



California
DEPARTMENT OF TECHNOLOGY

California Enterprise Architecture Framework

Version 2.0
August 01, 2013

This Page is Intentionally Left Blank

TABLE OF CONTENTS

1	Executive Summary	1
1.1	What is Enterprise Architecture?	1
1.2	Why do we need EA?	1
1.3	What are the benefits of EA?	2
1.4	How do we implement EA?	2
1.5	What is CEAF 2.0 and how does it support implementation of EA?	3
1.6	How do we know if EA is working?	4
2	Introduction	5
2.1	Background	6
2.2	Purpose	6
2.3	Intended Audience	7
2.4	Document Organization	7
2.5	Future Directions	7
2.6	Deferred Decisions	7
3	Enterprise Architecture in the State of California	9
3.1	Enterprise Architecture Defined	9
3.2	Enterprise Architecture Vision and Benefits	10
3.2.1	<i>Vision</i>	10
3.2.2	<i>Expected Benefits</i>	10
3.3	Enterprise Architecture Domains	12
3.4	Business Architecture	13
3.4.1	<i>Business Architecture Elements</i>	15
3.4.2	<i>Business Reference Model</i>	17
3.4.3	<i>BA Future State Planning</i>	19
3.5	Information Architecture	20
3.5.1	<i>Information Architecture Elements</i>	21
3.5.2	<i>Data Reference Model</i>	23
3.5.3	<i>IA Future State Planning</i>	24
3.6	Applications Architecture	25
3.6.1	<i>Applications Architecture Elements</i>	25

3.6.2	<i>Service Component Reference Model</i>	27
3.6.3	<i>AA Future State Planning</i>	28
3.7	Technology Architecture	29
3.7.1	<i>Technology Architecture Elements</i>	30
3.7.2	<i>Technical Reference Model</i>	31
3.7.3	<i>TA Future State Planning</i>	33
3.8	Motivation and Cross Domain Aspects	33
3.9	Enterprise Architecture Segments	35
3.10	How does EA Fit into the Organization	36
4	California Enterprise Architecture Framework	39
4.1	EA Framework Defined	40
4.1.1	<i>Characteristics of an EA Framework</i>	40
4.2	CEAF 2.0: EA Framework Component Overview	41
4.3	EA Deliverables	42
4.3.1	<i>Current State Architecture Views</i>	43
4.3.2	<i>Future State Architecture Views</i>	43
4.3.3	<i>Enterprise Roadmap</i>	44
4.3.4	<i>Content Meta Model</i>	45
4.3.5	<i>EA Repository</i>	48
4.4	Principles	48
4.4.1	<i>Strategic Goals to EA Principles</i>	52
4.5	Method	53
4.6	Tools	54
4.7	Maturity Model	55
4.7.1	<i>EA Maturity Model</i>	55
4.7.2	<i>EA Program Maturity Model</i>	58
4.8	Standards	59
4.8.1	<i>Reference Architectures</i>	60
4.8.2	<i>Information Technology Patterns</i>	61
4.8.3	<i>EA Standards Process</i>	61
4.9	Governance	62
4.10	Metrics	68
4.11	Reporting	69

5	Enterprise Architecture Services	70
5.1	Assist with Business and IT Strategies	71
5.1.1	<i>Operating Model</i>	72
5.2	Portfolio Rationalization	73
5.3	Target EA and Enterprise Roadmap	74
5.4	Project Prioritization	75
5.5	Assist with Project Concept and Business Case	75
5.6	Standards Establishment and Governance	75
5.7	Solution Architecture Guidance and Oversight	76
5.8	Harvest Reference Architectures and Reusable Assets	76
6	Target Architecture Vision.....	78
7	Glossary	83
8	References	86
9	Document History	87

LIST OF FIGURES

<i>Figure 3-1 Enterprise Architecture Domains</i>	<i>13</i>
<i>Figure 3-2 Business Architecture Elements</i>	<i>16</i>
<i>Figure 3-3 Mapping BRM to Business Architecture Elements</i>	<i>18</i>
<i>Figure 3-4 Information Architecture Elements.....</i>	<i>22</i>
<i>Figure 3-5 Mapping DRM to Information Architecture Elements</i>	<i>24</i>
<i>Figure 3-6 Applications Architecture Elements</i>	<i>26</i>
<i>Figure 3-7 Mapping SRM to Applications Architecture Elements</i>	<i>28</i>
<i>Figure 3-8 Technology Architecture Elements</i>	<i>30</i>
<i>Figure 3-9 Mapping TRM to Technology Architecture Elements</i>	<i>32</i>
<i>Figure 3-10 Enterprise Architecture Domains and Segments</i>	<i>36</i>
<i>Figure 3-11 Enterprise Architecture Interfaces</i>	<i>38</i>
<i>Figure 4-1 California Enterprise Architecture Framework</i>	<i>42</i>
<i>Figure 4-2 Enterprise Roadmap</i>	<i>45</i>
<i>Figure 4-3 Content Meta Model.....</i>	<i>47</i>
<i>Figure 4-4 Collaborative Planning Method</i>	<i>54</i>
<i>Figure 4-5 Four Stages of Enterprise Architecture Maturity</i>	<i>56</i>
<i>Figure 4-6 CEAF 2.0 EA Program Maturity Model.....</i>	<i>59</i>
<i>Figure 4-7 California Enterprise Architecture Governance</i>	<i>63</i>
<i>Figure 5-1 Enterprise Architecture Services Context</i>	<i>71</i>
<i>Figure 5-2 Enterprise Operating Models</i>	<i>73</i>
<i>Figure 5-3 Portfolio Rationalization</i>	<i>74</i>
<i>Figure 6-1 Target Architecture Vision</i>	<i>80</i>

LIST OF TABLES

<i>Table 2-1 Taking EA to the Next Level.....</i>	<i>6</i>
<i>Table 3-1 Benefits of EA</i>	<i>10</i>
<i>Table 4-1 EA Principles</i>	<i>48</i>
<i>Table 4-2 Strategic Goals to EA Principles</i>	<i>52</i>
<i>Table 4-3 Learning in EA Maturity Stages.....</i>	<i>58</i>
<i>Table 9-1 Document History</i>	<i>87</i>

This Page is Intentionally Left Blank

1 Executive Summary

This section provides an executive overview of enterprise architecture, the basic concepts of what it is, why it is needed, and what benefits can be expected from it. It provides a high level summary of how to establish an enterprise architecture, how the California Enterprise Architecture Framework, Version 2.0 (CEAF 2.0) helps to achieve that, and outlines the main components of CEAF 2.0.

1.1 What is Enterprise Architecture?

Enterprise Architecture (EA) identifies the business processes that execute or support an organization's mission and defines how Information Technology (IT) assets directly enable those processes. The purpose of EA is to optimize and transform the often fragmented processes, information, application systems and technologies into an efficient and integrated environment supportive of the execution of business strategy.

To help execute business strategy and realize strategic goals, EA defines a desired *target state view* of an enterprise's processes, information, application systems and technologies and an *enterprise roadmap* to progressively implement this target state through a series of projects.

1.2 Why do we need EA?

State agencies have their respective missions. They execute their mission through a set of business processes and provide government services through various programs. To improve program outcomes and drive business forward, agencies establish goals and objectives through strategic planning. Clearly defined goals and objectives, in turn, establish the business outcomes the agencies want to achieve.

Government leaders know that efficient business processes, and effective management and use of IT to support them are necessary for achieving the desired business outcomes – to *efficiently and effectively deliver government services*. This requires a business-outcome-driven approach to first analyze and determine the necessary improvements to business processes and IT assets and then to determine where to invest to make sure every dollar invested in implementing changes to processes and/or IT assets provides the best possible return on investment in terms of the business outcomes. EA helps identify these necessary improvements and how to progressively implement those improvements by defining the *desired target state* and an *enterprise roadmap*. In defining the desired target state, EA leverages or creates best-practice-based solutions which contribute to building business and technical capabilities that can be reused and shared throughout the state government.

The strategic context provided by EA through the desired target state architecture and enterprise roadmap is important to make sure individual projects build business and IT capabilities in support of the long-term business strategy – rather than just fulfill immediate needs. This is why EA is recognized as a *key business and technology best practice* and is needed to enable the achievement of business outcomes.

It should be noted that the state organizations that do not have a defined strategic plan, or have an extensive focus on ongoing projects due to their criticality, can also gain *near-term benefits* by adopting EA services to assist with business and IT strategies, and to provide solution architecture guidance and oversight to projects.

1.3 What are the benefits of EA?

When EA is effectively defined, implemented and followed, it can provide the following key benefits:

- **Bridge the gap between business strategy and implementation:** By defining the *target* business processes and IT assets required to satisfy the business objectives, and a *roadmap* for reaching that target, EA provides a clear vision to implement business strategy and helps reduce *ad hoc* implementations driven by a tactical and reactive approach.
- **Improve alignment of IT with mission, goals, and objectives:** By identifying how IT assets directly enable business processes and how those processes execute the organization's mission, EA promotes IT solutions that are more pertinent and relevant *for the business*.
- **Improve service delivery, business operations and business capabilities:** Adoption of EA results in streamlining business processes and in making IT operations more efficient. EA processes help identify gaps in business capabilities (such as business analytics and case management) and provide a long-term vision to improve and/or acquire those capabilities.
- **Improve interoperability and information sharing:** By defining enterprise-wide standards and specifications for how systems will “talk to each other”, EA makes the job of integrating multiple systems and sharing information easier.
- **Improve flexibility to dynamically respond to customer needs and statutory changes:** EA enables faster design of new systems and extensions to existing systems by pre-defining standards. By advancing service orientation, EA promotes creation of user applications as a composition of reused services, which results in faster adaptation to changes.
- **Reduce cost and cost of ownership:** EA enables economies of scale in purchasing and reduces training requirements and support costs by establishing a less complex environment (due to technical homogeneity), which is easier to support and results in faster repairs.
- **Reduce redundancy, duplication, complexity and information silos:** EA enables portfolio rationalization and simplification to promote more effective use of IT and other resources to efficiently support business processes.
- **Reduce business risk associated with IT and reduce risk for future IT investment:** Focus on strategic goals allows EA to identify weaknesses and threats in the existing IT portfolio and to address them in the target architecture. The risk of future IT investments not delivering business value is greatly reduced when investments are made in accordance with a well-defined enterprise roadmap.
- **Enable faster, simpler and cheaper procurement:** By defining the target architecture and a roadmap, EA facilitates “architect – invest – implement” approach that simplifies procurement decisions and ensures architectural coherence of multi-vendor solutions.
- **Enable predictable success of projects and realization of their defined objectives:** EA promotes undertaking projects within the context of a defined enterprise roadmap. EA provides guidance to these projects to ensure their progress towards the target architecture and to help realize their defined business objectives.

1.4 How do we implement EA?

EA must be developed, implemented and maintained effectively to be useful and provide benefits. EA, as the name indicates, is about the whole enterprise – not just about IT. *Analysis, design and modeling* together comprise only one essential component of the EA work; effective *communication* and *governance* are the other two critical components. Developing and sustaining an EA is a *complex process* due to the breadth and depth of the analysis and design,

and the communication and governance which involves many stakeholders and decision processes in the organization. The following key activities are intended to provide salient points associated with establishing EA:

- Establish an architecture team and charter them to provide *clearly defined services and deliverables*
- Adopt an *enterprise architecture framework* which, at a minimum, provides:
 - Common understanding of EA, its domains, and building blocks of each EA domain
 - A structure to support EA “models” by defining building blocks and their relationships
 - Effective methods, tools and guidance for developing actionable EA deliverables
 - Guidance for effective EA governance
 - Best-practice-based solutions to build common business and/or technical capabilities
- Analyze the business strategy and goals, and understand the business operating model
- Define a set of principles, enterprise-level requirements and constraints for the architecture
- Divide the EA into segments, and prioritize the EA work across these segments to incrementally develop EA in accordance with the business priorities
- Determine target maturity levels across EA segments to support the business operating model and long-term business strategy
- Develop and communicate the EA Plan including its incremental and federated approach, and gain stakeholder buy-in
- Execute the EA Plan to incrementally define target EA and a roadmap
- Measure the progress, maturity and effectiveness of EA program, and refine as necessary

1.5 What is CEAF 2.0 and how does it support implementation of EA?

CEAF 2.0 is an enterprise architecture framework designed to guide the development and use of comparable enterprise architectures within and across state agencies so that the resulting EA deliverables *enable mission success* with a lower total cost of ownership, faster time to delivery, and reduced duplication. It also promotes *cross-agency initiatives (CAIs)* for shared development of common business processes, business and technical services, and shared platforms.

CEAF 2.0 consists of the following three major components which are used together to support effective implementation of EA:

- **EA Framework:** Describes the domains and building blocks of EA, and provides a structure to guide the development of EA “models”. It also provides the *Principles, Method, Tools, Maturity Model, Standards, Governance, Metrics, and Reporting* to guide, support, and govern the development of actionable EA deliverables.
- **EA Services:** To facilitate *consistent and uniform* implementation of the EA program across state agencies, CEAF 2.0 recommends that the state agencies charter their EA teams to provide the following *eight defined services*:
 - Assist with Business Strategy and IT Strategy
 - Portfolio Rationalization
 - Future State (Target EA) Planning and Actionable Roadmap (Enterprise Roadmap) Development
 - Assist with Project Prioritization to help Drive Business Forward and Improve Program Outcomes
 - Assist with Concept and Business Case Development
 - Standards Establishment and Governance
 - Solution Architecture Guidance and Oversight

- Harvest Reference Architectures and Reusable Assets

This service-oriented approach to EA work is intended to increase the focus of EA programs on *mission effectiveness* while taking the confusion out of what EAs do and should do.

- **Reference Architectures:** Reference Architectures (RAs) are the means through which CEAF 2.0 provides *best-practice-based architectural solutions* to build common business and/or technical capabilities. RAs facilitate *repeatable solutions leading to shared solutions*. They also provide a key mechanism to *prevent* unchecked acceptance of too many different solutions, dilution of the talent pool, challenges in the ability to leverage solutions across state agencies, and increasing support and maintenance costs. RAs are described in separate documents which are or will be made available through the state EA standards publication process.

In addition to the above components, CEAF 2.0 provides a target architecture vision which is intended to serve as a “model” for state agencies. This target architecture vision and the RAs are key inputs to the agency architects in creating their agency’s target architecture. They constitute an approach to progressively mature the EA in the State of California to create statewide capabilities for standardized solutions and optimized core business processes, to improve interoperability and information sharing, and to expand shared business and technical services.

CEAF 2.0 incorporates *best practices* based on popular industry architecture frameworks, including the Federal Enterprise Architecture Framework (FEAF), The Open Group Architecture Framework (TOGAF), Medicaid Information Technology Architecture (MITA), and publications from National Institute of Standards and Technology (NIST), Massachusetts Institute of Technology (MIT) Sloan Center for Information Systems Research, Harvard Business Press, Gartner and Corporate Executive Board. This *adaptation of best practices* into CEAF 2.0 allows state agencies already implementing EA programs to easily integrate with CEAF 2.0, thereby allowing state agencies to build on and optimize what they have implemented to date.

1.6 How do we know if EA is working?

The value of EA is in both the EA deliverables and EA services. A tangible way to identify the effectiveness of EA is to determine how EA deliverables and services *enable* the organization to achieve the business outcomes that matter to senior executives. EA’s impact on the business outcomes should be identified and communicated in terms of EA’s *influence* on which projects are identified and initiated, and how these projects are *directed* in alignment with the target architecture and the enterprise roadmap.

It should be noted that the impact of EA on business outcomes is *indirect*. The business outcomes are actually achieved by the projects rather than directly by EA. Therefore, it is important to recognize that EA’s guidance is necessary to ensure these projects succeed not only individually, but also together.

It is also important to note that effective target architecture and roadmap development are not just an EA’s tasks or a CIO group’s tasks; they can only be successful with strong support from business leaders and through effective collaboration at all levels. Similarly, EA services are critical to strategic planning, investment decision-making, and efficient execution of projects. Effective EA service delivery requires strong executive support and effective collaboration with Portfolio/Project/Program Management Office, solution architects, domain architects and other key business and technical subject matter experts.

2 Introduction

Enterprise Architecture (EA) is a *key business and technology best practice* that enables state agencies¹ to evolve their capabilities to efficiently and effectively deliver government services. EA provides an *integrated view* of an enterprise's strategic goals, business processes, information, application systems and technologies across all lines of business, services, and systems. This integrated view identifies and communicates the necessary improvements to business processes and IT assets to enable the optimization of an organization's mission capabilities and resource utilization. It facilitates investment decisions based on architectural solutions that result in the achievement of strategic and/or tactical outcomes by employing technology and other resources in an effective manner. Thus EA supports intra- and inter-agency investment decision-making by promoting an “architect – invest – implement” approach to make sure that every dollar invested in implementing changes to processes and/or IT assets provides the best possible return on investment in terms of the business outcomes.

EA is important for evolving information systems, developing new systems, and for successful introduction of new technologies and operating paradigms that promote resource optimization, such as cloud computing, virtualization, the semantic web, mobile technologies, business intelligence, and social media. EA standards promote mission success by standardizing on common functions and IT solutions which will help state agencies implement changes in a timely manner. They also facilitate agencies select reusable and sharable services and products to obtain mission or support functionality. Without complete and enforced enterprise architecture, the state runs the risk of buying and building systems that are duplicative, incompatible, and unnecessarily costly to maintain and integrate.

At present, there is no other business and technology best practice, other than EA, that can serve as a context for enterprise-wide planning and decision making². When an EA is viewed as authoritative by agency leadership, then it becomes a catalyst for delivering thoughtful, innovative and quality solutions, and for remaining agile and effective with limited resources.

Enterprise architecture must be developed, implemented and maintained effectively to be useful and provide business value. The business value of EA is in both the EA products and EA services. CEAF 2.0 is a significantly enhanced enterprise architecture framework intended to assist the state agencies in defining, implementing, maintaining and using the enterprise architecture effectively. It also defines a set of EA services and provides guidance to help agency architects deliver those services.

For the purposes of this document, State of California as an *enterprise* is a *collection of various enterprises* – the Agencies, departments, boards, bureaus and commissions within the Executive Branch of California government. Accordingly, the term *enterprise architecture* from the state perspective refers to the *collection of the enterprise architectures* of these state entities. From a state agency perspective, enterprise architecture encompasses all of its processes, information and technology services, and infrastructure.

¹ When capitalized, the term “Agency” refers to one of the state’s super Agencies such as the State and Consumer Services Agency or the Health and Human Services Agency. When used in lower case, the term “agency” refers to any office, department, board, bureau, commission or other organizational entity within state government. In this document, “agency” and “department” are used interchangeably.

² Source: [The Common Approach to federal Enterprise Architecture, May 2, 2012](#)

2.1 Background

The California Information Technology Council (ITC) was set up to improve the effective and efficient management and oversight of the application of information technology to the operations of California's Executive Branch of government. ITC established the Enterprise Architecture Committee (EAC) to research, and recommend actions and policies that will promote California Enterprise Architecture and Standards.

During 2004 and 2005, EAC did an extensive research in the area of enterprise architecture. There were presentations by major vendors and departments who had developed EA. Research was done in the areas of the work done by the California Performance Review and other state and federal agencies. As a result of these efforts, the California Enterprise Architecture Framework Version 1.0 (CEAF 1.0) was released on July 15, 2005. As stated in CEAF 1.0, the framework must be refined from lessons learned, as state agencies use CEAF 1.0 to implement EA programs.

This document, *California Enterprise Architecture Framework Version 2.0 (CEAF 2.0)*, enhances CEAF based on the practical lessons learned from the implementation of CEAF 1.0. The objective is to take the California Enterprise Architecture practice to the next level - from focusing on just technology consolidation to enabling business capabilities and business outcomes. The following table summarizes differences between CEAF 1.0 and 2.0.

Table 2-1 Taking EA to the Next Level

Focus Area	CEAF 1.0 Focus (Technology Consolidation)	CEAF 2.0 Focus (Enabling Business Capabilities)
EA Deliverables and Services	- As-is Reference Models (data collection) - Ad hoc Artifacts	- Business-outcome-driven Actionable EA deliverables - Defined EA Services
IT Portfolio Planning and Stewardship	Infrastructure Standardization	- Portfolio Rationalization - Target EA and Enterprise Roadmap - Advancing SOA
Business Enablement	Technology Centric	Business Capability Centric
Project Engagement	Mandated Oversight	Triaged Involvement
EA Skills	Domain/ Platform Expertise	Cross Functional Hybrid Skills

2.2 Purpose

This document provides a framework for the practice of EA throughout the Executive Branch of the California State Government. It is designed to guide the *development and use* of comparable enterprise architectures within and among state agencies so that the resulting EA deliverables *enable mission success* with a lower total cost of ownership, faster time to delivery, and reduced

duplication. It also defines a set of EA services and provides guidance to help agency architects deliver those services.

This framework is not a one-time event but offers the opportunity for continuous improvement. As California uses enterprise architecture to improve the business of government, the framework will be refined from lessons learned.

2.3 Intended Audience

The primary audience for this document is California state employees who create enterprise architectures and enterprise roadmaps, and provide EA services. Other California state employees involved in planning, approving, executing and overseeing agency programs, and those in industry who support these activities can also benefit from this document.

2.4 Document Organization

This document is organized as follows:

- **Section 1 Executive Overview** provides an overview of enterprise architecture, its expected benefits, and CEAF 2.0 including its main components for executive-level audience
- **Section 2 Introduction** provides a brief introduction of and background to the enterprise architecture practice in the State of California
- **Section 3 Enterprise Architecture in the State of California** provides the definition of EA, describes its vision and benefits, and outlines the EA domains and building blocks. It also describes how enterprise architecture fits within an organization.
- **Section 4 California Enterprise Architecture Framework** provides an overview of CEAF 2.0 and describes the EA deliverables. It also describes the CEAF elements to guide, support, and govern the development of EA deliverables
- **Section 5 Enterprise Architecture Services** describes a set of eight services enterprise architecture teams provide to their organization to facilitate consistent and uniform implementation of EA program across state agencies through service orientation
- **Section 6 Target Architecture Vision** describes a vision for state level federated target architecture which is intended to serve as a “model” for state agencies and as a key input to the agency architects when creating their agency’s target (or future state)³ architecture

2.5 Future Directions

CEAF will be progressively refined (at least annually) based on the lessons learned from its implementation and based on the progression of enterprise architecture maturity. Below are some of the areas of focus for future CEAF improvements:

- **State-specific Reference Models**
- **Additional Reference Architectures and their implementation patterns**
- **Reusable Assets**
- **Further guidelines to create actionable EA deliverables and provide EA Services**

2.6 Deferred Decisions

The following elements of CEAF are deferred to future versions of this document:

³ This document uses the terms *target architecture* and *future state architecture* interchangeably

- **Metrics:** This element will address the common metrics for measuring the effectiveness of enterprise architecture practice in state agencies
- **Enterprise Architecture Reporting:** This element will address the content, structure and schedule for enterprise architecture reporting

3 Enterprise Architecture in the State of California

The development, use and maintenance of Enterprise Architecture in the State of California is planned to use a *federated approach*. In this federated approach, individual state agencies are responsible for developing, using and maintaining their respective Enterprise Architectures while utilizing the framework, method, guidance, standards and reusable assets provided by the state's Enterprise Architecture Office. To reduce duplication, redundancies and complexity, and to promote shared solutions including shared technology platforms, shared services and shared enterprise business applications, it is necessary to undertake Cross-Agency Initiatives (CAIs) to build/harvest such solutions. The state Enterprise Architecture Committee and the state's Enterprise Architecture Office are conduits to the identification of such CAIs along with other collaborative groups such as the ITC and the state Project Oversight. Once CAIs are identified, approved, and sponsored by authorized executives, the architecture work for those CAIs is planned to be accomplished through *collaboration* under the administrative direction of a designated executive sponsor. The resulting architectural solutions will be leveraged by state agencies and are integrated with their respective target enterprise architectures by the agency architects. This approach constitutes the federated approach.

Successful implementation of the federated approach, to achieve business outcomes that matter, requires consistent understanding of enterprise architecture concepts, laser focus on creating business-outcome-driven actionable EA deliverables, and uniform implementation of EA programs within and across state agencies.

This section defines enterprise architecture, describes the vision and benefits, EA domains and domain concepts, EA segments, and the principles used to create CEAF 2.0 to promote consistent understanding of enterprise architecture within the State of California. Subsequent sections of this document describe actionable EA deliverables, and a service-oriented approach to implement EA programs uniformly within and across state agencies.

3.1 Enterprise Architecture Defined

The State of California adopts the following Federal Chief Information Officers Council definition of enterprise architecture, as referenced in the [*Common Approach to Federal Enterprise Architecture*](#):

“Enterprise Architecture means a strategic information asset base, which defines the mission; the information necessary to perform the mission, the technologies necessary to perform the mission, and the transitional processes for implementing new technologies in response to changing mission needs; and includes a baseline architecture, a target architecture, and a sequencing plan.”

Essentially, EA identifies the business processes that execute or support an organization's mission and defines how Information Technology (IT) assets directly enable those processes. The purpose of EA is to *optimize and transform* the often fragmented processes, information, application systems and technologies into *an efficient and integrated environment* supportive of the execution of business strategy.

To help execute business strategy and realize strategic goals, the *primary focus* of the EA practice for a state agency is the creation of the above referenced *strategic information asset*

base. This strategic information asset base is intended to contain models and artifacts describing:

- Mission-specific business capabilities, supporting business capabilities and the business processes used to realize those capabilities (business architecture)
- Information models depicting the information used and maintained by these business processes (information architecture)
- Applications and their key components used to fully or partially automate the business processes and maintain the information (applications architecture)
- Technologies used by these applications (technology architecture), i.e., application platforms (including hardware devices and system software) and networks (to provide communication paths)
- Inter-relationships among the above components of the architectures and their relationships to organization's strategic goals and stakeholder needs

This *strategic information asset base* will include a baseline architecture and a target architecture reflecting the *enterprise transformation necessary* to meet its strategies goals and achieve its desired business outcomes. The target architecture is implemented through a series of transformation projects (and/or programs and initiatives). This series of transformation projects, each with clearly defined objectives and scope, also lays out a specific sequence in which those projects need to be executed, to reach the target enterprise architecture and thus progressively achieve desired business outcomes. This is what constitutes an enterprise roadmap or a sequencing plan. This *enterprise roadmap or a sequencing plan* is also a key component of an enterprise's strategic information asset base.

