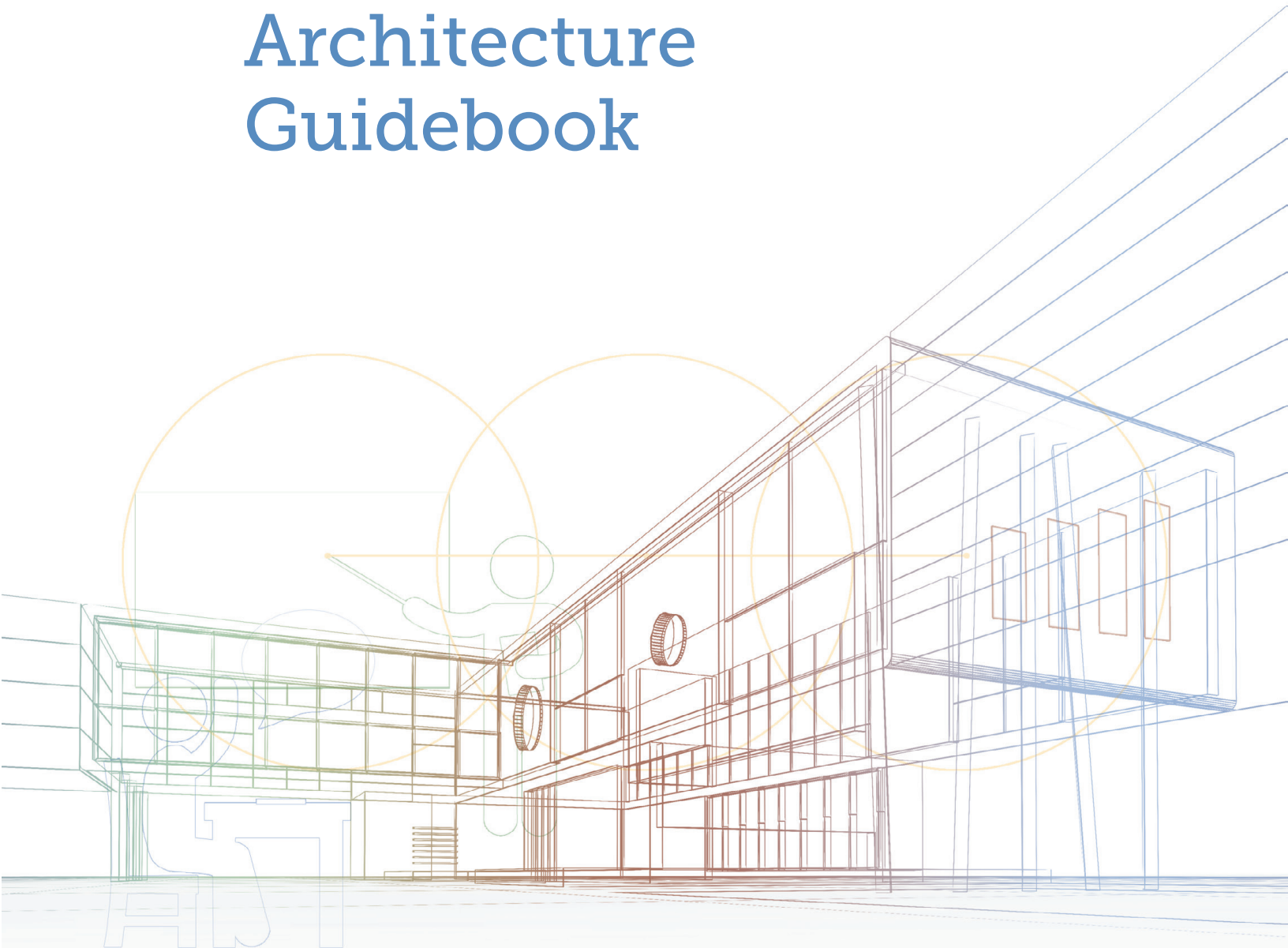




Education Enterprise Architecture Guidebook



March 2014

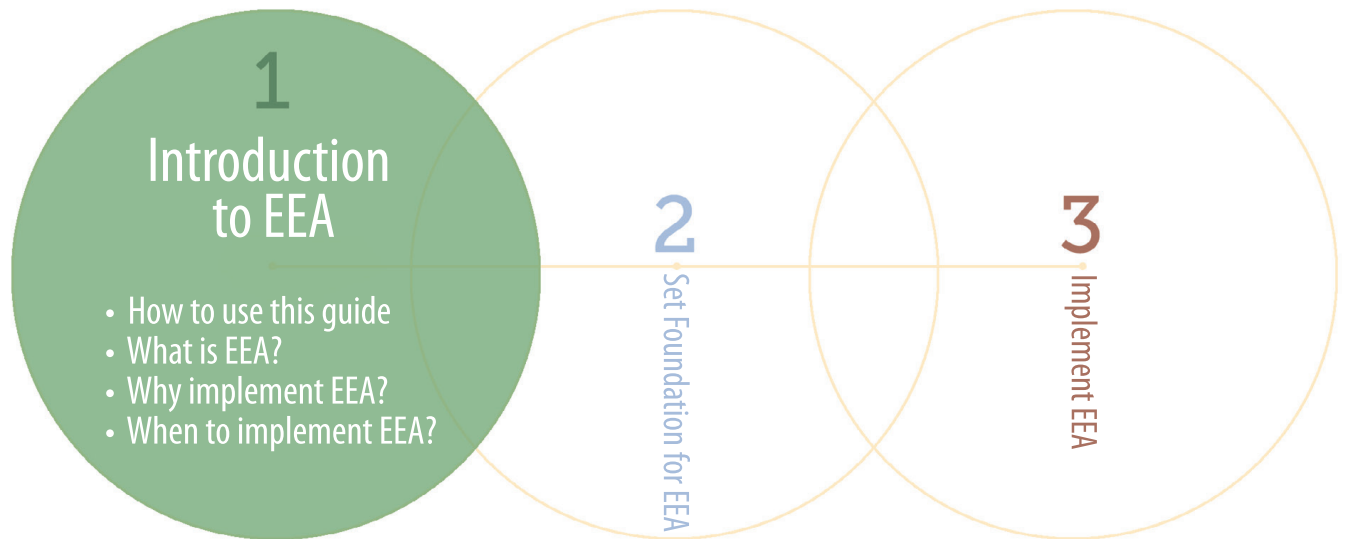
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The Reform Support Network, sponsored by the U.S. Department of Education, supports the Race to the Top grantees as they implement reforms in education policy and practice, learn from each other, and build their capacity to sustain these reforms, while sharing these promising practices and lessons learned with other States attempting to implement similarly bold education reform initiatives.

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Section 1. Introduction to Education Enterprise Architecture



How to Use This Guidebook

This guidebook will help the staff members of education agencies gain an understanding of what Education Enterprise Architecture (EEA) is and how it can help an agency accomplish its vision and goals. The audiences for this guidebook include agency staff already charged with leading agency-wide planning and implementation that encompasses the program side as well as data and technology elements. Chief information officers (CIOs) may use this guidebook to communicate the value of EEA to executive leadership and to develop a plan for establishing EEA in their agencies. Agency chief executive officers (CEOs) may pass this guidebook on to their CIOs and other teams responsible for planning EEA, such as the project management oversight committee, data governance policy group and strategic or performance management team. Program staff can read this guidebook to learn about EEA fundamentals and the importance of their roles in defining the business goals, strategies and processes that determine the data and technology requirements.

Section 1 describes the components and processes necessary to develop and implement an EEA blueprint. Its purpose is to help the leadership and staff members

of education agencies gain an understanding of what EEA is and how it can help an agency accomplish its vision and goals. It explains the value that EEA can bring to an education agency environment and equips readers with the foundational knowledge, practical steps and useful tools to begin implementing the framework.

Section 2 examines how an agency would go about establishing a foundation for an EEA implementation. It explains the four “architectures” that are components of EEA. It then considers establishing a vision and architecture principles to guide EEA implementation and define its scope. This is followed by a more detailed look at the steps of the process, including documenting the current and future states, conducting a gap analysis and devising the implementation plan. Lastly, the section considers several forms of governance for EEA.

Section 3 walks through one example of a segment architecture approach to EEA, beginning with determining scope, creating a project plan, and documenting current and future states.

What is Education Enterprise Architecture?

Education enterprise architecture, or EEA, is a strategic framework that can provide the structure, plan and processes to achieve an education agency's vision and goals by aligning its business and program side with information technology (IT). Developing and implementing an EEA blueprint—to integrate where the education agency is today, where it wants to be in the future and how it is going to achieve that future state—maximizes resources and expertise, sustains reforms and supports schools and classrooms.

Architecture... a unifying or coherent form or structure

[merriam-webster.com](https://www.merriam-webster.com/dictionary/architecture)

Why Education Enterprise Architecture?

Every State education agency (SEA) and local education agency (LEA), like any other complex organization, must develop an efficient and cost-effective set of structures for collecting, retaining and sharing information to accomplish its mission and goals. Yet today, education agencies face more frequent and fundamental policy and program reforms, even as they increasingly rely upon information to implement these reforms. They need to coordinate investments in people, processes and technology across the agency and ensure relevance to educational goals and stakeholders—and sustainability. The concept of enterprise architecture, borrowed from the business sector, offers a way to do so.

Scenario 1: An Agency Success Story

The Arizona Department of Education (ADE) has adopted the key disciplines around enterprise architecture. The ADE reached out to a diverse group of stakeholders that includes local teachers and administrators to gain an understanding of their education business and program needs. ADE is moving aggressively to fill these needs with a carefully architected blueprint for the future that spans from the classroom to the State department of education in its collection and presentation of data. The effort is called the Arizona Education Learning and Accountability System (AELAS). It establishes a comprehensive future-state architecture that includes services to the schools and LEAs as well as the SEA. It is an enterprise architecture approach that is service-oriented, providing districts with the option to use State-supported systems to reduce their costs of buying and managing these components individually. The architecture is enlightened by emerging best practices and trends in education, borrowing architecture components from other SEAs where appropriate.

The ADE documented a comprehensive business case for AELAS, which established a total net benefit of \$176.5 million over five years. These benefits are possible because of the centralized, opt-in service-oriented strategies developed as part of the overall future architecture.

LEAs, as well as the business community, support AELAS. The Maricopa County Education Service Agency partnered with ADE to establish the business need and served as a successful pilot site and avid supporter.

A natural extension of an agency's strategic planning, EEA offers a blueprint to map and align educational objectives, strategies, roles and responsibilities, data and technology. The objectives specified by the strategic plan often rely on IT components to become reality and to provide data for performance metrics. Planning for long-range sustainability especially benefits from the documentation of processes and clarification of ownership and responsibilities, which are elements of EEA. EEA is also a tool for cost-efficiency, reducing duplicative expenditures and achieving better return on investments. (See Appendix A for further description of benefits, from The Open Group Architecture Forum.)

Benefits of EEA¹

- More effective change management
- More planning for sustainability
- More efficient IT operations
- Better return on investment
- Faster, simpler and cheaper procurement

When IT is engaged from the outset, an agency's program planning and decisions about instructional technologies gain the advantages of timely collaboration and identification of concerns and solutions—incorporating those discussions through EEA offers one approach to doing so. The role of technology in teaching and learning inside and outside the classroom is expanding exponentially: planning statewide delivery of instructional resources, providing assistive technology tools, developing curriculum maps aligned to College and Career Readiness Standards, administering State and local Web-based assessments and using e-textbooks, for example. With EEA as the management tool, SEAs and LEAs can: (1) strategically focus technology on effective teaching, transformed learning and increased student achievement; and (2) effectively integrate technologies with aligned staffing, expertise, services, processes and organizational capacity throughout the agency.

¹ From The Open Group Architecture Forum (TOGAF). Welcome to TOGAF Version 9.1, an Open Group Standard. <http://pubs.opengroup.org/architecture/togaf9-doc/arch/index.html>

When Is the Time to Implement Education Enterprise Architecture?

Deciding that the time is right to implement EEA may happen either in an agency's ordinary course of business or in anticipation of a major reform opportunity. The regular cycle of strategic planning offers an opening to introduce EEA as a strategic management technique that may significantly strengthen the previous strategic planning approach. This decision may be reinforced by recognition within the agency that current trends in education—reforms, school and family reliance on data, proliferating technologies, new instructional and assessment strategies (many technology-based), online and open source resources—warrant a new, more comprehensive approach to strategic planning.

A planned reform initiative, such as personalized learning or blended learning or evidence of a serious issue on the horizon, may also inspire an agency to implement EEA. A few of the contemporary opportunities and/or problems that can benefit from EEA include the following:

- The planned launch of a major reform initiative that will require a lot of coordination to develop strategies, policies, processes, services and organizational capacity, will also require data systems to support these. Examples might include adopting a new set of instructional standards, moving to blended learning, flipping the classroom, personalizing instruction to the student level, and next generation assessments.
- A desire to better organize the availability and timeliness of data to meet instructional needs. EEA provides a good structure for exploring the strategies, policies, processes, services and organizational capacity required to accomplish this and define the data systems.
- A desire to coordinate program decisions to achieve better planning and anticipation of budgetary impacts on the organization and the technology systems.

- A desire to ensure that IT solutions are compatible and integrate with (for example, share data with) applications used elsewhere in the agency.
- Planned growth in the adoption and use and complexity of new technologies makes it more critical for planning and purchasing to occur within an organized, integrated structure.
- A desire to ensure that information solutions consistently support the agency's processes or meet the needs of its stakeholders—administrators, teachers, parents and students.
- A desire to better integrate, or in some cases eliminate, redundant sources or silos of data (from separate, non-integrated systems) that may hinder the likelihood that teachers will access and use the data to improve instruction.
- A desire to ensure that an agency's systems provide end users with the information they need and a user-friendly format.

