An Introduction to and Extended Review of Coherency Management

By John Gøtze and Pallab Saha

Available in July 2009, the new book, *Coherency Management: Architecting the Enterprise for Alignment, Agility and Assurance* discusses a more outcome-oriented way to envision the practice of Enterprise Architecture (EA). The book is edited by Gary Doucet, John Gøtze, Pallab Saha and Scott Bernard, and commenced with the publication of an article in the May 2008 edition of JEA that captured the essential elements of what Coherency Management is all about. This article also formed the basis of a solicitation that went out to Enterprise Architecture leaders throughout the world as the editors looked for others to contribute to the book. The result is a work that covers a wide spectrum of current EA theory and practice throughout the world, with Coherency Management as an organizing principal.

With submissions from over thirty authors and co-authors, the editors compiled a book that reinforces the idea that EA is being practiced in an ever-increasing variety of circumstances - from the tactical to the strategic, from the technical to the political, and with governance that ranges from sell to tell. The characteristics, usages, value statements, frameworks, rules, tools and countless other attributes of EA seem to be anything but orderly, definable, classifiable, and understandable as might be hoped given heritage of EA and the famous framework and seminal article on the subject by John Zachman over two decades ago.

The book also defines: Enterprise Architecture as being an inherent design and management approach that is essential for organizational coherence and which should to improvements in alignment, agility and assurance. This, the editors believe, is a huge leap forward from the way that EA is currently being practiced. Notably, EA is viewed as an Enterprise Design and Management approach, adopted to build better enterprises, rather than a IT Design and Management approach limited to build better systems. Furthermore, the book uses the term 'approach' in a generic manner. In enterprises, this can be manifested as strategies, policies, frameworks, models, blueprints, principles, structures, practices, taxonomies and ontologies. As an example, a possible realization of the approach is the Zachman Framework.

In this book, the editors also introduce a way to look at three fundamental yet distinct modes of how EA is to be practiced. These modes are progressive in nature and are summarized as follows:

Foundation – Where there is an enterprise-wide view and plan for technology and in more advanced enterprises there is use of Enterprise Business Architecture to ensure the technology and business are well aligned. This is the predominant form of EA practiced today.

Extended – Where the science, tools and techniques of EA are extended into (and used by) all parts of the enterprise to design/describe much more than technology. For example, it could be used to help design better policy or build better organization charts or improve service descriptions.

Embedded - Where EA science, tools, and techniques are ingrained in everyday processes and people contribute to the overall EA without being Enterprise Architects or necessarily knowing that they are contributing to the EA work. For example, the budget line items are conformant to EA standards which allows parts of the Enterprise's Architecture to be updated on a regular basis but by people doing budgets not EA. The classic Enterprise Architect then (in addition to former duties) also ensures the artifacts created by the various process owners adhere to and contribute to an overall EA effort.

Chapter 1 of the book is an expanded version of the May 2008 article in JEA on Coherency Management and sets the context for the rest of

the book. The following is a brief description of the book's subsequent chapters to show how they contribute to and further reinforce the idea of architecture-driven Coherency Management.

Chapter 2. *The Four Design Models of Enterprise Architecture*. Pallab Saha, National University of Singapore, Singapore

Organizations embark on formal EA journey for several reasons. In the current scenario there are several frameworks available for organizations to adopt and adapt. These frameworks come with their own body of knowledge that includes reference models, standards, guidance documents, toolkits, methodologies and illustrations. On discussions it is clearly evident from several adoptions of available EA frameworks, models, standards and methodologies that a 'one-size-fits-all' approach to EA development is neither feasible nor desirable. Though the frameworks themselves are holistic and generic to encourage widespread adoption, organizations have the discretion to design and tailor their EA programs to suit their business and technology objectives. This kind of flexibility to program design encourages autonomy and supports the federated governance structure at the whole-of-enterprise level, thereby enhancing the overall effectiveness of EA and EA programs. The need for good EA design is further exacerbated as EA is viewed as a strategy execution mechanism.

This chapter proposes and elaborately discusses the four potential design models. These design models present an approach to capture organizational EA programs via their various distinct characteristics. These design models allow organizations to select the 'right reasons' for doing EA and adapting the program to fulfill the real objectives. In the final section, the Chapter shows how each of design models enables the realization of organizational coherence.

Chapter 3: *Business Engineering Navigator: A Business-to-IT Approach to Enterprise Architecture Management*. Stephan Aier, University of St. Gallen, Switzerland; Stephan Kurpjuweit, University of St. Gallen, Switzerland; Jan Saat, University of St. Gallen, Switzerland; and Robert Winter, University of St. Gallen, Switzerland

"Business Engineering Navigator" is an overview of how Enterprise Architecture and its management can provide value to a variety of stakeholders. The author's are leading the research with the intent of ensure structured engineering for 'business-to-IT', integration management, IT/Business Alignment, and more. The concept is not necessarily new but Aier et al introduce a heuristic to accomplish this as well as have some tools in development based on their work. The precise tool is not being sold to the reader, rather the idea and heuristic approach is the target of our interest.

In Coherency Management, there is recognition that the Architecture for the enterprise is being created and maintained by many people not necessarily associated with IT, IM or the word 'Architecture'. BEN reaffirms that EA must help others by using structured approaches towards their work. In the editors' opinion there is a capability being developed which has the potential to be widespread throughout the business. Structured (engineering based) approaches to managing the Enterprise Architecture and recognition that architecture is widespread leads us to the idea that the EA Tool and EA Processes will also be widespread. As an enterprise gradually has more and more processes that align to EA in this fashion the more it will enable it self to become coherent.

Chapter 4. *Framing Enterprise Architecture: A Meta-Framework for Analyzing Architectural Efforts in Organizations*. Marijn Janssen, Delft University of Technology, The Netherlands

As part of EA planning EA programs have the need to estimate the effort needed. Current literature and practice approaches do not offer much help in this regard. EA effort estimation is dependent on the experience of the team involved. There is a clearly a lack of scientific / heuristic based approaches on offer.

The chapter presents an architecture meta-framework that views the architectural elements (subsystems) and the dependencies among the elements. These linkages captured through a series of layers provide the necessary inputs for coherency. The meta-framework is comprehensive to the extent that is looks into how it can useful in the 'extended' and 'embedded' mode. It is important to be mindful of

the fact that in the embedded mode, EA happens not because of a special program in the organization, but in the course of regular activities. The EA team / group sets the policies, principles, standards, formats etc. and the organization looks to harvest the usual management artifacts for the purposes of EA. This chapter integrates well with this future state model.

Chapter 5. *Enterprise Architecture, Strategic Management and Information Management*. Chris Aitken, Queensland Health, Australia

The idea of integrating EA with other practices like strategic management, information management and others, which is the topic of this chapter, is perhaps not new, but has been poorly practiced by many organizations. More and more organizations have realized the need to integrate these, and are starting to see the multiplier effect provided by one to the rest. This leads to the organization, as a whole, being more manageable. It is obvious that each of the disciplines presented and discussed in the chapter have a critical role to play in contributing to organizational coherency.

The chapter presents and discusses in detail a proposed methodology that neatly integrates the three disciplines of Strategic Planning, EA and IM. The methodology description consists of steps, key inputs, outputs, intended outcomes, governing policies, rules, primary stakeholders and concerns addressed in each step. Such a level of description, we believe, makes the proposed methodology open to further enhancements and subsequent adoption in organizations. The strength of the methodology is that it has been weaved in and presented along with a case study to further enhance its applicability. The methodology also shows how some of the existing organizational artifacts can be leveraged for use within the realms of EA. This is important as it then gets into the embedded architecture mode.

Chapter 6. *The Strategic Dimension of Enterprise Architecture*. Tanaia Parker, T.White Parker Consulting, United States of America

Ever since Ross and Weill's seminal book on Enterprise Architecture (2006) where they have made the case for EA to be part of organizational strategy, plenty of current research focuses on how this can be operationalized. This chapter adds to the growing literature in this regard. It starts with a brief overview of strategic management and its constituents (analysis, formulation, execution and governance).