While the target architecture may or may not be fully implemented by an organization, every change or a transformation project should be undertaken by the organization in accordance with the enterprise roadmap, to make sure that the changes and transformation projects contribute to improved efficiency, effectiveness, quality and agility.

3.2 Enterprise Architecture Vision and Benefits

This section identifies the vision and the benefits of implementing the Enterprise Architecture in the State of California.

3.2.1 Vision

To enable better information technology decisions that are driven by the business needs of the state in the delivery of services.

3.2.2 Expected Benefits

The following table shows the key benefits expected from implementing and using Enterprise Architecture in the State of California along with the EA focus necessary to realize those benefits:

Table 3-1 Benefits of EA

Key Benefits of EA	To realize the benefits, CEAF 2.0 expands EA focus to
<i>Bridge the gap between business strategy and</i>	▪ Provide architectural solutions to achieve business outcomes

Key Benefits of EA	To realize the benefits, CEAF 2.0 expands EA focus to
<i>implementation</i>	▪ Help undertake projects within the context of the target EA and an Enterprise Roadmap ▪ Help reduce <i>ad hoc</i> implementations driven by a tactical and reactive approach
<i>Improve alignment of IT with mission, goals, and objectives</i>	▪ Create an integrated view of the overall enterprise linking goals and objectives to mission and support business capabilities and their underlying business processes, information, applications and their components, and technologies ▪ Facilitate investment analysis (current and planned) with respect to the mission, goals and objectives ▪ Promote IT solutions that are more pertinent and relevant <i>for the business</i>
<i>Improve service delivery, business operations and business capabilities</i>	▪ Identify business capabilities to enhance and/or acquire ▪ Provide a long-term vision to improve and/or acquire the above business capabilities ▪ Identify opportunities to streamline business processes and to make IT more efficient ▪ Reflect enterprise transformation necessary to improve service delivery, business operations and business capabilities in the Target EA
<i>Improve interoperability and information sharing</i>	▪ Define standards and specifications for enterprise application and information integration ▪ Enterprise thinking in creating core capabilities for <i>master data management, information integration, application integration, and identity and access management</i> as opposed to project-specific solutions
<i>Improve flexibility to dynamically respond to customer needs and statutory changes</i>	▪ Identify the organization's Operating Model and determine necessary levels of standardization and integration to improve flexibility ▪ Use the Operating Model as a key driver to create a foundation through Target EA ▪ Enable faster design of new systems and extensions to existing systems by pre-defining standards ▪ Enable creation of user applications as a composition of reused services by advancing Service-Oriented Architecture
<i>Reduce cost and cost of ownership</i>	▪ Establish a less complex environment by limiting technology diversity while promoting <i>controlled</i>

Key Benefits of EA	To realize the benefits, CEAF 2.0 expands EA focus to
<i>Reduce redundancy, duplication, complexity and information silos</i>	<i>innovation</i> to reduce training requirements and support costs, and to enable economies of scale in purchasing ▪ Enable portfolio rationalization and simplification to promote more effective use of IT and other resources to efficiently support business processes ▪ Adopt cross-agency repeatable/ shared solutions and platforms, thereby enabling consistent, effective delivery of services to the employees, citizens, and businesses of California
<i>Reduce business risk associated with IT and reduce risk for future IT investment</i>	▪ Identify weaknesses and threats in the existing portfolio and address them in the target architecture ▪ Reduce the risk of future IT investments not delivering business value by enabling those investment decisions to be made in the context of an enterprise roadmap in accordance with the strategic goals
<i>Enable faster, simpler and cheaper procurement</i>	▪ Provide enterprise context through the target architecture and a roadmap to enable an “<i>architect – invest – implement</i>” approach to simplify procurement decisions ▪ Ensure architectural coherence of multi-project and multi-vendor solutions through the target EA
<i>Enable predictable success of projects and realization of their defined objectives</i>	▪ Help undertake projects within the context of an Enterprise Roadmap ▪ Provide architectural guidance and oversight to these projects to ensure their progress towards the target architecture through triaged involvement

3.3 Enterprise Architecture Domains

EA supports the execution of business strategy and realization of strategic goals by defining and documenting the baseline and target architectures as integrated views of the overall enterprise. Each of these integrated views is an *abstracted view* of the enterprise which comprises of four types of architectures that are commonly accepted as the four domains of the overall enterprise architecture:

- **Business Architecture (BA)** defines the business strategy, organization, business capabilities and key business processes which realize those business capabilities
- **Information Architecture (IA)** describes the fundamental organization of the data assets and data management resources that support an enterprise’s business processes and enabling application systems

- **Applications Architecture (AA)** describes the structure and behavior of the major kinds of application systems, their key components, their interactions, and their relationships to the core business processes
- **Technology Architecture (TA)** describes the logical software and hardware capabilities that are required to support the deployment of business, information, and application services. This includes IT infrastructure, middleware, networks, communications, processing, and standards

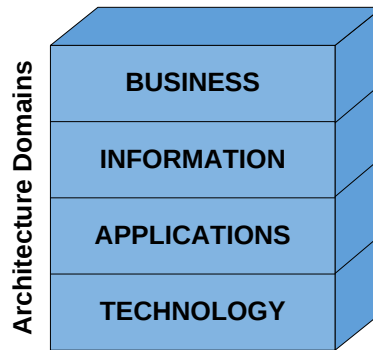


Figure 3-1 Enterprise Architecture Domains

Each domain represents a specific area of the overall enterprise architecture. These domains delineate the analysis and modeling necessary to meet stakeholder requirements. They serve to help understand how IT assets directly enable business processes and how those processes execute the organization's mission. Additionally, they allow further analysis to be performed from a top-down or a bottom-up perspective.

Core concepts of each of these four domains are described in the following subsections.

3.4 Business Architecture

State agencies establish goals and objectives to improve program outcomes and drive business forward. Clearly defined goals and objectives, in turn, establish the *business outcomes* the agencies want to achieve. These business outcomes drive the *strategies*. To achieve planned business outcomes, *strategic planning* needs to identify the business capabilities the agencies need to invest in, to improve existing capabilities and/or acquire new capabilities.

A *business capability* is the ability of an organization to use its assets and expertise to provide one or more *services* (or products) which contribute to one or more desired business outcomes. A business capability is implemented through a set of *business processes* (executed by *groups of people* or fully automated) supported by relevant application(s), information and underlying technologies. For example, *Case Management* may be a key business capability for an organization, but its practical realization may require a number of business processes such as *Establish Case*, *Manage Case Information*, *Perform Screening and Assessment*. Additionally, these processes may differ from one organization to another, based on the mission and business context. For example, in another organization, *Establish Case*, *Locate Case Members*, *Establish Case Member Relationships* can be some of the business processes realizing the *Case Management* capability.

Improving business capabilities is a primary concern for Business Architecture (BA), and doing so requires improvements to the underlying *Business Process Model*. At a conceptual level, BA focuses on identifying business capabilities and the services they support, but further

progression of BA from conceptual to logical level focuses on describing the enterprise's *business processes and activities* along with the key information (input information, output information, and referenced shared or stored information) used by the business processes through Business Process Models.

A *business process* defines a series of activities that start with one or more events, manipulate a set of data, and end with one or more results. A Business Process Model represents the sequential flow and control logic of all of the enterprise's key business processes. A Business Process Model describes what an organization or business does, including the events that initiate those processes (i.e., the business event) and the results of those processes. It is commonly visualized in the form of business process diagrams using a set of standard notations.

At enterprise architecture level, the business process representations in a Business Process Model include key business activities, key input and output information and key triggers rather than all the details of the process. Further business architecture and business analysis activities progressively detail all aspects of the business processes.

Business Process description or representation in a Business Process Model contains the following items:

- The external (e.g., to customers) and internal (e.g., to employees) business service provided through the business process and to whom this service is provided
- The business event (e.g., telephone call, receipt of an application, initiation of online self-service, completion of a predecessor process, a schedule date) that triggers (starts) the business process
- Input information included in the business event and its representation (e.g., a paper form, an electronic message)
- The sequence of steps of the business process. These steps represent the key business activities and/or sub-processes of the business process. These steps are driven by business rules. A business rule is a specific, actionable, testable directive that is under the control of the business and supports a business policy⁴. Business rules describe the operations, definitions, and constraints that apply to an organization. Business rules can apply to people, processes, corporate behavior and computing systems in an organization, and are in place to help the organization achieve its goals.
- Output information (i.e., data in motion) contained in the results of the business process and its representation. It includes the information produced by the business process.
- Shared or stored information (i.e., data at rest) used by the business process steps. A business process may require additional information typically stored in the organization's data stores
- Predecessors and successors
- Failure points where a business process may stop before completion
- The actors, their active roles and the activity conducted by each role
- Constraints that may affect the performance of the business process
- A grouping of related business processes into *business functions or lower level business capabilities*. It should be noted that, BA is an emerging architecture discipline, and business capability modeling is one of the more recent emerging areas of BA. As such, varying opinions about the relationship between a *business capability* and a *business function* exist, that can cause confusion regarding their representation in a BA model. To avoid that

⁴ Source: [Medicaid Information Technology Architecture \(MITA\)](#)

confusion, CEAF 2.0 considers that the top level business capabilities can be decomposed into lower level business capabilities so that these lower level business capabilities can be realized through a set of related business processes. Therefore, CEAF 2.0 treats the lower level business capability as a business function.

The above process-oriented approach views the business cross-functionally and organizes the actions of the business as a set of processes and activities that respond to business events. Adopting this approach facilitates real process improvements and significant business outcomes; one of the reasons is that this approach allows considering business processes without being bound by the existing organizational structures that may not share information readily. The focus of BA is on the business capabilities and the business processes (i.e., what business capability is realized through a business process, what initiates the business process, what service is provided by the business process and what information is used and produced by the business process). It should be noted that, although the information used and/or produced by a business process is discussed here, it can be treated as a part of the information architecture. In practice, information architects collaborate with the business architects to identify and organize the information used and/or produced by the business process.

Driving business forward and improving program outcomes require state agencies to advance business, information, applications and technologies to increased levels of maturity. State agencies are expected to develop and use the BA components to:

- Plan for improvements in the agency business processes, both in the delivery of mission-specific services to citizens and in their supporting internal operations
- Plan for improvements in the exchanges of information with other business processes and external stakeholders
- Identify opportunities for intra- and inter-agency business process and information standardization

The following subsections identify the core elements of BA from the above description *in the context of an “enterprise architecture model”*, and provide guidelines to plan future state BA. Additionally, a brief description of the relationship between the core elements of BA and the Federal Enterprise Architecture (FEA) Business Reference Model is provided for those State agencies that use FEA Reference Models to maintain compatibility with FEA.

3.4.1 Business Architecture Elements

Identification and documentation of *all* the business processes of an organization and *all* the elements (e.g., events, activities, business objects) of a given business process, including the process improvements necessary to support the business strategy, are complex and effort intensive activities. Therefore, practical development of BA requires both an incremental and iterative approach. The incremental approach allows the development of BA in segments. The iterative approach allows the business process elements to be progressively detailed. To support these incremental and iterative approaches, and to allow for capturing and managing complex relationships among many elements, visual modeling using modeling languages specifically designed to support enterprise architecture is highly desirable.

To illustrate visual modeling, Figure 3-2 below shows the core elements of the business architecture from the enterprise architecture perspective, using ArchiMate enterprise architecture modeling concepts.

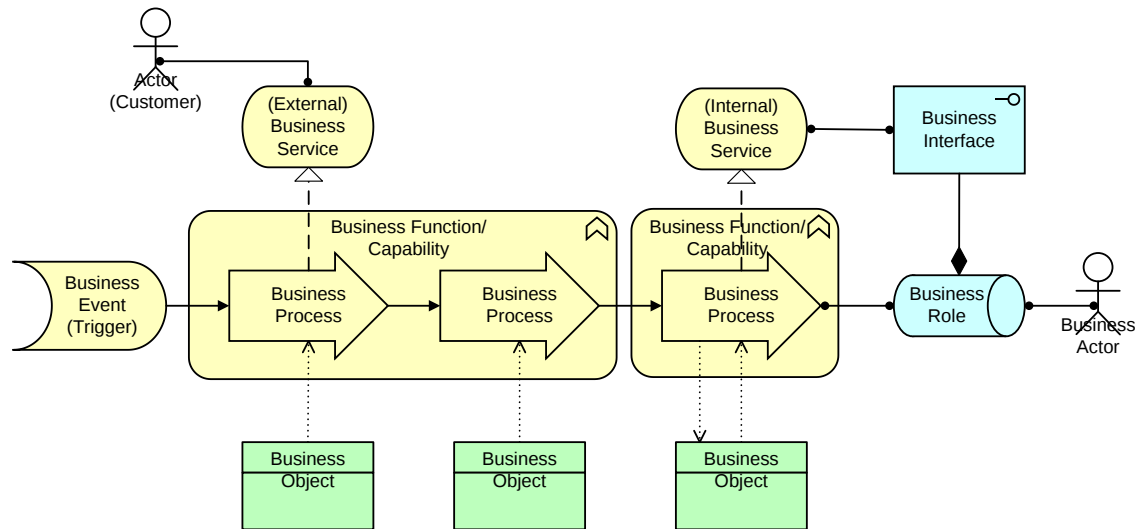


Figure 3-2 Business Architecture Elements

Brief descriptions of the elements shown in Figure 3-2 are provided below:

Business Actor is an organizational entity that may be assigned to one or more business roles. A business actor may be an individual person (e.g., employee) or a group of people (e.g., a business unit), and may include entities outside the actual enterprise (e.g., customers and partners).

Business Role is the responsibility for performing (or executing) specific business processes. A business role may be assigned to one or more business processes, while a business actor may be assigned to one or more business roles (e.g., an employee assigned to a role of *test administrator*). A set of business roles in an organization can be expected to be much more stable than specific actors fulfilling those roles.

Business Event is something that happens internally (e.g., originated from another business process) or externally (e.g., originated from a customer), which triggers or interrupts a business process. Business events include schedule related triggers such as “a specific time of day”.

Business Process is a set of related activities driven by business rules that together realize a business service or product, create business objects, and/or trigger other business processes. Business processes are assigned to business roles.

Business Function (or a lower level business capability) groups business processes based on a chosen set of criteria (e.g., required business resources, skills, competences, knowledge, etc.). There is a potential many-to-many relationship between business processes and business functions.

Business Service fulfills a business need for a customer (internal or external to the organization). Business services can be external, customer-facing services (e.g., a license renewal service) or internal support services (e.g., an inventory management service). Business services are realized by business functions and processes. In fact, business services are the main reason for the existence of business processes. A business service may be made available through a business interface (e.g., a web form).

Business Interface is a point of access or the channel (e.g., telephone, the Internet, local office, etc.) through which a business service is made available to consumers. A business service may

be exposed through different interfaces (e.g., a license renewal service may be exposed through the Internet and through the local office).

Business Object is an information entity that has relevance from a business perspective. Business objects represent the input information, output information, and shared or stored information used or produced by a business process. A business event may also be accompanied by business objects. Business objects are used to organize and map enterprise data entities to BA business processes.

Detailed information about the above elements and their relationships, including examples, can be found in *ArchiMate 2.0 Specification*.

Please note that some ArchiMate Business Architecture concepts have been excluded from the above illustration to simplify the BA models and to view the business cross-functionally. This approach to modeling allows an agency to incrementally develop BA by first identifying the business capabilities and processes, and then progressively adding more detail to include business events, business services, and business interfaces etc.

3.4.2 Business Reference Model

The Business Reference Model (BRM) is a classification taxonomy that can be used to *categorize* the type of business functions and services performed by the state agencies. With reference to the BA elements described in Section 3.4.1, BRM allows business functions (or lower level business capabilities) and business services to be *named or grouped consistently* so that the state government functions are described using a functional view rather than an organizational view.

The following are the benefits of BRM:

- Provides the “what we do” view of the state enterprise at an aggregated level
- Improves intra- and inter-agency communication and collaboration through a standardized way of identifying higher level government functions and services
- Allows the operational costs and proposed project costs to be aggregated and mapped to the budget function classification codes

CEAF 1.0 adopted the BRM provided by the Federal Enterprise Architecture (FEA). This BRM taxonomy is structured as a three-layer hierarchy in which the *BRM sub-function* is at the lowest level as shown in Figure 3-3. It should be noted that, due to the breadth of FEA’s coverage (of the business functions of the Federal enterprise), even the BRM sub-function represents an aggregated level business function or service in most cases. Industry best practices, such as those institutionalized by MITA, indicate that deeper analysis of *Business Processes* and the information used by them is necessary to:

- Identify process improvements
- Identify process standardization and integration opportunities
- Improve business capabilities

Therefore, CEAF 2.0 expands BA focus to business functions and processes, while allowing those functions and processes to be grouped into BRM sub-functions as shown in Figure 3-3. In cases where BRM sub-function does not provide the necessary granularity to properly group business processes, it is necessary to identify appropriate business function to first properly group the business processes and then to map that business function to a BRM sub-function. Thus, CEAF

2.0 provides flexibility to use FEA BRM V3.0 to allow state agencies that currently use or required to use FEA BRM to maintain compatibility with FEA.

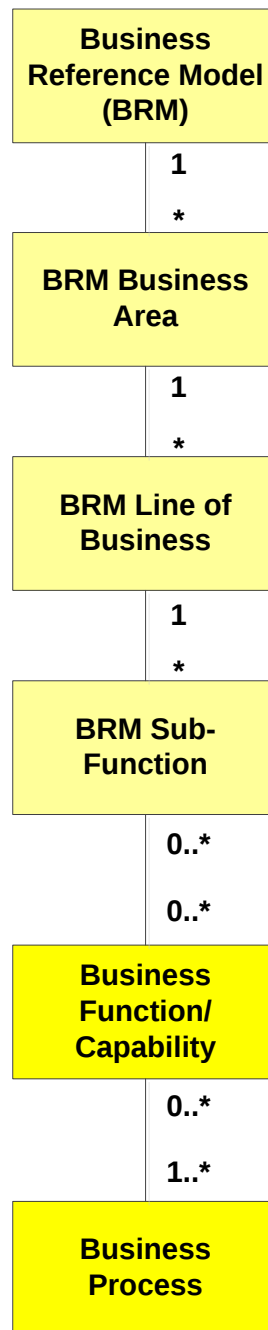


Figure 3-3 Mapping BRM to Business Architecture Elements

CEAF will continue to evolve over time. The State EA team will continue to support state agency EA efforts by serving as a conduit for improvements to CEAF so that all state agencies can benefit from the lessons learned and successful experiences. As such, CEAF and BA will evolve to include a state-specific BRM (to be developed in collaboration with agency business leaders) to better facilitate cross-agency initiatives to continuously improve the way state agencies deliver

services to consumers, account for outcomes, and respond dynamically to requests for information. It should be noted that FEAF-II contains an expanded BRM which, when published, will be used as a key input for the future CEAF BRM.

3.4.3 BA Future State Planning

BA will continue to evolve and change as state agencies identify and improve business operations. As the agencies mature, processes transform: some processes will be replaced and some other processes will be standardized across state agencies for effectiveness and efficiency. Changes and innovations in the industry may also change the way the state agencies do business. These changes may create new business processes and/or eliminate the need for one or more existing business processes.

BA future state planning requires an incremental approach (e.g., each line of business and each business capability) and a series of complex steps. The following steps represent a general approach for BA future state planning. CEAF 2.0 is intended to support over 120 state organizations, each with its own organizational structure, policies, and operational model and hence some of the following steps may not apply to a particular organization while another organization may require additional steps.

- **Process categorization and characterization:** BA future state planning starts with the categorization of the business processes based on the business capabilities they realize, the business services they provide, and their contribution to strategic goals.
- **Maturity assessment and operating model of current processes:** During this step, further analysis of the Business Capabilities and the underlying Business Process Model will be performed to identify the current strengths, weaknesses, opportunities and threats. This analysis will also identify the current levels of service and automation of the business processes, possibilities for improvements in effectiveness and efficiency in accordance with the strategic goals, and assigns a maturity level for the current business processes based on the business capabilities they support. A clear identification of an efficient set of business processes to realize a given business capability, the business processes which will benefit from improved coordination through improved data sharing and data standardization, the business processes which will benefit from improved process and data standardization (both intra- and inter-agency level standardization), and the sub-processes, activities and business rules which are common across business processes that can be modularized and reused will be a key to future state BA planning. Any workforce and security issues that will need to be addressed will also be identified in this step.
- **Opportunities and target maturity levels:** During this step, business processes that need to be reengineered and improved, business processes that need to be replaced with intra- or inter-agency standardized business processes, and any new business processes will be identified based on the results of the previous step in order to meet the organization's strategic goals and address other workforce and security issues, if any. A target maturity level will be assigned for those business processes.
- **Solutions and future state planning:** During this step, alternate options will be analyzed and preferred solutions to meet strategic goals and improve program outcomes will be selected. A future state Business Process Model will be developed to reflect the preferred solutions. Additionally, performance standards will be defined to allow all stakeholders to measure the same activity in the same manner and a process to measure the effectiveness and efficiency (e.g., time elapsed between the business event and the result) of the new Business Process Model to track the progression of business process transformation will be institutionalized.

Please note that the BA future state planning is not just an EA's task or a CIO group's task. It cannot be successful without the business leaders driving it and providing strong support. Collaboration with business architects, analysts and other business SMEs is extremely important to planning the future state BA.

3.5 Information Architecture

Information Architecture (IA) describes the fundamental organization of the data and information (structured, semi-structured and unstructured) that support an enterprise's business processes and enabling application systems.

Various definitions and industry's use of the terms data architecture, information architecture, data design, data modeling, and data engineering etc., often cause confusion regarding the scope of IA. To avoid this confusion, CEAF 2.0 considers IA, at enterprise architecture level, to deal with the *fundamental organization* of the data and information, and the principles guiding their detailed design and evolution. As such, IA, in the EA context, is *at a high level* and is mainly concerned with the overall *coherence* of data and information at the enterprise level.

Additionally, the terms *Conceptual Data Model (CDM)*, *Logical Data Model (LDM)*, and *Physical Data Model (PDM)* are often associated with both architecture and design. To avoid this confusion, CEAF 2.0 considers CDM, LDM and PDM as the *design* models (that may be produced by data architects, data analysts, data modelers, or other data-related SMEs) that describe the data and information in detail. In design, enterprise data is usually first organized into sub-groupings of information called "subject areas" and then the subject areas are progressively elaborated to create CDM, LDM, and PDM. *Subject areas* allow a portion of the model to be viewable as a whole, or an entire model to be viewable at an overview level, thereby eliminating some complexity involved in understanding a large model. *Conceptual Data Model (CDM)* identifies various entities (things of interest) in enterprise data and how they relate to one another. CDM also identifies some key attributes of these entities from business perspective, but not necessarily all the attributes. *Logical Data Model (LDM)* identifies all the relationships among these entities and all of the key logical data elements that are in motion, stored and/or shared within the enterprise. LDM also identifies all the primary keys and foreign keys, and typically normalizes the data model. LDM is not concerned about how these entities will be implemented, but is concerned with defining an *implementable* model. *Physical Data Model (PDM)* identifies how the LDM will be implemented by mapping the LDM entities and attributes to tables and columns and by defining integrity constraints. PDM also maps the tables to storage through logical objects (such as table spaces) specific to the Database Management System (DBMS) to specify how DBMS needs to manage persistence of table data on storage.

From CEAF point of view, at enterprise architecture level, IA focuses on identifying the key *business objects*, *data objects* and *data artifacts*, rather than all the details of the data and information. These business objects, data objects and data artifacts guide the *detailed design and evolution* of data and information into CDM, LDM and PDM respectively. Business objects, data objects and data artifacts and their relation to CDM, LDM and PDM respectively are described below.

As described in section 3.4, BA business process models describe the input information, output information, and shared or stored information used by the business processes. IA works with BA to organize this information into "business objects" and map enterprise data entities to BA business processes by using those business objects. These business objects represent the overall

conceptual structure of the data, independent of any software or data storage structure; they also provide a visual representation of the high-level information entities needed to run an enterprise or provide a business capability. Key attributes of interest to the business domain can also be captured in these business objects. Additionally, these business objects depict the key information exchanged (or information exchange packages) among business processes and with external stakeholders. These business objects constitute the high level CDM and guide further evolution of the CDM.

Identification of business objects and their mapping to business processes is critical to evaluating potential redundancies and gaps in business operations. For example, while issuing a *campsite use permit* and issuing an *oversized vehicle transportation permit* may both be considered an *Issue Permit* process in the BA, it may not be appropriate to combine applications supporting those processes - because of the large differences in the business objects involved in them. Conversely, multiple applications that support a similar BA business process (e.g., emergency response) and use similar business objects and elements (e.g., traffic accident data) have a higher potential for standardization, sharing or integration.

IA maps the business objects to the “data objects” that realize them, and in turn maps those data objects to the “data artifacts” that realize them. The data objects identify the key *information accessed* by application components and the key *information exchanged* (or information exchange packages) to collaborate with other application components to support business processes. These data objects constitute the high level LDM entities and guide further design and evolution of the LDM. The data artifacts represent the physical objects deployed on technology infrastructure that realize the data objects and from which information exchange packages are built. These data artifacts constitute the high level Physical Data Model (PDM) objects and guide further design and evolution of the PDM.

As mentioned above, at enterprise architecture level, IA focuses on identifying the key business objects, data objects and data artifacts, rather than all the details of the data and information. Further information architecture and data engineering activities will progressively detail all aspects of the data and information and describe those details through CDM, LDM and PDM. Information architects are responsible for first understanding the BA to create business objects, data objects and data artifacts, and then working with other data-related SMEs to create and maintain the detailed information designs in alignment with the progression of BA. Solution architects work with the business and information architects to maintain this alignment throughout the transformation projects. This cooperation continues through full deployment and ongoing operations.

The following subsections identify the core elements of IA from the above description *in the context of an “enterprise architecture model”*, and provide guidelines to plan future state IA. Additionally, a brief description of the relationship between the core elements of IA and the FEA Data Reference Model is provided for those State agencies that use FEA Reference Models to maintain compatibility with FEA.

3.5.1 Information Architecture Elements

Figure 3-4 below illustrates the core elements of the information architecture from the enterprise architecture perspective, using ArchiMate enterprise architecture modeling concepts.