Recognition that such opportunities are occurring or producing serious consequences may encourage an agency's decision makers to accept the introduction of EEA.

Prerequisites?

The right time for implementing EEA is also influenced by the agency's readiness for it. What conditions are necessary?

The active endorsement of the agency's leadership is critical—the agency's CEO understands the essential principles and functions of EEA and champions both EEA and the staff members to whom he has delegated the work. The CIO has a key leadership role in implementing EEA and is both knowledgeable and committed to it. These leaders, and others if appropriate, publicly state their commitment to EEA, to the people responsible for its day-to-day operations and to the intention of acting on the recommendations that evolve from the process. The agency's executive leadership endorses and champions the vision and principles created for EEA.

Agency leadership must also assign staff to manage EEA—staff who have the roles, responsibilities and

Is the Agency Ready for EEA?

1. Can the leadership (CEO and cabinet) become excited about and supportive of EEA?
2. Is there an important initiative that can be a key focal point and beneficiary of EEA—such as a major reform effort (for example, personalized learning, blended learning, etcetera)?
3. Has the organization shown a willingness to embrace the characteristics essential to successful EEA—such as strategic planning, process improvement, teamwork across departments and a desire for high quality information?
4. Is there knowledge of EEA within the organization or readily accessible in the local business community that can assist with initial planning, organizing and communicating an EEA launch?
5. Are there resources within the organization that can be assigned to help coordinate and facilitate an EEA effort?

expertise to carry it out. These staff members should also have the training, time, access to personnel and systems and other resources to sustain the work. In addition, regular two-way communications between the agency's leadership and EEA staff will ensure that the work stays on target and deals with issues as they arise. EEA, whether agency-wide or more focused, cannot be conducted effectively without practical support from management and teamwork and collaboration across the organization.

Lastly, the process of EEA requires assembling an array of resources, ranging from budgets, to strategic plans, to metadata. (See Appendix B for a detailed list.) Since assembling some of these resources occurs before EEA begins, the leadership will reserve staffing and time for the task.

Scenario 2: A Segment Architecture Success Story

In 2003, the superintendent for a large North Carolina urban school district established aggressive goals for improving overall student achievement, closing the achievement gaps between groups of students and raising the achievement of already high-performing students. A set of strategies were established for achieving these goals, which included:

- Use of data analytics to identify trends, weak curriculum and needs for professional development;
- Use of a common curriculum with well-defined scope, sequence and schedule;
- Use of benchmark assessments to determine progress at key intervals in the year; and
- Dispatching rapid response teams to assist the schools based on the results of the data.

The school district designed these strategies and related processes and tools to fit together, align to the original goals and form a larger architecture that worked seamlessly in the classroom and informed decision making from the school administrator to the superintendent. This is an example of segment architecture for teaching and learning. The strategies, processes and tools were developed, implemented and used to successfully improve student achievement, monitoring the progress in timely increments from the benchmark data. The accountability office took the lead role for this work, with information technology playing only a support role.

At the time, the concept of EEA was not yet established, but this initiative offers a classic example of a carefully designed, comprehensive architecture, built around a reform that addressed the organizational as well as the technical and information requirements for meeting the stated goals. Good leadership can accomplish reform such as this without necessarily implementing the discipline of EEA. However, consistently replicating such a success for future efforts and helping all leaders to be capable of coordinating and executing to such a high level, requires the type of discipline that can be found in EEA.

Scope?

Small is an option. The scope of EEA is up to the agency to determine; it is not by definition an agency-wide process. Agencies can define the scope to make it manageable and focused on the key areas that would most benefit—and gradually increase the architecture scope over time. New reforms, notably those that require significant organizational change and revisions or expansions of data systems, may offer a starting point.

Conducting “segment architecture” is one way to manage the scope of an EEA effort. Segment architecture focuses on one reform initiative or service area of an agency. For example, an agency could use a reform initiative such as an educator effectiveness system as the catalyst for conducting a segment architecture.

Segment architecture, however, encompasses all the frameworks and processes of a full EEA effort and sustains the big-picture architecture vision even while focusing on the segment. Architecture principles and data and technology standards established for the segment should align with the agency’s overall strategy and set precedents for future architecture work. (For further discussion, see Section 3.)

Cost Savings?

Similar to other management disciplines—like strategic planning, project management, and continuous process improvement—EEA can lead to substantial savings when performed well. The cost savings can be difficult to quantify, but identifying areas where savings are possible is straightforward:

- Savings from identifying and reducing duplicate systems. Education agencies often maintain multiple systems that perform similar functions. This is especially true on the instructional side. Eliminating, or avoiding a purchase up front, can have significant savings.
- Avoiding lost costs, missed opportunities and time wasted from major initiatives gone awry. It is not uncommon to find a major system housed within an education agency, such as a longitudinal data system or a learning management system, which has seen little or no productive use a year or more after the system's implementation. EEA can ensure that the functional specifications are understood before acquiring such systems, so that the systems are actually used and useful.
- Identifying areas for collaboration and teamwork in designing, acquiring and implementing new systems and processes. Often, departments within an organization, or education agencies across a State, have similar needs that can be met in a more cost-effective manner when the organizations collaborate through EEA. Such is the case in the AELAS scenario.

Scenario 3: A Cost Savings Success Story

In establishing AELAS, the ADE documented significant returns from an enterprise approach to designing systems. The department made certain investments in time and money to make these returns possible:

- Hiring an enterprise architect to design and oversee the implementation of the AELAS system.
- Establishing a data quality director and identifying data stewards.
- Hiring contract resources for the development of an AELAS business case and capturing the business needs.
- Establishing project and process management disciplines in the department.

The costs represented by these investments in EEA were in the range of 1 to 2 percent of the potential return. EEA has the potential to return many times the investment of time and money to an agency by avoiding the purchase of redundant systems, using good purchasing practices, spurring collaboration in the use and acquisition of systems, and reducing integration costs. This is demonstrated by the AELAS effort and documented in the AELAS business case.

Section 2. Setting the Foundation for EEA

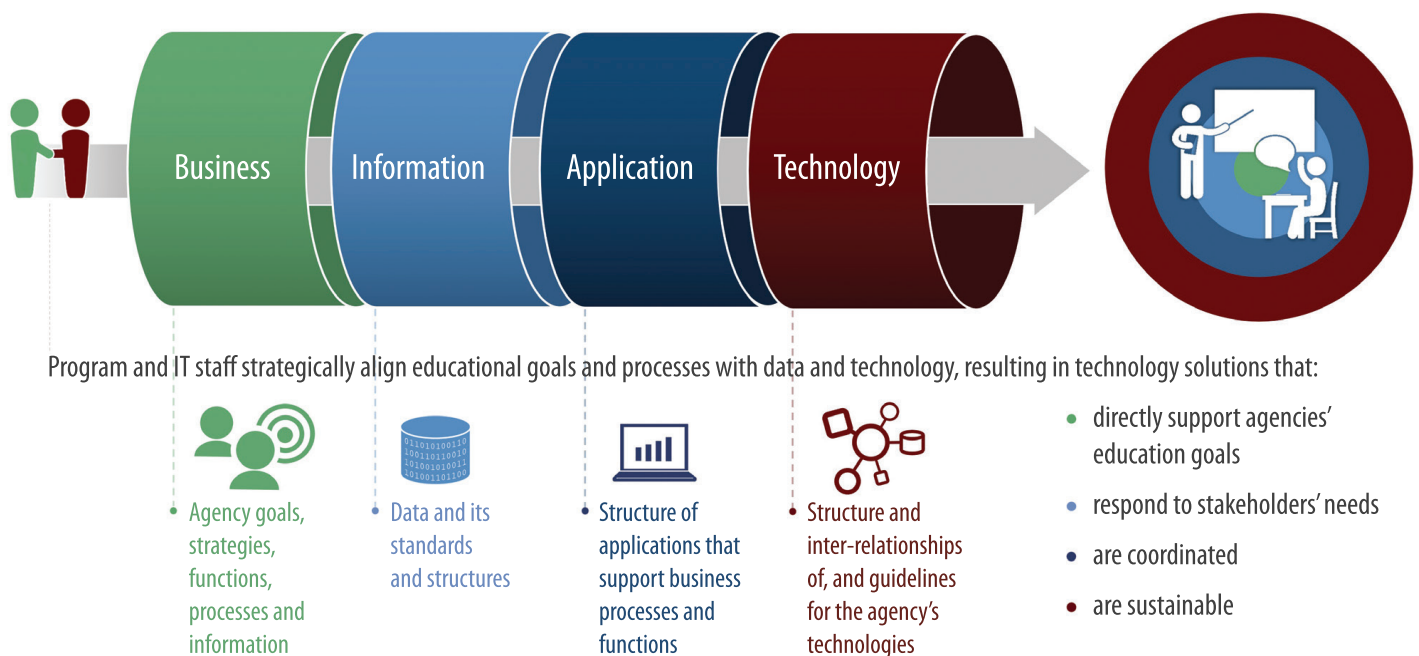


What Are the Components of Education Enterprise Architecture?

With this section of the guidebook, we expand upon the technical details of EEA, its design and implementation. This section describes EEA's four main components: Business, Information, Application

and Technology Architectures, shown in Figure 1. We describe for each component certain "resources," defined as important or essential "inputs" into the EEA process; for example, budgets and strategic plans are considered essential resources for Business Architecture, and metadata and database descriptions, for Information Architecture. (See Appendix B for a full list of resources.)

Figure 1



Business Architecture

Business Architecture is the foundation of EEA and drives all the other architectures to ensure that EEA focuses on the agency's goals and strategies. Business Architecture encompasses the what, who, how, when and why of the agency's business and describes the agency's strategic business intent (its vision, mission, goals and strategies) and how the core functions, processes, information and assets enact the strategic business intent.

Business Architecture offers a demonstrable, repeatable way to align business processes, systems and resources throughout the agency. In addition, documentation of Business Architecture provides a valuable tool for illustrating and communicating the business of the agency to all stakeholders. Another benefit of Business Architecture is its potential for building consensus among groups.²

Goals for Renovation

Business Architecture is analogous to a homeowner's goals for a home renovation. Those goals will drive all decisions—structural changes, electrical wiring, plumbing, window selection—just as Business Architecture drives the other components of EEA.



Information Architecture

Information Architecture depicts the agency's information assets and requirements and how the assets and requirements—and the systems that contain them—align with the business processes they are intended to support. Information Architecture includes information standards and structures, as well

² National Association of State CIOs, "Enterprise Architecture Development Tool-Kit v3.0," Business Architecture, October 2004, <http://www.nascio.org/committees/EA/download2.cfm>.

as processes that the information affects or is affected by. Conceptual, logical and physical data models are employed, and modified or developed, to help translate business information from the user's view into graphics or constructions like database tables.

Implementing Information Architecture helps an agency build upon the benefits of agency-wide data governance by providing a framework for how all the information systems interrelate and a set of standards to which all future data system procurements and construction must adhere. (Note that there are numerous national standards within education encompassing data, data movement, metadata and content; see Appendix C.) This process promotes increased collaboration, sharing and re-use of information; reduces information redundancy; and improves process interoperability across the agency.

Application Architecture

Application Architecture details the structure and interaction of applications (e.g., information management systems, web applications, analysis and reporting applications, student assessment tools, curriculum tools) that support business processes and functions and manage information assets. Application Architecture draws from the process and workflow diagrams that are part of Business Architecture to create use cases and functional specifications. A use case represents a discrete unit of meaningful work interaction between a user (human or machine) and the system; for example, login to system, register with system and create order are all use cases.

One key aspect of this architecture is how the applications interact with users. Application Architecture focuses on the relationships between applications and users and usually includes several matrices that depict these relationships: understanding each application and how it supports the organization, defining the requirements and roles of each application, ensuring internally consistent definitions across applications and combining similar applications to remove duplicate functionality.

Implementing Application Architecture establishes agency-wide application standards, identifies redundancies across current applications and pinpoints misalignments between the business

processes, the current applications and what users need. These steps may eventually reduce the human resources required to support the applications and their users.

Building Codes & Standards

Like Application and Technology Architecture, home renovations must align with established codes and standards (electricity, plumbing and zoning) to function well in the home environment (electric grid, water and sewer utilities and neighborhood aesthetics).



Technology Architecture

Technology Architecture documents the agency's infrastructure components (for example, servers, networks, storage devices, data centers, etcetera) to maximize their potential to support Information and Application Architectures. It develops a unified vision of the agency's infrastructure and technology platform by depicting the structure and inter-relationships of the agency's technologies, including guidelines for security, privacy, communication protocols, infrastructure build out, platform and operating system integration and user interfaces.

Creating Technology Architecture facilitates the design of flexible, reliable, scalable and secure systems that will support both anticipated and unanticipated future requirements in Applications and Information Architectures. It allows the agency to add systems and manage the life cycle of current systems, guiding investment and design decisions with the aim of striking an appropriate balance between technology agility and efficiency. In addition, Technology Architecture can increase the re-use of technology and configurations and reduce redundancy throughout the agency.

Technology Architecture is an essential component of EEA. However, because the IT industry has an abundance of information available to assist technologists in designing technology architectures, this document focuses more on the top three layers of EEA. Technology Architecture is not a primary focus of this guidebook and is not included in subsequent sections on implementing EEA.³

Establishing a Vision and Architecture Principles

Like any major initiative, it is important to establish a vision and guiding principles early in the planning for implementation of the EEA framework. The agency's executive leadership will endorse and champion both the vision and the principles to confirm that they reflect the agency's priorities.