The chapter decomposes strategic management into its core elements and presents their associations and linkages to EA. This allows readers to view the connections in a more holistic manner. Furthermore, it provides insights into ramifications of not taking advantage of EA in various activities of strategic management. It elaborates how organizations can operationalize the strategic management and enterprise architecture combination. This is done by a proposed Strategic Enterprise Architecture Framework (SEAF). The proposed framework provides a structured way for organizations to take advantage of this integration. There is no dearth of literature on the technical / engineering aspects of EA. This chapter takes a purely business-oriented view of the EA.

Chapter 7. *Engineering the Sustainable Business: An Enterprise Architecture Approach*. Ovidiu Noran, Griffith University, Australia

Environmental sustainability is fast becoming as important as economic viability for businesses to stay relevant and profitable. However, at present none of the architecture frameworks explicitly include environmental perspective. As a work around organizations typically handle EA and Environmental Management (EM) as two distinct and separate programs or initiatives. More often that not this leads to lack of synergy and consistency between the two. Needless to mention there are benefits of integrating the two by extending traditional EA programs to include aspects of EM. However this proposed integration brings forth several challenges.

The chapter clearly goes in-depth in demonstrating the benefit of using EA to address issues concerning sustainability and EM. This is unique and contributes to the EA literature. Furthermore, by including EM related issues within the realms of EA provides organizations to extend the role and influence of EA into non-IT areas. This, we believe, is a

promising entry point to the extended architecture mode. Though not explicitly depicted in the chapter, the idea of developing and adopting environmental reference models is utilitarian. These reference models when fully mature would have the ability to provide organizations the tools and mechanisms to adopt and take a more inclusive view to EM in general. The chapter proposes a meta-methodology for operationalizing the integrated approach. This, we believe, is useful as it allows organizations and architects to see how enhancing traditional EA programs to take-on EM related issues impacts the architectural activities and their associated artifacts.

Chapter 8. *Enterprise Architecture Formalization and Auditing*. Scott Bernard, Carnegie Mellon University, United States of America, John Grasso, Carnegie Mellon University, United States of America

This chapter focuses on the importance of formalizing and auditing enterprise architecture programs as a way to improve their value to public and private sector organizations. The authors discuss the formalization of an EA program as centering on the establishment and maintenance of six basic elements: governance, methodology, framework, tools/repository, and associated best practices. The EA Audit Model (EA2M) is an emerging element of the practice of EA and builds on established best practices including the CMMI and the U.S. Government Accountability Office's EA Management Maturity Model. The EA2M is presented as the basis for an audit procedure that reviews EA programs for maturity in three general categories: completeness, consistency, and utilization. The basic steps of the EA2M are described as a comprehensive and repeatable method for conducting EA program audits. Basic and advanced forms of the EA2M audit are also introduced as a way for organizations to have the option of doing preliminary reviews prior to comprehensive audits.

Chapter 9. *Issues in Using Enterprise Architecture for Mergers and Acquisitions*. John Mo, RMIT University, Australia; Laszlo Nemes, Nemes Consulting, Australia

Mergers and Acquisitions (M&A) are complicated affairs requiring incredible amounts of analysis before and after the purchase. The chapter explores the use of EA to help with these processes. It is primarily a research based chapter with an interesting exploration of a DNA based modeling approach. It is also worth noting that M&As share many similar challenges as large organizations simply trying to optimize their operations or act more horizontally such as is the case with many national governments.

As Editors we believe that EA can definitely help with M&As and there is literature which explains this in detail. However, there are some real challenges we need to address to make this more effective and easier. The idea that EA could use DNA type approach is worth exploring. The componentization of the enterprise has been a long mission of EA and the ultimate way we will describe our enterprises from an EA perspective is still evolving. Coherency Management is better made as the EA tools (such as the models discussed in this chapter) improve. If more enterprises start to use common models, then the ability to analyze merger opportunities as well as the ability to execute on those mergers greatly improves. The agility element of the coherent enterprise helps with M&As just as with any other change or in the consideration of change.

Chapter 10. *Applying Enterprise Architecture for Crisis Management: A Case of Hellenic Ministry of Foreign Affairs*. Leonidas Anthopoulos, Hellenic Ministry of Foreign Affairs, Greece.

In most Governments, the response to crises is largely reactive. Applying EA governments develop their plans and largely follow the plan to transition to the target architecture. Following the plan makes things relatively easier as outcomes are usually predictable. Hence the focus tends to be more on efficiency and effectiveness (alignment and assurance). Management of crises, where organizations must learn to deal with unpredictable situations can make things challenging and complex. In addition to alignment and assurance, responsiveness to the crises becomes an imperative.

The application of EA has been largely under conditions of 'normalcy' or 'business-as-usual' type of scenarios. However, in many scenarios, organizations must fine-tune their processes,

services and policies to enable crisis management methods and integrate them into their EA. This chapter is an application of EA for crises management with special focus on Hellenic Ministry of Foreign Affairs (Greece). There is very little literature on how EA can be leveraged in situations of crises. The chapter is particularly unique because it presents the case study of a government organization that is specifically tasked to manage crises [unlike the US Government's Federal Emergency Management Agency (FEMA) for instance]. This uniqueness brings forth several interesting insights and also proposes a 'crises architecture'. The chapter elaborates on how 'crises architecture' demands different practices, mechanisms and approaches as compared to the normal EA. The key success factor for EA applied in situations of crises is agility, i.e. how quickly the organization can respond decisively. It is beyond doubt that in such cases organizational coherence is critical.

Chapter 11. *Bridging the Gap between Enterprise Architecture Goals and Technology Requirements with Conceptual Programming*. Jorge Marx Gómez, Carl von Ossietzky Universität Oldenburg, Germany; Thomas Biskup, QuinScape GmbH, Germany

Small and Medium Enterprises (SME) form the backbone of most economies. One of the criticisms EA often faces is that it seems to favor large enterprises. While there may be some truth in that criticism, because architecture by its very nature brings greater benefits to organizations that are large. John Zachman asserts that the two fundamental reasons EA is an imperative is its ability to deal with 'complexity' and 'change'. Large organizations usually are more complex. However dealing with 'change' is precisely the reason why SMEs should be looking at EA. SMEs by and large have to be more responsive, agile and flexible given the unique challenges they face.

The approach 'Conceptual Programming' presented in chapter specifically analyses the unique needs of SMEs and discusses how EA can be made equally useful for such enterprises.

Chapter 12. *The Evolving Role of Enterprise Architecture within Syngenta*. Peter Hungerford, Syngenta Corporation, Switzerland.

Enterprises are starting to realize the criticality of EA. General EA practices are improving and maturing. Enterprises are expending lots of resources and time in establishing full time EA offices, governance processes, selecting the most relevant frameworks and methodologies, creating architecture artifacts and building business awareness. Despite all the good work that is being done, there is a growing realization that to sustain an EA practice, organizations need to link it to other management practices and approaches (strategic planning and solutioning). These linkages obviously extends the role of traditional architects to now understand and be intimately involved in aspects that were previously not thought are architecture activities in the classical sense.

The chapter positions EA within the context of IS strategic planning. Using Syngenta as a case study, it starts with a good description of the role of the EA office. The evolving role of the EA office is evident in the fact that it is shifting away from emphasizing purely on technology to business and information aspects.

Chapter 13. *Realizing the Business Value of Enterprise Architecture through Architecture Building Blocks*. Fred Collins, IBM Business Consulting Services, United States of America; Peter DeMeo, IBM Business Consulting Services, United States of America

Enterprise Architecture is a challenging endeavor. Organizations often express inability to embark on and sustain the resources and adequate management attention needed to take full benefit from EA programmes. Given such serious impediments to EA, a formal and discipline approach to EA provides organizations with the much needed guidance that they strive for. A formal, structured and disciplined approach to EA is usually captured as a methodology.

This chapter presents IBM EA Methodology. It does briefly discuss the various phases (neighborhoods), but the focus of the chapter is not so much the methodology per se but the value it brings to EA practice. The authors describe the purpose and key deliverables within the context of how they bring value to the organization. The chapter makes a good effort in showing an integrated approach of how IT gets linked up to business and how the transition

from business to IT can be made as seamless as possible. In building the case for an integrated approach, the chapter puts the idea of 'upstream' and 'downstream' EA. It provides a very good description of how the EA is linked downstream to solution architecture.