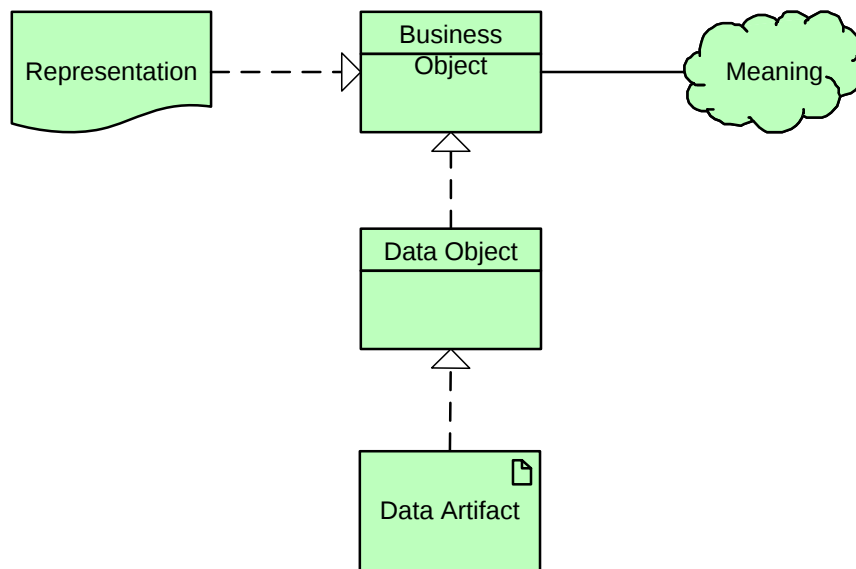


Figure 3-4 Information Architecture Elements

Brief descriptions of the elements shown in Figure 3-4 are provided below:

Business Object is an information entity that has relevance from a business perspective. Business objects represent the input information, output information, and shared or stored information used or produced by a business process. A business event may also be accompanied by business objects. Business objects are used to organize and map enterprise data entities to BA business processes.

Data Object realizes a business object, and may be realized by a data artifact. There is a potential many-to-many relationship between business objects and data objects, and between data objects and data artifacts. A data object is used by an application function. It may also be communicated via interactions between application components and used or produced by application services. A data object represents a self-contained piece of information with a clear meaning to the business, and with a well-defined logical data structure suitable for automated processing.

Data Artifact represents a concrete element such as a file, a set of database tables, messages etc., used to realize one or more data objects. An instance of a data artifact can be deployed on a node.

Meaning is the knowledge or expertise present in a business object or its representation, given a particular context. It is used to capture key information about the business object or its representation.

Representation is a perceptible form (e.g., message, document, electronic form etc.) of the information carried by a business object.

Detailed information about the above elements and their relationships, including examples, can be found in *ArchiMate 2.0 Specification*.

It should be noted that ArchiMate does not treat information architecture as a separate domain from modeling point of view. However, CEAF recognizes the elements shown in Figure 3-4 as the core elements of the IA (at EA level).

3.5.2 Data Reference Model

The Data Reference Model (DRM) is a classification taxonomy used to describe the context for information exchanges and the type of data entities and attributes that support an enterprise's business operations. DRM provides three standardization areas, namely, Data Description, Data Context and Data Sharing. With reference to the IA elements described in Section 3.5.1, DRM allows the business objects and data objects to be *categorized* in a standard way.

The following are the benefits of DRM:

- DRM can help identify opportunities for data sharing and reuse, and for increasing integration
- DRM can help identify opportunities for eliminating redundant data collection activities and storage within and across agencies

CEAF 1.0 adopted the DRM provided by the Federal Enterprise Architecture (FEA). As shown in Figure 3-5, this DRM standardizes the Data Description, Data Context and Data Sharing through the building blocks of *DRM entity* and *DRM exchange package*. The IA Business Objects and Data Objects can be mapped to the DRM Digital Data Resource, DRM Entity (a subset of DRM Digital Data Resource) and DRM Exchange Package as shown in Figure 3.5. Thus, CEAF 2.0 provides flexibility to use FEA DRM V2.0 to allow state agencies that currently use or required to use FEA DRM to maintain compatibility with FEA.

It is important to recognize that an *enterprise-wide data model* with consistent names and attribute definitions for core IA Business Objects and Data Objects, including the Business Objects that depict information exchanges, is a *foundation* to improve information sharing and interoperability. Accordingly, CEAF 2.0 allows and encourages state agencies to use and integrate applicable National Information Exchange Model (NIEM) Data Components and Information Exchange Packages in defining their IA.

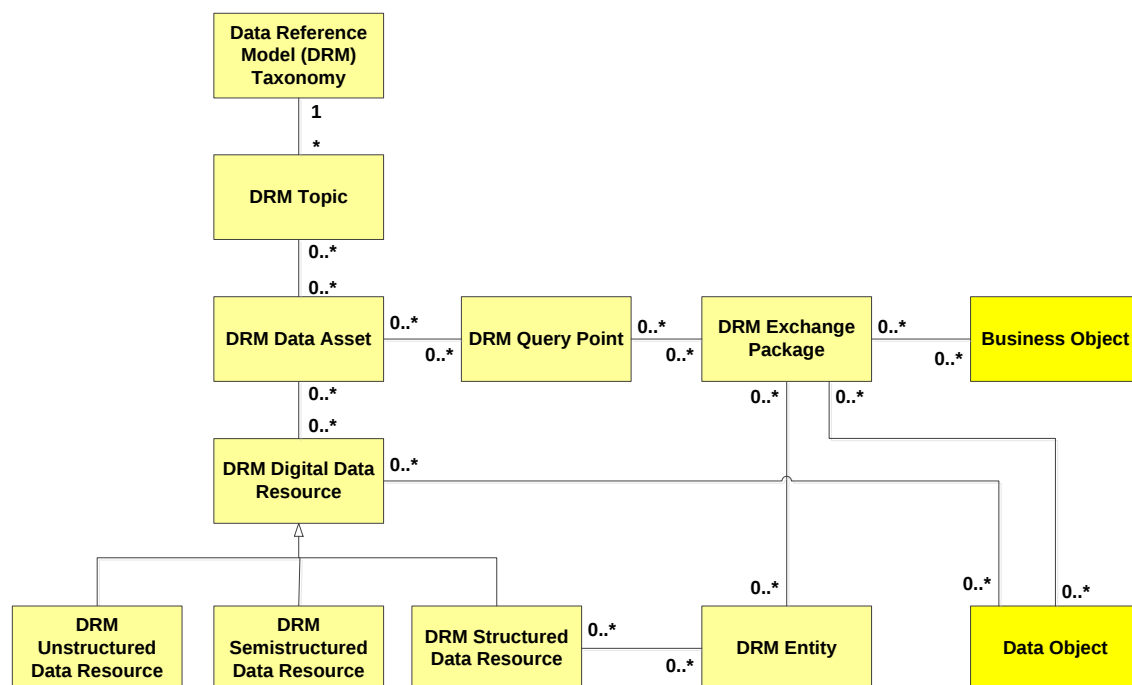


Figure 3-5 Mapping DRM to Information Architecture Elements

As CEAF continues to evolve, it will include a state-specific Information Reference Model (IRM) to better align IA with CEAF Reference Architectures, to better facilitate information sharing, reuse and integration, and to support reduction of redundant data collection activities. It should be noted that FEAF-II contains an expanded IRM which, when published, will be used as a key input for the future CEAF IRM, along with applicable NIEM Data Components and Information Exchange Packages.

3.5.3 IA Future State Planning

IA will continue to evolve and change as state agencies identify and improve business operations, standardize business processes and improve interoperability within the agency and with external business partners. As the agencies mature, some information redundancies will be eliminated and some information such as *master data* will be standardized across state agencies for improved information sharing and interoperability. Changes and innovations in the industry may also affect the way the state agencies do business. These developments may create new information and/or eliminate the need for one or more existing information sources (for example, when such information is standardized and shared in real-time by its authoritative source/owner).

IA future state planning needs to be aligned with the BA future state planning and requires a similar incremental approach (e.g., for each subject area). The following steps represent a general approach for IA future state planning. Given that CEAF 2.0 is intended to support over 120 state organizations, each with its own organizational structure, policies, and operational model, some of the following steps may not apply to a particular organization while another organization may require additional steps.

- Analyze the flows of information within and between business processes and identify which business processes are coordinated through information sharing and hence benefit from improved sharing and standardization. Then determine options to harmonize, standardize, and protect these information flows to promote efficient, accurate and secure information sharing
- Identify what information need to be restructured to improve interoperability
- Identify the information redundancies that need to be eliminated
- Identify what information needs to be maintained as enterprise-wide (intra- and inter-agency level) master data to reduce duplication and inconsistencies, and to improve access to and security of information
- Identify where NIEM can be effectively utilized to standardize data definitions and information exchanges
- Determine how the information will be formatted, stored and shared including opportunities for standardizing and leveraging data models
- Identify any workforce and security issues that will need to be addressed
- Define the future state IA

Please note that successful IA future state planning requires alignment with BA future state planning and collaboration with information architects, data engineers, database administrators and other data SMEs.

3.6 Applications Architecture

Applications Architecture (AA) describes the structure and behavior of the major kinds of application systems and their key components necessary to support the business processes and process the information to provide the desired business capabilities. AA also focuses on how application components interact with each other and with users and on the key information consumed and produced by them.

In Enterprise Architecture, AA is concerned with managing how multiple applications are positioned to work together to support the business. It is important to note that the AA at this level is not concerned with the detailed design of application systems. The goal here is to define what kinds of application systems are relevant to the enterprise, and what those applications need to do in order to manage data and to present information to the human and computer actors in the enterprise. Thus the main focus of applications architecture is the application-level components and services required to provide an integrated information systems infrastructure in support of the business rather than on their detailed internal structure. Further application architecture and design activities will progressively detail that internal structure and other internal design aspects of the applications.

The applications are described as logical groups of functions that manage the IA data objects and support the BA business processes/functions. The applications, their components and their functions are defined without reference to any particular technologies. In enterprise architecture, the services provided by the application components and their functions are mapped to business processes/functions, and the components are mapped to application platform technologies via nodes.

The following subsections identify the core elements of AA from the above description *in the context of an “enterprise architecture model”*, and provide guidelines to plan future state AA. Additionally, a brief description of the relationship between the core elements of AA and the FEA Service Component Reference Model is provided for those State agencies that use FEA Reference Models to maintain compatibility with FEA.

3.6.1 Applications Architecture Elements

Figure 3-6 below illustrates the core elements of the applications architecture from the enterprise architecture perspective, using ArchiMate enterprise architecture modeling concepts.

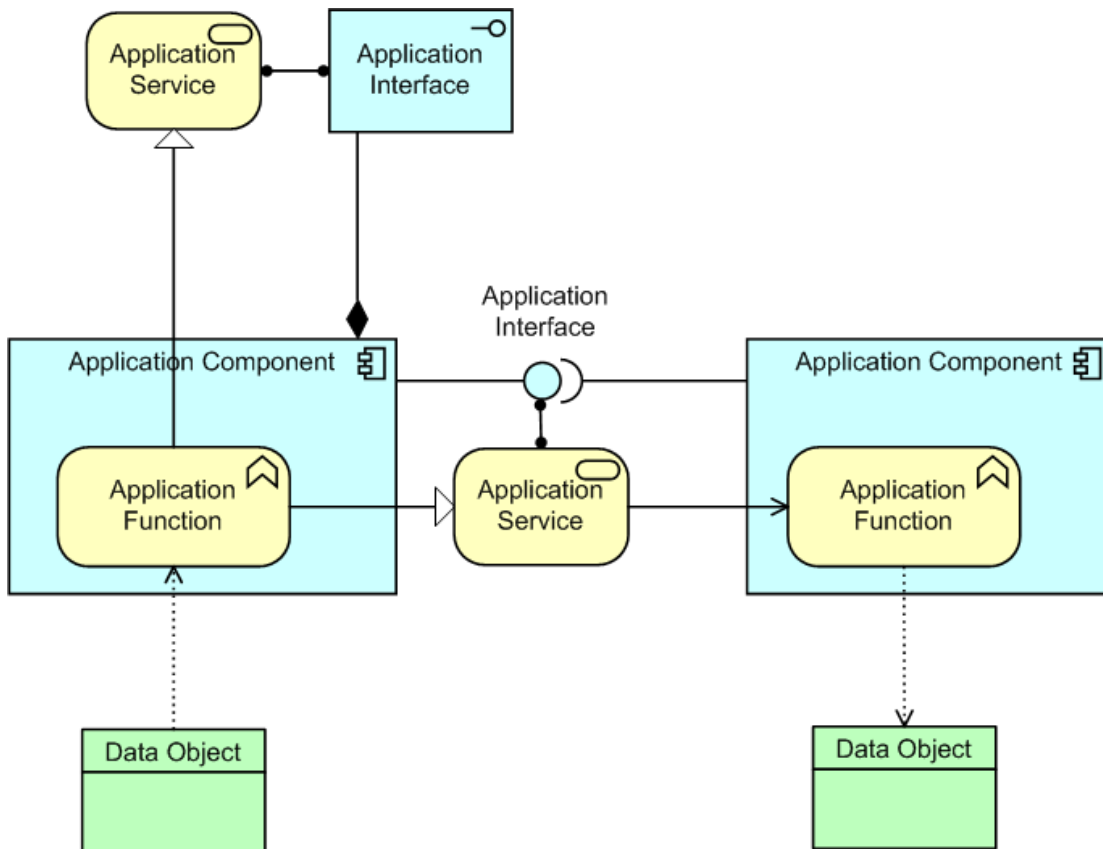


Figure 3-6 Applications Architecture Elements

Brief descriptions of the elements shown in Figure 3-6 are provided below:

Application Component is a self-contained unit of functionality. As such, it is an independently deployable, re-usable, and replaceable part of a system. It encapsulates its contents and exposes its functionality through a set of interfaces. An application component performs one or more application functions. It may collaborate with other application components through the application interfaces of those components.

Application Function describes the automated functionality performed by an application component. If this functionality is exposed externally, this is done through one or more application services. Thus an application function realizes one or more application services. An application function may use the services of other application functions. It may access or maintain data objects.

Application Service exposes the automated functionality of an application component. It is accessed through one or more application interfaces. An application service may be used by business processes, business functions, or other application functions. An application service should be meaningful to its consumers; it should provide a unit of functionality that is, in itself, useful to its consumers.

Application Interface is a point of access where an application service is made available to a consumer (e.g., a business process, another application component etc.). It specifies how the functionality of a component can be accessed by other components (i.e., a provided interface), or which functionality the component requires from other components (i.e., required interface). The same application service may be exposed through different interfaces.

Detailed information about the above elements and their relationships, including examples, can be found in *ArchiMate 2.0 Specification*.

Please note that some ArchiMate Application Architecture concepts have been excluded from the above illustration to simplify the AA models. This approach to modeling allows an agency to incrementally develop AA by first determining applications and their components, and then progressively adding more detail to include application services, interfaces, and relations to data objects etc.

3.6.2 Service Component Reference Model

The Service Component Reference Model (SRM) is a classification taxonomy that allows an organization to identify and *categorize* its existing and/or proposed application components, and the services provided by these components to support the execution of business processes and maintain the information. In SRM, *services* define a set of capabilities they support and *components* implement those services. A *component* is a self-contained business process or service with predetermined functionality that may be exposed through a business or technology interface. Components vary in size, from a small part of a single application to entire suites of applications crossing many lines of business and organizations. With reference to the AA elements described in Section 3.6.1, SRM allows AA Application Components and Application Services to be *named or grouped consistently* to support cross-application analysis in order to identify reusable and/or shareable application components and services within an agency or across the state.

The following are the benefits of SRM:

- Facilitates the identification of commonly used application components and services that can be standardized and harvested as reusable assets
- Allows identification of available application components for reuse or sharing to reduce costs
- Facilitates faster response to business needs by allowing new applications or extensions to existing applications to be built from pre-existing components
- Helps reduce risks on projects when proven components are leveraged
- Helps identify redundant existing or proposed applications and/or their components within an agency or across the state

CEAF 1.0 adopted the SRM provided by the Federal Enterprise Architecture (FEA). This SRM taxonomy is structured as a three-layer hierarchy as shown in Figure 3-3. It should be noted that, due to the breadth of FEA's coverage (of the types of applications and their components supporting the business functions of the Federal enterprise), the SRM Service Types and Service Components represent generic application components and/or services that are applicable to multiple types of applications. Industry best practices indicate that deeper analysis of applications is necessary to first identify relevant architecture areas (such as Business Intelligence and Identity and Access Management) or layers, and then identify the components and services in relation to the architecture areas or layers, in order to:

- Distinctly identify application components and services in the context of the application architecture
- Enhance the possibility of identifying reusable and/or shareable components
- Help create more reusable and/or shareable services by advancing service orientation

Therefore, CEAF expands AA focus to distinctly identify AA Application Components and Application Services in the context of the application architecture, while allowing them to be mapped to SRM Service Types and Service Components as shown in Figure 3-7. Thus, CEAF 2.0 provides flexibility to use FEA SRM V2.3 to allow state agencies that currently use or required to use FEA SRM to maintain compatibility with FEA.

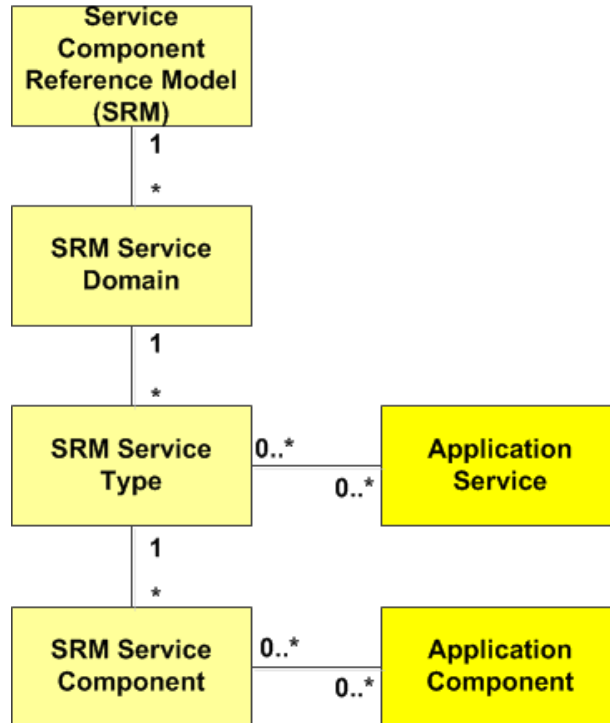


Figure 3-7 Mapping SRM to Applications Architecture Elements

As CEAF continues to evolve, it will include a state-specific Application Reference Model (ARM) to better align AA with CEAF Reference Architectures, and to better facilitate component reuse and sharing. It should be noted that the FEA-II integrated some of the SRM elements into the BRM, and introduced a new ARM which provides the basis for categorizing applications and their components. This FEA ARM, when published, will be used as a key input for the future CEAF ARM, along with CEAF Reference Architectures.

3.6.3 AA Future State Planning

AA will continue to evolve and change as state agencies identify and improve business operations, standardize business processes and improve interoperability within the agency and with external business partners. As the agencies mature, some application redundancies will be eliminated and some applications such as those supporting common business processes will be standardized across state agencies for improved process standardization, integration, information sharing, and interoperability. Changes and innovations in the industry may also change the way the state agencies do business. These changes may create new applications and/or eliminate the need for one or more existing applications (for example, when a set of business processes are standardized across state agencies and the supporting applications are shared through centralization or through software-as-a-service).

AA future state planning requires an incremental approach (e.g., for each line of business and/or a business capability) and a series of complex steps. The following steps represent a general approach for AA future state planning. CEAF 2.0 is intended to support over 120 state organizations, each with its own organizational structure, policies, and operational model and hence some of the following steps may not apply to a particular organization while another organization may require additional steps.

- **Application categorization and characterization:** AA future state planning starts with the categorization of the applications based on whether they support mission-related business capabilities or other support business capabilities, and based on their business value and relationship to strategic goals. Further categorization of the applications is based on the maturity of the technologies used to implement those applications.
- **Maturity assessment and portfolio rationalization:** During this step, further analysis of the applications will be performed to identify the current strengths, weaknesses, opportunities and threats. This analysis will also identify the current levels of service to support business processes automation and possibilities for improvements in accordance with the strategic goals. Additional factors such as ongoing maintenance costs, levels of usage, business value and technical maturity will be used to assign a maturity level to the existing applications. A clear identification of how applications collaborate and how these multiple types of applications can be made to work together effectively (where needed) will be a key to future state AA planning. Any workforce and security issues that will need to be addressed will also be identified in this step. This step results in further classification of existing applications into various categories, namely, applications to replace or retire, applications to modernize, applications to retain and consolidate and applications to leverage.
- **Opportunities and target maturity levels:** During this step, applications that need to be modernized/improved before they are made to be a part of the future state AA, applications that need to be replaced with intra- or inter-agency standardized applications, and any new applications to address the gaps will be identified based on the results of the previous step in order to meet the organization's strategic goals and address other workforce and security issues, if any. A target maturity level will be assigned for those applications.
- **Solutions and future state planning:** During this step, alternate options will be analyzed and preferred solutions to support business capabilities and future state Business Process Model and to generate, share and store their data will be developed. This will include the identification of applications that can be leveraged/shared (at intra- and inter-agency levels) and the application components that can be modularized to create shared business services. Additionally, performance standards will be defined to allow all stakeholders to measure the effectiveness and efficiency of these applications in the same manner and a process to measure and track the progression of AA will be institutionalized.

Please note that the AA future state planning is not a stand-alone EA task. Successful AA future state planning requires strong executive support and collaboration with solution/application architects, architects specializing in other domains, and SMEs.

3.7 Technology Architecture

Technology Architecture (TA) describes the logical software, hardware, and communication capabilities that are required to support the deployment of application and data components. Primary components of the TA are the computational resources including the hardware devices and system software, and the networks providing communication of these devices. TA also

describes the structure and interaction of the platform services provided by the computational resources and networks, and the technology components that enable these platform services.

In TA, a *node* is a primary computational resource on which application or data components are packaged as *artifacts* and deployed. A node is typically comprised of one or more *devices* and *system software* components. A node is responsible for providing an infrastructure function which in turn provides an infrastructure service to an application component.

At enterprise architecture level, TA defines what nodes host what application and data artifacts and what devices and system software comprise each node. TA also defines the types of networks that host the devices and provide communication paths to transport information & conversations. Additionally, TA defines the infrastructure interfaces/services used by the application components/functions. Thus the main focus of TA is the infrastructure-level components and services necessary to provide an integrated infrastructure in support of the business rather than on their detailed internal structure and configurations. Further technology architecture and engineering activities will progressively detail all aspects of the technology architecture.

The following subsections identify the core elements of TA from the above description *in the context of an “enterprise architecture model”*, and provide guidelines to plan future state TA. Additionally, a brief description of the relationship between the core elements of TA and the FEA Technical Reference Model is provided for those state agencies that use FEA Reference Models to maintain compatibility with FEA.

3.7.1 Technology Architecture Elements

Figure 3-8 below illustrates the core elements of the technology architecture from the enterprise architecture perspective, using ArchiMate enterprise architecture modeling concepts.

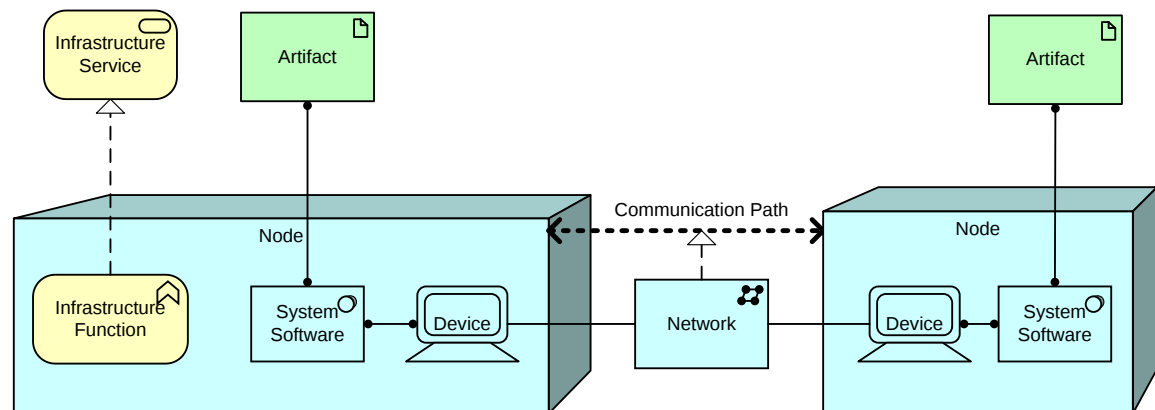


Figure 3-8 Technology Architecture Elements

Brief descriptions of the elements shown in Figure 3-8 are provided below:

Node is a computational resource upon which artifacts may be stored or deployed for execution. It is an active processing element that executes and processes artifacts, which are deployed representations of application components and data objects. Nodes are, for example, used to model application servers, database servers, content servers, or client workstations. A node is typically a combination of a hardware *device* (physical or virtual) and *system software*. Nodes can be interconnected by communication paths.

Device is a physical or a virtual hardware device (e.g., mainframe, PC, virtual Windows server etc.) with processing capability.

System Software is a software environment for specific types of components and objects that are deployed on it in the form of artifacts. This can be, for example, an operating system, a JEE application server, a database management system, a workflow engine, a rules engine, or a COTS software such as an ERP or a CRM package.

Artifact represents a concrete element such as an executable, a script, a set of files, or a set of database tables etc., used to realize one or more application components or data objects. An instance of an artifact can be deployed on a node.

Infrastructure Function groups the infrastructural functionality that can be performed by a node. If this functionality is exposed externally, this is done through one or more infrastructure services. Thus an infrastructure function realizes one or more infrastructure services. Infrastructure services of other infrastructure functions may be used by an infrastructure function.

Infrastructure Service is an externally visible unit of functionality, provided by a node, and meaningful to its consumers. It is exposed through one or more well-defined infrastructure interfaces. It should provide a unit of functionality that is, in itself, useful to its consumers, i.e., application components and other infrastructure functions.

Network represents the physical communication infrastructure. This may comprise one or more fixed or wireless network links. A network connects two or more devices. A network realizes one or more communication paths.

Communication Path is a link between two or more nodes, through which these nodes can exchange data. It represents a logical communication relation between nodes. It is realized by one or more networks, which represent the physical communication links.

Detailed information about the above elements and their relationships, including examples, can be found in *ArchiMate 2.0 Specification*.

Please note that some ArchiMate Technology Architecture concepts have been excluded from the above illustration to simplify the TA models. This approach to modeling allows an agency to incrementally develop TA by first determining nodes and their functions, and then progressively adding more detail to include devices, system software, and infrastructure services etc.