Vision

The point of establishing a vision is to clarify and agree upon the purpose of the architecture and communicate how its development will achieve that purpose. The vision depicts the capacity and value that the proposed architecture will yield, including addressing the agency's goals, its strategic objectives and stakeholder concerns. The vision may also describe the scope of the effort, sometimes through a concept diagram to illustrate the major components and its benefits for the agency.

Architecture Principles

Architecture principles define fundamental rules and guidelines for the deployment of all information and technology resources across the agency. Principles should be articulated for each aspect of the architecture. Respecting architecture principles helps to ensure a consistent approach to decision making, and together with the vision, provides a foundation upon which to build a future State architecture. To realize their full value, the agency applies architecture principles throughout the planning and

³A major resource for technology architecture is The Open Group Architecture Forum (TOGAF). Part II: Architecture Development Method (ADM) – Technology Architecture. <http://pubs.opengroup.org/architecture/togaf9-doc/arch/index.html>. Here readers will find reliable enterprise architecture standards and methodologies to aid practitioners.

Architecture Principles

There is a parallel between architecture principles and the home owner's overarching aims for the renovation. For example, "I want my home to conserve resources and be energy efficient" or "I want my home to adhere to universal design principles so that visitors of all ages and abilities will easily use and enjoy the home's space and features."



implementation of the EEA framework. Each principle is stated in everyday, non-technical language and clearly relates back to the agency's key goals and objectives. The most effective principles are few in number and cohere as a set.

Here are examples of Business, information, Application and Technology Architecture principles:⁴

Business Principles

- **Agency Benefits are Maximized:** Information management decisions provide maximum benefit to the agency as a whole.
- **Information Management is Everybody's Business:** All divisions within the agency participate in the information management decisions necessary to accomplish business objectives.
- **Service Orientation:** The architecture design is based on the services required to meet the needs of the agency's customers.

Information Principles

- **Data are Assets:** Data are assets of value to the agency and managed accordingly.
- **Data Stewardship:** Each data element has a steward accountable for data quality.

⁴ Adapted from The Open Group Architecture Forum, Chapter 29, pages 239–250, <http://www.opengroup.org/togaf>.

- **Common Vocabulary and Data Definitions:** Data are defined consistently throughout the agency, and all users can access and understand the definitions.

Application Principles

- **Common Use Applications:** Agency-wide applications are preferred over applications that only a few programs use, which may lead to the proliferation of similar or duplicative applications.
- **Technology Independence:** Applications are independent of specific technologies and, therefore, operate on a variety of technology platforms.
- **Ease-of-Use:** Applications are easy to use. The underlying technology is transparent to users, enabling them to concentrate on tasks at hand.

Technology Principles

- **Requirements-Based Change:** Changes are only made to applications and technology in response to business needs.
- **Interoperability:** Software and hardware should conform to defined standards that promote interoperability for data, applications and technology.
- **Limit Technical Diversity:** Technical diversity is limited to minimize the cost of maintaining expertise in and connectivity among multiple environments.

Determining Scope

Defining the scope of the EEA to be implemented is an essential early step to making the effort manageable and focused on key areas that would benefit the most. The scope can then be gradually broadened over time as new reforms or procurements are planned. The agency bases the decision about scope on a practical assessment of its resources and capacity and the value that could realistically be expected from the chosen scope.⁵ By examining strategic priorities and stakeholder needs, an agency may clarify which

⁵ Ibid., p. 70.

Scope of the Renovation

A homeowner may want and even need to replace or reconstruct the entire home, but this is not always practical or affordable. Similarly, an organization cannot easily afford to restructure all of its applications and data architecture at once. It becomes important to define the scope of the renovation, and EEA.



domains to include in the scope. One tool, created by the District of Columbia Public Schools, offers a rubric for agencies to assess their capacity and track improvement over time. (See Appendix D for the DCPS *Architecture Capabilities Maturity Model* rubric.)

Documenting and Analyzing the Four Architectures

Whether the scope defined is to be a segment architecture (i.e., limited to an internal division or functional area within the agency) or comprehensive, the agency will follow the same high-level process for the development of each of the four architecture components (business, information, application and technology):

1. Create a current picture of the agency and its operations (*current state*).
2. Define where the agency wants to be and what it wants to achieve in the future (*future state*).
3. Identify the differences between the current and desired future state (*gap identification*).

Some elements of the agency's work and infrastructure may not fit neatly into the current or future state because they are either being implemented or phased out. To accurately describe these in-flux elements, it may help to use common descriptors such as *emerging*, *current*, *twilight* and

sunset. For example, an agency might define a legacy teacher certification tracking system as a *twilight* element within Application Architecture until it is phased out and *sunsetting* (or replaced) in favor of an *emerging* online certification system.

As noted earlier, Business Architecture drives the other three architectures, but all four are interrelated. As a result, the agency will develop Business Architecture first, but may pursue a step of the process for two or more of the other architectures concurrently, to conserve staff time and recognize the interrelatedness of architectures. For example, documenting the current state of Information and Application Architectures together would avoid duplication of efforts and result in an integrated documentation of the two architectures. Alternately, the agency may want to document an architecture's current state and immediately proceed to defining the desired future state, to enable staff and stakeholders to think creatively about where they are and where they'd like to be. (This is an especially promising approach for Business Architecture.)

Once the agency has defined its current and future states, it can then analyze the differences between these states across all four components to determine *how* to achieve the future state, which is the implementation plan.

Current State

Before an agency can map out where it wants to go and what it wants to achieve, it must document and understand where it is. Documentation of its current state need not be as detailed as documentation for the future state. The goal is to gather and analyze only the information that could inform a strategy for moving toward a future state and to use existing materials whenever possible.⁶ The agency will determine the level of effort for developing each architecture. Its decisions about the scope and level of documentation, and which materials to use as inputs and create as outputs, will depend on whether the agency already has descriptions or documentation for the existing architecture, and the extent to which the

⁶National Association of State CIOs, "Enterprise Architecture Development Tool-Kit v3.0," Business Architecture, October 2004, p. 10, <http://www.nascio.org/committees/EA/download2.cfm>.

agency is likely to carry over existing elements of each architecture into the future state.⁷ (See Appendix B for a list of material resources that may serve either as inputs or outputs.)

Future State

The future state depicts where the agency wants to be and what it wants to achieve in the future—an enactment of the vision. The future state for Business Architecture forms the foundation and anchor for Information, Application and Technology Architecture future states: the level of detail and scope for each of these is determined by their relevance to attaining the Business Architecture future state.

Gap Identification

Gap identification is the process of determining and documenting the differences between the current state and the future state across all four architectures. Note that gap identification is not limited exclusively to absences of processes or systems—gaps also include redundancies, contradictions or any other type of difference between how the agency currently operates and how it plans to operate in its future state. Analyzing this collective array of gaps forms the

⁷The Open Group Architecture Forum, p. 89, <http://www.open-group.org/togaf>.

starting point for the implementation plan. Because of resource constraints and political factors, an agency is not likely to address all the gaps identified, but their documentation is a valuable way to ensure that the agency’s leadership has a comprehensive view of the issues to address if the agency is to realize its future state.

Implementation Plan

To establish an implementation plan for EEA, the agency’s team analyzes the gaps identified between the current and future state and decides which to address, and how and when to address them (see Figure 2). First, the team consolidates the gaps

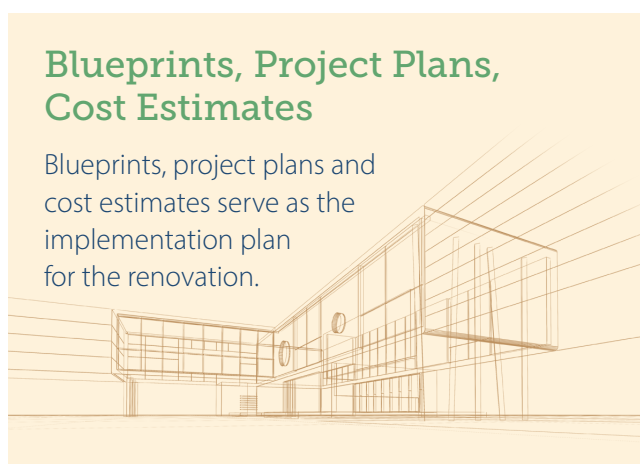
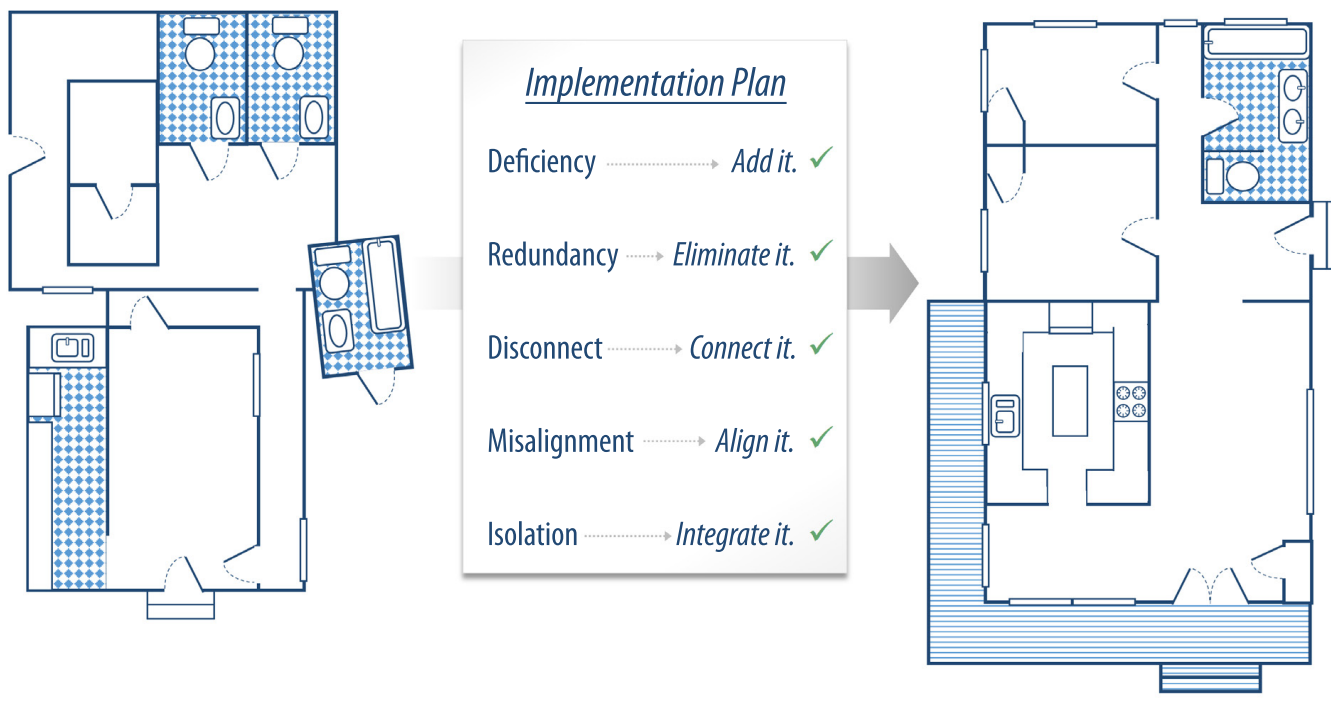


Figure 2



identified across all architectures, classifies similar gaps and assesses the implications of the gaps in terms of interdependencies and potential solutions. This analysis leads to the identification of solutions that might address one or more gaps.

To keep the future state in view while realizing incremental value throughout the implementation, both The Open Group Architecture Forum (TOGAF) and the National Association of State CIOs (NASCIO) recommend the use of a “road map” component of the implementation plan. A road map provides a timeline for the progression from the current to the future state and establishes criteria to determine the priority of the projects to launch.

In light of resource constraints, an agency may not be able to launch all the projects identified to fully realize the future state. Ascertaining the business value of the projects against the cost of delivering them can help reduce the scope and cost of implementation. Once the road map is created, the implementation plan will have a schedule for projects, with priority designation and the resources required.⁸ If the agency has a Project Management Oversight Committee in place, the implementation plan would then be delegated to this group.⁹

Governance for the Education Enterprise Architecture

An EEA governance structure, suited to the agency, is critical for long-term sustainability. Governance structures will vary, depending on factors such as the agency's size and complexity, resources and maturity in terms of processes like strategic planning, performance management, process management and data governance. Because EEA spans the agency, it requires understanding, participation and support from many people besides the CIO and IT staff. Starting with the CEO and executive leadership, and including data stewards and process owners (staff members responsible for defining and managing a process)

⁸ Ibid., p. 138.

⁹ For more information on the road map, see The Open Group Architecture Forum, Sections 13.4.11 (p. 138) and 36.2.7 (p. 441) and National Association of State CIOs, “Enterprise Architecture Development Tool-Kit v3.0,” Appendix B, *Discipline Profile*, p. 51.

Compliance and Approval

House renovations require building permits and inspections. Builders must comply with certain codes for the structural integrity of the building, for plumbing, electrical wiring, etcetera.

A municipal governing body for the permitting process is analogous to EEA governance.



throughout the agency, everyone must understand who is responsible for governance and accountable for its sustained contribution to the agency's success, and how communication and coordination among staff members is to occur.