Chapter 14. *Reference Models for Government*. Neil Kemp, Swift Fox Strategies, Canada.

It is fair to say that Enterprise Architecture is in a bit of an identity crisis vis-à-vis its relationship to Technology. Many prominent experts on the subject will often say that EA is about more than technology but their message has less impact than hoped because the examples tend to be quite focused on the technology view of solving the business problem and realizing true business value. Its not that business value is bad, it's that it primarily limits approaches to the value proposition of how IT will serve the business.

This chapter has a summary of a model for describing pubic services in the Governments of Canada. The interesting thing to note in that this public sector reference model supports the standardized and structured representation of the business for business design purposes, not simply to have captured the requirements effectively. The other major learning in this chapter is that Business Architecture is much more than Process Reengineering. It involves (among other things) understanding the services value chain through modeling which takes a rather scientific view of how our actions benefit those we attempt to serve.

Chapter 15. *Chief Information Officers, Enterprise Architecture and Coherency Management*. Jean-Pierre Auffret, George Mason University, United States of America.

The role of CIO is evolving. This has been very well documented in the book "The New CIO Leader" by Broadbent & Kitzis. There is a growing acceptance that the CIO could play a very critical role in ensuring organizational coherence. Though the CIO is not the only potential candidate, but given the CIO emerging as a business leader, the CIO is a very promising candidate. We believe that from a practicality point of view, especially in the 'embedded' mode, the CIO may be a most likely 'delegate' to performing the task.

The author recognizes the critical role of the CIO in ensuring coherency; the chapter extends the thought by comparing various CXO roles and their suitability in being responsible for coherency management. The chapter presents brief cases about the adoption of EA in US, Japan, Indonesia and Vietnam and explicitly discusses the roles of the CIO in the context of Coherency Management in both the public and private sectors.

Chapter 16. *A Pragmatic Approach to Enlisting the Support of CEOs for Enterprise Architecture*. Larry DeBoever, EA Directions, United States of America; George Paras, EA Directions, United States of America; Timothy Westbrock, EA Directions, United States of America.

According to recent surveys, most EA programs globally still largely are done within the context of IT. This is not necessarily undesirable and many times given their unique knowledge about all key aspects of the organization, IT departments may actually be at advantage to trigger and drive the EA. However, this does create acceptance challenges as the IT departments attempt to convince the executive leadership about the benefits of EA to all parts of the organization. If EA is just used to derive a list of technology initiatives, then this is a recipe for disaster, as getting the CEO's attention, buy-in and active involvement becomes an uphill task.

This chapter elaborates on the organizational situations and conditions that favor and work better in adopting EA based approach. Such favorable situations include: (a) Inducting a new CIO who comes from the 'business-side'; (b) Existence of near term business threat; and (c) Clearly defined need to IT-enabled business transformation. These, of course, represent different situations that provide numerous leverage points for organizations to plan, design and implement their EA.

Chapter 17. *The Future of Enterprise Engineering*. Peter Bernus, Griffith University, Australia.

A lot of current EA efforts have been expended to build frameworks, reference models, languages, notations, tools and maturity models. Almost of current literature view EA in the 'foundation' mode. While this acceptable as a starting point in organizations, over time, we believe that organizations must add elements and characteristics of 'extended' and eventually 'embedded' modes. In reality, it is almost impossible for a small team of 'enterprise architects' to develop the complete architecture. We believe moving forward in future, the onus of developing the architecture will be equally shared between the dedicated team of architects and the line managers themselves. Coherency will be achieved through the common meta-models, frameworks, structures, procedures etc. by both the groups.

The chapter looks at EA as a way to manage change and in general a way to enable the development of enterprises (not just IT / IS). It is a well known paradigm that every architecture artifact must address one or more stakeholder concerns. If it doesn't then it is not needed. By nature stakeholders and their concerns are very different in the three modes of EA. The chapter identifies a representative set of such concerns across the three modes and presents / discusses the artifacts that could be utilized to address such concerns. Furthermore, the chapter strongly makes the case for the need of enterprise to be 'designed' and envisions the evolving role of enterprise architect in this context.

Chapter 18. ***Marketing Communications for Coherency Management*****.** Thom Kearney, Rowanwood Consulting, Canada.

The following chapter delivers a key message for all Enterprise Architecture practitioners around the world. It is quite often said that a critical success factor for Enterprise Architecture is communication, starting with a good Communication Plan. We believe, however, that this is only part of the solution. In these days of competing sounds bytes and information overload it is absolutely essential to also consider marketing.

In this chapter, Thom Kearney introduces us to the key aspects of marketing and follows up with an applied true example.

Chapter 19. ***Profile of Government of Canada Internal Services*****.** Rick Bryson, Government of Canada, Canada; Bruce Stacey, Government of Canada, Canada.

This chapter is essentially a copy of an operational working product from the Government of Canada. What is most important about this chapter is how little it looks like an EA project. This is intentional and best represents what happens when EA actually becomes embedded within the existing operational processes of the enterprise. As is usually the case in the public service, the government of Canada reports its budget expenditures and results (planned and/or actual). It has done this for years but the way this is done varies from government to government and quite often the model morphs within the governments to deal with pressures and interests of the day. Most recently, the office Results-Based Management Division in the Expenditure Management Sector of the Treasury Board Secretariat steers this annual process.

The profile presented in this chapter is remarkable because it is a normative model penned by the Enterprise Architecture Division of the Treasury Board Secretariat in close collaboration with many people across the government. The normative model for Internal Services is a primary example of the Embedded Architecture, as described in chapter 1, is making its way to the budget process. This is just a small part of the budget but as the normative models prove themselves useful then other parts of the budget can start to adopt EA based models in other services areas (not just internal). The budget has always been filed, it is not new, but this year part of the budget will be in accordance with the standards of EA. Embedded EA is exactly this. It is about getting existing process owners to recognize that they are contributing to the design, plan and 'architecture' of this enterprise. If we do it together, supported by the standards, models and techniques of EA (while also being active with the foundation and extended modes of EA) then we can become coherent.

Chapter 20. ***Commencing the Journey: Realizing Coherency Management*****.** Gary Doucet, Government of Canada, Canada; John Gøtze, Copenhagen Business School, Denmark; Pallab Saha, National University of Singapore,

Singapore; Scott Bernard, Carnegie Mellon University, United States of America.

This final chapter discusses how to implement Coherency Management in the context of an enterprise-wide architecture to improve strategic alignment, business agility, and risk assurance for that enterprise. Prior chapters defined the concept of Coherency Management, the need for coherency in an organization, and the role of enterprise architecture (EA) in enabling coherency. This chapter amplifies and extends a number of those concepts, including the critical roles that the CEO and Chief Enterprise Architect play, the role of other architecture positions in creating coherency, the introduction of a general framework for coherency management, and a proposed assessment approach.

An Invitation

Coherency Management is not simply a project. It is not like the building of a bridge where one day we put down our tools, remove the barricades and then redirect the traffic. This is continuous improvement! So, some day in the future a business decision will be more correct, an operation will be more efficient, knowledge will be more complete and someone will not remember that EA enabled it or that the coherency management practice was in the mix. These things will have become the ferment of future innovations.

Until that day, we have much to do, many steps to climb, mistakes to correct, innovations to discover and invent. We invite everyone to join us in this process at the web site we've dedicated: www.coherencymanagement.org

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Article

A Need for Formalization and Auditing in Enterprise Architecture Approaches and Programs

By Scott Bernard and John Grasso

Abstract

This article discusses two important improvements that are needed in Enterprise Architecture (EA) programs: (1) formalization in EA approaches and (2) auditing of EA programs. Formalization occurs through the implementation of six elements that are foundational to any EA approach: governance, methodology, framework, artifacts, repository, and best practices. Auditing is accomplished through an approach-neutral process that evaluates completeness, consistency and utilization to promote transparency, accountability, maturity, and value. The article provides context through a discussion of the background of EA, the growing popularity of EA programs in the public and private sectors, and the mixed record of value the EA programs have produced for different stakeholder groups, some of whom tend to view a formalized architecture as expensive to develop, light on returns, and a threat to project or system-specific interests. Auditing is discussed as a best practice that should be considered as an essential aspect of any EA program, just as auditing is integral to most quality assurance approaches and is the impetus for several influential federal laws that seek to improve accountability, accuracy, and service delivery. The article concludes with an introduction of the EA Audit Model (EA2M) as a method to support the formalization and maturation of EA programs.