3.7.2 Technical Reference Model

The Technical Reference Model (TRM) is a classification taxonomy that allows an organization to identify and *categorize* its existing and/or proposed technologies and standards to enable the delivery of application services and components. The TRM also identifies where each technology or standard is in its lifecycle - if the technology is cutting edge, end of life, etc. With reference to the TA elements described in Section 3.7.1, TRM allows TA Network, Node, Device or System Software to be *named or grouped consistently* to support agency- or state- level identification of opportunities for reusing the best solutions, technologies and standards.

The following are the benefits of TRM:

- Helps identify opportunities to reduce costs and technical complexity by controlling technology diversity and promoting standards
- Enables economies of scale in purchasing

- Supports the IT standards process.

CEAF 1.0 adopted the TRM provided by the Federal Enterprise Architecture (FEA). This TRM taxonomy is structured as a three-layer hierarchy as shown in Figure 3-9. Industry best practices indicate that deeper analysis of technology architecture elements is necessary to distinctly identify them in the context of the technology architecture and then link them to the components of the applications architecture rather than to higher level SRM service types and service components. Therefore, CEAF 2.0 expands TA focus to enable this identification, while allowing the TA elements to be mapped to TRM Service Standards as shown in Figure 3-9. Thus, CEAF 2.0 provides flexibility to use FEA TRM V2.3 to allow state agencies that currently use or required to use FEA TRM to maintain compatibility with FEA.

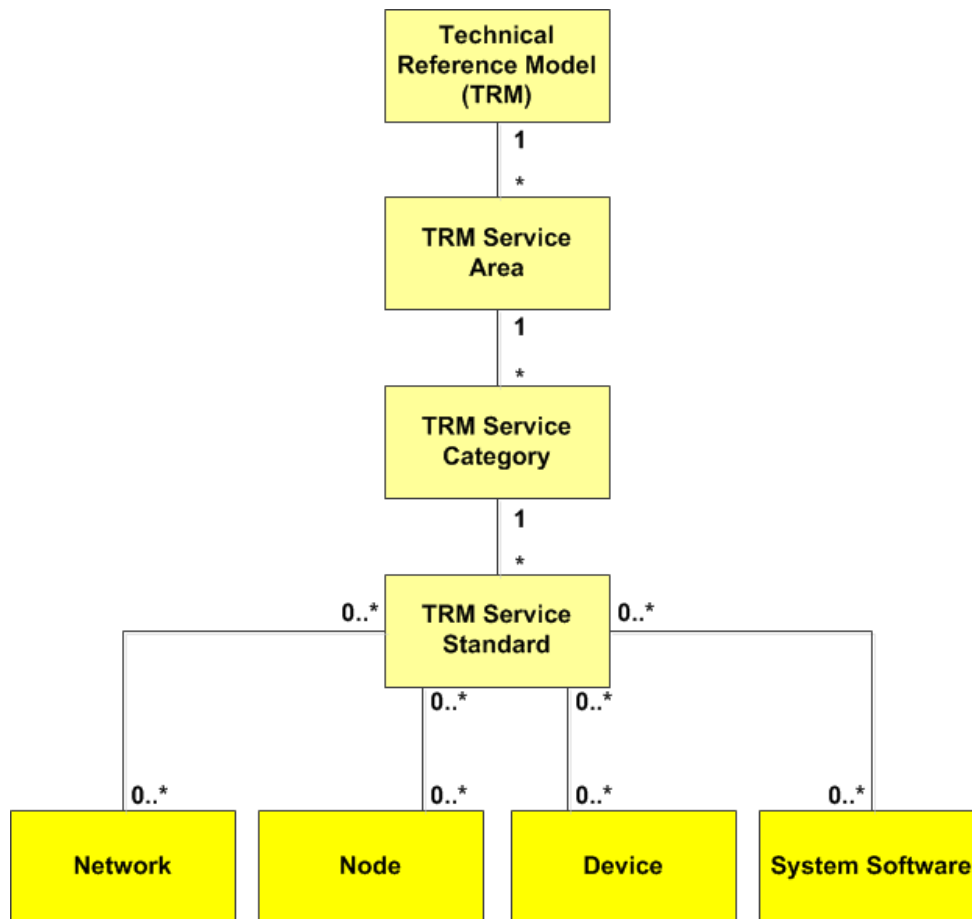


Figure 3-9 Mapping TRM to Technology Architecture Elements

As CEAF continues to evolve, it will include a state-specific TRM to better align TA with CEAF Reference Architectures, and to better facilitate the adoption of technology standards in the context of an overall architecture area in order to maintain architectural coherence and interoperability of platform components. It should be noted that FEA-II introduced an Infrastructure Reference Model (IRM) which provides a categorization scheme for physical IT assets, the operating systems and firmware that run them, and the locations or facilities that host the physical IT assets. This FEA IRM, when published, will be used as a key input for the future CEAF TRM, along with CEAF Reference Architectures.

3.7.3 TA Future State Planning

TA will continue to evolve and change as state agencies identify and improve business operations, standardize business processes and improve interoperability within the agency and with external business partners. As the agencies mature, some technology redundancies will be eliminated and some technologies will be standardized across state agencies for improved ability to support them and for interoperability. Changes and innovations in the industry may also affect the way the state agencies do business. These changes may introduce new technologies and/or eliminate the need for one or more existing technologies (for example, when such technologies are standardized and shared).

TA future state planning needs to be aligned with the AA future state planning and requires a similar incremental approach (e.g., each solution domain). The following steps represent a general approach for TA future state planning. CEAF 2.0 is intended to support over 120 state organizations, each with its own organizational structure, policies, and operational model and hence some of the following steps may not apply to a particular organization while another organization may require additional steps.

- Analyze the current technology investments and identify the current strengths, weaknesses, opportunities and threats
- Determine if any of these technologies (and platforms) need to be upgraded/improved before they are made to be a part of the future architecture
- Identify the technology redundancies that need to be eliminated
- Identify what technologies will be maintained and expanded as enterprise-wide (intra- and inter-agency level) standards to reduce duplication, technology diversity, and inconsistencies
- Identify what new technologies (or capabilities) will be required to support the future state applications and information architectures
- Identify the technologies for each solution domain based on the type of solution and the underlying reference architecture to promote interoperability and ease of maintenance so that they can form enterprise-wide (intra- and inter-agency) standard platforms
- Identify any workforce and security issues that will need to be addressed
- Define the future state TA

Please note that successful TA future state planning requires alignment with IA and AA future state planning and collaboration with application architects, information architects, system administrators, data engineers, database administrators and other SMEs.

3.8 Motivation and Cross Domain Aspects

Motivational Elements and Cross Domain Aspects are important elements of Enterprise Architecture that need to be addressed, in addition to the domain-specific elements already described in previous sections.

Motivational Elements are the actual motivations or intentions (i.e., goals, principles, requirements, and constraints) and the sources of those motivations or intentions (i.e., stakeholders, drivers, and assessments) that together affect the Enterprise Architecture. Motivational elements *are related to* the core domain elements *via* the *requirement or constraint* concept. Relating motivational elements to the core domain elements provides better integrated view of strategic, business, information, applications and technology domains across all lines of business, services, and systems as represented in Enterprise Architecture.

Cross Domain Aspects are aspects of Enterprise Architecture present in a number of architectural domains, rather than functioning as separate domains. In the industry, there are a number of areas commonly referred to as *architectures*, such as security *architecture*, performance *architecture*, interoperability *architecture*, or service-oriented *architecture*, and the terms used suggest that these areas are enterprise architectural domains of their own. However, closer examination shows that they are present in a number of architectural domains – hence the label “Cross Domain Aspects”. Based on this characteristic, and following the approach in commonly used industry EA frameworks, CEAF treats security, performance, interoperability, and SOA as cross domain aspects and standards. The practical consequence of this approach is that cross domain aspects are discussed once rather than for each architectural domain. However, it must be also kept in mind that these aspects apply by default to a given architectural domain under discussion.

In CEAF, both motivational elements and cross-domain aspects are fully integrated with Enterprise Architecture domains in a simple yet effective way:

- Cross domain aspects and standards are linked to *goals, requirements or constraints* (that is, to motivational elements)
- Motivational elements are linked in turn to the *core domain elements*.

The following points explain the motivational elements and their relationship to the core EA domain elements and cross domain aspects:

- **Stakeholder** is an individual, team, or organization (or classes thereof) that represents their interests in, or concerns relative to, the outcome of the architecture. To direct efforts to these interests and concerns, stakeholders set, change, and emphasize *goals*.
- **Driver** is something that creates, motivates, and fuels the change in an organization. Drivers may be internal, in which case they are usually associated with a *stakeholder*. Some internal drivers are “customer satisfaction”, “compliance to legislation” and “operational expenses”. Drivers may also be external, e.g., “changing legislation”.
- **Assessment** is the outcome of some analysis of some driver. An assessment may reveal strengths, weaknesses, opportunities, or threats for an area of interest. These outcomes need to be addressed by adjusting existing *goals* or by setting new *goals*. For example, a weakness “customers complain about long wait times” may lead to a goal “reduce customer wait time by 60%”. These goals may, in turn, trigger changes to the enterprise architecture. For example, the goal “reduce customer wait time by 60%” may lead to the implementation of “self-service kiosks” and/or “enhanced business process automation system”.
- **Goal** is an end state that a stakeholder intends to achieve. Goals are generally expressed using qualitative words; e.g., “increase”, “improve”, “reduce”. It is also common to associate concrete objectives to goals; e.g., “increase real-time electronic SSN verifications to 99%”, “improve customer satisfaction with help desk by 25%”, “reduce operational expenses by 15%”. Due to varying practices in writing goals and related objectives among state agencies, CEAF treats both goals and objectives as *goals*.
- **Principle** is a normative property of all systems in a given context, or the way in which they are realized. Principles are related to *requirements* and *goals*.
- **Requirement** is a statement of need that must be realized by a system. The term “system” in this context is used to indicate its general meaning as a group of functionally related elements rather than just as an IT system. As such, a requirement relates to almost any of the domain architecture elements described in the preceding sections. However, for a

simple, yet effective association of requirements to the domain elements, CEAF relates *requirements* to the following core domain elements:

- Business Process
- Information Object
- Application Service
- Infrastructure Service

Requirements model the properties of the above domain elements that are needed to achieve the end state represented by the *goals*. It should be noted that, these requirements are *high level enterprise requirements* derived from the goals and principles; they are not detailed software requirements.

- **Constraint** is a restriction on the way in which a system is realized. This may be a restriction on the implementation of the system (e.g., specific technology to be used) or other restriction such as the budget constraint. Similar to requirements, constraints will be related to the core domain elements of Business Process, Information Object, Application Service and Infrastructure Service.
- **Cross Domain Aspects** such as security, availability, and standards will first be related to *goals, requirements* and *constraints*. For example, security aspects such as Intrusion Detection and Encryption will be represented as requirements and associated with Infrastructure Service and Application Service while some other security aspects such as Auditing and Supervisor Approval will be represented as requirements and associated to the Business Process. Similarly, standards such as “Java is the standard programming language” will be represented as *constraints* and associated to the Application Service.

Future enhancements to CEAF may introduce separate domains and/or reference models to address cross domain aspects such as security depending on industry developments and to maintain compatibility with FEAF.

3.9 Enterprise Architecture Segments

An Enterprise Architecture Segment is a part of the overall EA that documents the architecture of one or more Lines of Business or Business Capabilities. Segments are individual components of the enterprise describing core mission areas, supporting processes, and common or shared business services and enterprise services. Segments can be defined either organizationally (e.g., as a business unit and per the organization chart) or functionally (e.g., as a vertical or crosscutting mission or support service or capability). A crosscutting segment serves several Lines of Business within or between agencies. Examples include email systems that serve the whole enterprise, and financial systems that serve several lines of business. Figure 3-10 shows how the architecture can be decomposed into segments (that follow structural or functional lines in the organization), their relationship to architecture domains, and how shared services will be positioned.

Segment analysis focuses on a particular service area or business unit within an agency or between agencies. The result is a detailed, results-oriented baseline and target architecture as well as any transition strategy necessary for a portion or segment of the enterprise.

CEAF supports and promotes implementation of enterprise architecture using a segment approach. Segment approach provides the following benefits:

- It facilitates incremental development of an agency's enterprise architecture. Since developing enterprise architecture across all lines of business of an agency can take a significant amount of time and effort, segment approach provides value more quickly and helps to gain executive support for a sustained enterprise architecture program.
- It allows identification of crosscutting segments that serve several Lines of Business within or between agencies and other common vertical segments across programs that support similar mission areas. Segment level architectures can then be developed or best-of-breed segment architectures can be reused through Cross Agency Initiatives (CAIs) and/or through collaborative Communities of Interest (COIs). This approach will lead to state-wide target architectures for common segments, and over time to shared segments. As segment architectures are harvested as reusable assets, state agencies need to plan to use them in their future state enterprise architectures.

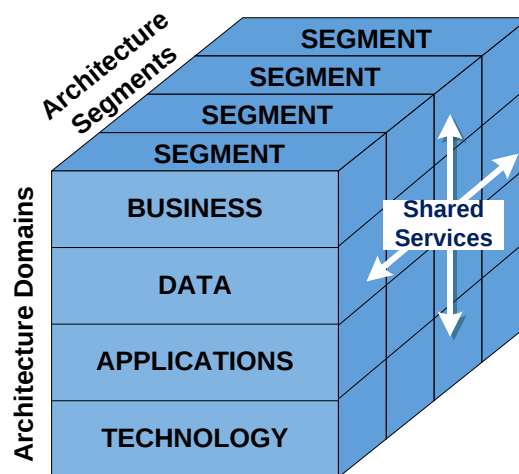


Figure 3-10 Enterprise Architecture Domains and Segments

3.10 How does EA Fit into the Organization

Success in accomplishing an agency's mission and goals while optimizing resources, at a minimum, requires the following four components:

- A coherent and consistent understanding of program and service performance
- A thorough analysis of opportunities and solutions to improve program and service performance
- Agile planning and decision making
- Meticulous execution of transformation programs, projects and other initiatives to incrementally achieve agency's goals and objectives

The above components and an *integrated planning approach* are more important than ever in today's resource-constrained agency operating environments, which demand more efficient government through the reuse of solutions and through shared service models. Program, systems, and services interoperability are foundational for agencies to be able to successfully partner in new shared service models that may involve outside providers and new roles for participation (e.g., consumer, developer, or provider).

EA provides an integrated, consistent view of strategic goals, mission and support services, information, systems and enabling technologies across the entire organization. As an authoritative reference, the current view of EA provides *key inputs* to strategic planning processes in terms of current strengths, weaknesses, opportunities and threats to enable agency-wide consistent understanding of program and service performance and *of the opportunities to improve* performance. Future view of EA incorporates thorough analysis of opportunities and resulting solutions to improve program and service performance in accordance with the strategic goals and desired business outcomes. It provides the context and can be the source of standards for all levels of interoperability, for reuse of solutions and for shared service models. Therefore, EA is foundational to ensuring that IT enables the business and mission functions to achieve optimum performance.

Agencies need an effective EA program and standard methods that support efforts to leverage other government and industry experiences and results as a means to most efficiently solve priority needs and progressively achieve agency's strategic goals. In its most successful form, EA is used by agencies to enable consistent planning and decision making, and to guide and govern transformation projects. Figure 3-11 illustrates how enterprise architecture fits into the overall organization and its key interfaces with other processes such as strategic planning, portfolio and capital planning, investment management, and project management. The following points describe these interfaces:

- California government leaders provide state-wide and agency-wide **strategic direction** to meet growing/evolving customer needs, to improve program and service performance, and to optimize resources to accomplish their mission and goals. EA provides key inputs to strategic planning process by informing current strengths, weaknesses, opportunities and threats, current levels of program and service performance, opportunities to improve performance and helps formulate strategic goals, plans and initiatives to meet customer needs and improve performance.
- The vision, mission, goals and the operating model of the organization **drive the development of future state enterprise architecture**. While the future state enterprise architecture may be elaborated in segments to incrementally develop an agency's enterprise architecture, the outputs from strategic planning (strategic goals and initiatives) drive the prioritization of EA efforts in these segments to provide value near-term while maintaining long-term focus. It is important to note that the strategic goals and initiatives of an organization change based on customer needs and a variety of other factors that cannot be anticipated or controlled (e.g., new laws, policies, and regulations, or new technologies and innovations) and hence the future state enterprise architecture is primarily driven by the *operating model* of the organization to provide the necessary agility.
- Strategic direction also drives other key **planning and decision making** processes, such as the portfolio and capital planning, investment reviews and project approvals. EA plays a key role in portfolio planning and prioritization of programs, projects and other initiatives to develop an enterprise roadmap. Investment decisions with a future state architecture and with an enterprise roadmap to incrementally reach that future state architecture can potentially result in elimination of waste, duplication and in improved focus on long-term program and service performance.
- While EA is foundational to consistent planning and decision making, improvements in program and service performance are indirect outcomes of EA as they are normally the more direct outcomes of the transformation programs, projects and initiatives. Therefore, it is important to both **guide and govern** these transformation programs, projects and

initiatives from an enterprise perspective, in order to make sure they succeed in achieving the business and IT objectives assigned to them while advancing the enterprise towards the future state EA. EA provides the guidance and helps govern those transformation programs, projects and initiatives from an enterprise perspective through EA deliverables and EA services.

- When EA deliverables and services are used by agencies as described above, there is a greater possibility to **transform state's IT investments** into a business aligned, optimized and interoperable IT environment comprised increasingly of agency-level and state-level standardized solutions and shared services while including/limiting special purpose solutions for unique/distinct segments.

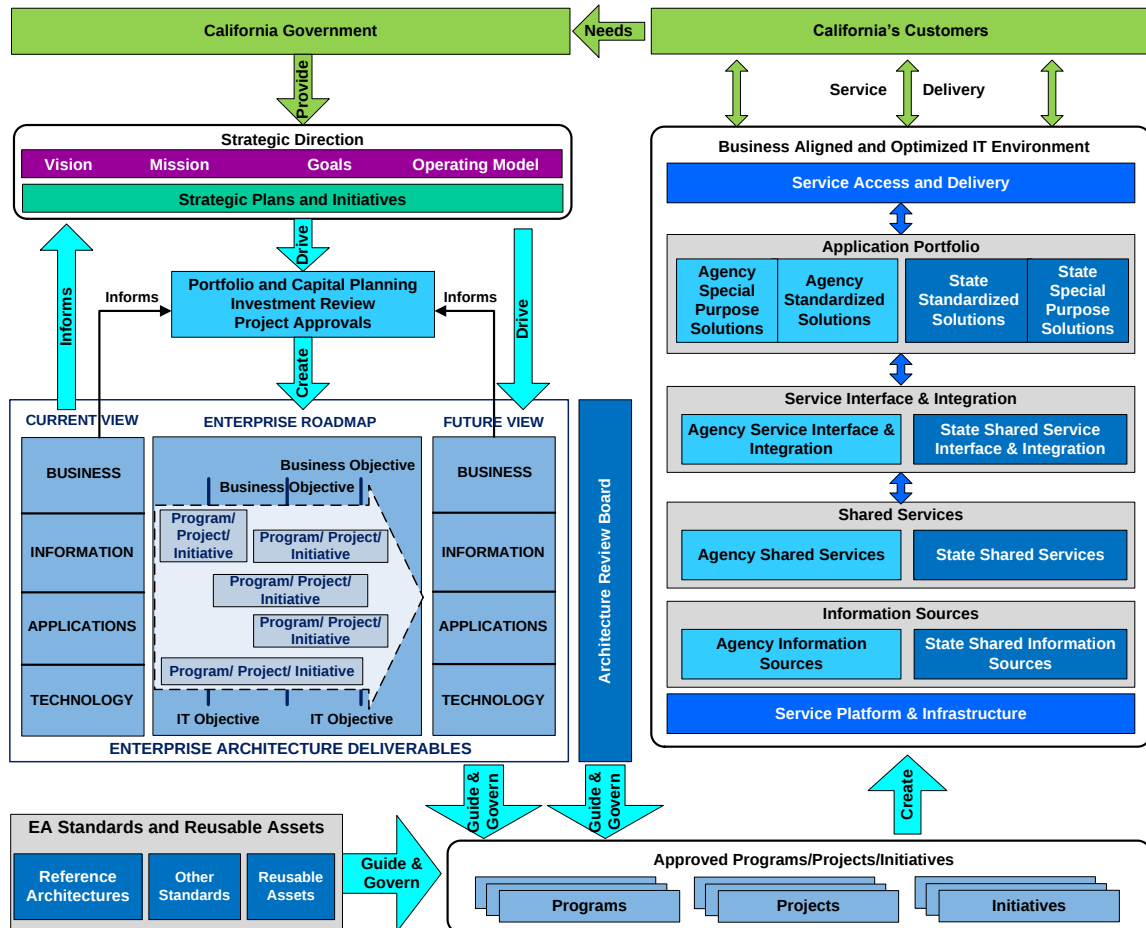


Figure 3-11 Enterprise Architecture Interfaces

4 California Enterprise Architecture Framework

CEAF 2.0 is designed to *guide* the implementation of effective EA programs within and among state agencies so that the resulting EA deliverables and services *enable mission success* with a lower total cost of ownership, faster time to delivery, and reduced duplication. CEAF 2.0 helps state agencies advance in maturity of their enterprise architectures, so they can improve business and IT capabilities, improve interoperability and information sharing, expand shared business and technical services. It also promotes cross-agency initiatives for shared development of common business processes, common business and technical services, and reusable and shareable application platforms.

CEAF 2.0 consists of the following three major components which are used together to support effective implementation of EA programs:

- **EA Framework:** Provides an *organized structure for actionable EA deliverables* and describes *eight basic elements to guide, support and govern* the development of these actionable EA deliverables.
- **EA Services:** To facilitate *consistent and uniform* implementation of the EA programs across state agencies, CEAF 2.0 recommends that the state agencies charter their (enterprise) architecture teams to provide a set of *eight defined services* (described in Section 5). This service-oriented approach to EA work is intended to increase the focus of EA programs on *mission effectiveness* while taking the confusion out of what EAs do and should do.
- **Reference Architectures:** Reference Architectures (RAs) are the means through which CEAF 2.0 provides best-practice-based architectural solutions to build common business and/or technical capabilities. They are a part of the *standards* (a basic element of CEAF 2.0) which facilitate *repeatable solutions leading to shared solutions*. They provide a key mechanism to *prevent* unchecked acceptance of too many different solutions, dilution of the talent pool, challenges in the ability to leverage solutions across state agencies, and increasing support and maintenance costs. RAs serve as a key input to the agency architects in creating their agency's future state EA. RAs contribute to improving their ability to create future state EAs that support long-term business strategy; this, in turn, significantly enhances the overall effectiveness of the EA program. Therefore, RAs are a key part of the CEAF 2.0's approach to progressively mature the EA in State of California.

It requires stressing that CEAF 2.0 is not an innovation in itself but rather a *cohesive adaption of the best (and successful) practices* based on popular industry architecture frameworks, including the Federal Enterprise Architecture Framework (FEAF), The Open Group Architecture Framework (TOGAF), Medicaid Information Technology Architecture (MITA), and publications from National Institute of Standards and Technology (NIST), Massachusetts Institute of Technology (MIT) Sloan Center for Information Systems Research, Harvard Business Press, Gartner and Corporate Executive Board. This *adaption of best practices* into CEAF 2.0 allows state agencies already implementing enterprise architecture programs to easily integrate with CEAF 2.0, thereby allowing state agencies to build on and optimize what they have implemented to date.

The following sections describe CEAF 2.0. The descriptions are organized as follows:

- **Section 4.1** defines an EA Framework and describes the characteristics of an EA framework
- **Section 4.2** provides an overview of the *EA framework part* of CEAF 2.0

- **Section 4.3** describes the *actionable EA Deliverables* that are the main focus of a state agency's EA program and their *organized structure* provided by CEAF 2.0 through the underlying *Content Meta Model*
- **Section 4.4 through Section 4.11** describe the *eight basic elements of CEAF 2.0 that guide, support and govern* the development of these actionable EA deliverables

Although RAs are a major component of CEAF 2.0, they are not included in this document; each identified RA is described in its own separate document. RA documents are or will be made available through EA standards publication process.

4.1 EA Framework Defined

Framework is a structure for organizing the information within the scope of the architecture (what will be documented) and how the types of information in respective areas or domains of the architecture are mutually related. An EA framework defines the structure for the architectural information and for the relationships of architecture views, in order to facilitate analysis, design, documentation, reporting and decision making. Additionally, an EA framework contains features to guide and support the development of the architectures and for their governance.

