable quality assurance reviews are essential for quality business modeling and proper information sharing across all concerned elements within the agency.

The IV&V should be conducted by a qualified entity that has no specific vested interest in the outcome and can thereby remain independent and objective. Results of the IV&V should be made public and an immediate action plan prepared for addressing any weaknesses found.

4. New Challenges

While the development of an EA has always been a challenging undertaking, recent work by the Federal Enterprise Architecture Program Management Office (FEAPMO) and the need for greater communication and collaboration between federal, state and local governments will add considerably to the already formidable challenges. Agencies will be required to align their EAs with the FEA reference models, and will have to manage their EA development across the Federal Government to leverage common business-line functions developed by other agencies/departments, as well as to facilitate the management of access channels between federal, state and local governments. Agencies will also need to more clearly drive their IT investments by the business value realized by implementing their target EA and the projects in the sequencing plan. Exhibit 4-1 illustrates this new EA management focus.

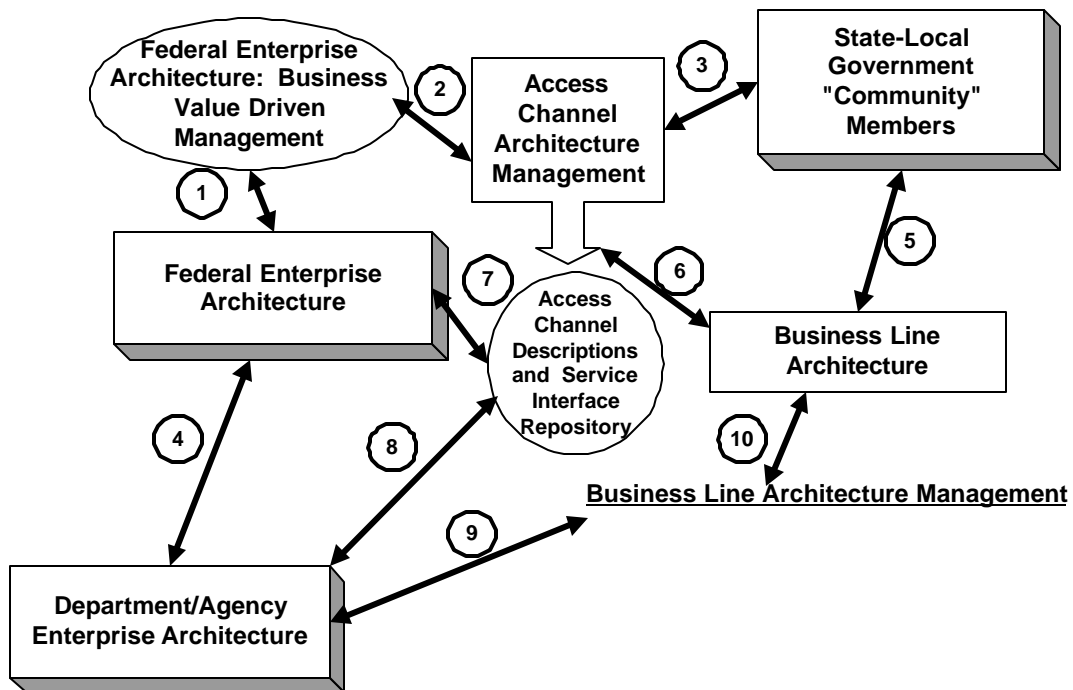


Exhibit 4-1 Cross-Government Enterprise Architecture Management

Responding to these challenges will need updates to the EA development process, as well as to agency/department governance structures.

5. Summary and Recommendations

This white paper has identified EA development activities that have been successfully employed by agencies with mature EAs and that will aid those that are less mature to grow and achieve higher maturity levels. The successful practices presented in this paper are not intended to be comprehensive.

5.1 Sharing of EA Artifacts and Lessons Learned

EA programs in Federal organizations (e.g., departments and agencies) would benefit from sharing of lessons learned, successful/best practices and artifacts relating to the best practices, as well as pitfalls to be avoided in order to enhance the pace as well as the quality of EAs being developed. IAC recommends that the CIO Council Architecture and Infrastructure Committee, through its new Structures sub-committee, facilitate this sharing of lessons learned. In particular, specific steps that could be taken by the Committees and with the IAC as partners include:

- Sponsor a series of conferences to share successful practices and pitfalls encountered. These could incorporate a variety of examples from cross cutting business line architectures, state and local examples as well as from private industry. These could also be culled for specific documents and artifacts to populate the repository recommended below.
- Develop a process and a set of quality criteria (and/or template) for documenting, collecting and vetting EA lessons learned across Federal (and other applicable) organizations, and make them available in either a repository or a directory of links that serve as an organizing metaframe for use by all agencies.
- Develop a process for identifying, evaluating, selecting, collecting and vetting examples of high quality EA documents, models, artifacts and work products, and make them available in a repository for use by all agencies.

5.2 Meeting the Objectives of the FEA

Agencies will need to work cooperatively with each other and with OMB in order to meet the objectives of, and to update their enterprise architectures to align with the FEA as defined in the reference models. This is a significant undertaking and must be carefully orchestrated so as not to derail previous IT management improvements. In order for the updates to occur with minimal breakage, we have a number of recommendations based on and aligned with recommendations made in several companion papers prepared by the IAC Enterprise Architecture Shared Interest Group. In keeping with its EA role, OMB should provide leadership and stewardship for the emerging FEA, set policies, provide forums for interagency cooperation, and supply approved official guidance for implementing updates to agency/department EAs in a manner that is efficient and cost-effective. Specific recommendations are:

- Provide a forum, and establish policies, for encouraging business process factoring (sharing, alignment and reuse) across agencies. The reference models provide the basis for performing this factoring; however stepwise detail methods are lacking. As further analysis occurs within these crosscutting business segments these models should be further defined and built out. For example, the BRM should be decomposed down to a further level of detail. The other reference models should be completed and explicitly linked such that they form a high order set of templates for the FEA development and design. This would provide the context for the agencies' EAs and enable them to perform cross-agency business processes factoring.
- Select (with CIO Council assistance) and prototype several cross cutting business segments within the FEA, for detailed process analyses, factoring and interface frameworks development.
- Define and develop a set of frameworks, technical standards or reference models for specifying interagency interfaces within various cross cutting business segments to facilitate interoperability and integration.
- Update and extend the EA process in the FEAF, and the other EA Guides to integrate interagency business segment definitions and process factoring, the use of the FEA reference models, interface frameworks and guidelines on defining and using component based architectures in order for agencies to update their EAs, building on work already done.
- Develop a strategy to address the "what's in it for me" questions that are likely to be asked by the agencies and to resolve concerns regarding how to transition to a common FEA while balancing the agency specific EA implementations
- Develop and implement a "realistic plan" for developing the above definitions, frameworks, processes and guidance for the agencies, and for the agencies in turn to implement the necessary EA updates.

The Industry Advisory Council's Enterprise Architecture SIG hopes that the successful practices and recommendations presented in this white paper provide value and insight to FEA-PMO and others who are considering implementing an EA. The EA field would clearly benefit from additional information sharing, cooperation, and maturity.