Keywords

Enterprise Architecture, Audit, Capability Maturity Model, Process Improvement, Value

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INTRODUCTION

Enterprise Architecture (EA) is a management and technology discipline that has emerged during the last two decades. In this timeframe, EA has evolved from a concept for improving the use of information technology (IT) to a holistic approach for all dimensions of an enterprise: strategic, business, and technology. This is done by linking strategic drivers, business requirements, and technology solutions within and between all of an enterprise's lines of business. Today, the primary goal of EA is to improve performance by achieving and maintaining coherence, which is a clear understanding of an enterprise's current capabilities and future options.

During the past twenty years, formal EA programs have been established in many public, private, military, academic, and non-profit organizations around the world. This is especially true for large, complex enterprises that continually deal with issues of aligning strategic goals and integrating business requirements across a broad spectrum of stakeholder interests. The popularity of EA programs has grown with the increasing importance of IT within organizations, especially in the form of e-business and e-government applications. Nevertheless, EA programs have produced varying degrees of value for different stakeholder groups, some of whom tend to view a formalized architecture as expensive to develop, light on returns, and a threat to project or system-specific interests.

The fact that some EA programs have not produced desired levels of value is an indication that requirements and/or expectations for EA development and use are often not sufficiently articulated. Also, even with twenty years of

investment, the EA discipline is still evolving toward a useful meta-architecture, so perceptions of low value delivery among some stakeholder groups is to be expected and is not an indication of EA's ultimate capability. Additionally, it should be recognized that the very act of 'structuring' an organization (or other type of enterprise) inherently creates an architecture, which may remain undocumented and therefore may not be available as a reference for planning and decision-making. The lack of a formalized architecture that can help to manage change and create agility is arguably more of a problem than are the issues associated with the creation and use of a documented EA.

Having said this, two concepts are discussed in this article that can improve EA program development and use in public and private sector organizations:

Architectures Must Be Formalized. Harnessing the power of an enterprise-wide architecture requires that it be formally documented and maintained on an ongoing basis through an EA program that meets criteria for formalization and completeness.

Architectures Must Be Audited. EA program performance and value can be enhanced through the use of a best practice - a formal audit process that is applied on a periodic basis through annual reviews and no-notice spot checks. The "EA Audit Model" that is presented in basic form for the first time in this article builds upon and extends prior methods, is current in that it accommodates many popular EA approaches (e.g., Zachman, TOGAF, DODAF, EA3), and is comprehensive in auditing three primary areas: completeness, consistency, and utilization.

BACKGROUND

Enterprise Architecture Approaches and Assessment Methods

The widely-acknowledged initial description of what was to become the practice of EA was published in a 1987 article entitled "Information Systems Architecture" by John Zachman in the *IBM Systems Journal.* His approach began with a set of data, function, and network artifacts (artifacts are models and other types of documentation) that were expanded in 1992 to include people, time, and motivation-related artifacts (Zachman, 1997; Zachman & Sowa, 1992). In 1992, a book on "Enterprise Architecture Planning" by Steven Spewak (Foreword by John Zachman) presented the first EA development methodology and a framework that called for the development of current and future views of an enterprise's business, data, application, and technology sub-architectures using Zachman's initial artifact set. What was different about the writings of Zachman, Spewak, and Sowa is that they moved the initial thinking about IT architecture from a systems-centric view to an enterprise-wide view.

While this new architecture thinking expanded the focus beyond the individual system, most practitioners continued to treat the development of an architecture as an IT activity. This IT-centric view continued until the mid-1990s when business requirements were increasingly recognized as the driver for IT solutions, and EA began to be described in more business/mission-centric terms for use in the public and private sectors (Cook, 1996; Federal CIO Council, 1999). The expansion continued when a decade later a strategic level of the architecture was specified apart from the business layer. Indeed, strategic goals and initiatives were recognized as being the context and rationale for identifying business workflow requirements and technology solutions at the application, system, and infrastructure levels (Bernard, 2004, Ross et al., 2006). Additional topics such as security and workforce planning also began to emerge in several EA approaches (Bernard, 2004; Federal EA Security and Privacy Profile, 2005).

During the past decade, a parallel development was the emergence of methods to assess the maturity and effectiveness of EA programs, led primarily by the U.S. Federal Government. This movement began in 1996 with passage the Clinger-Cohen Act, which mandated the development and maintenance of an IT architecture by each Federal Agency (Public Law 104-106). From this, two government approaches were articulated: (1) the "C4ISR Framework" published in 1997 and re-released in 2001 as the Department of Defense Architecture Framework (DODAF) which is mandated for use in defense agencies, and (2) the Federal CIO Council's publication of the Federal EA Framework in 1999 for use in civilian agencies.

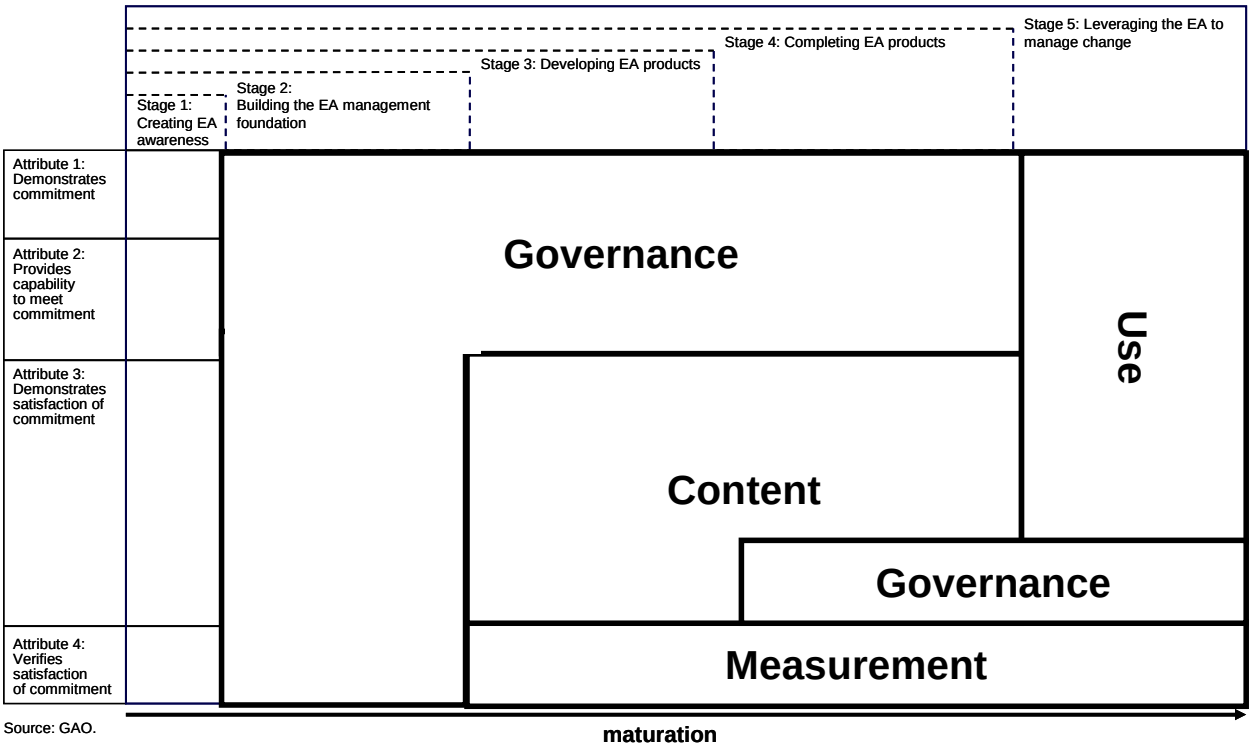
The General Accounting Office, later renamed the Government Accountability Agency (GAO), is an organization in the Legislative Branch of the U.S. Government that supports Congress by performing various assessment functions, including audits of Federal Government agencies in the Executive Branch to determine if the mandates of laws passed by Congress are being correctly and effectively implemented by the agencies. To do this GAO develops assessment and audit methods, some of which become best practices in the public and private sectors. In 2002, GAO developed the EA Management Maturity Framework (EAMMF) for use by GAO and Federal Government agencies to assess compliance with the EA-related provisions of the Clinger-Cohen Act and the maturity of managing agency EA programs. The EAMMF identifies five stages of architecture management maturity and four sets of success attributes for an EA program, as well as nineteen core elements that must be achieved for an agency's EA program to be ranked at the top stage of maturity. The EAMMF was updated in 2003 to extend to thirty-one core elements and has been used in subsequent government-wide surveys and EA program audits conducted by GAO. The maturity levels, success attributes, and core elements of the EAMMF are shown in Figure 1, and the general evaluation purposes of the EAMMF (governance, content, measurement, and use) are shown in Figure 2 (GAO, 2007).