There are helpful resources for EEA governance, such as the NASCIO Enterprise Architecture Toolkit and TOGAF, both available to State and local education agencies at no cost. This guidebook's intent is not to recommend a structure, but to communicate the importance of EEA governance and the key components to establish within an education agency. These components include:

- **An EEA manager and champion(s)** who together serve as sponsors, facilitators, catalysts and organizers for the EEA.¹⁰ In a larger agency, the CIO might serve as champion and a chief technology officer (CTO) or IT architect as the manager. In smaller agencies, the responsibility might be blended; for example, the CIO or CTO may serve as the champion and the data governance coordinator as manager.
- **A cross-organization EEA steering committee or architecture review board,**¹¹ consisting of key managers and senior leaders assigned by top

¹⁰ National Association of State CIOs, “Enterprise Architecture Development Tool-Kit v3.0,” *Introduction & Governance*, p. 45.

¹¹ The National Association of State CIOs Enterprise Architecture Development Tool-Kit, *Introduction & Governance* refers to this as an Overseer committee (p. 49).

management to oversee the implementation of the EEA. This group oversees EEA policies and principles, architecture blueprints, resource allocation and priority ranking regarding all aspects of moving from current to future state.¹²

- **An architecture compliance strategy** that ensures conformance with EEA by all parts of the agency and engages the purchasing division, because compliance includes EEA policies and practices that involve procurement. The strategy is a critical step toward ensuring that the entire agency makes purchasing decisions in the context of the business, application and information architectures.¹³
- **Inclusion of other State agencies.** Significant connections may exist between the SEA's EEA initiative and the State CIO's agency, higher education and such agencies as labor, health and social services. Including other agencies in governance is especially important if the State has or is developing a statewide longitudinal data system for P-20W (early education through postsecondary education and the workforce).
- **Inclusion of school districts and charter schools.** Including these stakeholders in EEA governance encourages incorporation and alignment of future designs for local systems and processes within the SEA's future state architecture.

¹² For The Open Group Architecture Forum explanation of an architecture review board, see <http://pubs.opengroup.org/architecture/togaf9-doc/arch/index.html>. For a description of Pennsylvania's architectural review process, see <http://www.portal.state.pa.us/portal/server.pt?open=514&objID=210791&mode=2>.

¹³ For The Open Group Architecture Forum explanation of an architecture compliance strategy, see <http://pubs.opengroup.org/architecture/togaf9-doc/arch/index.html>. For an example of a procurement process from North Dakota that utilizes EEA, see <https://www.nd.gov/itd/standards/it-procurement/information-technology-procurement>

Other key participants in EEA governance include process owners, data stewards and project managers. The following sections discuss these roles.

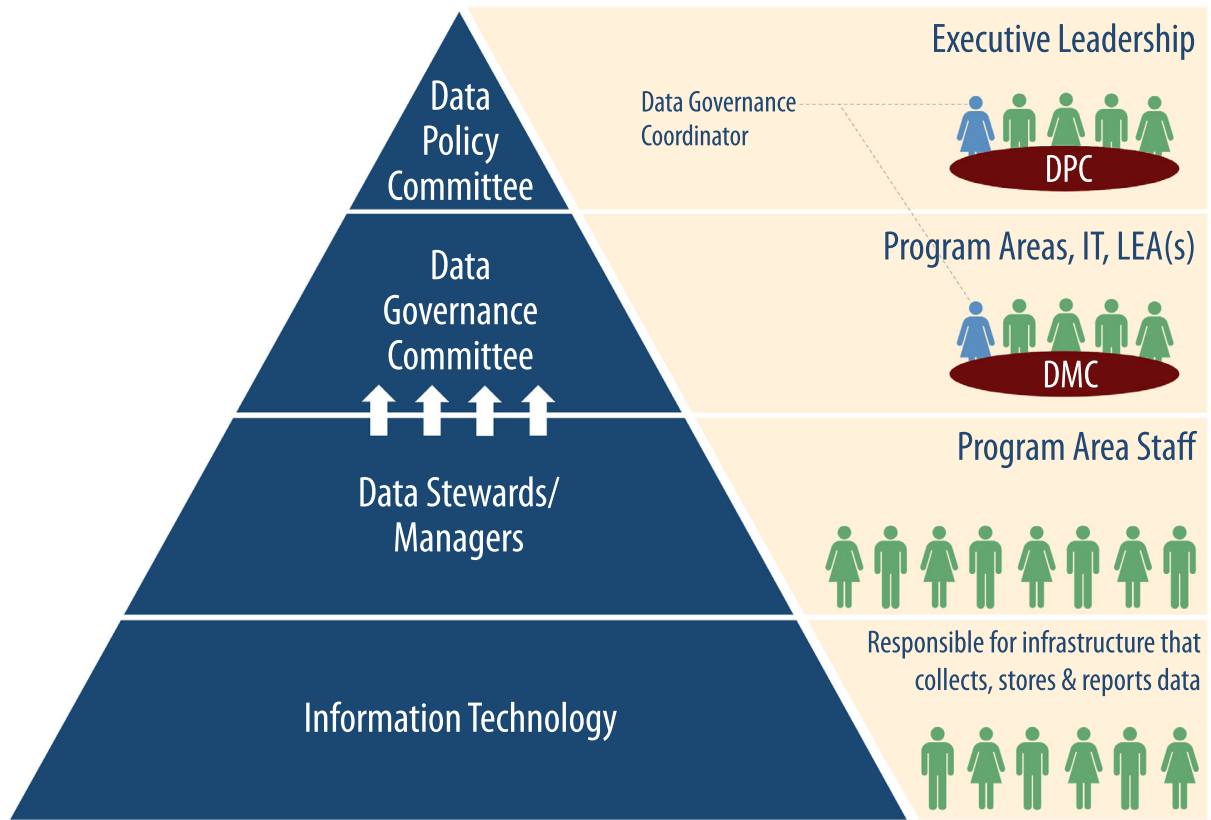
Data Governance as an Element of EEA Governance

EEA will consistently use data stewards to further refine Business Architecture and serve as subject matter experts in the development of designs, specifications and business rules for data structures, data access and security and integration strategies. For this reason, the agency will benefit from establishing a data governance structure and integrating it with EEA governance. The U.S. Department of Education's Statewide Longitudinal Data Systems (SLDS) Program provides useful materials on an effective data governance process.¹⁴

Many education agencies have taken steps to configure their information assets by implementing data governance and data standards and assigning greater responsibility for managing information to data stewards in the program and business areas. These steps may establish a foundation for collaborative decision making and coordination essential to an agency developing and implementing EEA. Data governance structures may identify key strategic decisions, core agency processes and process owners, policy requirements and organizational and capacity issues and initiate the architecture. (See Figure 3.)

¹⁴ See Statewide Longitudinal Data Systems data governance information at <http://nces.ed.gov/programs/slids/resources.asp>.

Figure 3



The data governance coordinator, as described in the Statewide Longitudinal Data Systems (SLDS) materials from the U.S. Department of Education, may serve an important role in EEA governance to coordinate and mentor the data stewards and managers shown in Figure 3. The functions of this role may include:

- Directing EEA governance and working closely with the CIO (a pragmatic solution for agencies that cannot afford separate positions for EEA and data governance).
- Serving as a member of the steering committee or architecture review board.
- Coordinating the data stewards who are conducting the data inventory that documents the current state for Information Architecture.
- Securing and reviewing feedback on the future state for Information Architecture.
- Updating the current and future state diagrams for Information Architecture.

- Referencing both the architecture principles and the future state for Information Architecture, as guidance in considering new information repositories and in resolving data issues within the data governance committee.

Data stewards provide assistance to:

- Help process owners and application architects determine the source systems of record for data used as inputs to processes.
- Help determine the data stores that will serve as repositories for data output from processes.
- Help establish business rules for data extractions, reports and cleansing.
- Help resolve data issues that result from the multiple needs of the various process owners.

The future state Information Architecture and the architecture principles associated with it become a focal point for the data stewards and data governance

coordinator. Each meeting of the data governance committee may call upon the future state Information Architecture as a reference to focus discussions, resolve issues and prioritize data-related projects. In this manner, this group advocates for the future state EEA.

Process Management as an Element of EEA Governance

In architecture, form follows function. This is why EEA begins with an understanding of the agency's Business Architecture. The agency uses its vision and goals to define the strategies to achieve them and translates strategies into programs and services. The disciplines of process management, in turn, structure how programs and services are provided. Like data governance, the agency's selection of a process management or continuous process improvement (for example, Total Quality Management, Baldrige, Six Sigma and LEAN) discipline is another element of successful EEA.

Form Follows Function

When renovating a home, form follows function. Understanding the functions for the renovation (e.g., recreation, office work or exercise) helps to determine the form they will take. The same is true when moving from current to future state architecture. It is essential to understand the functions (e.g., services, processes and their accompanying use cases) to be supported. In home renovation, function is determined by the home owner, not the builder. In EEA, functions are determined by the business owner, not IT staff.



The EEA initiative may then consistently call upon the process owners and process improvement experts as intermediaries for the business areas and IT to refine Business Architecture into processes and services and translate these into information and application system designs and specifications. (See Figure 4.)

Figure 4



A critical first step in moving toward a culture of data use and an integrated, future state EEA is not a technical effort, but rather a business effort.

The American Productivity and Quality Council has established a set of process management practices and a process classification framework for education, a relevant resource for capturing a current state EEA.¹⁵ By identifying a responsible person for defining and managing each process (the process owner), the agency takes a first step in clarifying responsibilities for how work is performed, services are provided and programs are structured. As the agency identifies a segment of EEA as a priority, employing the process framework may help define the boundaries of the EEA scope. Process owners help document the current state architecture by identifying the applications that support their processes, the source systems for the data that are inputs to the processes and the data repositories for information created by the processes. They may also identify missing application functionality and issues with the data and source data structures. Their documentation can form the foundation for the gap analysis and future state architecture.

¹⁵ See <https://rtt.grads360.org/services/PDCService.svc/GetPDCDocumentFile?fileId=3781>.

Project Management as an Element of EEA Governance

Once the agency completes the gap analysis and establishes the road map for moving to the future state, a group or department within the agency (e.g., the project management office [PMO]) ensures that the projects on the road map are properly scoped, executed and completed. Projects are defined as organizational efforts with beginning and end points, unlike efforts that are ongoing. The PMO or another functional group responsible for project management develops and deploys new initiatives, by aligning resources specific to the project and organizing them into a set of activities and decisions. Project management confirms that information systems adhere to EEA, identifies new or revised processes and cross-references them with current state Business Architecture. The PMO helps program and initiative owners identify their needs—through business analysis—within the EEA framework and manages the agency’s movement from current to future state.

Each individual project also has a project team, which includes representatives of the agency sectors affected by the new system, to ensure that they participate in integrating the changes. The project team proactively manages procurement policies and practices to ensure that the purchase of products and services comply with the EEA. Enterprise-wide technology standards and/or enterprise architecture are a foundation for ongoing procurement.

Project Management

A general contractor, with sub-contractors, oversees a major house renovation. The PMO, like the general contractor, keeps the big picture in mind and ensures all the associated activities are coordinated and sequenced in keeping with the big picture and timeline.

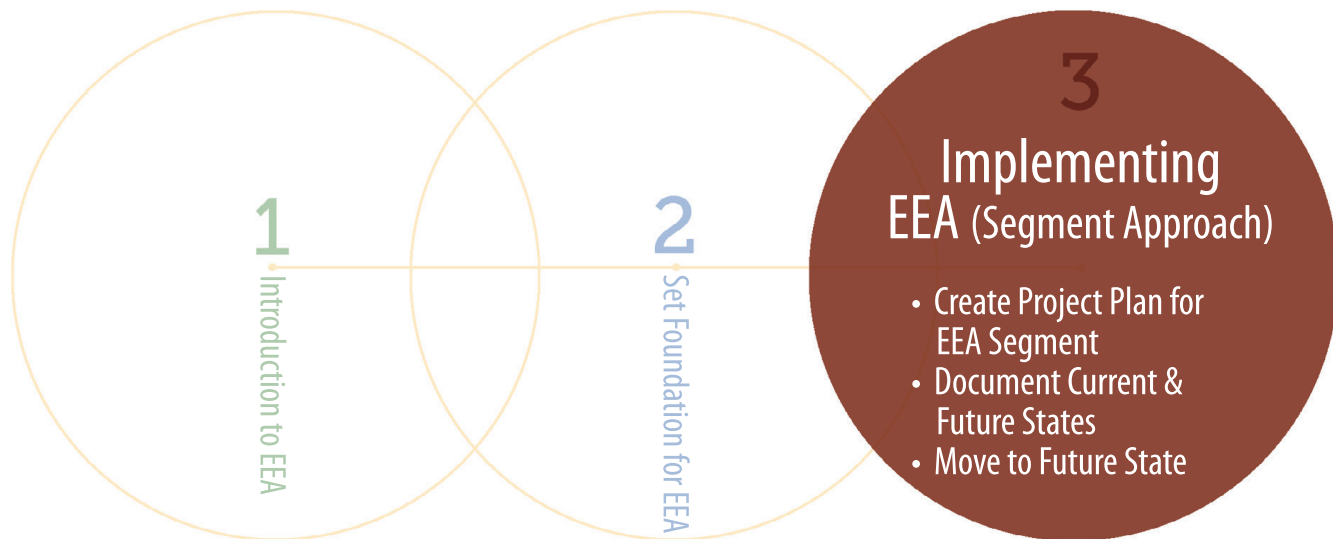


North Carolina¹⁶ and Pennsylvania¹⁷ are two States that operate with a PMO. North Carolina’s mission statement for its PMO reads in part “to provide leadership for the improvement and expansion of Project Management across state government.” An education agency without a PMO is not necessarily unable to implement EEA. However, effective project management and its associated disciplines may enhance the EEA initiative.

¹⁶To learn more about the North Carolina Project Management Office, see <http://www.epmo.scio.nc.gov>.