4.1.1 Characteristics of an EA Framework

There are a number of EA frameworks in use in the public and private sectors. Some of those frameworks are designed to support a multitude of enterprises in multiple industries and include comprehensive methods and guidance. Some of the other frameworks are intended to simplify the initiation of an EA program. And some other frameworks provide generic or sector-specific taxonomies. Requiring or enforcing a single type of EA framework is not the primary concern for CEAF. Rather, it is designed to meet the specific needs of the California state agencies, by using the EA best practices and lessons learned. Consequently, from the CEAF point of view, there are the following characteristics that an EA framework should possess:

- **Comprehensive:** EA framework should cover all aspects of an agency through current and future views of the strategic, business, information, application systems, and technology areas while supporting incremental development through Lines of Business, Segments or Domains
- **Integrated:** EA framework should provide a mechanism (e.g., meta model) to show the relationships among architecture domains for business, information, application systems, and technology and their relationships to organization's mission and strategic goals through an integrated model
- **Scalable:** EA Framework should support architecture practices at various organizational levels and scopes (e.g., state, agency, cross agency initiative, line of business, segment, solution)
- **Flexible:** EA Framework should provide the flexibility to support architecture practices using a top-down (business-driven) approach which is strongly recommended, or a bottom-up approach (initially driven by the need to improve IT efficiencies and standardization) to enable architecture teams to start small, demonstrate the value of EA, gain executive support and expand over time
- **Standards and Reusable Assets:** EA Framework supporting many state agencies should provide standards including best-practice-based architectural solutions (such as Reference Architectures) to build common business and/or technical capabilities, and other reusable

assets to enhance the ability of agencies to create effective and comparable target enterprise architectures

CEAF 2.0 has been created using the following basic principles to meet the above criteria:

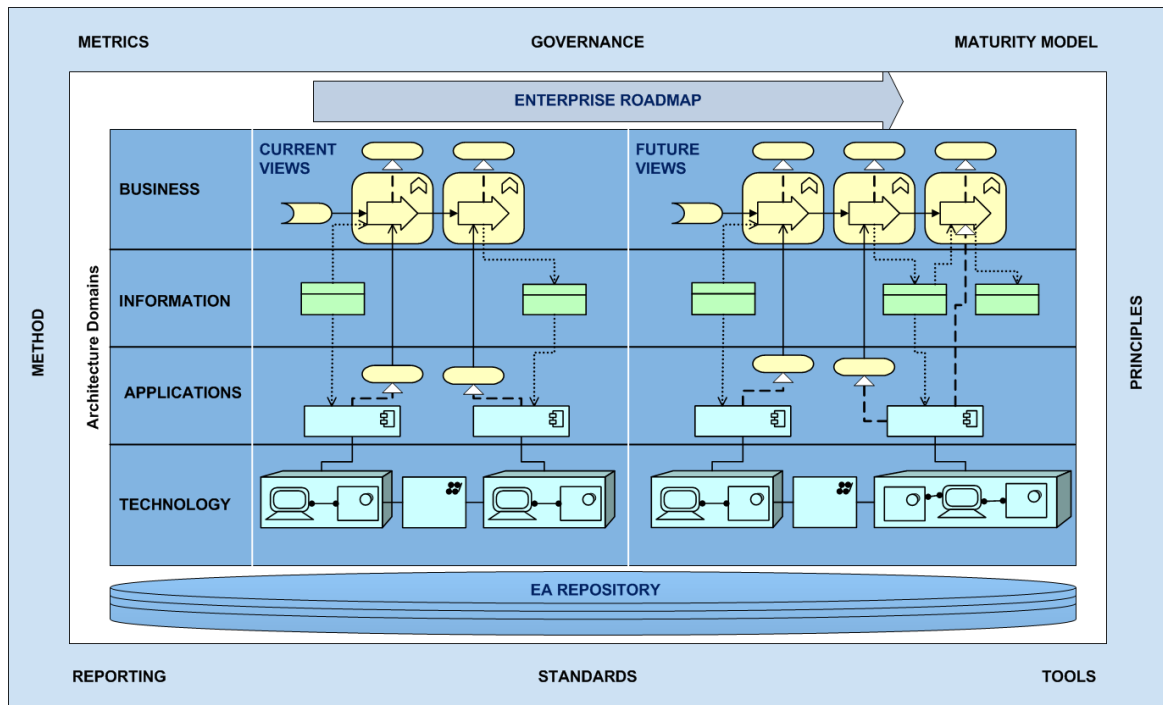
- Create a structure that allows departments already implementing enterprise architecture programs to easily integrate with CEAF 2.0
- Leverage work already performed through previous versions of CEAF and associated policies
- Include involvement by many state agencies to encourage collaboration, buy-in and synergy
- Maintain compatibility with the FEAF
- Align with the California Technology Governance Structure
- Utilize principles as a way to make fully supportable and consistent information technology investment decisions
- Facilitate both short-term improvements that provide quicker value and longer-term improvements that provide more substantial value over time
- Focus on creating actionable deliverables that will be used for decision-making rather than just “shelf ware”
- Provide the ability to measure the value of enterprise architecture

4.2 CEAF 2.0: EA Framework Component Overview

The *EA framework part* of CEAF 2.0 is illustrated in Figure 4-1 below. The *actionable EA deliverables* are shown in the middle section of Figure 4-1 and form the contents of an EA repository. This part illustrates the relationship of the four architecture domains that serves to emphasize that strategic goals drive business capabilities, which in turn provide the requirements for enabling *business processes, information, application systems and technologies*. There are *eight basic elements* represented as elements surrounding the deliverables in Figure 4-1 that *guide, support and govern* the development of these actionable EA deliverables. They are:

- Principles
- Maturity Model
- Metrics
- Reporting
- Method
- Tools
- Standards
- Governance

The above elements are described in the following subsections.



California Enterprise Architecture Framework (CEAF) 2.0

Figure 4-1 California Enterprise Architecture Framework

4.3 EA Deliverables

CEAF 2.0 attempts to expand the focus of agency EA programs to creating *actionable* EA deliverables. *Actionable* means that the architecture analysis and documentation can be used by executives, managers, and staff to support portfolio planning, resource planning, decision-making, and management to achieve strategic business outcomes.

While As-Is Reference Models provide an *authoritative reference* for a state agency or the state as a whole at a high level, they themselves *do not lead to an action* to improve mission outcomes in accordance with the strategic goals of a state agency. A future state architecture and a road map to get to that future state architecture from the current state are the primary deliverables that are *actionable*. Creation of the future state architecture, however, requires relevant information from the current state to analyze options and communicate alternatives and benefits to the decision makers. Consequently, the current state architecture - at a level of detail necessary to provide an authoritative reference and communicate the benefits of the future state architecture - is also a key EA deliverable.

Both the current state architecture and future state architecture can be thought of as two integrated views of the same enterprise; they can take the form of a set of interconnected models that support better planning, decision making and management both within a state agency and across multiple agencies for cross agency or statewide strategic initiatives. These models describe the relationship between an agency's strategic goals, business functions, information and enabling applications and technologies in an explicit and manageable way.

Accordingly, in CEAF 2.0, based on EA best practices, a minimum set of *core* artifacts that comprise the actionable deliverables are the two views of the overall enterprise architecture (current state and future state) and one enterprise roadmap for the overall enterprise. The

roadmap and views provide a picture of the architecture in terms of what exists currently, what is planned for the future, and what programs, projects and initiatives constitute an enterprise roadmap to transition to the future state architecture in all four architecture domains. Since government operations and strategic goals are not static, these deliverables must be updated periodically to reflect new realities and changing directions.

An individual transformation program, project or other initiative may result in an intermediate architecture. When undertaking such a program, project or initiative, such an intermediate architecture becomes the target architecture from the point of view of that program, project or initiative. After successful completion of that program, project or initiative, its target architecture gets incorporated into the current view of the enterprise architecture. To support the business case and subsequent investment review and approval processes, a detailed transition plan may be required for a specific program, project or initiative. This detailed transition plan would include the current state and future state architecture views from that project's point of view.

This section describes the deliverables and a framework for *an organized structure* of the current and future state architectures. This does not contain actual architecture views of an agency or the state as a whole; those actual architecture views are the *output products* of successful implementation of an EA program using the framework described in this document.

4.3.1 Current State Architecture Views

The current state architecture views represent the current state or baseline for the enterprise and consist of the following models:

- Current Business Architecture – it describes the current state business capabilities and the business process model
- Current Information Architecture – it describes the structure of an organization's existing logical and physical data assets and data management resources supporting the business processes
- Current Applications Architecture – it describes what applications are in place to manage the information and support the business processes including their key components and interactions
- Current Technology Architecture – it describes what logical software and hardware capabilities and what networks providing communication paths are in place to support the business, information, and application services

Additionally, current state architecture views also represent the motivational elements pertaining to the current state as (identified) assessments, requirements, and constraints.

The type and depth of documentation of the above models should be guided by the need for detail and answers to questions about requirements, benefits, alternatives, applicable standards, and available resources while making sure that the EA focus is on business outcomes and is not diverted to documentation.

4.3.2 Future State Architecture Views

The future state architecture views represent the future state (or "to be built" state) of the enterprise within the context of the strategic direction and the operating model and consist of the following models:

- Future Business Architecture – it describes the future state business capabilities and the business process model
- Future Information Architecture – it describes the structure of an organization's logical and physical data assets and data management resources required to support the future state business process model
- Future Applications Architecture – it describes what application systems are necessary and relevant to the enterprise and how those multiple applications work together to support the future state business process model and manage the information
- Future Technology Architecture – it describes what logical software and hardware capabilities and what networks providing communication paths will be necessary and relevant to the enterprise to support the future state business process model, information, and application services

Additionally, future state architecture views also identify the motivational elements pertaining to the future state and relate them to other architecture elements as described in Section 3.8.

The type and depth of documentation of the above models will be guided by the need for detail and answers to questions about objectives, requirements, applicable standards, timeframes, and resources. To ensure interoperability and share-ability of services, which will be developed as part of a cross-organization extended Service Oriented Architecture (SOA) and other cross-agency initiatives, these future state architecture views need to sufficiently describe the architecture components in each domain and specify their key attributes.

Additionally, these models should incorporate state enterprise architecture standards including the reference architectures as applicable, based on the required business capabilities. Reference architectures are a key input to creating the future state architectures. Most applications require basic IT capabilities such as Identity and Access Management, Enterprise Application Integration and Business Intelligence. When planning the future state architecture, agency EAs can use the state reference architectures as a basis and use “enterprise thinking” to architect these basic IT capabilities as *enterprise-wide multi-tenant enabled capabilities* that can potentially be shared not only within the agency but also with other state agencies when needed.

Creation of future state architecture covering all lines of business of a state agency could take a significant amount of time. CEAF recommends that this effort be initially focused on a small number of *key business outcomes and the underlying segments* to provide quick value and gain executive support. This incremental approach allows the EA program to evolve over time.

4.3.3 Enterprise Roadmap

Enterprise Roadmap, also referred to as Sequencing Plan, provides a road map to get to the future state architecture through a prioritized sequence of transformation programs, projects and other initiatives. It promotes *long-term focus* and facilitates *continuity* (e.g., when key business or IT leaders change). The programs and projects identified in the enterprise roadmap may not represent *projects approved by state oversight groups* but represent the desired projects from an agency perspective.

A well designed enterprise roadmap also specifies key business outcomes expected from each program/project/initiative, when a specific business outcome will be achieved, when a specific business and/or information technology objective will be accomplished and how those outcomes and accomplishments will be measured. Without such measurable objectives, it may

not be possible to validate the value and progression of programs and projects (during their execution) towards the target enterprise architecture and in turn this can affect the governance of those programs and projects.

It should be noted that both the target enterprise architecture and the enterprise roadmap can be incrementally developed through Lines of Business, Segments or Domains by focusing on a few key business outcomes for each increment.

Figure 4-2 below illustrates the Enterprise Roadmap.

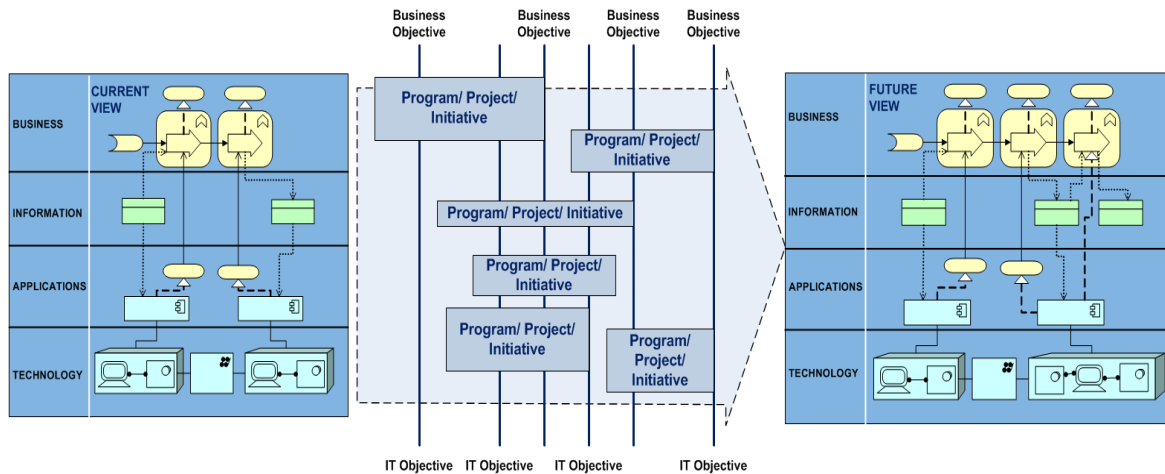


Figure 4-2 Enterprise Roadmap

The Enterprise Roadmap is a key input to the following activities:

- **Investment Management Review** - provides information to support the investment review decision process from an enterprise-wide perspective rather than in silos and thus prevents/reduces isolated/silo investments without enterprise perspective. It also supports investment decision-making in the context of an “architect–invest–implement” approach
- **Procurement Practices** - aligns procurement activities with the enterprise architecture and other transitional processes
- **Cross-agency Initiatives** - provides information to support opportunities for cross-agency initiatives and to expand cross-organization extended Service Oriented Architecture (SOA) to ensure interoperability and share-ability of systems and services
- **Program/Project Governance** - provides information to plan, execute, monitor and control programs/projects to ensure incremental progress towards business outcomes, and business and IT objectives. This in turn contributes to predictable success of multi-year programs/projects
- **Architecture Governance** – provides information to coordinate the effort and ensure architectural coherence of multi-project and multi-vendor solutions

4.3.4 Content Meta Model

Core concepts of each of the four domains of CEAF 2.0 along with the motivation and cross domain aspects from the enterprise architecture perspective have been described in Section 3 and illustrated using ArchiMate modeling concepts and conventions. Figure 4-3 shows the CEAF 2.0 Content Meta Model that provides a structure for organizing the architecture information in each of the four domains along with the relationships among the components of this information. Additionally it shows a simple, yet effective way to represent motivational

elements and cross domain aspects and relate them to core domain elements via *requirements* and *constraints*.

This Content Meta Model is based on the ArchiMate Meta Model, but it is significantly simplified to accelerate its adoption in the state. Using this Content Meta Model to develop current and future views of enterprise architecture allows agencies - currently using other frameworks such as FEAF, TOGAF and MITA - to maintain compatibility with those frameworks, while enabling them to visually represent their enterprise architectures for faster modeling and better communication. Additionally, adoption of the Content Meta Model promotes consistent views within and between architectures and promotes interoperability within and between state government organizations.

This Content Meta Model is intended to be flexible rather than prescriptive to enable state agencies to initially model their architectures with a few components and then expand over time based on the need for additional detail. For example, in the *technology architecture* domain, the *infrastructure service*, *infrastructure function* and *infrastructure interface* can be ignored during initial architecture development efforts (thus mapping an *application component* or *artifact* directly to a *node*) but these elements can be added later when that level of detail is required for communication and/or decision-making.

For a description of the elements of this Content Meta Model, please refer to Section 3.

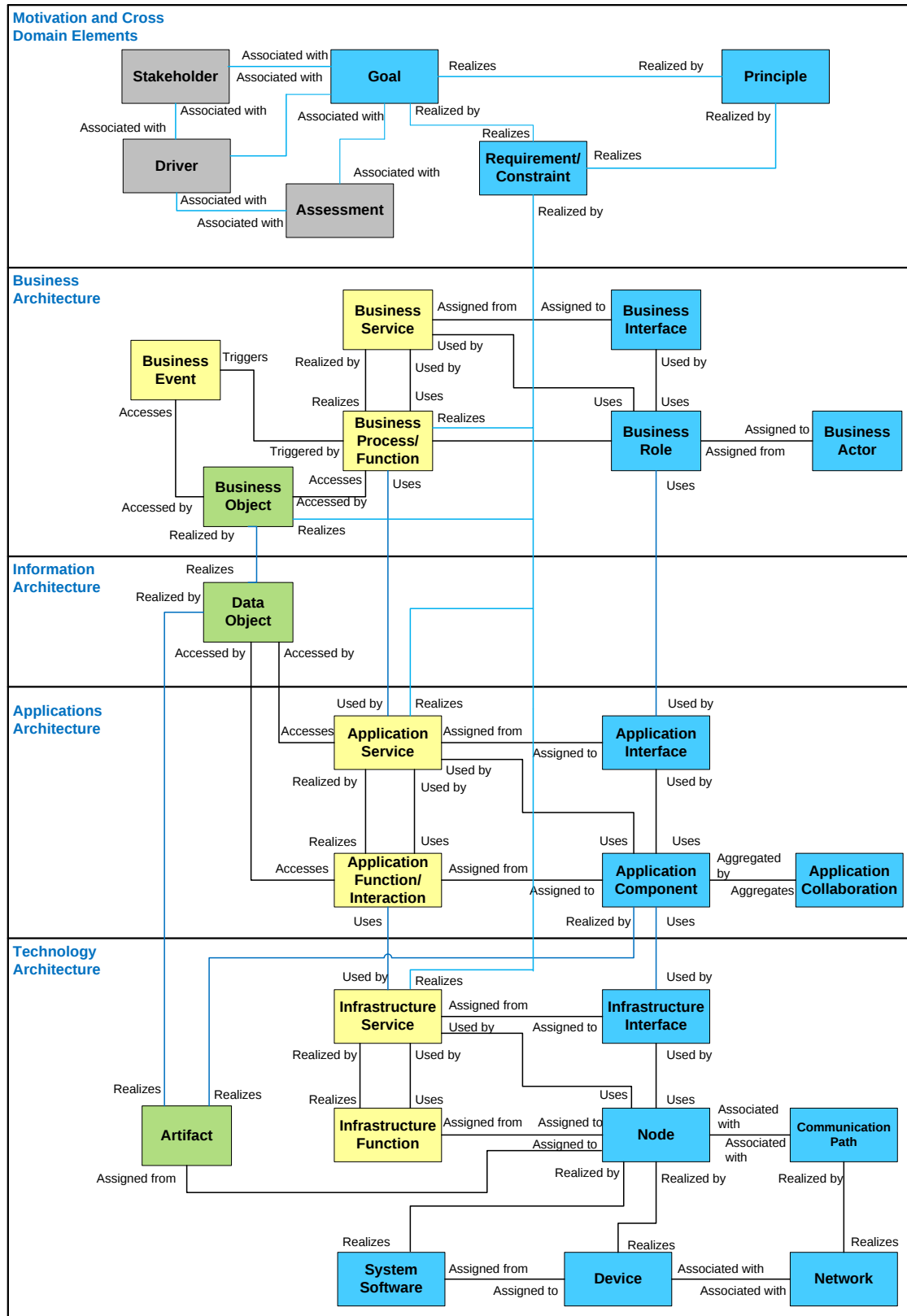


Figure 4-3 Content Meta Model

4.3.5 EA Repository

In using architecture information to support planning and decision-making, the EA repository is intended to provide a single place for storing and accessing architecture artifacts. Preferably the artifacts are created using EA tools, but some of the artifacts may be custom developed for particular uses. A repository works best if it is easy to access and use, if it is integrated with an EA tool, and if it allows custom developed artifacts to be stored. Additionally, the repository will facilitate configuration management of EA artifacts.

4.4 Principles

EA is most effectively practiced in a common way when it is based on principles that guide the actual analysis and design work that forms the basis of architecture projects.

CEAF 2.0 promotes the following principles to serve as a guide for EA programs and architecture projects. These principles represent the criteria against which potential investment and architectural decisions are weighed.

Table 4-1 EA Principles

Principle #1	Business Drives Information Technology
<i>Rationale</i>	Information technology direction will be driven by what the business needs to serve their customers. Business events represent the essential activities that define the boundaries of a good information technology environment. Without knowing the business, the information technology infrastructure may be over- or under- built, and this can result in excessive technical complexity, cost and delays. This principle fosters a culture where the information environment changes in response to the needs of the business, rather than having the business change in response to information technology changes. Changes in technology provide an opportunity to improve the business process and to better address business needs.
<i>Implications</i>	- Minimize unintended effects on business due to information technology changes - Build what we need, not what we want - Easier to identify technical impacts when business events change - Must include the business and its perspective in the process
Principle #2	Enterprise Focus
<i>Rationale</i>	Information management decisions will consider the impact and maximize the benefit to the state as a whole. Decisions made from a statewide perspective have greater long-term value than decisions made from any particular organizational perspective.
<i>Implications</i>	- A governance structure must be implemented that will support statewide investment decision-making - Achieving maximum statewide benefit requires changes in the way we

	plan and manage information. Technology alone cannot bring about this change - Some organizations may have to concede their own preferences for the greater benefit of the entire state - Information management initiatives should be conducted in accordance with the statewide plan. Individual organizations should pursue information management initiatives that conform to the blueprints and priorities established by the state
Principle #3	Common Business Solutions
<i>Rationale</i>	Development of common solutions used across the state is preferred over the development of similar or duplicative solutions that are only provided to a particular organization. Duplicative solutions are expensive and proliferate conflicting data and data representations.
<i>Implications</i>	- Organizations will not be allowed to develop solutions for their own use that are similar or duplicative of a statewide solution. In this way, expenditures of scarce resources to develop essentially the same capability in marginally different ways will be reduced - Applications components should be shared across organizational boundaries - May require changes to legislation and government code to guide separate departments to act in a unified manner - A common technology and organization infrastructure will be needed to support common business solutions
Principle #4	Data is an Enterprise Asset
<i>Rationale</i>	The state will coordinate inter-agency and inter-governmental data collection and management, to improve data sharing capabilities and reduce costs of acquiring and managing data. To enable the work of government, agencies need to combine data across systems; agencies need to share data with other agencies; users need to access information and services from varied sources; and businesses and governments need to interface. Government work demands interoperability.
<i>Implications</i>	- Laws and statutes must be considered when sharing data across organizational boundaries - Data and information used to support statewide decision-making will be standardized to a much greater extent - Data standards and quality must be utilized across the enterprise
Principle #5	Secure Enterprise Information
<i>Rationale</i>	Enterprise information will be secure from unauthorized access, modification, or destruction. Hacking, viruses, and terrorism increasingly

	threaten the state's systems. Government has a responsibility to maintain the public trust in its services by protecting these systems from unauthorized access and by protecting data integrity and confidentiality. Secure systems ensure the continuity of the state's business. Systems and data must be secured using security best practices and by conducting security assessments on a regular basis.
<i>Implications</i>	▪ Loss of public trust if not done correctly ▪ Must identify, publish, and keep applicable policies current ▪ Security must enable but not impede business ▪ It is extremely costly to repair systems that have been compromised ▪ Security must be designed into systems from the beginning; adding it later is expensive, time-consuming and not reliable ▪ Information must be safeguarded against inadvertent or unauthorized alteration, sabotage, disaster, or disclosure
Principle #6	Compliance with Statewide Standards
<i>Rationale</i>	Compliance with statewide standards will facilitate interoperability and consistency across solutions. Use of proven technology will simplify software design, reduce application development time, facilitate learning, improve systems maintenance and support, and promote information-sharing among organizations within the state, and thus reduce total cost of ownership.
<i>Implications</i>	▪ A process must be established for setting, reviewing and revising standards periodically, and granting exceptions. The process must be sufficiently agile to support business and design drivers within required timeframes ▪ Standards will be followed unless there is a compelling business reason to implement a non-standard solution ▪ Information technology policy and procedures must be tied directly to this principle ▪ Fewer products and configurations simplify the information technology environment
Principle #7	Compliance with Law
<i>Rationale</i>	Enterprise information management processes comply with all relevant laws, policies, and regulations. Statewide policy is to abide by laws, policies, and regulations. This will not preclude business process improvements that may require or lead to changes in policies and regulations.
<i>Implications</i>	▪ The state must be mindful to comply with laws, regulations, and external policies regarding the collection, retention, and management of data ▪ Changes in the law and changes in regulations may drive changes in the state's processes or applications

<i>Principle #8</i>	<i>Control Technical Diversity</i>
<i>Rationale</i>	There is a real and substantial cost of infrastructure required to support alternative technologies for processing environments. Limiting the number of supported components will simplify maintainability and reduce costs. The business advantages of minimum technical diversity include: standard packaging of components; predictable implementation impact; predictable valuations and returns; utility status; and increased flexibility to accommodate technological advancements. Common technology across the enterprise brings the benefits of economies of scale to the enterprise. Technical administration and support costs are better controlled when limited resources can focus on this shared set of technology.
<i>Implications</i>	▪ The target architecture must be used in conjunction with the organization's investment review process and technology insertion plans. Relying on the architecture as an integral component of IT decision making helps control the introduction of incompatible products ▪ Policies, standards, and procedures that govern acquisition of technology must be tied directly to this principle ▪ Technology choices will be constrained by the choices available within the technology blueprint. Procedures for augmenting the acceptable technology set to meet evolving requirements will have to be developed and emplaced ▪ The technology baseline will not be frozen. Technology advances will change the technology blueprint when compatibility with the current infrastructure, improvement in operational efficiency, or a required capability has been demonstrated to promote controlled innovation
<i>Principle #9</i>	<i>Ease-of-Use</i>
<i>Rationale</i>	Applications must be easy to use and maintain. The underlying technology should be transparent to users, so they can concentrate on tasks at hand. The more a user has to understand the underlying technology, the less productive that user is. Ease-of-use is a positive incentive for use of applications. It encourages users to work within the integrated information environment instead of developing isolated systems to accomplish the task outside of the enterprise's integrated information environment. Most of the knowledge required to operate one system will be similar to others. Training is kept to a minimum, and the risk of using a system improperly is low. The underlying structure and technology of applications will be increasingly componentized and standardized for improved maintainability.
<i>Implications</i>	▪ Applications will be required to have a common "look and feel" and support ergonomic requirements. This means that the common look and feel standard must be designed and usability test criteria must be developed ▪ Guidelines for user interfaces should not be constrained by narrow

	assumptions about user location, language, systems training, or physical capability. Factors such as language of interaction, customer physical infirmities (visual acuity, ability to use keyboard/mouse), and proficiency in the use of technology have broad ramifications in determining the ease-of-use of an application Applications should leverage standard reference architectures based on their type and required capabilities and should be implemented following best practice implementation patterns for improved maintainability
Principle #10	Business Continuity
<i>Rationale</i>	Enterprise operations are maintained in spite of system interruptions. As system operations become more pervasive, we become more dependent on them; therefore, we must consider the reliability of such systems throughout their design, construction, and use. Business premises throughout the enterprise must be provided with the capability to continue their business functions regardless of external events. Hardware failure, natural disasters, and data corruption should not be allowed to stop or even disrupt enterprise activities. The enterprise business functions must be capable of operating on alternative information delivery mechanisms.
<i>Implications</i>	- Dependency on shared system applications mandates that the risks of business interruption must be established in advance and managed. This includes but is not limited to periodic reviews, testing for vulnerability and exposure, or designing mission-critical services to assure business function continuity through redundant or alternative capabilities - Recoverability, redundancy, and maintainability should be addressed at the time of design - Applications must be assessed for criticality and impact on the enterprise mission, in order to determine what level of continuity is required and what corresponding recovery plan is necessary

4.4.1 Strategic Goals to EA Principles

The following table shows the relationship between the EA principles and the State's strategic goals established through the California Information Technology Strategic Plan (2013 Update).