	Stage 1: Creating EA awareness	Stage 2: Building the EA management foundation	Stage 3: Developing EA products	Stage 4: Completing EA products	Stage 5: Leveraging the EA to manage change
Attribute 1: Demonstrates commitment		Adequate resources exist. Committee or group representing the enterprise is responsible for directing, overseeing, and approving EA.	Written and approved organization policy exists for EA development.	Written and approved organization policy exists for EA maintenance.	Written and approved organization policy exists for IT investment compliance with EA.
Attribute 2: Provides capability to meet commitment		Program office responsible for EA development and maintenance exists. Chief architect exists. EA being developed using a framework, methodology, and automated tool.	EA products are under configuration management.	EA products and management processes undergo independent verification and validation.	Process exists to formally manage EA change. EA is integral component of IT investment management process.
Attribute 3: Demonstrates satisfaction of commitment		EA plans call for describing both the "as-is" and the "to-be" environments of the enterprise, as well as a sequencing plan for transitioning from the "as-is" to the "to-be." EA plans call for describing both the "as-is" and the "to-be" environments in terms of business, performance, information/data, application/service, and technology. EA plans call for business, performance, information/data, service, and technology descriptions to address security.	EA products describe or will describe both the "as-is" and the "to-be" environments of the enterprise, as well as a sequencing plan for transitioning from the "as-is" to the "to-be." Both the "as-is" and the "to-be" environments are described or will be described in terms of business, performance, information/data, application/service, and technology. Business, performance, information/data, application/service, and technology descriptions address or will address security.	EA products describe both the "as-is" and the "to-be" environments of the enterprise, as well as a sequencing plan for transitioning from the "as-is" to the "to-be." Both the "as-is" and the "to-be" environments are described in terms of business, performance, information/data, application/service, and technology. Business, performance, information/data, application/service, and technology descriptions address security. Organization CIO has approved current version of EA. Committee or group representing the enterprise or the investment review board has approved current version of EA.	EA products are periodically updated. IT investments comply with EA. Organization head has approved current version of EA.
Attribute 4: Verifies satisfaction of commitment		EA plans call for developing metrics for measuring EA progress, quality, compliance, and return on investment.	Progress against EA plans is measured and reported.	Quality of EA products is measured and reported.	Return on EA investment is measured and reported. Compliance with EA is measured and reported.

Source: GAO.

maturation

Figure 1. GAO's Enterprise Architecture Management Maturity Framework (EAMMF), Version 1.1



Source: GAO.

Figure 2. EAMMF – General Evaluation Categories

In 2004, the U.S. Office of Management and Budget (OMB) developed the EA Assessment Framework (EAAF) that has been used on an annual basis as a self-assessment tool for Federal Agencies. OMB is part of the Executive Office of the President and provides budget and program policy, guidance, and procedures to all of the agencies in the Executive Branch of the U.S. Federal Government (there are over two-hundred Departments, Agencies, Boards, and Commissions). OMB is "focused on helping agencies develop their Enterprise Architecture (EA) programs so that they can benefit from the results of using EA as a strategic planning tool. OMB is striving to help agencies link departmental-level EA throughout their operations, so that its value is reflected in both internal operational decision-making, as well as the identification of government-wide common solutions for improved service to citizens. The EAAF was updated in 2006 and 2007 to reflect new initiatives and guidance developed within the Federal EA community" (OMB 2008). The EAAF is organized into three capability areas: Completion, Use and Results. The current version (3.0) of the EAAF had a number of changes, which OMB described as follows:

"*Enterprise Architecture Assessment Framework (EAAF) Version 3.0 measures planned and delivered improvements to agency performance in five ways:*

- *Closing agency performance gaps identified via agency performance improvement and strategic planning activities.*
- *Saving money and avoiding cost through:*
- *Collaboration and reuse;*
- *Process reengineering and productivity enhancements; and*
- *Elimination of redundancy.*

Strengthening the quality of investments within agency portfolios as reflected in critical attributes including (but not limited to): security, inter-operability, reliability, availability, end-user performance, flexibility, serviceability, and reduced time and cost to deliver new services and solutions.

Improving the quality, validity, and timeliness of data and information regarding program performance output and outcome; program and project planning and management; and cost accounting.

Under previous versions of the EAAF, agencies have achieved, to varying degrees, a basic level of process and architectural maturity. Looking forward, the evolution of the EAAF is being driven by what agencies are doing to drive to outcome-focused architecture. In particular, recognizing that strategic planning, enterprise architecture (EA), capital planning and investment control (CPIC), and performance assessment and management are linked processes. And that the only way to insure that they work together towards targeted outcomes is to insure that at each step we understand and measure process outcomes vs. process compliance.

The scope of EAAF Version 3.0 spans planning, investment, and operations activities required to work in concert to improve agency performance through the management and use of information and information technology. EAAF Version 3.0 features extensive use of key performance indicators (KPIs) measuring outcomes across strategic planning, EA, CPIC, and performance data. To support automation and accuracy in producing the KPIs, EAAF Version 3.0 moves agency EA submissions to a template-based model similar to the current agency budget submission process for the Exhibit 53 and Exhibit 300.

EAAF Version 3.0 also changes the assessment and reporting process. Instead of a single annual assessment, Version 3.0 moves to separate submissions for each of the Completion, Use, and Results capability areas in order to better align EA with the other linked processes. Also, the thresholds for certain KPIs are being phased in over two submission cycles to allow agencies the opportunity to properly implement the changes required in the move to Version 3.0.

The EAAF supports the policy implementation assessment and enforcement for achieving the EA and related requirements set forth in OMB Circulars A-130 and A-11. EAAF Version 3.0 is closely aligned with the methodologies, reporting templates, and tools such as the Federal Transition Framework (FTF), the Federal Segment Architecture Methodology (FSAM), and VUE-IT or Visualization to Understand Expenditures in Information Technology."

In 2004, Jaap Schekkermann, founder of the Institute for EA Developments in the Netherlands developed the Extended Enterprise Architecture Maturity Model (E2AMM) that lists six maturity levels and the following eleven areas for measuring maturity:

- Business & Technology Strategy Alignment
- Extended Enterprise Involvement
- Executive Management Involvement
- Business Units Involvement
- Extended Program Office
- Extended Developments
- Extended Enterprise Architecture Results
- Strategic Governance
- Enterprise Program Management
- Holistic Extended Enterprise Architecture
- Enterprise Budget & Procurement Strategy

Process Maturity Approaches

Many approaches to evaluating process maturity were influenced by the work of Philip Crosby (1979) and Watts Humphrey (1989). Crosby introduced the concept of a "quality management maturity grid" with five stages of maturity for initiatives intended to manage quality in organizations, and Humphrey applied this to the task of managing quality in the domain of software development. In 1991, Humphrey's efforts at Carnegie Mellon University's Software Engineering Institute (SEI) bore fruit in the form of the publication called the Capability Maturity Model® (CMM®; see Paulk, et al., 1991). The CMM contained five levels of maturity for software development organizations, along with an auditing method useful to guide their self-improvement or as a framework for a formal, external capability determination. In 2002 the newer CMM Integration[SM] (CMMI®) model was introduced, along with training components and a family of appraisal methods (the Standard CMMI Appraisal Method for Process Improvement, SCAMPI[SM] Class A, Class B, and Class C). Class A appraisals are complete in documenting and verifying objective evidence and in validating findings. They provide reliable and repeatable rating results. Class B and C appraisals are less intensive, using fewer resources and smaller teams, for example, to perform a preliminary analysis of an organization's processes. (Note: The terms Capability Maturity Model, CMM, and CMMI are registered with the U.S. Patent and Trademark Office by Carnegie Mellon University. The terms

"CMM Integration" and "SCAMPI" are service marks of Carnegie Mellon University).