¹⁷To learn more about the Pennsylvania Project Management Office, see http://www.portal.state.pa.us/portal/server.pt/community/procedures/10302/project_approval/551989.

Section 3. A Segment Approach to EEA Implementation



Conducting segment architecture is one approach to managing the scope of an EEA effort, as noted earlier. Segment architecture employs the frameworks and processes of a complete EEA effort, but focuses on a single business case or service. Taking a segmented approach to the implementation of EEA may make it more manageable and permit new users to gain expertise with the various processes.

The first step in creating segment architecture is to examine strategic priorities and stakeholder needs and identify one area in the SEA of high importance or great need upon which to begin applying EEA principles. To illustrate, here is an example of an agency goal with related strategies that could provide a starting point for segment architecture:

The Goal: Improved student achievement through increased personalized learning

The Strategies:

1. Work with interested districts to define their strategies for personalized learning and their need for the State to supply tools and processes (for example, a model for the district Business Architecture). These might include support for such approaches as Response to Intervention, competency-based learning and targeted student remediation.

2. Determine the processes, roles, tools and support structures that the State would provide to districts, in the areas of Business, Application, Information and Technology Architecture.
3. Implement these processes, roles, tools and support structures to aid the districts as they work to improve student achievement through increased personalized learning.

Such goals and strategies will require that a robust set of policies, services and processes be in place both in the State and district.

A Minimalist Approach to EEA

A segment architecture focuses on a single service or business case within an agency in order to reduce the challenging scope of a full EEA implementation. A homeowner may decide to begin a renovation with a makeover of the kitchen alone, rather than a reconstruction of the entire house.



Determining the Scope and Vision

To pursue this example of segment architecture, the agency's next step could be to apply the *Architecture Capabilities Maturity Model* rubric in Appendix D to determine whether the agency has the capacity to tackle all of the policy, process and systems work to implement this goal. Questions 3, 4 and 5 in this model—concerning business linkage, senior management involvement and operating unit participation—are particularly relevant to this segment architecture. Achieving a goal of personalized learning requires many changes within an education agency, many of which concern the teacher's role. Defining the policies, services, processes and systems to effect such changes will require executive and program leadership and active participation, within both the SEA and LEAs.

Defining the scope for this example of segment architecture next requires a clear vision and definition of personalized learning in all its facets—its meanings from the perspectives of the school district, students, teachers and parents, once fully implemented. Use cases are often created to portray such a complex vision. A scope that is exact and detailed helps the team stay focused and aligned to the goal.

Another useful tool to establish scope is a list of the agency's "processes," which the team can review to identify those processes that the scope would properly incorporate. Appendix E lists many processes the team could consider in establishing a scope for any segment architecture.

Creating a Project Plan for EEA Segment Architecture

With the scope determined, the elements of the EEA segment architecture are spelled out in the project plan or "charter." These elements include:

- Creating a current picture of where the agency is and how it operates (current state).
- Defining where it wants to be/what it wants to achieve in the future (future state).

- Identifying the differences between the current state and future state (gap analysis).
- Developing a road map and implementation plan to close the gaps and reach the desired architecture.

Architecture principles not only provide guiding statements for the segment architecture, but also lay the foundation to ensure that future segment architectures connect with and build upon this segment's results. For this example, the architecture principles might reflect Business Architecture guiding statements or core beliefs to guide the implementation (with fidelity) of personalized learning practices throughout the system to reach into every classroom and each student's experience.

The exact order of the steps the agency takes to prepare a project plan may vary from agency to agency, but it must first establish concrete goals, objectives and desired outcomes. Knowing the scope allows the right people to be invited to the table. Once established, the project team engages in the development of a project plan which includes the following steps:

- 1. Identify desired outcomes or results.** Establish a set of desired outcome statements that describe what success should look like at the end of this effort, for example:
 - Districts, schools and classrooms understand and clearly define personalization.
 - District administrators and teachers agree with the personalization strategies, actively support the concept and use the tools and processes to achieve personalization.
 - The SEA plays clearly defined roles in support of district implementation of personalized learning.
 - The SEA has implemented processes and tools to carry out its roles.
- 2. Articulate goals and objectives clearly.** For example, to improve achievement through increased personalized learning, objectives might include:

- Increase third grade reading performance by 10 percent next year.
 - Increase the number of students in higher level math courses by 15 percent in two years.
- 3. Create project deliverables.** Deliverables are documents or other products that create or exemplify the desired outcomes, for example:
 - A clearly articulated vision and definition of personalized learning that includes use cases from the perspectives of a teacher, student and parent
 - Architecture principles that support personalized learning
 - Visuals that depict the future architecture
 - Documentation of the current and future state
 - Gap analysis
 - A list of projects and a road map for achieving the future state
 - 4. Establish project organization.** This step specifies the people, their roles and a description of those roles in terms of this project. For the personalized learning effort, the SEA would engage staff members from curriculum, instruction, assessment, professional development, information technology, project management and communication, as well as personnel in similar roles employed by school districts. See Appendix H for guidance on the selection of a segment architecture project team.
 - 5. Schedule and staff project action plan.** Tasks or action steps assigned to a responsible person with start date, projected end date and status.

Delaware's Strategic Project Management Process Project Proposal Template, available at this [link](#), offers one template for developing a project plan. Additionally, a visual is often an effective tool for communicating the scope of the proposed architecture. Aligned with the agency's overall vision, the visual may help everyone involved adhere to the principles. Several SEAs have developed visuals to depict their architectures. Appendix F includes examples from Arizona and Massachusetts.

Documenting the Current State and Future State

Earlier this guidebook introduced the four architectures and their documentation. In this section, the guidebook goes into more detail about each architecture and documenting current and future states.

As noted previously, it may be more efficient to conduct current state architecture analysis across all architectures (Business, Information, Application and Technology Architecture) concurrently; Appendix G offers a template for starting this process. This sample template addresses the high-level processes and sub-processes required to support personalized learning with an instructional improvement system, the data required by these processes and the applications to support them. The analysis using this template provides information about the foundational architectures: Business Architecture (the business of instructional improvement), Information Architecture (the data required to make good instructional decisions), and Application Architecture (the technology applications that allow these processes to run efficiently and effectively).

Business Architecture

To understand the current state Business Architecture, the project team will review many resources during the process of documentation, including:

- The agency's strategic plan (including strategies and theories of action)
- Organization charts (including roles and responsibilities)
- Performance measures
- Budgets
- Program definitions (including services provided)
- Process maps (for the processes targeted by the documentation)

Appendix B provides a complete list of resources for documentation of current and future states.

Once the current state Business Architecture is documented, creating the future state Business Architecture can begin by asking questions about the future-state business processes:

- Is there a clear process owner for each business process within the scope of this segment architecture?
- Are the processes clearly defined and documented?
- Have issues surfaced regarding any processes during the data analysis?
- Are there new processes to be defined?

The future state Business Architecture may also capture the vision for personalized learning. The future state describes the school district strategies for personalized learning, which will require active participation and buy-in from the districts. Use cases offer a helpful format for depicting strategies.

The future state Business Architecture may also define the roles of the SEA, school districts and schools. A useful instrument for this step is again to review the list of processes, modified to support the future state vision. The team may wish to add additional processes to support personalized learning. For each process identified, the future state will describe the roles to be played by the SEA, school districts and schools. The goal of the future state Business Architecture is to establish processes that are well-defined, identified with owners, and understood by the agency's stakeholders. The design of the future state architecture should mirror the agency's real-world teaching and learning processes that support personalized learning.

Outputs from the future state Business Architecture review may include:

- Vision
- Principles
- Use cases
- Process descriptions and process owners

Information Architecture

The project team may review a variety of resources to arrive at an understanding of the current state Information Architecture:

- Data governance policy
- Data dictionary
- Master data management plan
- Data standards
- Technology plan
- Data access and privacy policy
- Description of databases (including contents and purposes)

As the project team discusses each process with stakeholders, they identify both the data that feed into each process (inputs) and the data that are outcomes for each process (outputs). For example, in the realm of personalized learning, teachers may use assessment items (data) from many sources: textbook end-of-chapter tests, released State summative assessment items, an integrated learning system, an interim assessment system, embedded assessment items in a model curriculum unit and so forth. All of these provide data inputs to the process. Outputs to the process include student assessment results aligned to content standards and recommendations regarding knowledge or skills required for content mastery. These data outputs may be formatted as a report or set of reports, or stored so that other processes can access the data as inputs. The project team calls upon all this information to define and diagram the current state Information Architecture.

Once the current state is understood, the team analyzes it in light of the future state Business Architecture to explore questions that lead to the definition of the future state Information Architecture:

- Are all the data that the process requires available?
- Are the data timely?
- Are the data in the proper format for use by the process?

In the future state, all the data required by a process are accessible and actionable. Mapping the process for the future state defines the expected output and the data necessary to produce that output. Personalized learning, for example, requires Information Architecture carefully crafted to maintain instructional and assessment process connections between the student, the teacher, the course and course content, formative and classroom assessment results and personalized remediation. Standards and metadata schemas are emerging to help States and school districts maintain these connections and share instruction content and assessment items across States and school districts. (Appendix C lists data and content standards.)

In addition, it may be important to create data structures that allow timely (daily if not real-time) updates and tracking over time to support classroom teachers who need access to the most current information about their students.

Outputs from the future state Information Architecture review may include:

- Data standards
- Master data management plan
- Data processes
- Conceptual data diagram
- Logical data diagram

Application Architecture

Resources that provide an understanding of the current state Application Architecture include:

- Descriptions of applications (including purposes and users)
- Visual diagram of all applications (including data flows among them)
- Instructional process to application map

The *Instructional Process to Application Map* template (see Appendix G) provides a space to identify the application(s) that support each process listed. In many cases one major application supports most processes in a particular area. Once processes, data

and applications are identified, it may be useful to create a unified diagram of the current state.

Not infrequently, asking stakeholders what they use to accomplish their work uncovers “rogue” applications employed to support a process. For example, to provide report cards or progress reports to parents, some agencies maintain an enterprise student information system (SIS) that processes the data provided by teachers, synthesizes and integrates it with other data (for example, attendance and demographic data) and produces the report card or progress report. When an agency lacks SIS functionality, teachers may maintain spreadsheets, grade books, paper records and other applications to store the data they provide to parents. In the latter situation, an agency might choose to reexamine its applications.

Once the current state is documented, the team may begin to develop the future state Application Architecture by reviewing the future state Business and Information Architectures and asking questions:

- Are any applications missing that are essential to support the process and the required data?
- Are duplicate applications supporting the process?
- Do the applications have the proper functionality to support the process?

Identifying missing or duplicate applications may clarify the improvements needed to those supporting applications. Also helpful is analysis of the functionality of current applications and their alignment with the process. Applications that are easy to use, and based on easily accessible technology, allow teachers, administrators, students and parents to focus on improving learning without distraction.

Outputs from the future state Application Architecture review may include:

- Application function matrix
- Logical application model
- Functional requirements
- Use cases

Technology Architecture

While the focus of this guidebook is not on Technology Architecture, it is worth noting the importance of this component to the success of the other components. The future state Technology Architecture is driven by the other three architectures but is also required to ensure their success. Also, a Technical Architecture review of current and future state can provide many opportunities for cost savings by leveraging economies of scale, moving to cloud-based services and identifying opportunities for infrastructure upgrades. Many states are pursuing such Technology Architecture strategies as providing cloud-based services to districts, one-to-one devices for students and statewide network connectivity services.

Moving from Current State to Future State

To move the agency from where it is to where it needs to go, the team first conducts a gap analysis between the current state and future state for each architecture, and then uses the results of the analysis to create a road map for the future and a corresponding implementation plan.

Taking the personalized learning example, gaps in Business Architecture that might be anticipated include:

- Content management processes to vet and tag content aligned to the State standards
- Item writing processes to develop item banks and assessments for classroom instruction
- Professional development in using data to personalize instruction

The gap analysis might also identify Business Architecture gaps in policy (to support differentiated instruction), organizational capacity (too few curriculum specialists to identify and tag content), culture (unwillingness to learn the tools required to

personalize instruction) or skills (lack of understanding of data analytics). Such gaps may exist within both SEAs and LEAs. Before moving forward with the rest of the architecture, the team will plan how to address the gaps.

Information Architecture gaps might include:

- Data stores that can capture and retain real-time data from all the necessary local systems (for example, local SIS, individualized education program system, local assessment systems)
- Data standards for metadata tagging across the State and districts
- Content libraries that can house and share all of the unstructured content data

Application Architecture gaps might include:

- Dashboards for use in the classroom that report on real-time assessment data, integrated with other student indicators such as attendance or discipline
- Assessment tools for delivering and scoring online assessments
- Data integration tools for extracting and cleansing real-time data from local systems

Many of the gaps overlap with each other. Creating a road map becomes useful to explain how to approach the gaps and in what sequence, how to group or combine them, who would sponsor and lead each effort and how to allocate resources for the work.

The road map helps create the implementation plan, which describes all the projects required by the road map, their scope and deliverables, the project manager and team makeup, expected start and finish dates, project dependencies and risks and expected costs.

From here, the project management process begins, to ensure adherence to the plans and high-quality deliverables from the work performed, and steady progression toward the future state architecture.

Closing Remarks

This guidebook has examined the components and processes necessary to develop and implement an EEA framework (see Appendix I for a checklist to aid in developing and EEA). Like other complex organizations, education agencies must establish efficient and cost-effective structures to collect, retain and share information in pursuit of their mission and goals. Yet even as education agencies rely increasingly on information and information systems to implement reforms, they face more frequent and fundamental policy and program reforms that require coordinating

investments in people, processes and technology across the agency and guaranteeing relevance to educational goals and stakeholders. The concept of enterprise architecture, borrowed from the business sector, offers structures and processes for doing so.