Table 4-2 Strategic Goals to EA Principles

Strategic Goal	What does this mean to EA	Related EA Principle(s)
Responsive, Accessible and Mobile Government	- EA should promote ease of use - EA should promote high availability, reliability and business continuity	- Principle #1: Business Drives Information Technology - Principle #5: Secure Enterprise Information - Principle #7: Compliance with Law

		- Principle #9: Ease-of-Use - Principle #10: Business Continuity
Results Through Leadership and Collaboration	Collaboration with emphasis on enterprise focus yields shareable, repeatable and best practice based reusable solutions	Principle #2: Enterprise Focus
Efficient, Consolidated, and Reliable Infrastructure and Services	Common business solutions and compliance with State standards and Laws promote consolidation and drive business and operational efficiencies	- Principle #3: Common Business Solutions - Principle #6: Compliance with Statewide Standards - Principle #7: Compliance with Law - Principle #8: Control Technical Diversity - Principle #10: Business Continuity
Information is an Asset	Enterprise perspective on data and efforts to standardize data and improve data sharing will enable better interoperability and contribute to more efficient services	- Principle #4: Data is an Enterprise Asset - Principle #5: Secure Enterprise Information
Capable Information Technology Workforce	Standards-based, reusable solutions utilizing proven technologies will improve the ability of the workforce to build and maintain them more effectively	- Principle #6: Compliance with Statewide Standards - Principle #8: Control Technical Diversity

4.5 Method

In its most successful form, EA is used by organizations to enable consistent planning and decision making to improve business outcomes. Enterprise Architects have an important role to play in the planning and the resulting investment, implementation, and performance measurement activities and decisions. It is crucial for the EA method to be integrated with the overall planning method of the enterprise. Therefore, CEAF 2.0 adapts the Collaborative Planning Methodology (CPM) described in the [Common Approach to Federal Enterprise Architecture](#) which is designed to support integrated planning, implementation and measurement activities. Over time, this method will be tailored/ simplified to better integrate with the planning methods of the state agencies.

CPM is illustrated in Figure 4-4 below. For detailed descriptions of the phases and steps of the CPM, please refer to the [Common Approach to Federal Enterprise Architecture](#).

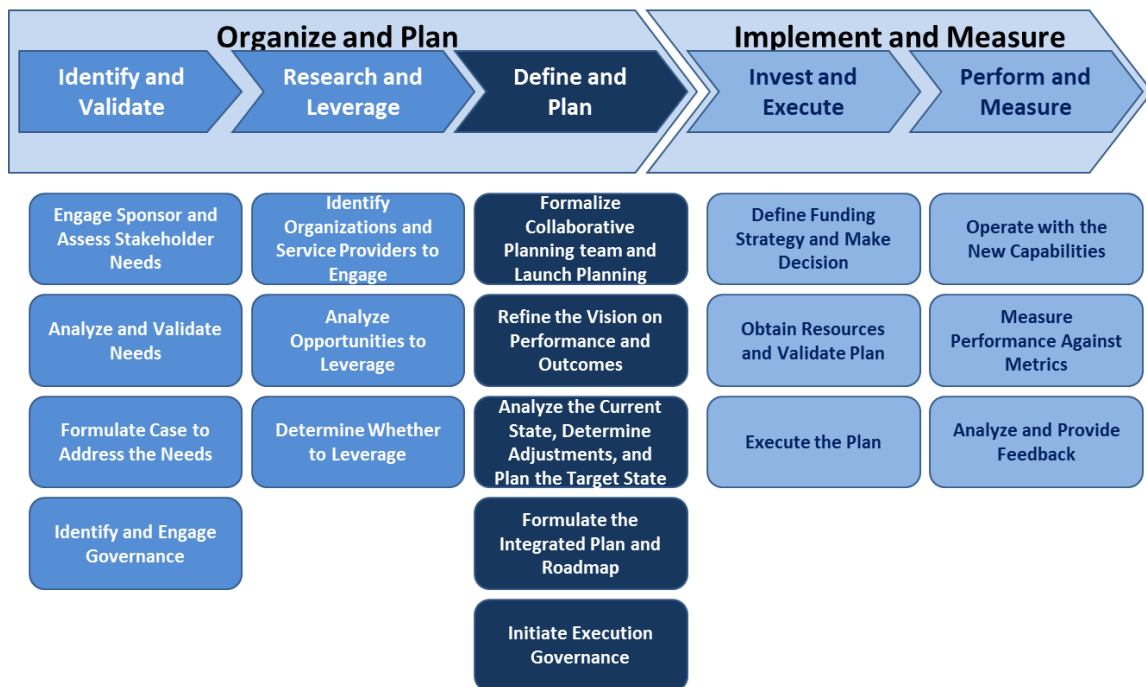


Figure 4-4 Collaborative Planning Method

It should be noted that the above phases and steps encompass the overall planning and implementation at the enterprise level while allowing flexibility to tailor and integrate a detailed methodology for a specific step (e.g., a detailed architecture development method at *Analyze the Current State, Determine Adjustments, and Plan the Target State* step).

4.6 Tools

Enterprise architects, beyond the getting-started stage, are eventually faced with a number of problems beyond the capabilities of office productivity tools. Typical challenges include:

- Managing a large number of artifacts
- Capturing complex relationships between many elements across those artifacts
- Performing gap analysis, impact analysis, scenario planning and modeling
- Presenting appropriate information to stakeholders to support planning and decision-making

Professional-grade enterprise architecture (EA) tools designed to address the above challenges are required to support EA documentation and analysis activities. When used properly, these professional-grade EA tools contribute to improved business outcomes by capturing, integrating, analyzing and communicating information to strategically guide decisions. The tools that an agency selects for use with an EA program should provide the following features:

- Support for standard business, information, applications and technology views (visual representation) and their relationships and ability to decompose the overall architecture and specific architectures into these views
- Modeling capabilities, which support all architecture views including business process models, physical and logical models of information and applications, and physical and logical models of infrastructure, networks, and cloud computing environments
- Support for ArchiMate modeling concepts and notation

- Configurability capabilities that are extensive, simple and straightforward to accomplish, while providing flexibility to modify the content meta model
- Ability to extend to link to strategic goals and transformation projects
- Decision analysis capabilities, such as gap analysis, impact analysis, scenario planning and system thinking
- Presentation capabilities, which are visual and/or interactive to meet the information needs of stakeholders to support planning and decision-making
- Administration capabilities, which enable security, user management and other tasks; preferably in conjunction with the enterprise Identity and Access Management system
- Usability, including intuitive, flexible and easy-to-learn user interfaces. Web-based viewing capabilities are preferable to promote pervasive use of EA
- Built-in repository, configuration management and quality standards

Troux and Rational System Architect were the baseline standard EA tools prior to CEAF 2.0. CEAF 2.0 intends to expand this baseline to include additional tools based on the features they provide (from the above list) – in order to accommodate smaller agencies, facilitate reduction in the total cost of ownership of EA tools, and to promote a standard EA modeling language (e.g., ArchiMate). Such standards will be published outside of this document using the process outlined in Section 4.8.

4.7 Maturity Model

Current industry EA maturity models focus on EA program maturity and assessment. These models are somewhat similar to the Capability Maturity Models used in other disciplines and provide a means to measure, assess, plan and improve the maturity of the EA program. However, due to the breadth of enterprise architecture, these models do not present a *clear relationship between EA program maturity and the maturity of enterprise architecture* itself. A highly mature EA program does not necessarily translate into highly mature enterprise architecture.

CEAF 2.0 distinguishes EA program maturity model from the EA maturity. As a result, it adapts a maturity model for the EA and a maturity model for the EA program. The two maturity models are discussed in the following subsections. Future versions of CEAF will adapt an integrated maturity model which will tie the maturity of an EA program with the maturity of the EA itself.

Please note that the maturity of EA in this context refers to the overall EA, which includes business, information, applications and technology domains. Even with the maturity model for EA, separate evaluation models would still be required for assessing the maturity of business processes and their capabilities, and the maturity of application and technology portfolios.

4.7.1 EA Maturity Model

Many of the processes and systems that an organization has built over time may become obstacles to achieving the strategic goals of the organization. Building future state enterprise architectures to improve program outcomes and drive business forward requires changing core processes, systems and technologies even as the organization depends on those existing processes, systems and technologies to perform its daily business operations. Therefore, organizations need to follow a consistent pattern to plan and build their future state enterprise architectures without affecting daily business operations. This consistent pattern involves progressively maturing the enterprise architecture through four subsequent stages.

The following subsections describe enterprise architecture maturity stages⁵, key learning in each stage and how to use this maturity model in planning the future state enterprise architecture and an enterprise roadmap.

4.7.1.1 Four Stages of EA Maturity

Figure 4-5 shows the following four stages of EA maturity:

- **Business Diversity:** In Business Diversity Architecture stage, organizations look to maximize individual business unit needs or functional needs
- **Standardized Solutions:** In Standardized Solutions Architecture stage, organizations look to achieve IT efficiencies through standardization of solution architectures and corresponding technologies for common domains and, in most cases, with increased centralization of technology management
- **Optimized Core:** In Optimized Core Architecture stage, organizations look to achieve enterprise-wide data and process standardization as appropriate for the operating model
- **Business Modularity:** In Business Modularity Architecture stage, organizations manage and reuse loosely coupled IT-enabled business process components to preserve enterprise-wide standards while enabling local differences

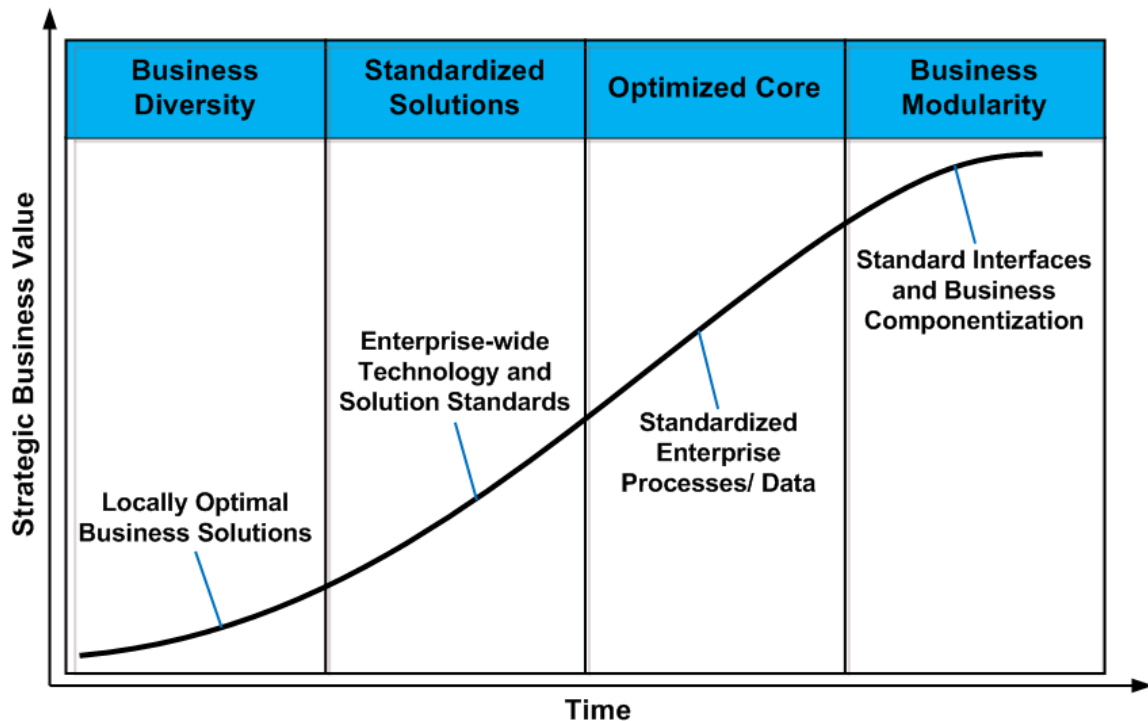


Figure 4-5 Four Stages of Enterprise Architecture Maturity

It is important to note that the target EA maturity can be different for different segments within an enterprise - depending on the operating model in the segment. For example, enterprise architecture segments may be classified into core (common capabilities/processes across many state organizations), common (common capabilities/processes across many business units within one or more state organizations) and distinct (capabilities/processes specific to a state

⁵ Source: Adapted from *Enterprise Architecture As Strategy* published by Harvard Business Press

organization or a business unit within a state organization). Depending on the classification, different target maturity levels can apply.

From the state perspective, the desired target maturity stage for core segments is *optimized core*, and for common segments it is the *standardized solutions*. The distinct segments may also benefit from *standardized solutions*, except when allowing a specific non-standard solution can be justified based on its relative benefits for that segment.

4.7.1.2 Learning in EA Maturity Stages

As organizations migrate through the architecture maturity stages, they shift from a focus on local business unit or functional area optimization to *enterprise-wide* optimization. This evolution has important implications for organizational flexibility as they exchange local flexibility for enterprise-wide flexibility.

In the Business Diversity stage, business unit leaders have full control over their business and IT decisions. From an enterprise perspective, this limits enterprise-wide flexibility.

In Standardized Solutions stage, business units give up some discretion over technical solutions and standards and learn to work within the constraints and benefits of those solutions and standards. While this reduces local business unit level flexibility, the adoption of standard solutions and technologies increases enterprise-wide flexibility by reducing technical complexity, improving maintainability and thus reducing implementation time and risk.

Organizational change is most pronounced in the Optimized Core stage. Local business units lose discretion over core business processes and sometimes over the people and systems that execute them. Enterprise-wide data and process standards disrupt local decision-making patterns. But enterprise-wide flexibility increases as data becomes more transparent and processes become more comparable and predictable.

In the Business Modularity stage, flexibility grows both locally and enterprise-wide. With a solid platform of data, processes, solutions and technologies, organizations can plug-and-play business modules on either level and modular interfaces make changes simpler to implement.

The shifting of flexibility from local business unit or functional area to enterprise highlights the magnitude of change as organizations move through the architecture maturity stages. It is important that both IT and business leaders allow time to manage this change and learn new behaviors to achieve predictable success and realize benefits from architecture maturity. Key learning in each of the architecture maturity stages in six areas is shown in Table 4-3 below.

Table 4-3 Learning in EA Maturity Stages

	Level I Business Diversity	Level II Standardized Solutions	Level III Optimized Core	Level IV Business Modularity
Business objectives	ROI of local business initiatives	Reduced IT costs	Cost and quality of business operations	Speed to market; strategic agility
IT Capability	Local IT applications	Shared technical platforms	Standardized processes and/or data	Plug-and-play business process modules
Funding priorities	Individual applications	Shared infrastructure services	Enterprise applications	Reusable business process components
Who defines applications	Local business leaders	IT and business unit leaders	Senior management and process leaders	IT, business and industry leaders
Strategic implications	Local/ functional optimization	IT efficiency	Business operational efficiency	Strategic agility
Service delivery implications	Response to service requests	Standard platform offerings	Standard application offerings	Reusable business services offerings

It is important to note that, because of the organizational changes encountered at each new stage, skipping stages can have a negative effect if the organizational changes introduced by a stage exceed the organization's capacity for change.

Therefore, it is important to identify the target maturity stage and to plan how to reach that maturity stage through the intermediate stages when planning the future state enterprise architecture and the Enterprise Roadmap.

4.7.2 EA Program Maturity Model

EA Program maturity primarily indicates a level of development of the EA processes, resources, stakeholder support and deliverables. Popular EA program maturity models include the following:

- NASCIO EA Maturity Model
- U.S. Department of Commerce (DOC) Enterprise Architecture Capability Maturity Model (EACMM)
- U.S. Office of Management and Budget (OMB) EA Assessment
- Gartner

While any of the above models can be implemented for EA program maturity assessment, CEAF 2.0 includes an EA Program Maturity Model based on Gartner and NASCIO EA Maturity Models primarily due to their current usage in state agencies. This allows state agencies to easily adopt the CEAF 2.0 Maturity Model.

CEAF 2.0 EA Program Maturity Model consists of five levels of maturity along eight dimensions that are indicative of the overall maturity of an EA program. Figure 4-6 shows these eight dimensions along with a desired maturity level.

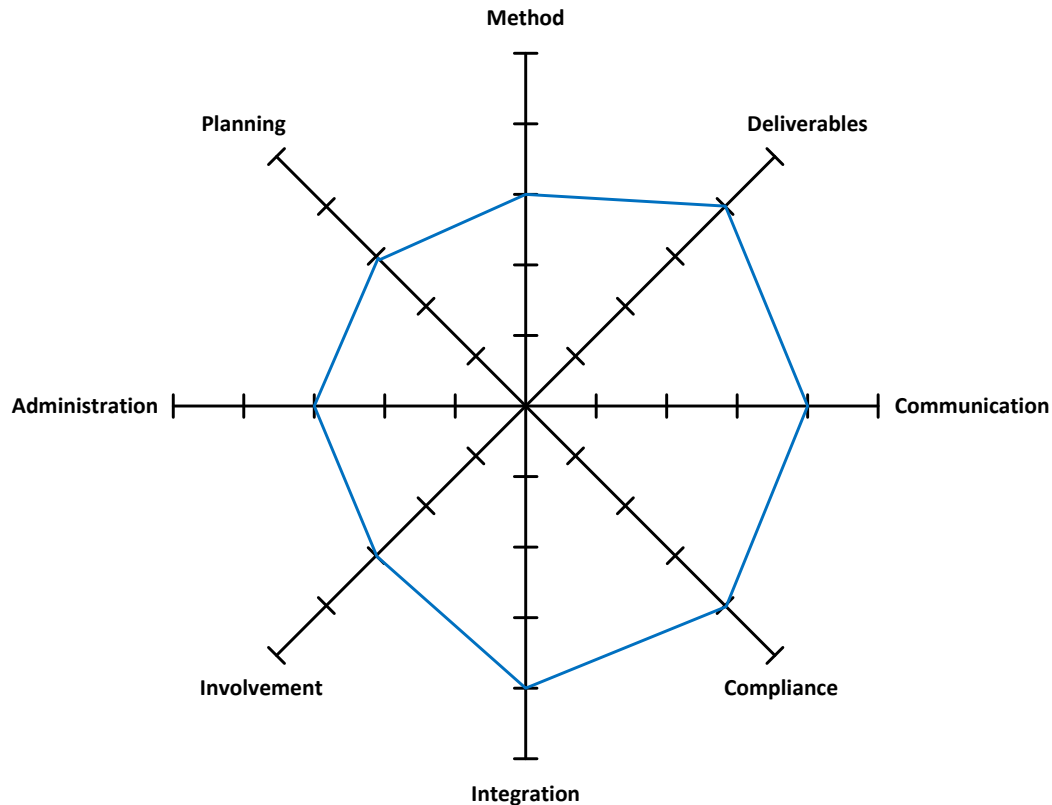


Figure 4-6 CEAF 2.0 EA Program Maturity Model

Descriptions of these dimensions, a set of questions for assessing an organization’s EA program maturity, and recommendations to progressively improve the maturity are provided in the Maturity Scorecard which is available on the EA wiki [here](#).

4.8 Standards

Architectural standards apply to all areas of EA practice and are essential to achieving interoperability and resource optimization through common methods for analysis, design, documentation, and reporting. Without standards, EA models and analyses will be done differently and “likewise comparisons” will not be possible between systems, services, lines of business, and organizations.

In addition to the applicable standards from leading bodies, including the National Institute of Science and Technology (NIST), the Institute of Electrical and Electronics Engineers (IEEE), the International Organization for Standardization (ISO), and the European Committee on Standardization (CEN), CEAF 2.0 includes standards based on the non-proprietary standards and best practices from a number of authoritative sources which support the ability to develop and use architectures within and among state organizations. These standards include the Content Meta Model (described in Section 4.3.4) for EA Models, Reference Models (described in Section 3), Reference Architectures (described in Section 4.8.1), Information Technology Patterns (described in Section 4.8.2), and other standards published through Statewide Information Management Manual (SIMM). These standards contain guidelines and best practices from which all state agencies can benefit from. Some of these standards are or will made mandatory following the process described in Section 4.8.2. State agencies may develop additional

standards to augment statewide standards and bring forward their best practices for consideration to include them in statewide standards so that all state agencies can benefit from them. EAC and ITCEC (see Section 4.9) are key forums to facilitate this.

It is important to note that the EA Models are important standardization elements. These models describe a part or all of an enterprise architecture; they provide the ability to see a hierarchy of views of the organization and/or lines of business that can be examined from several perspectives. Standardizing on ArchiMate as the modeling language for EA models following the Content Meta Model described in section 4.3.4 is under consideration.

4.8.1 Reference Architectures

A *Reference Architecture (RA)* is a template architecture for a specific architectural subject area. It is an abstraction of multiple solution architectures designed and implemented to solve a specific (recurring) business or technical problem in a given problem space. An RA incorporates knowledge, patterns, and best practices gained from multiple successful implementations. RA guides and constrains the instantiations of multiple architectures and solutions.

RA explains the context, goals, purpose, problem being solved and major foundational components (e.g., architecture building blocks) of the architecture at multiple levels of abstraction (conceptual, logical and physical) and provides guidance on when and how RA should be used. It also provides concepts, elements and their relationships that are used to direct/guide and constrain the instantiation of repeated concrete solutions and architectures. Thus RAs serve as a reference foundation for architectures and solutions and may also be used for comparison and alignment purposes. This alignment will facilitate repeatable solutions across state agencies that will lead to shared solutions.

RAs also provide a key mechanism to prevent unchecked acceptance of disparate solutions, diluting the talent pool, and increasing support and maintenance costs. RAs reduce challenges in the ability to leverage solutions across state agencies. For architects, they serve as a key input when creating their agency's future state enterprise architecture. Additional benefits of RAs include risk mitigation, simplified decision making, improved deployment speed and cost reduction.

CEAF 2.0 views RAs as a key part of the EA standards. From a detailed analysis of (available) existing state IT investments and major in-progress programs/projects/initiatives of various state agencies, the following eight architectural subject areas have been identified and RAs for each of these areas at a logical level have been created as part of the CEAF 2.0 effort:

- Identity and Access Management (IdAM)
- Cloud Computing (CC)
- Business Intelligence (BI)
- Master Data Management (MDM)
- Service-Oriented Architecture (SOA)
- Enterprise Application Integration (EAI)
- Enterprise Content Management (ECM)
- eGovernment (eGOV)

These RAs have been documented in separate documents. Please note that the effort to create and harvest reference architectures and other reusable assets is not a one-time event but is an ongoing process of continuous improvement.

4.8.2 Information Technology Patterns

An information technology pattern identifies how a set of technology elements should interact and deploy to best deliver a particular type of concrete solution and architecture to support a particular type of application or system. Since applications and systems have a limited number of “styles” in which they can be implemented and use a limited number of architectural subject areas, a pattern based on reference architectures or a pattern composed of reference architectures such as “E-Business”, “Service-Oriented Architecture”, or “Interoperability Architecture”, defines how technology elements - such as computational resources, networks and system software - will work together to best meet the needs of the application or system in a cohesive and interoperable manner.

In CEAF, information technology patterns will be based on concrete implementations of CEAF 2.0 reference architectures in the state. They are expected to provide the following benefits:

- Ensure individual technology elements and corresponding standards are interoperable and work together in the context of a larger application, system, or a system-of-systems
- Ensure standards are relevant; if a standard/technology is never used in a pattern, perhaps it is not needed
- Reduce technical complexity by reusing patterns and technology components within and across state agencies
- Enhance ability to leverage solutions across state agencies
- Reduce risk, improve deployment speed and reduce support and maintenance costs
- Provide a mechanism for a more accurate estimation of capital and operational expenses
- Simplify information technology purchasing and training needs
- Improve communication of technology trends and issues that affect the state
- Position the state service delivery organizations to leverage cloud computing technologies to provide self-service provisioning capabilities for the *whole pattern* and when feasible to enable these patterns *for multi-tenancy* for sharing of a whole pattern (or topology) as platform-as-a-service

CEAF 2.0 recommends a bottom-up approach for creating these information technology patterns. Using the reference architectures created as part of CEAF 2.0 effort, state departments can create their implementation patterns based on their ongoing projects or recently created or modernized application systems. Those patterns can then be reviewed for consideration as a statewide standard through EAC, ITCEC and COIs.

4.8.3 EA Standards Process

This process develops and maintains statewide EA standards in the areas identified in Section 4.8. The following points describe the steps of the principle-driven EA standards establishment process and the corresponding roles and responsibilities:

- An area for a new statewide EA standard or modifications to an existing EA standard will be identified through several mechanisms including industry trends, advancements in technologies, executive direction, requests for research from ITC, EAC and other state forums. State EAC will perform preliminary research and determine if the standard should be pursued or not. At this stage the standard will be in “Researching” status
- EAC will form a Working Group under the direction of the EAC chair and develop a draft standard and supporting documentation. At this stage the standard will be in “Proposed” status

- The proposed EA standard will then be reviewed by the EAC or the EA Policy Working Group (if the standard is identified to be enforced through policy). At this stage the standard will move to “EAC Review” status
- When EAC approves the standard, it will move to “EAC Approved” status. Otherwise, the above two steps will be repeated until EAC approves the standard
- A standard approved by EAC will then be submitted for executive approval. Executive approval process follows the policy life cycle which involves Policy Steering Committee approval and State CIO approval. The standard will remain in “Executive Approval” status until it is approved by the State CIO (or designee)
- Upon executive approval, the standard will be published through an IT Policy Letter and/or SIMM updates. At this stage, the standard will move to “Published” status

State agencies may follow a similar process at agency level for internal agency EA standards when agencies need to augment statewide standards for internal purposes.

4.9 Governance

Governance identifies the planning, decision-making, and oversight processes and groups that will determine how the EA is developed, verified, versioned, used, and sustained over time with respect to measures of completeness, consistency, coherence, and accuracy from the perspectives of all stakeholders.

Figure 4-7 shows the recommended EA governance structure. It depicts the following:

- Recommended structure for the development and governance of a state agency’s EA deliverables (right segment of Figure 4-7 under *Agency/Department Architecture Development*)
- Recommended structure for the development and governance of a Cross-Agency or Statewide Initiative’s (referred to as CAI) architecture deliverables (middle segment of Figure 4-7 under *CAI Architecture Development*)
- Recommended structure for providing Statewide Framework and Process Support to the CAIs and to the agencies including policies, standards and other support processes (left segment of Figure 4-7 under *Framework and Process Support*)

Main groups/stakeholders involved in EA governance at agency, CAI and state level are described below along with their specific role in EA.