Since 2002, the CMMI product suite has expanded to include model components, training components, and appraisal components organized by areas of interest called "constellations." As is shown in Figure 3, three of SEI's constellations are "CMMI-DEV" for organizations that develop products or services, "CMMI-ACQ" for organizations that are acquiring products and services, and "CMMI-SVC" for organizations that are service providers or their clients. The current set of constellations contains 16 common core process areas, plus additional process areas that are unique to each constellation. Taken together, the process areas encompass the ways an organization performs its work, so the set of process areas comprise a framework to implement best practices and thereby gain expected improvements in cost, schedule, productivity, quality, and customer satisfaction. SEI reports that, since 2002, more than 80,000 people have received training on CMMI models, and more than 3,000 SCAMPI appraisals have been conducted by organizations in over 60 countries around the world (for more information see www.sei.cmu.edu). Stimulated by this approach, many other capability models and/or maturity models have emerged in many different application domains.

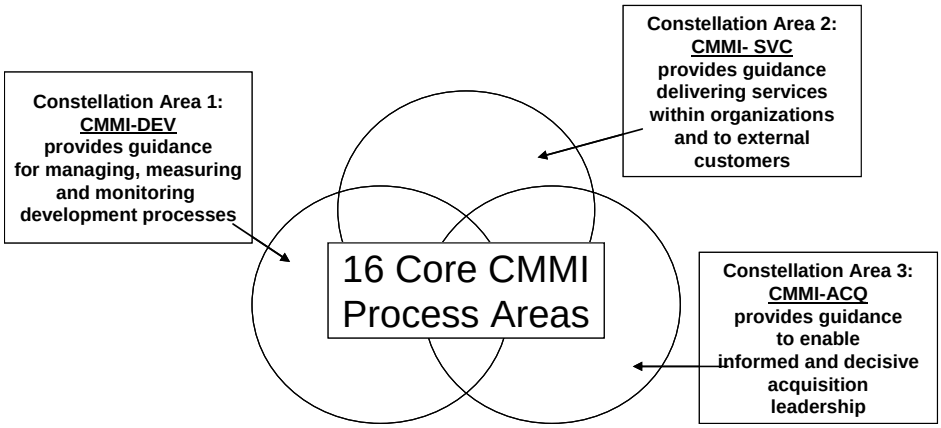


Figure 3. CMMI Constellation Areas and Core Processes

ENTERPRISE ARCHITECTURE FORMALIZATION

For an EA to be effective and authoritative at all levels and in all dimensions of an enterprise, the EA must integrate the strategy, business, and technology aspects of the architecture through a formal, ongoing program and an approach that has six basic and essential elements: (1) an EA governance process that integrates with other management processes; (2) a repeatable methodology that supports program implementation and maintenance: (3) a framework to establish the scope of the architecture and the relationship of sub-architectures and other components; (4) a comprehensive and integrated set of documentation artifacts; (5) documentation tools to assist with modeling, and configuration control that uses an on-line repository for storing the documentation; and (6) associated best practices to guide EA documentation and use. Figure 4 shows the six essential elements of an enterprise architecture approach.

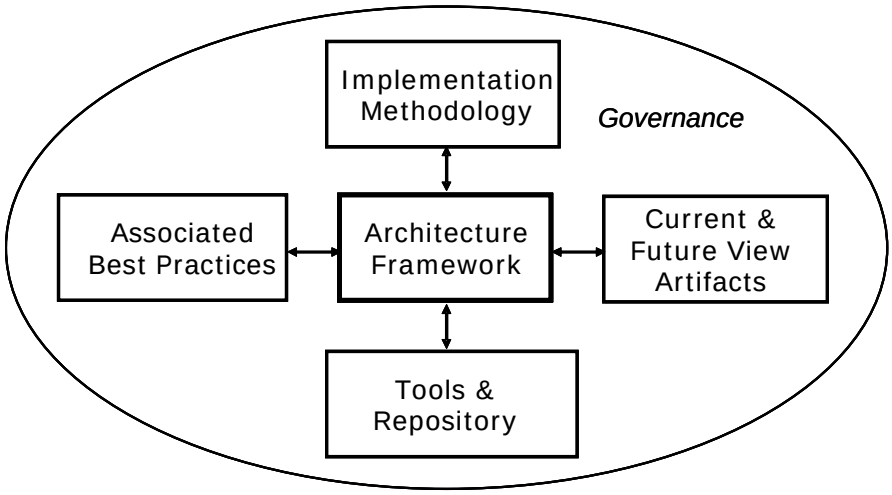


Figure 4. The Essential Elements of an Approach to Enterprise Architecture

Each of these six basic and essential elements plays an important part in the development, maintenance, and use of the architecture. The elements must not only be present, but they must be designed to work together to make the EA approach useful in the strategic, business, and technology dimensions across all lines of business. Their presence is also key to enabling the EA to serve as the meta-architecture for an enterprise and is essential to achieving higher levels of architecture maturity. Therefore these elements are a foundational part of the EA audit procedure described later in this article. A number of current EA approaches do not have all six of these elements and therefore are lacking in fundamental ways. For example, without a prescribed artifact set that covers all areas of the framework, it is not possible to document and relate the strategic, business, and technology areas of the architecture in a consistent way across all lines of business. Without a specified way to select associated best practices for use within the EA approach at various sub-architecture levels, there can be confusion about which one is the meta-approach and which one is the supporting approach (e.g., Balanced Scorecard™, service-oriented architecture methods, object-oriented database design methods, CORBA software integration standards, and IT Infrastructure Library™ standards). EA has evolved to be a meta-approach, which stands in contrast to other planning, design, analysis, modeling, and management methods – which are best suited to serve in a supporting role in the strategic, business, data, application, infrastructure, and/or security areas of the EA. Figure 5 provides an example EA approach called the "EA^3 Cube" (Bernard, 2004) which contains all six essential elements in a way that is designed to integrate the elements. The governance element provides for how the architecture information is used by stakeholders; the methodology element provides how to establish and maintain the EA and ongoing program; the framework establishes the scope and relationship of the architecture; the artifacts document the architecture (in current and future states); the repository is designed to contain the artifacts in a navigable way and align with the underlying framework; and best practices are identified for use at each sub-architecture level that is defined in the framework.

The auditing of EA programs, which is described in more detail later in this article, would be considered as one of the "best practice" elements, in that it is a proven way to improve many types of programs and processes.