EEA offers a blueprint to map and align educational objectives, strategies, roles and responsibilities, data and technology. Planning for sustainability especially benefits from the documentation of processes and clarification of ownership and responsibilities that are elements of EEA.

Appendix A. Benefits of Enterprise Architecture

The national enterprise architecture organization, The Open Group Architecture Forum (TOGAF) has documented key benefits of using Enterprise Architecture:¹⁸

- **More effective change management** – planning and implementing reforms in an integrated manner to ensure current program operations are not adversely affected; providing a long-term framework that can span leadership transitions.
- **Strengthened efficiency of the organization** – streamlining and eliminating redundant processes, identifying interdependencies across the agency, strategically allocating staff resources, clarifying roles and responsibilities, lowering operation costs and promoting sharing of organizational capabilities across the agency.
- **Increased efficiency of IT operations** – lowering software development, support and maintenance costs; increasing portability of applications; improving ability to address agency-wide issues such as security; and making upgrades and exchanges of systems components easier.
- **Better return on existing investments and reduced risk for future investment** – providing a structured, consistent way to define and document business requirements; reducing the complexity of programs and IT; increasing flexibility to build, buy or out-source IT solutions; and reducing overall risk in new investments and their cost of ownership.
- **Faster, simpler, and cheaper procurement** – making information governing procurement readily available in a coherent plan and providing consistent and common language for requests for proposals.

¹⁸ <http://pubs.opengroup.org/architecture/togaf8-doc/arch/toc.html>

Appendix B. Resources for Documentation of Current and Future States

Resources are work products that describe an aspect of the architecture, classified as catalogs (lists of things), matrices (showing relationships between things) and diagrams (pictures of things).¹⁹ Resources are separated into inputs (materials and resources needed to commence or inform activities) and outputs (materials and resources developed through the process).

	Input	Output
Across all Architectures		<ul style="list-style-type: none"> • EEA vision • EEA principles • Current-state and future-state diagram • EEA roadmap • Compliance strategy • Current to future-state gap analysis
Business Architecture	<ul style="list-style-type: none"> • Strategic plan including strategies and theories of action • Organization charts, roles and responsibilities • Performance measures • Budgets • Program definitions, including services/function(s) provided • Process maps or descriptions • Project Management Plan • Customer engagement strategy (who are your customers and how will you do business with them—to include local educational agencies and schools) 	<ul style="list-style-type: none"> • Process maps
Information Architecture	<ul style="list-style-type: none"> • Data governance policy/process • Metadata (e.g., data dictionary) • Master data management plan • Data standards • Technology plan • Access/privacy policy • Description of databases including contents of and purposes served by each 	<ul style="list-style-type: none"> • Data standards • Master data management plan • Data processes • Conceptual data diagram • Logical data diagram
Application Architecture	<ul style="list-style-type: none"> • Description of applications and purposes/users served by each • Visual of all applications and data flows among them 	<ul style="list-style-type: none"> • Application/function matrix • Visual of all applications and data flows among them • Logical application model • Functional requirements • Use cases

Note: Materials considered essential by RSN experts appear in **boldface**.

¹⁹ <http://pubs.opengroup.org/architecture/togaf8-doc/arch/toc.html>

Appendix C. Data and Content Standards

Source: Center for Educational Leadership and Technology, Data and Content Standards, Organizations and Initiatives. June 11, 2013.

Appendix C is intended as a brief listing of current national standards and initiatives within the field of education that encompass data, data movement, metadata and content. Inclusion on this list does not constitute an endorsement by the U.S. Department of Education, nor is this list intended to be comprehensive.

Data Standards

Common Education Data Standards

<https://ceds.ed.gov>

The Common Education Data Standards (CEDS) project is a national collaborative effort to develop voluntary, common data standards for a key set of education data elements to streamline the exchange, comparison and understanding of data within and across institutions and sectors from early education through postsecondary education into the workforce (P-20W). CEDS provides a common vocabulary and reference structure through a data dictionary and logical data model for data that needs to be shared across education organizations.

P20W Education Standards Council (PESC)

<http://www.pesc.org>

PESC is a data standards setting body that focuses primarily on student-based data, standards needed to link stakeholders across the P20W spectrum and the numerous processes undertaken by stakeholders of student data. The council has produced numerous PESC standards for sharing specific types of education data, such as financial aid, transcript, and admissions information.

Data Movement

Assessment Interoperability Framework (AIF)

<https://ceds.ed.gov/aif.aspx>

The Schools Interoperability Framework Association and IMS have released version 1 of the AIF as part of a joint partnership established to support the U.S. Department of Education's Race to the Top Assessment Consortia. AIF provides a common structure to allow for the transfer of any data associated with assessment systems: including student and teacher information, learning standards, assessment items, results and related data across systems.

State Educational Technology Directors Association (SETDA) Digital Passport

<http://www.setda.org/web/guest/digitalpassport>

Digital Passport is a tool that brokers the exchange of student data between States or districts to enable electronic record transfer as students move from one school to another.

Experience API (xAPI)

<http://www.adlnet.gov/tla/experience-api/>

xAPI is a protocol and simple data format for sharing learning activity streams among systems to track student activities and securely expose data to other learning systems.

Open Badges Infrastructure (OBI)

<http://openbadges.org>

The Open Badges Infrastructure is a standard and platform for issuing, storing and sharing “micro-credentials,” recognition for skills and achievements that learners have completed.

SIF Implementation Specification

<https://www.sifassociation.org/Specification/Pages/default.aspx>

The SIF (School Interoperability Framework) Association brings together the developers and vendors of school technology with the Federal, State and local educators who use that technology. SIF defines the rules for data movement between applications—efficiently, accurately and automatically—in the SIF Implementation Specification. The SIF Implementation Specification is a technical standard that is used by developers of education software to ease the transfer of data among applications in use by schools, districts and State education agencies.

Content Standards

Academic Benchmarks

<http://academicbenchmarks.com>

The Academic Benchmarks Standards Registry is the largest and most comprehensive source of academic standards with more than 2.6 million State, national, district and international standards in a configurable, digital format. Academic Benchmarks has its own set of globally unique identifiers (GUIDS) for their standards sets as opposed to the Achievement Standards Network GUID, the Common Core State Standards dot notation, or the Common Core State Standards GUID.

Achievement Standards Network (ASN)

<http://asn.jesandco.org/>

The ASN provides open access to machine-readable representations of learning objectives published by education agencies and organizations including the Common Core State Standards. The ASN assigns a uniform resource identifier (URI) to each standard creating an entity on the Semantic Web that can be linked and referenced. Users correlate to ASN’s open-source URI’s to enable the discoverability and accessibility of their content.

Common Core State Standards (CCSS)

<http://www.corestandards.org>

The CCSS (structure below) are to be accessed by a CCSS dot notation, CCSS GUID (globally unique identifier), or CCSS uniform resource locator.

Mathematics	English Language/Literacy
Initiative	Initiative
Framework	Framework
Set	Set (optional)
Grade	Strand + Domain
Domain	Grade
Cluster	Standard
Standard	Component (optional)
Component (optional)	

Granular Identifiers and Metadata (GIM) for the Common Core State Standards Project

<http://www.setda.org/web/guest/Interoperability>

The Partnership for Assessment of Readiness for College and Careers, Smarter Balanced Assessment Consortium and State Educational Technology Directors Association, working in partnership with the Council of Chief State School Officers, have launched a collaborative, State-centric project—GIM-CCSS—to facilitate the long-term technical implementation of the CCSS in a digital format that meets the diversity of stakeholder needs in the field, while preserving the conceptual and structural integrity of the standards. GIM-CCSS applies fine-granulated identifiers to the CCSS to enable them to be aligned to education resources, for use by digital content creators to align their materials to specific standards.

Next Generation Science Standards (NGSS)

<http://www.nextgenscience.org/next-generation-science-standards>

Through a collaborative, State-led process managed by Achieve, new K–12 science standards are being developed that will be rich in content and practice, arranged in a coherent manner across disciplines and grades to provide all students an internationally benchmarked science education. The NGSS will be based on the Framework for K–12 Science Education developed by the National Research Council.

Metadata Models

Dublin Core Metadata Initiative (DCMI)

<http://dublincore.org>

The DCMI supports shared innovation in metadata design and best practices across a broad range of purposes and business models.

IMS Global Learning Consortium (GLC)

<http://imsglobal.org>

The IMS GLC is a global, nonprofit, member organization that strives to enable the growth and impact of learning technology in the education and corporate learning sectors worldwide. IMS GLC has approved and published some 20 standards that are the most widely used learning technology standards in the world. Widely-used IMS GLC standards include meta-data, content packaging, common cartridge, enterprise services, question & test, sequencing, competencies, access for all, ePortfolio, learner information, tools interoperability, resource list, sharable state persistence, vocabulary definition and learning design. IMS content, application and data standards enable teachers to mix and match educational content and software from different sources into the same learning platforms.

Learning Resource Metadata Initiative (LRMI)

<http://www.lrmi.net>

The LRMI is co-led by the Association of Educational Publishers and Creative Commons. The Association of Educational Publishers was invited by the Bill & Melinda Gates Foundation to continue work on the second phase of the LRMI, which focuses on adoption and implementation of the LRMI metadata specification. Activities for Phase II include:

- Producing a proof of concept of the LRMI specification to demonstrate the value of the LRMI properties in a search environment and document the tagging process
- Analyzing the impact of LRMI on the educator community as well as the educational resource industry
- Informing and encouraging the Schema.org adoption process
- Providing ongoing education and support to the learning resource industry through instructional videos, webinars and briefings at industry events, including ISTE, EdNET and the Frankfurt Book Fair

LRMI provides a common structure for tagging learning resources that can be used by online search engines and content delivery platforms to deliver more precise results and richer filtering capabilities.

Schema.org

<http://schema.org>

In early June 2011, the three big search engines Bing, Google and Yahoo! introduced

Schema.org, a collection of terms that webmasters can use to mark up their pages to improve the display of search results. This site is a complementary effort by people from the Linked Data community to support Schema.org deployment and usage with a special focus on Linked Data:

- It provides markup examples and tutorials about publishing and consuming data with Schema.org terms.
- It maintains mappings from Web Data vocabularies such as the DBpedia ontology to Schema.org terms.
- It lists tools and libraries that are able to consume or produce Schema.org-based data.
- It automatically scrapes the Schema.org terms on a daily basis and generates the following formats:
 - RDF/Turtle
 - RDF/XML
 - RDF/NTriples
 - JSON
 - CSV

Sharable Content Object Reference Model (SCORM)

<http://www.adlnet.gov/scorm/>

SCORM is a compilation of technical specifications for Web-based e-learning. The SCORM standards are governed and published by the Advanced Distributed Learning Initiative.

Appendix D. Architecture Capabilities Maturity Model Rubric

Source: Center for Educational Leadership and Technology, Architecture Capability Maturity Model Rubric. June 17, 2013.

Question #	Enterprise Architecture Elements	Maturity Level	1	2	3	4	5
1	Architecture Process		Processes are ad hoc and localized. Some enterprise architecture processes are defined. There is no unified architecture process across technologies or business processes. Success depends on individual efforts.	Basic enterprise architecture process is documented. The architecture process has developed clear roles and responsibilities.	The architecture is well defined and communicated to IT staff and business management with operating unit IT responsibilities. The process is largely followed.	Enterprise architecture process is part of the culture. Quality metrics associated with the architecture process are captured.	Concerted efforts to optimize and continuously improve architecture process.
2	Architecture Development		Enterprise architecture processes, documentation and standards are established by a variety of ad hoc means and are localized or informal.	IT vision, principles, business linkages, Baseline and Target Architecture are identified. Architecture standards exist, but not necessarily linked to Target Architecture. Technical Reference Model and Standards Profile framework established.	Gap analysis and Migration Plan are completed. Fully developed Technical Reference Model and Standards Profile. IT goals and methods are identified.	Enterprise architecture documentation is updated on a regular cycle to reflect the updated enterprise architecture. Business, Data, Application and Technology Architectures defined by appropriate de jure and de facto standards.	A standards and waivers process is used to improve architecture development process.
3	Business linkage		Minimal or implicit linkage to business strategies or business drivers.	Explicit linkage to business strategies.	Enterprise architecture is integrated with capital planning and investment control.	Capital planning and investment control are adjusted based on the feedback received and lessons learned from updated enterprise architecture. Periodic re-examination of business drivers.	Architecture process metrics are used to optimize and drive business linkages. Business involved in the continuous process improvements of enterprise architecture.
4	Senior management involvement		Limited management team awareness or involvement in the architecture process.	Management awareness of architecture effort.	Senior management team aware of and supportive of the enterprise-wide architecture process. Management actively supports architectural standards.	Senior management team directly involved in the architecture review process.	Senior management involvement in optimizing process improvements in architecture development and governance.