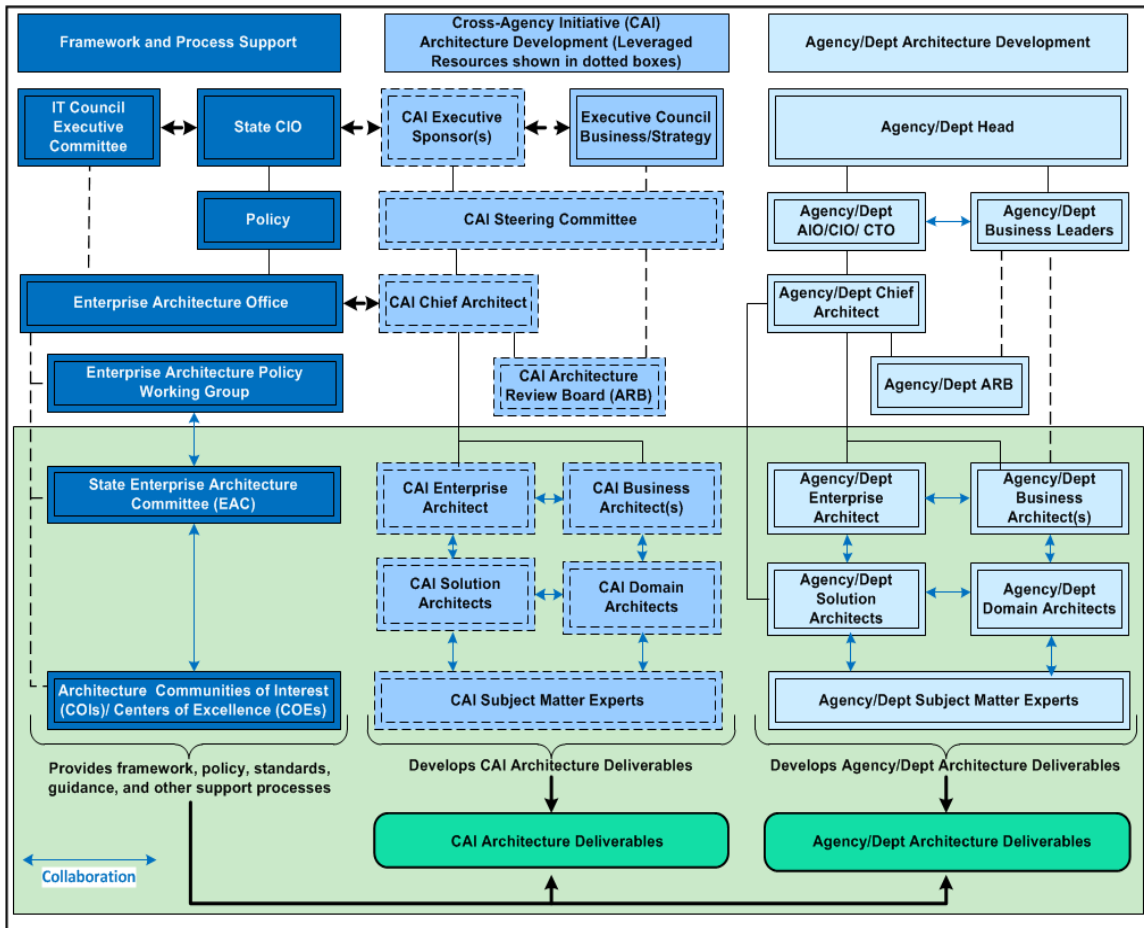


Figure 4-7 California Enterprise Architecture Governance

State Chief Information Officer

Senior advisor to the Governor with full responsibility and authority for statewide technology vision, strategic planning and coordination, technology policies and standards for secure technology solutions, technology architecture, technology acquisition, project management and defining a streamlined technology project review and approval process.

Enterprise Architecture Role

- Provides strategic direction to the Enterprise Architecture Office and Enterprise Architecture Committee
- Advocates and educates information technology stakeholders (Agency heads, Legislature, Governor's office) on enterprise architecture and its benefits
- Markets the benefits of enterprise architecture via collaborative forums
- Obtains participatory commitment from state executives
- Selects members of the California Information Technology Council Executive Committee
- In collaboration with Business Executive Council (or a similar leadership function), decides which CAIs to undertake and selects an Executive Sponsor for those CAIs

California Information Technology Council Executive Committee

California Information Technology Council Executive Committee (ITCEC) advises the State Chief Information Officer on matters related to information technology in the California Executive Branch, including the development of statewide information technology strategic plans and the adoption of enterprise-wide information technology standards and policies.

Enterprise Architecture Role

- Charters the Enterprise Architecture Committee
- Ensures alignment with the California State Information Technology Strategic Plan
- Identifies policy gaps and recommends areas for enterprise architecture policy development and/or standards
- Reviews and approves all enterprise architecture policies and deliverables

Committee Composition

The California ITCEC membership represents stakeholders in the Executive Branch's Information Technology program, including stakeholders from several constitutional offices, the state's support agencies (Department of Finance, Department of General Services, Department of Personnel Administration and the state data centers), Agency Information Officers, departmental Chief Information Officers, the judiciary and local and federal governments.

Enterprise Architecture Office

The California Enterprise Architecture Office is led by the State Chief Enterprise Architect and is responsible for the statewide enterprise architecture framework, processes, standards including reference architectures, and investment reviews for compliance with statewide architecture standards and vision.

Enterprise Architecture Role

- Create and maintain the California Enterprise Architecture Framework and principles
- Create and maintain statewide EA-related policies
- Provide education on California Enterprise Architecture Framework, Standards and Policies
- Chair the Enterprise Architecture Committee and facilitate adoption of California Enterprise Architecture Framework, Standards and Policies.
- Facilitate creation and maintenance of Reference Architectures and Reusable Assets
- Serve as state's lead advisor on Enterprise Architecture and Information Technology Initiatives
- Selects members of the California Enterprise Architecture Committee and Enterprise Architecture Policy Working Group
- Facilitates statewide architectural collaboration through EAC and COIs
- May lead architecture development for a CAI

Enterprise Architecture Committee

The Enterprise Architecture Committee (EAC) was created by the California ITCEC to promote California Enterprise Architecture Framework and Standards. The primary goals are to develop a statewide enterprise architecture framework that will promote comparable architectures across the State Government which will be more useful in managing change and enabling mission success with a lower total cost of ownership, faster time to delivery, and reduced duplication. The Enterprise Architecture Committee manages the enterprise architecture process and directs the Enterprise Architecture Working Groups.

Enterprise Architecture Role

- As the Steering Committee for the California Enterprise Architecture, develops strategy, performs planning and allocates resources
- Assists with the creation and maintenance of the California Enterprise Architecture Framework and principles
- Charters, sponsors, and oversees the work of the Enterprise Architecture Working Groups, including the coordination between the groups
- Reviews and presents enterprise architecture policies and deliverables for review and approval by the ITCEC
- Provides education on California Enterprise Architecture Framework and Standards
- Works with other California Information Technology Council for alignment and consistency with the California Enterprise Architecture Framework and Standards
- Promotes adoption of California Enterprise Architecture Framework, Standards and Policies

Committee Composition

Members consist of key architects, information technology and business subject matter experts from various departments and agencies, and key information technology stakeholders. Members are recommended by the California Information Technology Council and are selected by the Enterprise Architecture Committee Chair.

Enterprise Architecture Policy Working Group

The Enterprise Architecture Policy Working Group is accountable to the Enterprise Architecture Committee Chair. This group collaboratively develops EA-related policies.

Enterprise Architecture Role

- Assist with the creation of statewide EA-related policies
- Perform internal reviews of EA-related policies and revisions thereof
- Present EA-related policies to EAC and coordinate EAC reviews to achieve buy-in and approval
- Coordinate presentation of EA-related policies to ITCEC and through the ITCEC review process until approval

Team Composition

Enterprise Architecture Policy Working Group is composed of selected members of the EAC. These members are typically the Agency/Department chief architects but other members of EAC may volunteer to participate in the Policy Working group or be nominated by the ITCEC and selected by the EAC Chair.

Architecture Communities of Interest

The Architecture Communities of Interest (COIs) are groups of architects and other information technology and business subject matter experts that have common interest in a particular architecture area which may include an architecture domain, standard or reference architecture, segment, line of business or a CAI. COIs meet, discuss and share information on this architecture area including best practices and lessons learned to help advance that architecture area so that all state agencies can benefit from it.

Enterprise Architecture Role

- Help advance an enterprise architecture area through collaboration so that all state agencies can benefit from those advancements

Team Composition

COIs are composed of architects and other information technology and business subject matter experts from various departments and agencies. Members are typically volunteers who have a common interest in a particular architectural area.

CAI Executive Sponsor

The State CIO, in collaboration with Business Executive Council (or a similar leadership function), selects an Executive Sponsor (or a Project Executive) when a Cross-Agency Initiative to develop and implement a shared system, service or an IT platform that would benefit multiple state agencies. The CAI Executive Sponsor has full responsibility and authority to implement the CAI.

Enterprise Architecture Role

- Develops the CAI vision
- Selects a Chief Architect for the CAI
- Establishes a CAI steering committee

CAI Steering Committee

For each CAI, the CAI Executive Sponsor will establish a steering committee. The steering committee will be charged with oversight and visioning of the architecture for the CAI. Committee membership will be at the executive level (with attendance at meetings by designees allowable). The CAI Executive Sponsor will chair these steering committees.

Enterprise Architecture Role

- Establishes an Architecture Review Board (ARB) for that CAI with recommendations from the CAI Chief Architect
- Approves all architecture deliverables for the CAI

CAI Chief Architect

The CAI Chief Architect is responsible for:

- Managing the CAI architecture development
- Chairing the CAI Architecture Review Board
- Ensuring that the CAI Architecture Review Board contains members with appropriate skill sets depending on the architecture domain
- Promoting the adoption of CEAF 2.0 and its standards including reference architectures for the CAI architecture development
- Serving as a conduit for collaboration with EAC to identify improvements to CEAF based lessons learned and successful experiences and to expand reference architectures, standards and other reusable assets so that all state agencies can benefit from them

CAI Architecture Review Board

The CAI Architecture Review Board will review all architecture deliverables and ensure that all work is completed in order to achieve the CAI level strategic goals and architecture vision. They

will also monitor the CAI project(s) to make sure the implementation is progressing in accordance with the architecture and all applicable standards.

CAI Architecture Team

The CAI architecture team develops the CAI architecture deliverables. This team will be composed of (leveraged) employees in various roles and with various skill sets depending on the mission scope, size and complexity of the CAI. The key roles that are part of this architecture team include Enterprise Architect, Business Architect, Solution Architect, and other Domain Architects. Other information technology and business subject matter experts assist this team in one or more specific technologies and/or business processes.

Agency/Department Chief Architect

The Agency/Department Chief Architect is responsible for:

- Managing the Agency/Department EA Program
- Coordinating Agency/Department architecture projects
- Chairing the Agency/Department Architecture Review Board
- Ensuring that the Agency/Department Architecture Review Board contains members with appropriate skill sets depending on the architecture domain
- Promoting the adoption of CEAF 2.0 and its standards including reference architectures in the Agency/Department
- Serving as a conduit for collaboration with EAC to identify improvements to CEAF based lessons learned and successful experiences and to expand reference architectures, standards and other reusable assets so that all state agencies can benefit from them
- Achieving Agency/Department executive support for the EA program and intergroup collaboration

Agency/Department Architecture Review Board

The Agency/Department Architecture Review Board will review all enterprise architecture deliverables and ensure that all work is completed in order to achieve the Agency/Department level strategic goals and architecture vision. They will also monitor Agency/Department transformation projects to make sure the individual solution and domain architectures are aligned with the target enterprise architecture and all applicable standards.

Agency/Department Architecture Team

The Agency/Department architecture teams will develop the Agency/Department EA deliverables. This team will be comprised of employees in various roles and with various skill sets depending on the mission scope, size and complexity of Agency/Department EA. The following key roles are part of the architecture team:

- Enterprise Architect: In coordination with the Chief Architect, Enterprise Architect works with executives, managers, other architects and subject matter experts to identify requirements and enterprise level architectural solutions in all domains and segments/ lines of business
- Business Architect: In coordination with the Chief Architect and other architects, Business Architect works collaboratively with stakeholders to create, improve, or re-engineer business processes. Business Architect is the primary interface between business leaders

and the architecture team. Business Architect in collaboration with the Enterprise Architect serves as a conduit to communicate business needs and goals to the architecture team and architecture capabilities to improve business processes and program outcomes to the business leaders

- **Solution Architect:** In coordination with the Chief Architect, and/or an Enterprise Architect, Solution Architect works collaboratively with stakeholders to create a detailed solution to meet business and technical requirements for a specific program, project, or initiative.
- **Other Domain Architects:** In coordination with the Chief Architect and other architects, Domain Architects work collaboratively with stakeholders to perform architecture analysis and provide architectural designs in their domains (e.g., Data, Technology, Infrastructure, Security)
- **Subject Matter Experts:** Although not directly part of the architecture team, Agency/Department information technology and business subject matter experts contribute to the EA deliverables by providing subject matter expertise to the architecture team in one or more specific technologies and/or business processes.

The work of the architecture teams will be organized and led by the Agency/Department Chief Architect.

4.10 Metrics

Metrics will be finalized after the rest of the framework is reviewed and accepted in concept. The following description reflects the current thought process on metrics. This is intended to facilitate further discussions and activities of EAC to finalize the metrics.

One of the top challenges for EA practitioners is demonstrating the business value of enterprise architecture. Enterprise Architecture is still an emerging practice. Less than 44% of EA practitioners have any defined metrics⁶.

Most EA practitioners focus metrics on EA operational activities which measure *business value* in terms of *EA activities* or “*doing EA*”. While some of these metrics (e.g., EA maturity assessments, stakeholder surveys, projects and deliverables) are important for EA practitioners to track and measure their own activities to ensure that they are progressing EA, these metrics may mean little to senior executives. Effective EA programs should communicate and demonstrate the value of EA, by focusing on how EA enables the organization to meet business outcomes that matter to senior executives. The difficulty in communicating and demonstrating the value of EA in terms of business outcomes arises from the fact that these business outcomes are actually achieved by the transformation projects rather than directly by EA. The impact of EA on business outcomes is indirect, and for EA to take direct credit for positive outcomes would be a misrepresentation of the role of EA.

It is important to recognize the role of EA is to plan the future state EA, develop an Enterprise Roadmap in collaboration with other planners, and provide guidance and advice to transformation projects. Therefore, Enterprise Architects must position their impact on the business outcomes in terms of their influence on which transformation projects are identified, initiated, and how these transformation projects are directed in alignment with the future state EA and the Enterprise Roadmap.

⁶ Source: *EA Business Value Metrics You Must Have Today*, Gartner Research Note, Published: 23 January 2013.

EA metrics will include key operational metrics for internal use by EA practitioners and business value metrics that communicate and demonstrate the value of EA as an “enabler” of business outcomes to senior executives.

4.11 Reporting

Reporting will be finalized after the rest of the framework is reviewed and accepted in concept. The following description reflects the current thought process on reporting. This is intended to facilitate further discussions and activities of EAC to finalize the reporting.

The reporting function of an EA program is important in maintaining an understanding of current capabilities and future options. Providing a repository of architecture artifacts, plans, solutions, and other information is not enough for effective reporting. Periodic reporting on capabilities, options and progression of enterprise architecture in a standardized way is important to demonstrate value and sustain executive support for the EA program.

Effective reporting will be based on EA services, outcomes that matter to executives, and the requirements of Project Approvals and Project Governance. Reporting integrates with internal EA program communications.

Reporting elements under consideration are:

- An Annual EA Plan, detailing how the overall EA is planned to be developed in segments, current status and progress to-date
- Enterprise Roadmap (partial, complete for a segment, or complete for the organization)
- EA Program Maturity Scorecard
- Business Process Maturity Scorecard
- Portfolio Rationalization Results
- Catalog of Reusable Services and Assets
- Reference Architecture Technology Standards Matrix
- Candidate Reference Architectures

5 Enterprise Architecture Services

Enterprise Architects facilitate and support a common understanding of needs and help formulate recommendations to meet those needs. They contribute to the development of a plan of action that is grounded in an integrated view of not just technology planning, but the full spectrum of planning to include mission/business planning, application portfolio planning, security planning, infrastructure planning, capital planning and human capital planning.

Enterprise Architects enable this collaborative planning, and work with specialists and subject matter experts from these planning groups in order to formulate a plan of action. The plan of action should not only meet needs but be also implementable within existing financial, political, and organizational constraints. In addition, Enterprise Architects have an important role to play in the investment, implementation, performance measurement activities, and decisions that result from this integrated planning⁷.

The level and breadth of the Enterprise Architect's involvement in planning - and ultimately in the creation of an enterprise roadmap and in providing guidance to transformation projects - requires EA work to be consistently defined so that the EA programs across state agencies are consistently positioned to support the achievement of business outcomes that matter. Therefore, to facilitate consistent and uniform implementation of the EA program across state agencies, CEAF 2.0 recommends that the state agencies charter their Enterprise Architecture teams to provide the services listed below:

1. Assist with Business Strategy and IT Strategy
2. Portfolio Rationalization
3. Future State (Target) EA Planning and Actionable Roadmap (Enterprise Roadmap) Development
4. Project Prioritization to help Drive Business Forward and Improve Program Outcomes
5. Assist with Concept and Business Case Development
6. Standards Establishment and Governance
7. Solution Architecture Guidance and Oversight
8. Harvest Reference Architectures and Reusable Assets

This *service-oriented approach to EA work* is intended to increase the focus of EA programs on mission effectiveness while taking the confusion out of what EAs do and should do. The context for these eight services is illustrated in the Figure 5-1. Detailed descriptions of these eight services including guidance to provide these services are provided in the following subsections.

⁷ Source: [The Common Approach to federal Enterprise Architecture, May 2, 2012](#)

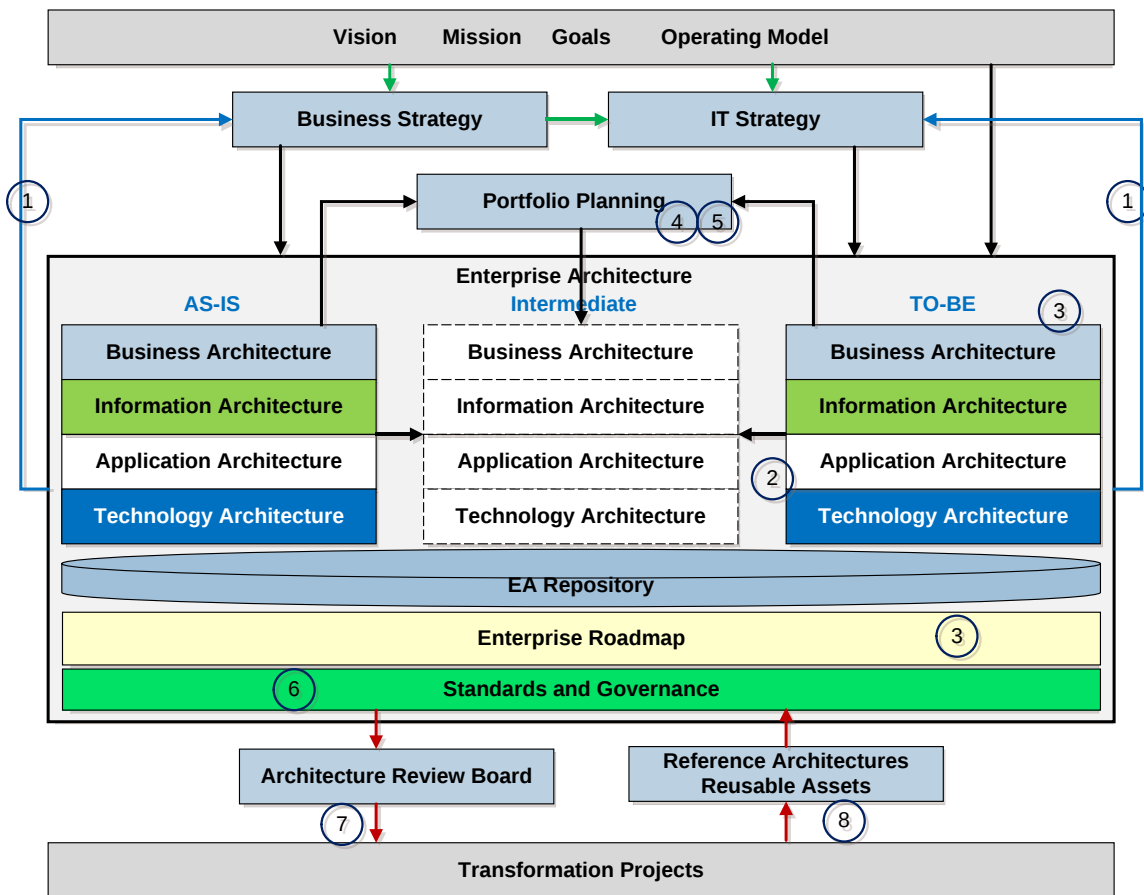


Figure 5-1 Enterprise Architecture Services Context

5.1 Assist with Business and IT Strategies

Business Strategy articulates the *direction* a business/organization will pursue and *specific actions* it will take to achieve its goals. It results from *goals established* to support the stated mission of the business/organization.

IT Strategy focuses on how *IT will help the business achieve its goals*. It also helps *guide the business strategy based on IT capabilities and opportunities*. IT strategy determines the contribution of IT to delivering on the business strategy.

IT strategy aligns with business strategy when IT capabilities support the business capabilities that are needed to execute the business strategy and have the flexibility to accommodate business strategy changes.

Strategic direction becomes clearer when it is expressed as defined target enterprise architecture and *strategies* become actionable when they are expressed as a portfolio of planned projects to be executed in a defined sequence. Therefore, creation of enterprise architecture deliverables (i.e., target enterprise architecture and enterprise roadmap) is a necessary first step towards realizing the business and IT strategies. Hence, EA involvement in strategy formulation is beneficial to both the organization and its EAs. This is the reason why *Assisting with Business and IT Strategies* is listed as a key EA service in CEAF 2.0.

Enterprise Architects *assist with* the development of Business and IT Strategies as follows:

- Identify strengths, weaknesses, opportunities and threats from the business and technology environmental scans and develop transformation ideas as input to the enterprise business strategy
- Advise business leaders on where and how technology can support the business transformation and where technology can be an inhibitor
- Provide inputs on opportunities to improve business process maturity and thus enhance enterprise business capabilities
- Provide inputs on IT capabilities and performance (e.g., cost of ownership vs. business value) and opportunities to improve IT capabilities and performance to better support business transformation
- Facilitate IT strategy align with business strategy

By assisting with the development of Business and IT Strategies, Enterprise Architects learn the following and use them as inputs to provide subsequent EA services:

- Learn the organization's Operating Model as this model drives the target enterprise architecture.
- Learn the business priorities as these priorities drive intermediate architecture, portfolio planning and project prioritization
- Learn the funding constraints and priorities as these indicate where to focus EA efforts on and how to align Enterprise Roadmap with these constraints and priorities

5.1.1 Operating Model

Operating Model is the necessary level of business process integration and standardization in a given organization⁸.

Based on the necessary level of business process integration and standardization, an organization's Operating Model falls into one of the four Operating Models illustrated in Figure 5-2 below.

The Operating Model of the organization *drives* the target enterprise architecture. It is also the Operating Model that influences which Reference Architectures are applicable in a given context and to what degree. For example, in a Diversification Operating Model, there is very little need to share data; in such a case, a solution such as an *enterprise-level Master Data Management* serves very little purpose. Taking into account this aspect of the organization - as captured in the applicable Operating Model - is vital for creating viable target enterprise architecture.

⁸ Source: Adapted from *Enterprise Architecture As Strategy* published by Harvard Business Press

Four Operating Models

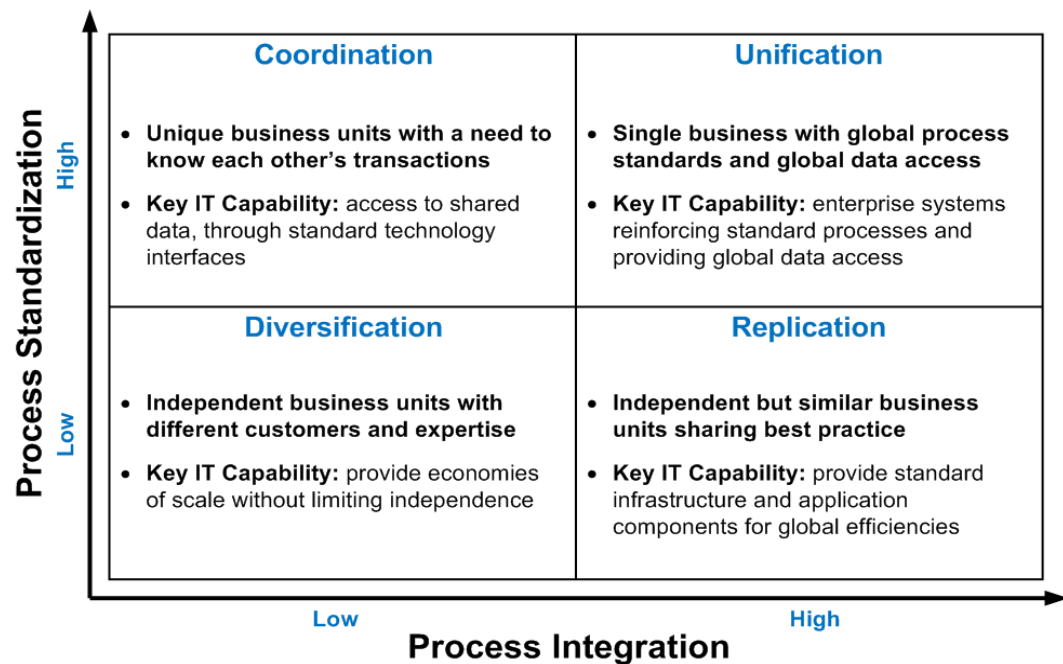


Figure 5-2 Enterprise Operating Models

5.2 Portfolio Rationalization

Portfolio Rationalization aims to *analyze and restructure* the complete set of applications in an organization. It involves *assessing and evaluating* the existing portfolio and *planning actions* to streamline the portfolio in order to achieve the following:

- Improve efficiency
- Reduce complexity
- Lower Total Cost of Ownership

Streamlining portfolio is accomplished by the following:

- Retiring aging and low business value applications
- Modernizing aging and high business value applications
- Eliminating redundant applications and technologies
- Standardizing on common technology platform
- Consolidating the applications either physically, logically, or both

In the context of Enterprise Architecture, carrying out Portfolio Rationalization involves the following steps:

- Develop the business process model (of the business architecture):
 - Identify the maturity level of each business process.
 - Capture business capabilities and processes to identify redundancies, gaps and inefficiencies in the portfolio.
 - Use this information and the learning from assisting with the business and IT strategies to *prioritize the areas for focus*.
- Understand the Operating Model and Target Architecture Maturity (see Section 4.7.1)
- Understand/develop architecture principles and standards

- Develop future state architecture vision
- Define a strategy and scope for PR
- Rationalize the portfolio (Inventory and Map, Analyze and Recommend)

The portfolio rationalization results (recommended actions) can be depicted as shown in Figure 5-3 below.