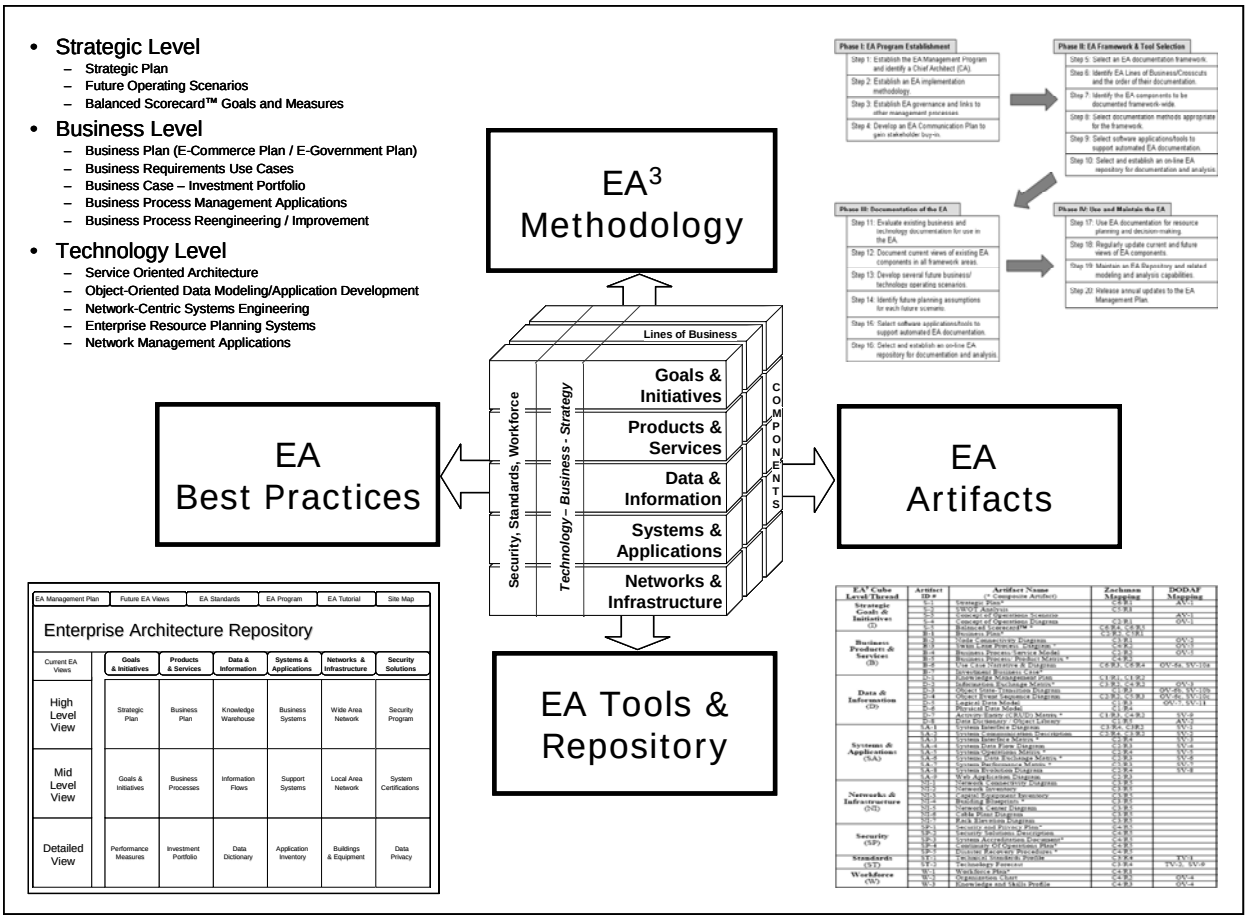


Figure 5. Example of the Essential Elements of a Complete EA Approach – EA^3 Cube

AUDITING AN ENTERPRISE ARCHITECTURE PROGRAM

Since the primary purpose of an EA program is to document an enterprise in current and future states to improve performance and coherency, the process for auditing an EA program must include general areas for completeness, consistency, and utilization. The Enterprise Architecture Audit Model (EA2M) follows generally accepted audit procedures and can be used with public and private sector EA programs based on any specific approach (e.g., Zachman, TOGAF, DODAF, FEAF, EA3, and GERAM) to measure maturity in the three areas: Completeness, Consistency, and Utilization. For example, in the 'Completeness' audit category the six basic elements of any EA approach are evaluated. In this way, the audit method can be consistently employed and resulting maturity scores can be used to track progress. Figure 6 shows the basic format, audit categories, maturity levels, and indicators of the EA2M approach.

Most of these public and private sector EA approaches do not have program formalization, activity, or maturity evaluation or auditing methods at present, which is a gap in the general practice of EA that the EA2M closes in that it can be used with any of them because EA2M's three maturity areas (Completeness, Consistency, and Utilization) are general (yet foundational) in nature and it is the particular EA2M audit template for each approach that provides the specificity needed for an effective audit – in the context of that approach.

Enterprise Architecture Audit Model (EA2M)					
Maturity Level	Level 1	Level 2	Level 3	Level 4	Level 5
	No Formalized Architecture	**Foundational Architecture** (General Indicators)	**Extended Architecture** (General Indicators)	**Embedded Architecture** (General Indicators)	**Balanced Architecture** (General Indicators)
Audit Category #1: Completeness					
Governance	Default initial level	EA Governance process selected	Governance initial implementation	Governance full implementation	Ongoing integration with management processes
Methodology		EA Methodology steps selected	Methodology initial implementation	Methodology full implementation	Methodology repeatable and steps optimized
Framework		EA Framework design selected	Framework initial implementation	Framework full implementation	Framework design optimized
Artifacts		EA Artifact set selected	Artifact intial implementation	Artifact full implementation	Artifacts used to support planning/decision-making
Tools / Repository		EA Tools & Repository selected	Tool & Repository initial implementation	Tool & Repository full implementation	Tool use & Repository design optimized
Best Practices		Best Practices selected	Best Practices initial implementation	Best Practices full implementation	Ongoing integration of Best Practices
Audit Category #2: Consistency					
Program	Default initial level	EA program approved	EA program initial implementation	EA program full implementation	EA program optimized
Policy		EA policies selected	EA policy initial implementation	EA policy full implementation	EA policy optimized
Resources		EA resources identified	EA resource requirements met	EA resources fully utilitzed	EA resources optimized
Training		EA training requirements identified	EA training initial implementation	EA training full implementation	EA training optimized
Audit Category #3: Utilization					
Strategic Value	Default initial level	Strategic goals & metrics identified	Strategic goals & business svcs mapped	Strategic goal attainment supported by the EA	Strategic goal attainment optimized via the EA
Business Value		Business services & requirements indentified	Business requirements and IT solutions mapped	Future business service scenarios established	Business services optimized via the EA
Technology Value		Current technology solutions identified	Future technology solutions refined	Future technology scenarios established	Technology use optimized via the EA
Risk & Security Management		Risk & security areas identified	Risk & security solution initial implementation	Risk & security solution full implementation	Risk mitigation optimzed via the EA
Coherency		Coherency goals & metrics identified	Coherency goals initially met	Coherency goals fully met	Coherency optimized via the EA

Figure 6. The Enterprise Architecture Audit Model (EA2M)

The EA2M's five maturity levels are based on the progressive stages of development that architectures go through (Doucet et al, 2009). Table A describes in summary form each of the five levels. It should be noted that just as with the CMMI maturity method, reaching each subsequent level for EA program maturity is a cumulative process, in that the key elements of the architecture at each maturity level are retained as the program progresses upward toward Level 5. This top level is where all of the elements of the EA program are working synergistically to create value as the architecture is used to support planning, decision-making, and to drive change in the organization.

EA Program Maturity Level 1	EA Program Maturity Level 2	EA Program Maturity Level 3	EA Program Maturity Level 4	EA Program Maturity Level 5
No Formalized Architecture	**Foundational Architecture**	**Extended Architecture**	**Embedded Architecture**	**Balanced Architecture**
Maturity Level 1 is the 'default' level for all enterprises that do not have an established EA program and/or documented architecture.	At Maturity Level 2, the 'foundational' elements of the EA are being put in place. EA is documented for the entire enterprise in its current and future states. The focus is on well-architected, well-designed IT systems with enterprise-level alignment, efficiency, and interoperability. Accordingly, EA at this level is very IT-centric, and for many people the EA would be viewed as a data and technology architecture, except that it is being implemented at the enterprise level. This perspective does help to leverage concepts such as federated patterns, but under-delivers from an enterprise-wide strategy and business perspective. Also, the value of EA is measured according to the success of IT investments.	At Maturity Level 3, the architecture is 'extended' to focus on engineering an entire enterprise from an integrated strategy, business, & technology perspective. To support this, approaches and tools are developed to provide standardized, repeatable methods for describing the enterprise in all dimensions - beyond just the IT perspective. Whereas early EA used architecture methods and tools to capture business requirements in order to design IT systems, an "extended" EA approach uses architecture methods and tools to capture strategic goals and related business requirements in order to design the enterprise.	At Maturity Level 4, EA tools, methods, and models become 'embedded' in the normal (usually existing) processes of the day. Rather than relying on processes and people extraneous to the business programs (and their processes), the architecture is produced by the processes themselves. In this way the architecture is organic and is renewed on an ongoing basis as a natural outcome of normal business processes.	At Maturity Level 5, the elements of architecture at the three previous levels are 'balanced' and are all working synergistically to optimize EA completeness, consistency, and utilization. In so doing, the EA helps the organization to be more agile and competitive as various future operating scenarios are envisioned on an ongoing basis and appropriate courses of action are chosen and implemented in ways that effectively mitigate risk and help to manage change, innovation, and continuous improvement.