Question #	Enterprise Architecture Elements	Maturity Level	1	2	3	4	5
5	Operating unit participation		Limited operating unit acceptance of the enterprise architecture process.	Responsibilities are assigned and work is underway.	Most elements of operating unit show acceptance of or are actively participating in the enterprise architecture process.	The entire operating unit accepts and actively participates in the enterprise architecture process.	Feedback on architecture process from all operating unit elements is used to drive architecture process improvements.
6	Architecture communication		The latest version of the operating unit's enterprise architecture documentation is on the web. Little communication exists about the enterprise architecture process and possible process improvements.	The operating unit enterprise architecture web pages are updated periodically and are used to document architecture deliverables.	Architecture documents updated regularly on enterprise architecture web page.	Architecture documents are updated regularly, and frequently reviewed for latest architecture developments/standards.	Architecture documents are used by every decision-maker in the organization for every IT-related business decision.
7	IT security		IT security considerations are ad hoc and localized.	IT security architecture has defined clear roles and responsibilities.	IT security architecture Standards Profile is fully developed and is integrated with enterprise architecture.	Performance metrics associated with IT security architecture are captured.	Feedback from IT security architecture metrics are used to drive architecture process improvements.
8	Architecture governance		No explicit governance of architectural standards.	Governance of a few architectural standards and some adherence to existing Standards Profile.	Explicit documented governance of majority of IT investments.	Explicit governance of all IT investments. Formal processes for managing variances feed back into enterprise architecture.	Explicit governance of all IT investments. A standards and waivers process is used to make governance-process improvements.
9	IT investment and acquisition strategy		Little or no involvement of strategic planning and acquisition personnel in the enterprise architecture process. Little or no adherence to existing standards.	Little or no formal governance of IT investment and acquisition strategy. Operating unit demonstrates some adherence to existing Standards Profile.	IT acquisition strategy exists and includes compliance measures to IT enterprise architecture. Cost benefits are considered in identifying projects.	All planned IT acquisitions and purchases are guided and governed by the enterprise architecture.	No unplanned IT investment or acquisition.

Appendix E. Elements of Instructional Processes

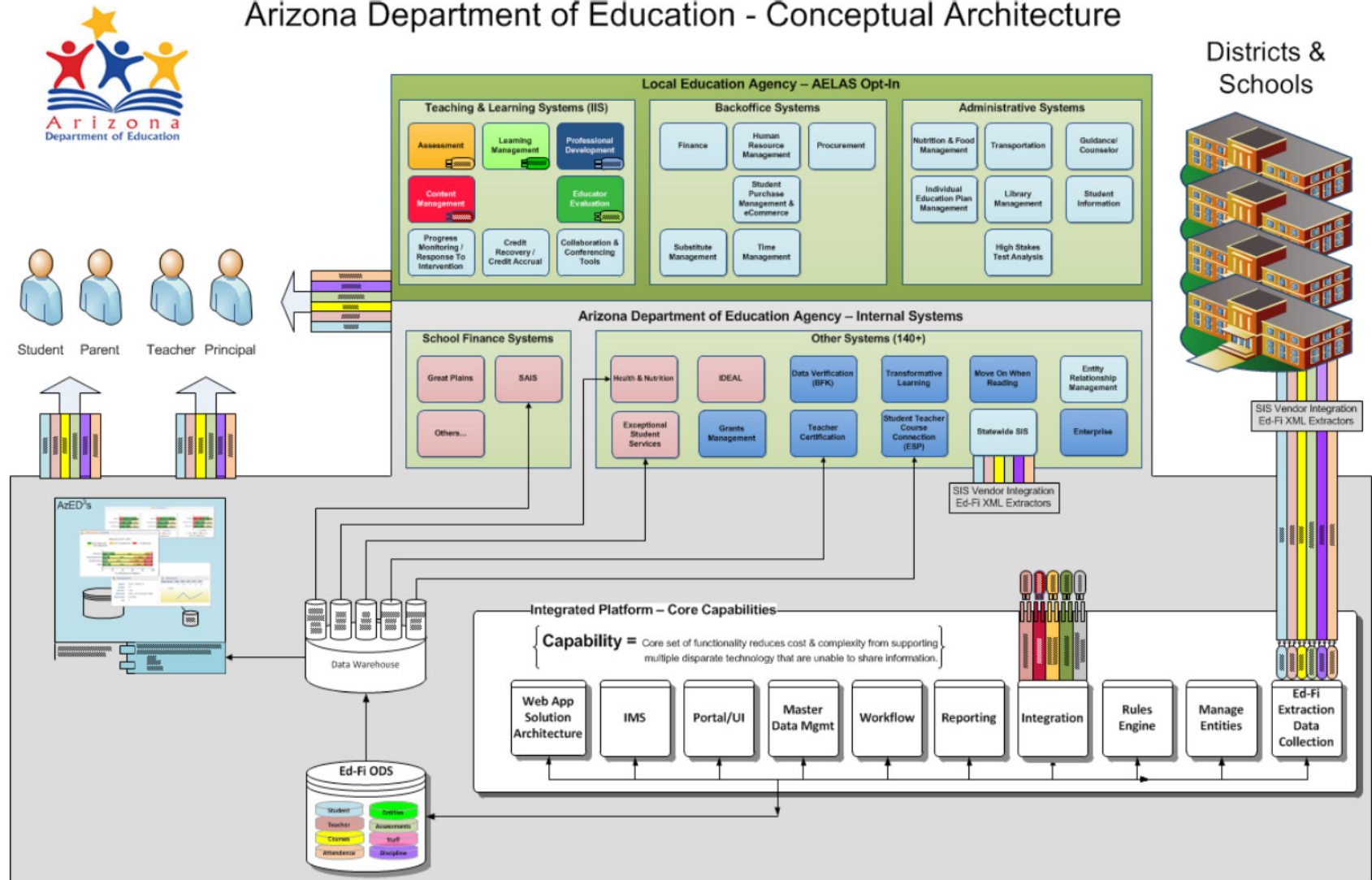
Source: Center for Educational Leadership and Technology, Process to Application Map. June 7, 2013.

Process name/sub-processes	In scope (Y/N)
1. Develop curriculum	
1.1. Define/design curriculum development procedures	
1.2. Align with State/local standards	
1.3. Provide for key customer and stakeholder input	
1.4. Develop scope/sequence/timeline (curriculum maps)	
1.5. Develop instructional calendars/pacing guides/local assessments (grade-level expectations)	
1.6. Select instructional resources (identify standards-based resources)	
1.7. Pilot the curriculum (curriculum review)	
1.8. Implement the curriculum	
1.9. Monitor integrity of curriculum implementation	
2. Design effective instructional programs	
2.1. Use diagnostics to determine readiness to learn	
2.2. Identify best practices based on data	
2.3. Establish best practice instructional strategies	
2.4. Develop an implementation plan	
2.5. Determine expectation for lesson design (learning maps, Universal Design for Learning, Response to Intervention)	
2.6. Provide differentiated instruction based on individual student needs (personalized, blended, etcetera)	
2.7. Align after school and summer program curriculum	
2.8. Design instructional programs to accelerate learning for students below grade-level standards	
2.9. Support instructional collaboration (teacher, parent, student)	
3. Assess student achievement and growth	
3.1. Plan district assessment program	
3.2. Develop/administer formative assessment tools (develop/manage assessment item bank)	
3.3. Develop/administer interim assessments	
3.4. Administer summative assessments	
3.5. Score and compile assessment data	
4. Develop and manage learner profiles	
4.1. Consolidate learner information from all systems	
4.2. Provide role-based access to all information	
5. Perform data analysis and reporting	
5.1. Analyze and evaluate assessment results	
5.2. Provide training to staff, students and parents on analyzing and using data	
5.3. Report assessment results to students, stakeholders and district leadership	
6. Develop and manage human capital	
6.1. Manage employee performance	
6.2. Manage employee development (plan and establish professional development opportunities)	
6.3. Develop and train employees (manage teacher competencies)	

Appendix F. Visuals of Architectures from Arizona and Massachusetts

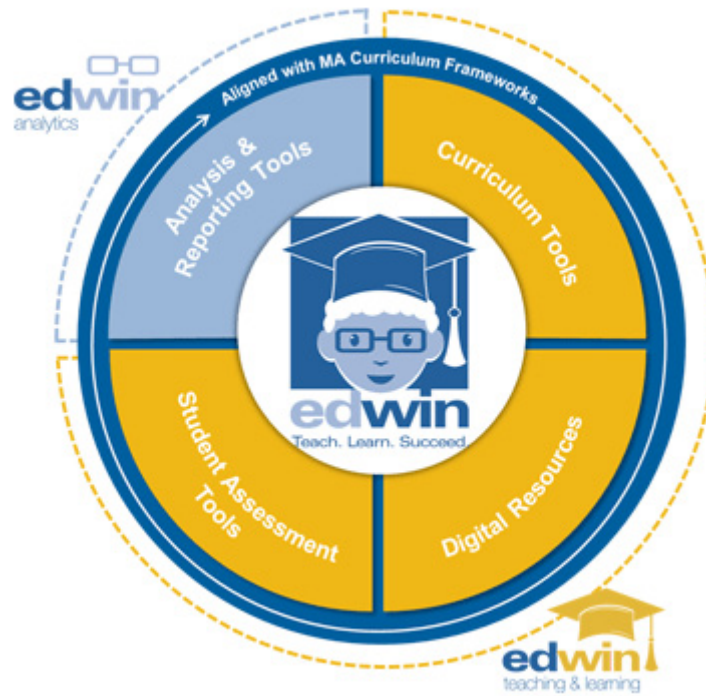
Arizona

Arizona Department of Education - Conceptual Architecture



Arizona Education Learning and Accountability System (AELAS) Business Case: "Preparing Arizona Students for College and Career Success." October 4, 2013 Arizona Department of Education. 119. <http://www.azed.gov/aelas/files/2013/10/aelas-business-case-v1.5.pdf>

Massachusetts



Massachusetts Department of Elementary and Secondary Education. <http://www.doe.mass.edu/edwin/>

Appendix G. Instructional Process to Application Map

Appendix G provides a template for conducting a current state architecture analysis across business, information, application, and technology architectures. This sample template addresses the high-level processes and sub-processes required to support personalized learning with an instructional improvement system, the data required by these processes and the applications to support them.

Process Name/ Subprocesses	Process Owner	Current Application(s) in Use to Support the Process	What Data is Input into the Process?	What Data is Output from the Process?	Functional Assessment (see note 1)	Technical Assessment (see note 2)	Standards Classification (see note 3)	Process Issues/ Concerns	State Outcomes	District Outcomes	School Outcomes
1. Develop Curriculum											
1.1 Define/Design curriculum development procedures									Standards-aligned curriculum, assessments and interventions have been adopted/ approved.	A standards-aligned curriculum has been adopted and is aligned both vertically and horizontally.	The standards-aligned curriculum and assessments have been adopted and are being implemented throughout each school.
1.2. Align with federal/state/ local standards								"Challenging content standards have been adopted for all grades, subjects, students, and schools. Documentation of the alignment of the most current state standards and core curriculum in all grade levels and content areas is present."	"Documentation of the alignment of the most current state standards and core curriculum in all grade levels and content areas is present. Instructional leaders and specialists adhere to the aligned state standards and curriculum in supporting schools."	"Documentation of the alignment of the most current state standards and core curriculum in all grade levels and content areas is present. Units/lessons and instructional resources aligned with the most current state standards and core curriculum are consistently in use."	
1.3. Provide for key customer and stakeholder input										A plan to gather input from stakeholders and provide input to the state regarding the standards and curriculum is in place, aligned and being implemented.	

Process Name/ Subprocesses	Process Owner	Current Application(s) in Use to Support the Process	What Data is Input into the Process?	What Data is Output from the Process?	Functional Assessment (see note 1)	Technical Assessment (see note 2)	Standards Classification (see note 3)	Process Issues/ Concerns	State Outcomes	District Outcomes	School Outcomes
1.4. Develop scope/ sequence/ timeline (curriculum maps)										A scope, schedule and sequence have been developed for each course.	The scope, schedule and sequence for each course are evident in each school's instruction, syllabi and calendars.
1.5. Develop instructional calendars/ pacing guides/local assessments (grade level expectations)									Gaps and redundancy in curriculum have been eliminated.		
1.6. Select instructional resources (identify standards- based resources)									A sufficient supply of resources is provided to each district to support instructional preparation and delivery.	"Instructional resources and model programs have been selected for all content areas and students, including those participating in programs for general education, advanced studies, ELL, SWD, GT, AE, and CTE. Special courses are added to the curriculum offerings based on student need. Sufficient resources have been provided to the faculty and students to meet standards."	Research-based instructional resources, interventions, enrichment and model programs are being implemented in each school to benefit students in general education, advanced studies, ELL, SWD, GT, AE, and CTE programs.

Process Name/ Subprocesses	Process Owner	Current Application(s) in Use to Support the Process	What Data is Input into the Process?	What Data is Output from the Process?	Functional Assessment (see note 1)	Technical Assessment (see note 2)	Standards Classification (see note 3)	Process Issues/ Concerns	State Outcomes	District Outcomes	School Outcomes
1.7. Monitor integrity of curriculum implementation									There is a written plan in place for the ongoing revision of the curriculum and achievement standards, which includes the involvement of stakeholders.	Standards for instructional resources are established and monitored.	Input and feedback regarding the standards and curriculum are provided to the district and state.
2. Design Effective Instructional Programs											
2.1. Identify best practices based on data									Model interventions and programs are identified through the monitoring of current and longitudinal data.	Model interventions and programs are identified and replicated through the monitoring of current and longitudinal data.	Model interventions and programs are identified and replicated through the monitoring of current and longitudinal data.
2.2. Establish best-practice instructional strategies									Research-based instructional standards have been identified and shared with all district leaders.	Instructional standards have been adopted and shared with all educators.	Resources and instructional time are used in an efficient way.
2.3. Develop an implementation plan										Schools are adequately and equitably stocked with instructional materials, supplies and resources.	Classrooms are adequately and equitably stocked with instructional materials, supplies and resources.
2.4. Determine expectation for lesson design (learning maps, UDL, RTI)										A model instructional planning process has been designed and shared with all school administrators and teachers.	Teachers participate in a planning process that includes the preparation of engaging materials and tools to support instruction specific to each student's standards-based learning needs.