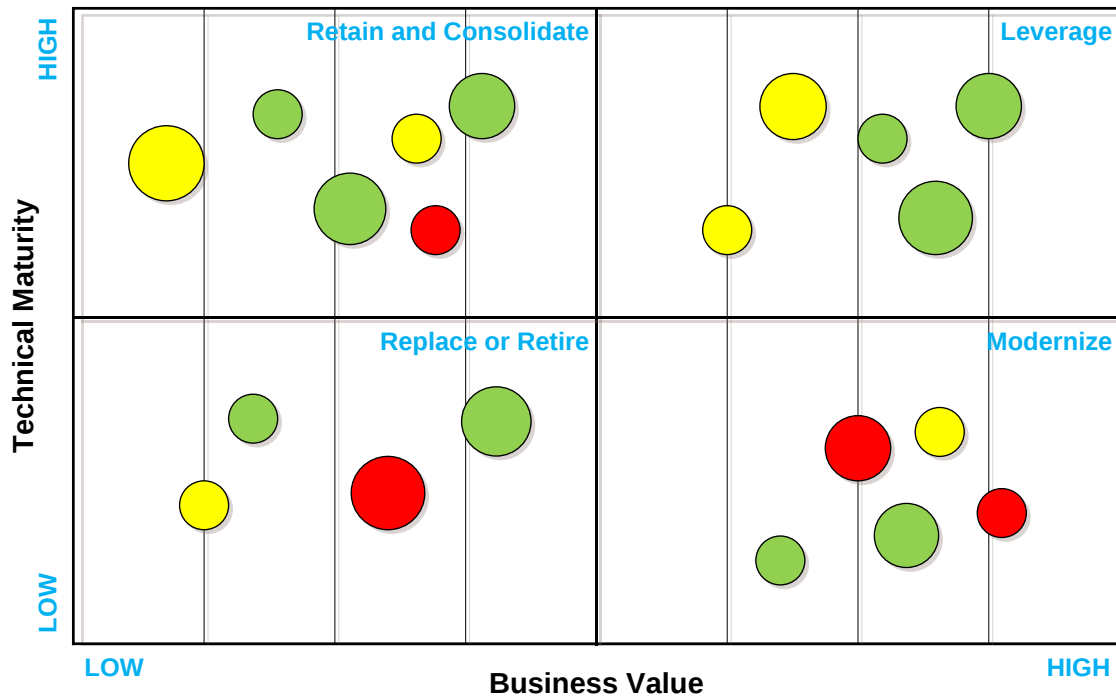


Figure 5-3 Portfolio Rationalization

In Figure 5-3, colored circles represent specific systems or applications subjected to rationalization. The color of the circle indicates operational expense (red – high relative to the size of the system, yellow – medium relative to the size of the system, green – low relative to the size of the system), and the size of the circle indicates the relative size of the system or application.

5.3 Target EA and Enterprise Roadmap

Target Enterprise Architecture describes the desired capability and structure of future state Enterprise Business Processes, Information, Applications, Information Technology Infrastructure and how they support the strategic business objectives of the organization.

Enterprise Roadmap, also known as Sequencing Plan, provides a step-by-step process (an actionable road map) for evolving the enterprise from its existing baseline architecture to the target architecture through a set of interdependent activities and incremental builds (or projects) by taking into account:

- The business priorities
- Opportunities with greatest potential payoff for the organization
- Actions identified in Portfolio Rationalization

- Budgetary and other constraints

For more information on Enterprise Roadmap, please refer to Section 4.3.3.

5.4 Project Prioritization

IT investments should be justified on the basis of the benefits from the business transformations they enable to help drive business forward and improve program outcomes. To make sure every dollar invested in implementing changes to business processes and/or IT assets provides the best possible return on investment in terms of the business outcomes, every project undertaken should be *aligned with the future state EA and the enterprise roadmap*. Project prioritization should be based on opportunities with greatest potential payoff for the organization.

Enterprise Architects, as the primary authors of the future state EA and the enterprise roadmap should assist their organizations in prioritizing projects in accordance with the criteria described above. State organizations with existing processes for project prioritization (e.g., through Program or Project Management Office processes) should integrate EA and leverage EA services for more effective prioritization of projects to align with the future state EA.

5.5 Assist with Project Concept and Business Case

Project approval processes typically require a clear description of the project concept and its business case explaining the desired outcome, business benefits and how they will be measured. Enterprise Architects, based on the services they provide, are uniquely positioned to assist business and IT leaders with the Project Concept and Business Case development.

Project concepts and business cases can be more complex to describe in more mature EA stages where projects are undertaken to create IT capabilities, standardized processes and/or shared services. They require knowledge of overall enterprise roadmap to clearly communicate the business case to those project review/approval groups that may not be familiar with the enterprise roadmap of the proposing agency.

5.6 Standards Establishment and Governance

Standards establishment encompasses the following areas:

- Product standards including best practices for product configuration
- Reference architectures
- Implementation patterns
- Best practices

Standards establishment should augment and drive the reference architectures describing how specific products can be combined to deliver a cohesive, cost effective and sustainable solution. The standards should promote *controlled innovation* to balance advancements in technology with an organized, business-oriented technology *planning and governance effort*.

Governance ensures alignment of projects and initiatives with the future state architecture and enterprise roadmap. It also ensures adherence to standards and reference architectures. Governance includes an EA solution review and approval process for all new architecturally significant projects and initiatives. An Architecture Review Board (ARB) at the organization level and/or state level will perform architecture reviews to ensure alignment.

5.7 Solution Architecture Guidance and Oversight

The relationship between a particular solution architecture and Enterprise Architecture, and the need to provide guidance, oversight and/or facilitation in the solution architecture design requires the tactical/project involvement of the Enterprise Architects. This allows Enterprise Architects to perform the following:

- Make sure the project specific solution architectures are aligned with the future state EA, reference architectures and their implementation patterns
- Be abreast of any specific capabilities required in individual solutions to promote controlled innovation while taking those innovations back to the reference architectures for broader use
- Contribute to complex or otherwise architecturally significant solutions when EA skills enhance the success of the projects
- Ensure the transformation projects are best positioned to deliver their assigned outcomes, and business and IT objectives

EA involvement in solution architecture design and oversight is also intended to assist the specific project management team achieve predictable success in their projects. It helps balance project management and technical leadership. Maintaining this balance throughout the project life cycle is a *key* for the success of transformation projects.

5.8 Harvest Reference Architectures and Reusable Assets

Reusable assets include the following:

- Reference Architectures - they simplify decision making, improve deployment speed, reduce cost and mitigate risk. Reference Architectures facilitate repeatable solutions leading to shared solutions. They provide a key mechanism to prevent unchecked acceptance of too many different solutions, diluted talent pool, challenge in the ability to leverage solutions across agencies and the state, and increasing support and maintenance costs.
- Shared Services
- Best Practices, including guidelines for a given area of activity (e.g., design, software construction, or testing) and tools to diagnose conformance with the guidelines
- Solution Documents, including a record of design decisions and related applied design patterns
- Code Fragments illustrating a design pattern, best practice, or relevant guidelines
- Logical Data Models and Information Exchange Package Documentations

State-wide focus on identifying (during project approval), tracking (during execution) and harvesting reusable assets can significantly contribute to the following:

- Reduced IT project costs
- More predictable success of IT projects
- Reduced operational costs
- Reduced risk
- Faster delivery
- Growing the talent pool

Agency leaders should charter their EAs and broader architecture teams to create these reusable assets at their organization level and share them through the EAC and COI channels to benefit other state agencies. Agency Information Officers can play a significant role in promoting

the creation and use of reference architectures and reusable assets with assistance from the Agency-level and their constituent department-level EAs.

6 Target Architecture Vision

Figure 6-1 below shows the state level target architecture vision. It does not show an all-inclusive target architecture of the state, but rather it is intended to serve *three main purposes* described below:

- Serve as a “model” for state agencies and as a key input to the agency architects when creating their agency’s target enterprise architecture
- Serve as a communication tool which depicts the *federated model* of the agency- and state-level target enterprise architectures
- Serve as a communication tool which depicts how Reference Architectures can be used as *building blocks* in creating an agency’s target architecture as well as state level target architecture for shared platforms, services and systems

The federated model of the target architecture is an important part of the vision. On one hand, it enables state agencies to realize synergies and efficiencies across diverse business units. On the other hand, it allows for business unit autonomy when it is the best course of action. The key distinction present in the model is the distinction among *distinct, common, and core elements* of the architecture.

When considering business operations, the distinction helps analyze existing business processes – so that they can be classified into *distinct, common and core* processes based on the business drivers and strategic goals:

- Distinct business processes are *specific to a business unit* with little to no integration or coordination with the processes of other business units. For example, business processes associated with Debt Management, Debt Collection, and Construction Management capabilities may be viewed as distinct business processes in the context of state business operations. Special purpose custom or COTS applications typically support these business processes and, in some cases, may benefit from enterprise-wide standardized technologies and shared services.
- Common business processes are those that are *common to some (but not all) business units*. For example, business processes associated with Customer Relationship Management, Inventory Management, and Supply Chain Management capabilities may be viewed as common business processes in the context of state business operations. From state perspective, these common business processes may be found across several state agencies. In target architectures, these common business processes will be supported by standardized solutions or shared enterprise applications at agency and/or state levels. Standardized solutions focus on the standardization of the overall application structure, deployment topology, tools and technologies while allowing variations of business logic and rules with the objective of controlling technical diversity and sharing platforms. In contrast, enterprise applications focus on sharing all components of the underlying architecture (business processes, applications, data sources and technology) while protecting access to information based on “ownership” rules.
- Core business processes are those that are *common to all business units*. For example, business processes associated with Finance, Human Resources Management, and Procurement capabilities may be viewed as core business processes in the context of state business operations. From state perspective, these core business processes may be found across several state agencies. In target architectures, these core business processes will be supported by shared enterprise applications at agency and/or state levels.

The standardized solutions and shared platforms illustrated in Figure 6-1 are intended to communicate the position and applicability of Reference Architectures in the target architecture. The approach of using Reference Architectures to facilitate repeatable solutions, possibly leading to identification and implementation of shared solutions, *will continue to evolve*. It is likely that additional Reference Architectures, for more architecture areas (including the areas of Business Architecture), will be created and integrated into the target architecture to progressively move towards higher levels of integration and sharing across business units.

It should be noted that the goal of the federated model is not to impose that everything must be standardized, centralized and/or shared. Although the future state enables more of standard and shared solutions at the *common or core levels* of the state organizations, the decisions as to which solutions should be treated as standardized, shared, or common, should be driven by the business operating model, the business strategy, and the desired business outcomes.

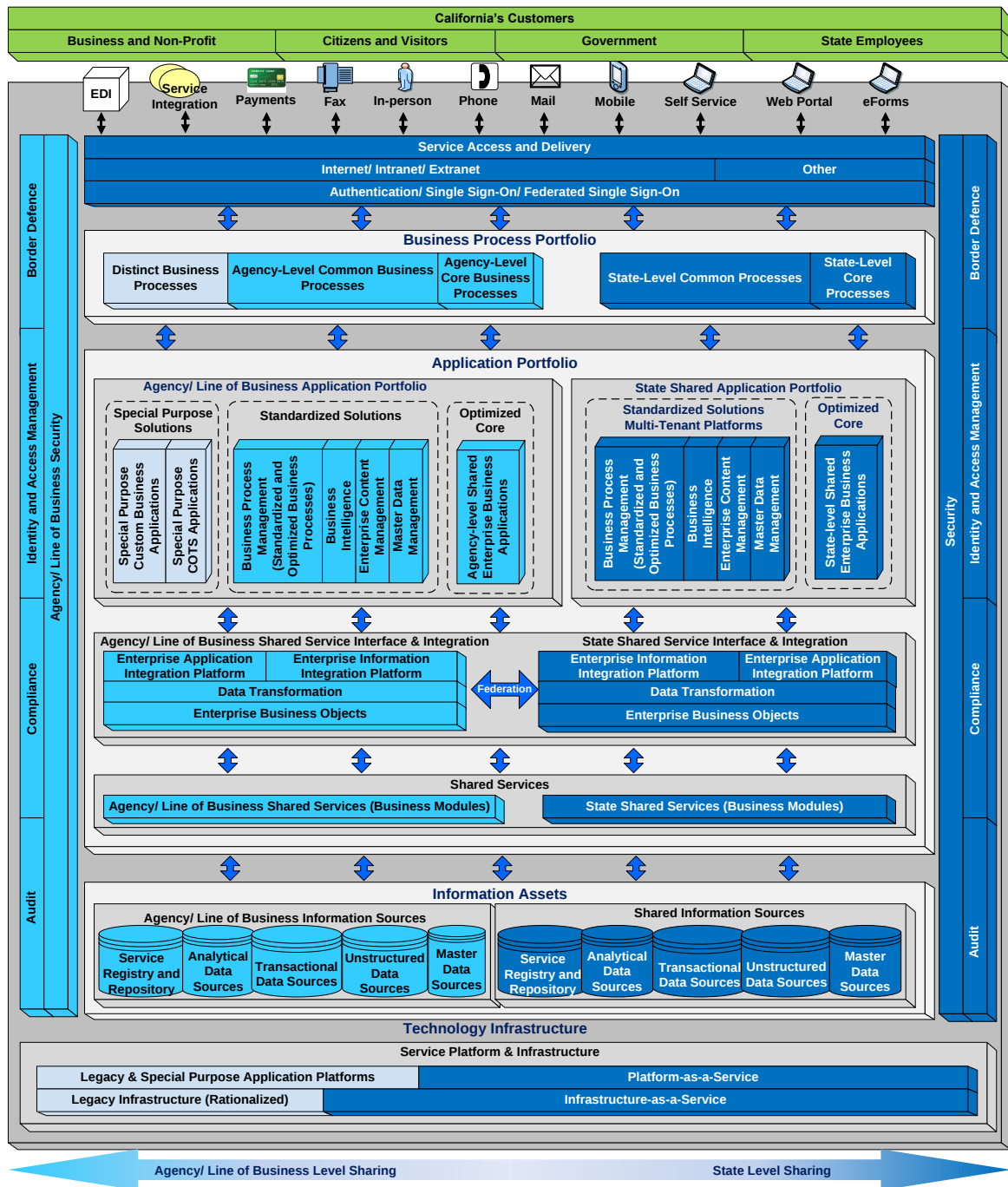


Figure 6-1 Target Architecture Vision

With reference to Figure 6-1, the progression of the target architecture as envisioned is described below:

- As state agencies advance the maturity of their enterprise architectures, special purpose custom and COTS applications and their infrastructure (application and technology) will be limited to distinct business operations which do not require data sharing and coordination

- with other business operations. These special purpose applications would still share some business services and technical services such as those provided by a common infrastructure
- As the agency enterprise architectures mature, they implement standardized solutions (including their implementation patterns and technologies) for common business capabilities/ processes. These solutions include Business Intelligence, Enterprise Content Management, and Master Data Management. These solutions improve consolidation and standardization of data and reduce data redundancies. They also create the foundation for further progression of enterprise architecture by creating standardized capabilities for interoperability through enterprise-wide application and information integration platforms, and enterprise business objects (application neutral enterprise data model). When these solutions and corresponding platforms are standardized, Agencies can share them among their constituent departments thereby eliminating or reducing the need for duplicate investments and enhancing their workforce capabilities to better support them. As this progression continues, state can implement multi-tenant platforms and solutions for state-level sharing (through CAIs) and automate service management by leveraging cloud computing technologies.
 - Further enterprise architecture maturity will lead to standardized core and support business processes within and among state Agencies. Business process management solutions at Agency and State level support sharing of processes and data within the departments of a state Agency and among Agencies. Intra- and inter-agency shared business services will increase and interoperability reaches an optimal state.
 - With the capabilities created through standardized solutions, optimized core processes, interoperability, and increased shared business and technical services, state agencies achieve architectural agility to improve business operations, dynamically respond to customer needs and statutory changes by reaching a maturity level where business and technical services can be assembled to create new and/or improved business services. State agencies will achieve an advanced and cross-organization extended Service Oriented Architecture (SOA)

This target architecture vision represents a long-term vision for evolving the enterprise architecture in the State of California. It must be stressed that this target cannot be realized quickly, or without collaboration, or without long-term focus. Intra- and inter-agency collaboration is critical for achieving higher levels of enterprise architecture maturity and realize the corresponding benefits.

The following steps provide guidance to develop or align implementation strategies for transformation projects, and to facilitate advances in the maturity of enterprise architectures described above:

- Architecture drivers, dependencies and the capabilities of ongoing transformation projects will be used to determine the selection of the architecture areas to create statewide standardized solutions
- Reference architectures will be integrated into these projects to provide guidance to their solution architecture efforts. Implementation patterns of current reference architectures and additional reference architectures for common capabilities will be harvested as reusable assets based on best-practice implementations. Principles-based decision-making will be used in the creation of these implementation patterns. Principles reduce conflict and help progress by focusing discussions away from specific organization or technology preferences and by allowing fully supportable and consistent statewide decisions

- Collaboration with technology service providers (such as state Data Center Service) will enhance state's capabilities to provide the above implementation patterns (whole pattern, its topology and technologies rather than individual computational resources) as standard services as multi-tenant platforms or repeatable platforms that can preferably be provisioned through automation using cloud computing technologies
- This collaboration continues to analyze agencies' enterprise roadmaps to identify and undertake cross-agency initiatives to develop shared solutions to further reduce duplication, improve time to deployment, reduce future operational expenses while facilitating progressive transformation of California to a citizen-centric, results-oriented, and cost effective government

Successful implementation of the California Enterprise Architecture Framework requires strong and effective collaboration at all levels among state agencies. When EA is viewed as authoritative by agency leadership, and the agency leadership facilitates collaboration, then EA becomes a catalyst for the agencies to remain agile and effective even with limited resources at their disposal.

7 Glossary

Applications Architecture – Describes the structure and behavior of the major kinds of application systems, their key components, their interactions, and their relationships to the core business processes.

Architecture – A set of design artifacts, or descriptive representations, that is relevant for describing an object such that it can be produced to requirements (quality) as well as maintained over the period of its useful life (change) [John Zachman & adopted by the Federal Chief Information Officer Council].

Architecture Drivers – The external component of the California Enterprise Architecture representing an external stimulus, which causes the enterprise architecture to change. Architecture drivers consist of two sub-components: business and design drivers.

Architecture Product – The structure of components, their interrelationships, and the principles and guidelines governing their design and evolution over time. Architecture products include Business Process Models, Data Models, Application Models and Technology Models [IEEE STD 610.12 and adopted by Federal Chief Information Officer Council].

Architecture Segment – Focus on a subset or a specific business area within the enterprise. It can be considered to be an event-driven process, such as grants, that crosses the enterprise and has commonality of process, data, components, and technology. Each architecture segment is composed of current and target architectures, limited in scope by the focus of the segment.

Business Architecture – Defines the business strategy, organization, business capabilities and key business processes which realize those business capabilities.

Business Drivers – A type of architecture driver that identifies the strategic business needs an information technology environment must support.

Business Reference Model (BRM) – A taxonomy of common (shared) mission and support service areas for categorizing the business operations of the State of California independently of the agencies that perform them.

California Enterprise – Defined as those agencies, departments, boards, bureaus and commissions within the Executive Branch of California government. However, the California Information Technology Council and the State Chief Information Officer may choose to expand the scope of the California Enterprise to include entities in other branches, cities, and counties.

Current Architecture – Represents the current state or baseline architecture for the enterprise. In terms of the California Enterprise Architecture Framework, the current architecture includes business, information, application, and technology.

Data Reference Model (DRM) – A taxonomy used to describe the context for information exchanges and the type of data entities and attributes that support an enterprise's business operations.

Design Drivers – A type of architecture driver that identifies a technology change that can represent revolutionary ways of meeting state business needs.

Enterprise – An organization supporting a defined business scope and mission. An enterprise is comprised of interdependent resources (people, organizations, and technology) that should

coordinate their functions and share information in support of a common mission (or set of related missions) [Treasury Enterprise Architecture Framework].

Enterprise Architecture – A strategic information asset base, which defines the mission; the information necessary to perform the mission, the technologies necessary to perform the mission, and the transitional processes for implementing new technologies in response to changing mission needs; and includes a baseline architecture, a target architecture, and a sequencing plan [Federal Enterprise Architecture Framework].

Enterprise Architecture Principles – Represent the criteria against which all potential investment and architectural decisions are weighed.

Federal Enterprise Architecture Framework (FEAF) – The Federal Enterprise Architecture Framework is an organizing mechanism for managing development, maintenance, and facilitated decision-making of the Federal Enterprise Architecture. The framework provides a structure for organizing federal resources and for describing and managing Federal Enterprise Architecture activities.

Federated Enterprise Architecture – Defines common or shared architecture standards across autonomous program areas, enabling federal government entities to maintain diversity and uniqueness, while providing interoperability [Federal Enterprise Architecture Framework].

Framework – A logical structure for classifying and organizing complex information [Federal Enterprise Architecture Framework].

Goals and Objectives – Part of the strategic direction describing opportunities to accomplish the vision.

Information Architecture – Describes the fundamental organization of the data assets and data management resources that support an enterprise's business processes and enabling application systems.

Information Management – The planning, budgeting, manipulating, and controlling of information throughout its life cycle [Federal Chief Information Officer Council].

Information Technology Patterns – Identifies how a set of technology elements should interact and be deployed to best deliver particular types of applications or systems.

Line of Business – The purpose of government in functional terms and the support functions the government must conduct in order to deliver services to citizens.

Methodology – A documented approach for performing activities in a coherent, consistent, accountable, and repeatable manner [Treasury Enterprise Architecture Framework].

Principles – Statements that guide design decisions, serve as a tiebreaker in settling disputes, and provide a basis for dispersed, but integrated, decision-making.

Reference Model – A classification taxonomy for understanding significant relationships among the entities of some environment, and for the development of consistent standards or specifications supporting that environment. A reference model is based on a small number of unifying concepts and may be used as a basis for education and explaining standards to a non-specialist [Federal Chief Information Officer Council].

Segment – A targeted line of business that typically slices through all four architecture domains.

Service Component Reference Model (SRM) – A classification taxonomy that allows an organization to identify and categorize its existing and/or proposed application components and services provided by those components to support the execution of business processes and maintain the information.

System – A collection of components organized to accomplish a specific function or set of functions [IEEE STD 610.12].

Target Architecture – Represents a desired future state or "to be built" architecture for the enterprise within the context of the strategic direction. In terms of the California Enterprise Architecture Framework, the target architecture includes business, information, application, and technology.

Technical Reference Model (TRM) – A taxonomy that allows an organization to identify and categorize its existing and/or proposed technologies and standards to support and enable the delivery of application services and components.

Technology Architecture – Describes the logical software and hardware capabilities that are required to support the deployment of business, information, and application services. This includes IT infrastructure, middleware, networks, communications, processing, and standards.

Transitional Processes – These processes support migration from the current architecture to the target architecture.

Vision – A succinct and strategic statement describing the targeted end state for the architecture in five years. The vision provides strategic direction and is used to guide resource decisions, reduce costs, and improve mission performance.

8 References

Documents

1. State of California, *California Information Technology Strategic Plan*, 2013 Update
2. State of California, California Performance Review Report
3. Chief Information Officers Council, *Federal Enterprise Architecture Framework*, Version 1.1, September 1999
4. Chief Information Officers Council, *A Practical Guide to Federal Enterprise Architecture*, Version 1.0, February 2001
5. [A Common Approach to Federal Enterprise Architecture](#), May 2, 2012
6. Federal Enterprise Architecture Program Management Office, *The Business Reference Model*, Version 3.0
7. Federal Enterprise Architecture Program Management Office, *The Service Component Reference Model*, Version 2.3
8. Federal Enterprise Architecture Program Management Office, *The Technical Reference Model*, Version 2.3
9. Federal Enterprise Architecture Program Management Office, *The Data Reference Model*, Version 2.0
10. *Enterprise Architecture As Strategy*, Harvard Business Press
11. *ArchiMate 2.0 Specification*, The Open Group
12. *EA Business Value Metrics You Must Have Today*, Gartner Research Note, January 23, 2013
13. *Rechartering EA*, Corporate Executive Board, Annual Executive Retreat, November 16, 2012, Sacramento, CA
14. *Enterprise Architecture Capability Maturity Model*, United States Department of Commerce, December 10, 2007
15. *NASCIO Enterprise Architecture Maturity Model, Version 1.3*, NASCIO, December 2003
16. *ITScore for Enterprise Architecture*, Gartner, September 17, 2010

Web Sites

1. California State Chief Information Officer, California Information Technology Council, Committees <http://www.cio.ca.gov/ITCouncil/Committees/Committees.html>
2. The Open Group Architecture Framework (TOGAF) 9.1, <http://pubs.opengroup.org/architecture/togaf9-doc/arch/>
3. Medicaid Information Technology Architecture (MITA), <http://www.medicaid.gov/Medicaid-CHIP-Program-Information/By-Topics/Data-and-Systems/Medicaid-Information-Technology-Architecture-MITA.html>
4. National Institutes of Health (NIH) Enterprise Architecture, <https://enterprisearchitecture.nih.gov/Pages/homepage.aspx>

9 Document History

Table 9-1 Document History

Release	Description	Date
1.0 Final	Final version approved by the IT Council at the July 15, 2005 meeting.	July 15, 2005
2.0 First Draft	Initial draft of CEAF 2.0 from the State EA Office for Enterprise Architecture Committee review	April 22, 2013
2.0 Second Draft	Second draft of CEAF 2.0 from the State EA Office with updates based on EAC review comments	May 17, 2013
2.0 Final Draft	Final draft of CEAF 2.0 with updates based on the review comments from third-party research organizations	June 17, 2013
2.0 Final for Executive Approval	Final CEAF 2.0 for executive approval with updates based on additional review comments from third-party research organizations and the Policy Steering Committee	July 18, 2013
2.0 Final	Final CEAF 2.0 with updates based on comments from the State CIO	August 01, 2013