Table A. Maturity Levels of the EA Audit Model

EA2M AUDIT PROCEDURE

Auditing is accomplished through an approach-neutral process that evaluates completeness, consistency and utilization to promote transparency, accountability, maturity, and value Auditing is an essential aspect of most program/process quality assurance approaches (including CMMI), as well as a number of public laws that seek to improve accountability, accuracy, and service delivery. These include the U.S. Government's Federal Financial Management Improvement Act of 1996 (FFMIA), the Sarbanes-Oxley Act of 2002, and the Federal Information Security Management Act of 2002 (FISMA). Auditing of EA programs has been occurring in U.S. government agencies since 2002 and EA audits were included as a mandate of the Korean Government's IT Architecture Act of 2006.

The EA2M audit is designed to help organizations to identify the strengths and weaknesses of their EA program, reveal crucial risks, set priorities for improvement plans, derive ratings, and support realistic benchmarking. The EA2M is the evaluation 'framework' to be used for the collection and analysis of information, and to generate accurate and valid level ratings to be reported to the organization.
The EA2M Audit Procedure (EA2M-AP) is the method including all steps necessary for objective evaluation, including preparation, collection of evidence, formulation of preliminary findings and ratings, finalizing findings, reporting, and follow-on activities. As with SCAMPI Class A, B, or C appraisal methods, which vary in their intensity and resource consumption, each organization should tailor their audit plans on dimensions including the goals to be served, the amount of objective evidence to be gathered, the resources to be allocated, the size of the team to be involved, and the nature and use of final reports to be prepared. The following is the set of steps covering the basic elements of the EA2M-AP:

1. Plan & Prepare for the EA Program Audit
1.1 Set Goals, Analyze Objectives/Requirement
1.2 Develop an Audit Plan and Schedule
1.3 Select and Prepare an Audit Team
1.4 Obtain/Inventory Initial Objective Evidence
1.5 Prepare for Conduct of the Audit

2. Conduct the EA Program Audit
2.1 Prepare Participants
2.2 Examine and Collect Objective Evidence
2.3 Document Objective Evidence
2.4 Verify Objective Evidence
2.5 Prepare and Validate Preliminary Findings
2.6 Generate Audit Results

3. Report Audit Results
3.1 Deliver Audit Results
3.2 Package and Archive Appraisal Assets

The EA2M-AP is intended to be implemented at both a basic and an advanced audit level to allow organizations to choose the depth to which they want the audit analysis to occur. A basic audit provides an organization with an initial estimate of the maturity of the program, or may be used to assist in establishing an EA program, with no 'official' maturity rating being given. The advanced audit provides a comprehensive look at all aspects of the EA program using the audit categories and indicators in the EA2M model, and results in an 'official' maturity level rating. Repeated annual audits and periodic spot checks that use the EA2M are the best way to ensure consistency in evaluating the EA program and progress in attaining higher levels of maturity. A summary of these audit levels is provided in Table B as follows:

	Basic EA Program Audit	**Advanced EA Program Audit**
Audit Team	1-2 People	2-5 People (Depends on EA Program Size)
Timeframe	2-4 Days	5-10 Days (Depends on EA Program Size)
Depth of Analysis	Cursory	Complete
Recommended Groups	Beginning EA programs and all initial audits. Provides feedback but no official rating.	After the basic audit is done and for subsequent audits. Allows for consistency in maturity tracking. Only way to get official rating.

Table B. Basic and Advanced EA2M Audit Characteristics

The final aspect of the EA2M-AP to be covered is the training and credentialing of the auditors. To maintain consistency and respect for the audit procedure, findings, recommendations, and ratings it is important that the auditors be experienced senior enterprise architects who are trained in the EA2M-AP process. At present, the authors are the only approved EA2M auditors, yet auditor training courses are planned for the mid- to late-2010 timeframe. Links with existing quality assurance groups are also in coordination to promote consistency in the training levels and integration with other quality approaches.

CONCLUSION AND NEXT STEPS

This article focused on the importance of formalizing and auditing enterprise architecture programs in order to improve their value to public and private sector organizations. Formalization of an EA program centers on the establishment and maintenance of six basic elements: governance, methodology, framework, tools/repository, and associated best practices. The EA Audit Model (EA2M) was presented as the basis for an audit procedure that reviews EA programs for maturity in three general categories: completeness, consistency, and utilization. The basic steps of the EA2M Audit Procedure were introduced which create a comprehensive and repeatable method for conducting EA program audits. Basic and advanced forms of the EA2M audit were also introduced as a way for organizations to have the option of doing preliminary reviews prior to comprehensive audits. The training and certification of EA2M auditors is in the beginning stages, with courses and reference materials planned for release in 2010. Subsequent research in this area and application of the EA2M audit process will provide the basis for additional writings, an EA2M Auditor's Handbook, and applied case studies. Templates for using the EA2M to audit architectures based on popular approaches will also be provided (e.g., Zachman, DODAF, TOGAF, FEAF, and EA3).

AUTHOR BIOGRAPHIES

Scott Bernard. Dr. Bernard is the founding editor of the *Journal of Enterprise Architecture* and teaches at Syracuse University and Carnegie Mellon University. In 2004 he wrote the book *An Introduction to Enterprise Architecture* that presented the 'EA^3 Cube' architecture framework, the 'Living Enterprise' repository design and an associated implementation approach. Dr. Bernard has over 20 years of experience in IT management, including work in the academic, government, military, and private sectors. He's held positions as a Chief Information Officer, management consultant, line-of-business manager, network operations manager, telecommunications manager, and project manager for several major IT systems installations. Dr. Bernard has developed enterprise architectures for public, private, and military organizations, started an EA practice for an IT management consulting firm, developed his own consulting practice, and taught EA at a number of universities, businesses, and agencies. He holds a Ph.D. in Public Administration from Virginia Tech (2001); a M.S. in IT Management from Syracuse University (1998); a M.A. in Business Management from Central Michigan University (1984); a B.S. in Psychology from the University of Southern California (1977), and a CIO Certificate from the U.S. National Defense University (2000). Dr Bernard can be reached at sabernar@syr.edu.

John Grasso. Dr. Grasso is the Director for Strategic Development and Distance Learning, in the Institute for Software Research International (ISRI), in the School of Computer Science at Carnegie Mellon University. In addition to his administrative role, he is appointed as Special Faculty in the School of Computer Science. He joined Carnegie Mellon after serving as Professor and Director in applied research at West Virginia University (WVU) for 17 years. His research career includes topics in technology, human resource development, and their contributions to productivity. His clients included telecommunications, manufacturing, mining, and software industries, U.S. and global companies, U.S. State and Federal Government, and other universities. In the area of software engineering, Dr. Grasso has taught the Management of Software Development, a core course in Carnegie Mellon's Master of Software Engineering program. In the area of quality management, he developed and delivered training for small and mid-sized companies, ranging from requirements management through acceptance testing and final evaluation. In

software engineering, he was the WVU team leader on a large project ("AdaNET") for the NASA Johnson Space Center, on certification of software objects for software re-use in the space shuttle program. This project has evolved into the current Electronic Library Services and Applications (ELSA) project, the operational part of the Repository Based Software Engineering (RBSE) program sponsored by NASA at the University of Houston - Clear Lake. Dr. Grasso holds a B.Sc. in Computer and Information Science and Ph.D. in Human Resource Policy, both from The Ohio State University (1970, 1975). Dr. Grasso can be reached at john.grasso@cmu.edu.

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