Process Name/ Subprocesses	Process Owner	Current Application(s) in Use to Support the Process	What Data is Input into the Process?	What Data is Output from the Process?	Functional Assessment (see note 1)	Technical Assessment (see note 2)	Standards Classification (see note 3)	Process Issues/ Concerns	State Outcomes	District Outcomes	School Outcomes
2.5. Provide differentiated instruction based on individual student needs (personalized, blended, etc.)										<p>"Instructional leaders/mentors support schools in using a sufficient range of instructional techniques to address individual students' strengths and needs.</p> <p>Instructional leaders/mentors support schools in providing research-based instruction and developmentally appropriate content to every student in every content area."</p>	<p>"Individual teachers and teams of educators collaboratively review student data and work products to plan for differentiated instruction.</p> <p>A sufficient range of instructional techniques are being utilized to address individual students' strengths and needs.</p> <p>Research-based instruction and developmentally appropriate content are offered to every student in every content area."</p>
2.6. Design instructional programs to accelerate learning for students below grade level standards										<p>"A sufficient range of courses have been scheduled at each academic level (elementary, middle and high school) to include appropriate programs for general education, ELL, GT, AE, SWD, and CTE students.</p> <p>Research-based intervention programs and strategies are introduced to district personnel."</p>	<p>"A sufficient range of courses have been scheduled at each academic level (elementary, middle and high school) to include appropriate programs for general education, ELL, GT, AE, SWD, and CTE students.</p> <p>Model intervention and enrichment programs and strategies are implemented for identified students."</p>

Process Name/ Subprocesses	Process Owner	Current Application(s) in Use to Support the Process	What Data is Input into the Process?	What Data is Output from the Process?	Functional Assessment (see note 1)	Technical Assessment (see note 2)	Standards Classification (see note 3)	Process Issues/ Concerns	State Outcomes	District Outcomes	School Outcomes
2.7. Support instructional collaboration (teacher, parent, student)									Model intervention and enrichment programs are identified and recommended to district personnel for review.	Model intervention and enrichment programs and strategies are identified, articulated and made available to schools based on student need.	"Parents are continuously provided with ideas and tools to support their children's progress. Students are provided with timely feedback and remediation activities."
3. Assess student achievement and growth											
3.1. Plan the assessment program (Develop/ manage assessment item bank)									Standards-aligned summative assessment items have been created for all appropriate students.	Standards-aligned district level formative assessment items have been created for all students.	Standards-aligned school and classroom-based formative assessment items have been created for all students.
3.2. Develop/ Administer formative assessments											"Standards-aligned school and classroom-based formative assessments have been developed for all students. Teachers frequently create and easily access standards-aligned assessments to determine prior learning and measure progress. The school and classroom-based formative assessment process is well managed."

Process Name/ Subprocesses	Process Owner	Current Application(s) in Use to Support the Process	What Data is Input into the Process?	What Data is Output from the Process?	Functional Assessment (see note 1)	Technical Assessment (see note 2)	Standards Classification (see note 3)	Process Issues/ Concerns	State Outcomes	District Outcomes	School Outcomes
3.3. Develop/ Administer interim assessments										"Standards-aligned district interim assessments have been developed for all students. Summative and interim assessments are securely and efficiently stored. The district's interim assessment process is well managed."	
3.4. Develop/ Administer summative assessments									"Standards-aligned summative assessments have been developed and are securely and efficiently stored for all appropriate students. The summative assessment process is well managed."		
3.5. Score and compile assessment data									Summative assessments are scored and processed in a consistent and efficient manner.	The district's interim assessments are scored and processed in a consistent and efficient manner.	"Students and parents promptly receive results on district and classroom-based formative assessments. Students and parents promptly receive results on standards-aligned, teacher-made tests."

Process Name/ Subprocesses	Process Owner	Current Application(s) in Use to Support the Process	What Data is Input into the Process?	What Data is Output from the Process?	Functional Assessment (see note 1)	Technical Assessment (see note 2)	Standards Classification (see note 3)	Process Issues/ Concerns	State Outcomes	District Outcomes	School Outcomes
4. Develop and manage learner profiles											
4.1. Consolidate learner information from all systems											
4.2. Provide role-base access to all information											
5. Perform data analysis and reporting											
5.1. Analyze and evaluate assessment results									"Disaggregated summative academic performance is reported to appropriate stakeholders (i.e. AYP group and grade, school, academic, district, and state levels). Disaggregated summative and formative assessment results are frequently monitored to measure the effectiveness of and inform planning for interventions and programs."	"Disaggregated summative and interim academic performance is frequently monitored and reported to appropriate stakeholders (i.e. individual, group, classroom, grade, school, academic, district, and state levels). Disaggregated summative and interim assessment results are frequently monitored to measure the effectiveness of and inform planning for interventions and programs."	"Disaggregated summative, interim, and formative academic performance is frequently monitored and reported to appropriate stakeholders (i.e. individual, group, classroom, grade, school, academic, district, and state levels). Disaggregated summative, interim, and formative assessment results are frequently monitored to measure the effectiveness of and inform planning for interventions and programs."

Process Name/ Subprocesses	Process Owner	Current Application(s) in Use to Support the Process	What Data is Input into the Process?	What Data is Output from the Process?	Functional Assessment (see note 1)	Technical Assessment (see note 2)	Standards Classification (see note 3)	Process Issues/ Concerns	State Outcomes	District Outcomes	School Outcomes
5.2. Provide training on analyzing and using data to staff, students, and parents									State leaders/mentors work with school administrators and teacher leaders to analyze current and longitudinal data to identify strengths and areas of need, and plan for district support.	"District leaders/mentors frequently assist educators in analyzing current, longitudinal and predictive assessment data (by item and skill) to identify strengths and areas of need, and plan for school support. Based on the analysis of student data, intensive assistance support teams are assigned to design and provide intervention and enrichment programs for students."	Professional Learning Communities (PLCs) meet regularly to plan for differentiated instruction and programs based on current, longitudinal and predictive assessment data (by item and skill) and student work products.
5.3. Report assessment results to students, stakeholders, and district leadership											"Parents receive timely feedback on their children's performance and are provided with ideas and tools to support their children's progress. Students receive timely feedback on their performance and have opportunities to track their progress and direct their own learning to meet standards."

Process Name/ Subprocesses	Process Owner	Current Application(s) in Use to Support the Process	What Data is Input into the Process?	What Data is Output from the Process?	Functional Assessment (see note 1)	Technical Assessment (see note 2)	Standards Classification (see note 3)	Process Issues/ Concerns	State Outcomes	District Outcomes	School Outcomes
6. Develop and Manage Human Capital											
6.1. Manage employee performance									State level professional development plans are designed, implemented, monitored, and updated based on the regular analysis of students' performance on assessments.	Based on the analysis of student performance on assessments, intensive assistance support teams are assigned to design and provide instructional coaching for teachers.	When warranted, based on achievement data, school-based leaders collaborate with district-assigned intensive assistance support teams to design and provide instructional coaching for teachers.
6.2. Manage employee development (Plan and establish professional development opportunities)									A research-based, PD plan that has been aligned to each district's strategic plan, curriculum and educators' needs has been adopted.	District PD plans are aligned with schools' strategic plans, curriculum and educators' needs, and updated based on the frequent analysis of students' performance on assessments.	Research-based professional development plans are designed, implemented, monitored, and updated based on the frequent analysis of students' assessment data.
6.3. Develop and train employees (Manage teacher competencies)											

Note 1: Functional Assessment Rating Description

- 1 = product does not meet the needs of the customer
- 2 = product meets some of the needs of the customer
- 3 = product meets the needs of the customer
- 4 = product sometimes exceeds the expectations of the customer
- 5 = product consistently exceeds the expectations of the customer

Note 2: Technical Assessment Rating Description

- 1 =
 - Software does not have any vendor support
 - Software is on an unsupported hardware and/or operating system platform that cannot be expanded or upgraded
 - Software runs on a single workstation and has only one point of data entry
 - Software is not supported by a commercially available database
 - Software was developed in a language not easily supported
 - Software relies on utilities or subsystems that are no longer supported
- 2 =
 - Vendor support is available but maintenance fees have not been paid
 - Hardware and/or operating system can be upgraded or expanded but at a high cost
 - Software runs over the network – uses excessive network resources – similar to how Access behaves over the network
 - Software is supported by a commercially available database
 - Software is client/server based with no plans to convert to Web-based
- 3 =
 - Supporting data bases are relational
 - Hardware and operating system software are industry standard and/or readily available on the market at competitive prices or system upgrades/expansions readily available on the market at competitive prices
 - The software is regularly upgraded through releases from the vendor
 - The software is planned to become fully Web enabled
 - The software has the capability to add extensions to the functionality without modifying the core code from the vendor
 - Data is stored in one place – no redundant data entry
- 4 =
 - Data base structure is relational with supporting data query tools
 - The software is fully Web enabled
 - The software vendor has a major portion of the market share for this type of application
- 5 =
 - The software vendor is the industry leader for this type of application

Note 3: Standards Definitions

CORE	Technology that represents the current infrastructure which should be replicated as the standard solution throughout the organization.
DECLINING	Technology that is broadly deployed throughout the infrastructure but is not the technology of choice for new systems.
EMERGING	Technology identified in the architecture that has a potential future role as Core or Specialized technology.
SPECIALIZED	Technology that is deployed only to meet specific unique needs and is approved for that purpose.

Business Continuity Plan

Yes = there is a plan in place, shared with appropriate departments (including TSD) and tested.

No = no plan is written, shared and tested.

Note that a plan should include as a minimum: location of alternative office space and equipment (phones, workstations, etc.), procedures for operating in a recovery mode, steps to take to be able to continue work on critical processes, steps to take to recover all critical hard-copy files, and steps to take to recover computer files and applications.

Recovery Priority - Criteria:

High = Involves safety or legal issues or very high visibility to community - recover ASAP

Medium = Can shut down operations - recover within 5 to 7 business days

Low = All others - recover within 15 business days

Appendix H. Selecting a Segment Architecture Project Team

As part of the project organization, it is important to determine whom to involve in the work. Consider the individuals or groups that are affected by the project to identify team members.

The National Association of State CIOs Enterprise Architecture Tool-Kit version 3.0 suggests that various groups or individuals can play a “primary role” or a “supporting role.”²⁰ Those individuals who play a “primary role” are ones with “consistent” architecture responsibilities and those in the “supporting role” are “contributors.” For this approach it is important that each team member understands the EEA business principles to ensure a consistent approach to decision making.

Specific individuals to involve in a segment architecture project team would include:

- *Chief Academic Officer (SEA)*
- *Director of Assessment (SEA)*
- *Director of Accountability (SEA)*
- *Director of Instruction (SEA)*
- *Director of Services for Students with Disabilities (SEA)*
- *Chief Academic Officer (LEA)*
- *Director of Assessment (LEA)*
- *Director of Accountability (LEA)*
- *Director of Instruction (LEA)*
- *Director of Services for Students with Disabilities (LEA)*
- *Teacher and Administrator representatives*

A sample template is provided below to help clarify the project roles of different members.

Name of Individual	Group Represented	Role on Team	Responsibility	Primary or Supporting	Value to Team
Joe	Manager of the Data Governance Group	Liaison to Data Governance	Represents the Data Governance Team; provides feedback from the Governance Team	Primary	Method of communications to and from Data Governance
Bob	CIO	Liaison to the DOE IT team	Represents the IT team; understands the resources	Primary	Provides information about IT standards, available resources and supports
Susan	Director of Instruction (LEA)	Liaison to all LEA directors of instruction	Provides feedback from the districts that will be implementing the effort	Primary	Understands district, school and classroom needs; understands how the end user will implement the effort

²⁰ National Association of State CIOs, “Enterprise Architecture Development Tool-Kit v3.0,” p. 2, <http://www.nascio.org/committees/EA/download2.cfm>

Appendix I. Checklist for Developing an Education Enterprise Architecture

Establishing a Vision and Architecture Principles

- Develop a clear, well-communicated EEA vision that fits within the broader vision of the SEA and LEAs.
- Identify guiding principles across business, information, application and technology architectures.
- Appoint an EEA manager and champion(s) to sponsor and facilitate the development of the EEA.
- Incorporate stakeholders from other State agencies, school districts and charter schools to encourage broad acceptance and future alignment.

Defining Scope

- Translate the vision into a set of defined and specific strategic objectives.
- Assess resources and the agency's capacity to define the scope of the EEA to be implemented.
- Examine strategic priorities and stakeholder needs to clarify which domains to include in the scope.

Documenting the Current State and Future State

- Create a current picture (the current state) of the agency and its operations across all four architectures (business architecture, information architecture, application architecture and technology architecture)
- Define where the agency wants to be and what it wants to achieve across all four architectures (future state)

Moving from Current State to Future State

- Identify the differences between the current and desired future state for all four architectures (gap identification).
- Establish a road map which provides a timeline for the progression from the current to the future state and criteria to determine the priority of the projects to launch.

Creating a Project Plan for the EEA

- Establish an implementation plan that address the gaps identified between the current and future state.
- Articulate EEA goals and objectives clearly.
- Identify desired outcomes or results.
- Create project deliverables.
- Establish project organization.
- Schedule and staff project action plan.

Governance for the EEA

- Establish a cross-organization EEA steering committee or architecture review board.
- Develop an architecture compliance strategy that ensures conformance with EEA by all parts of the agency.
- Incorporate stakeholders from other State agencies, school districts, and charter schools to encourage broad acceptance and future alignment.
- Establish agency data governance structure and integrate with integrate EEA governance.

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