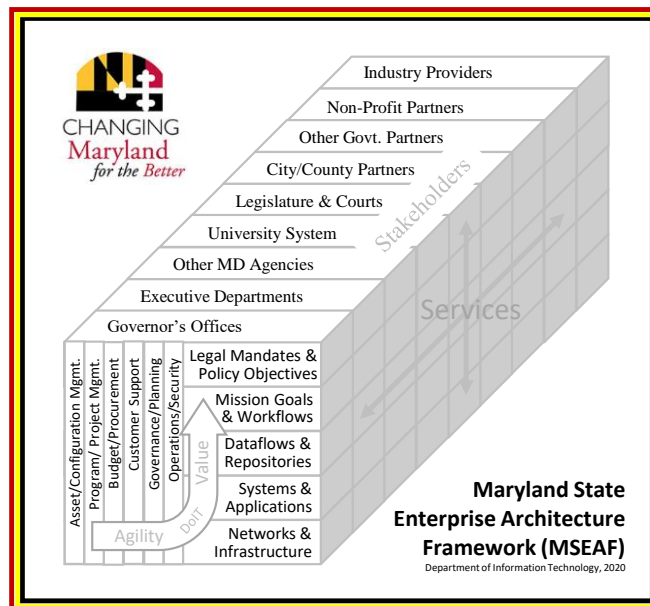


Maryland State  
Department of Information Technology



# Enterprise Architecture Handbook

Version 1D



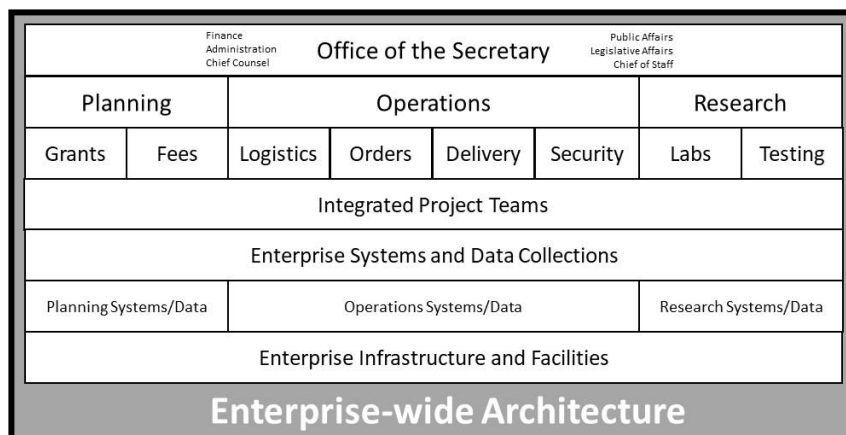
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## 1.0 Overview

### 1.1 The Purpose of Enterprise Architecture

Enterprise Architecture (EA) is a blended management and technology discipline that examines all aspects of information technology (IT) services within and between Maryland State Agencies to improve mission effectiveness, the efficient use of resources, and agility when faced with changes. To do this, EA uses an integrated approach to strategic, business, and technology planning to produce high-level and detailed views of services, systems, solutions, and standards. The following diagram shows an example agency and high-level view of structure and functions, with EA providing a consistent holistic context.



### 1.2 The Value & Risk of Doing Enterprise Architecture

The products of an organization-wide EA program are often welcomed by agency leadership and stakeholders who benefit from enterprise-level solutions. EA is usually not welcomed by program-level stakeholders who benefit from local control and program-specific solutions. Additionally, the historical culture and processes of an agency may not be supportive of enterprise-wide standards so active change management will be required. The following are some specific areas of value and risk when doing EA:

#### 1.2.1 Value Areas

**Goal Alignment.** Strategic goals are the priority objectives that enable an Agency to accomplish its mission, doing so in alignment with the Governor's priorities and in a legally compliant manner. Goals do not accomplish themselves, so initiatives (activities) are required in the form of ongoing programs and focused, time-specific projects. EA also promotes the use of Key Performance Indicator (KPI) metrics for cost, schedule, and performance to track an initiative's status.

**Resource Efficiency.** EA helps to ensure that an agency's resources are best positioned to support the achievement of strategic goals. These resources include people, skills, funding, workflows, data, systems, networks, and facilities. By providing an agency-wide view of business and technology resources, gaps and overlaps become apparent and can be addressed.

**Cost Reduction.** Enterprise-wide solutions normally have a lower total cost of ownership than multiple instances of similar capabilities among program offices. Similarly, EA can provide analyses to guide system and service outsourcing/insourcing decisions, as well as enterprise-level software licensing that often provides a lower per-seat and per-instance cost. EA also promotes a portfolio approach to business and technology capital and operating expenses, which involves identifying, prioritizing, and funding program assets.

Increased Agility. EA promotes agency-wide standards, methods, and solutions. This decreases gaps and overlaps in capabilities and increases the amount of coordination within and between agency operating units. These changes increase in the agency's ability to adopt new approaches and technologies at a more rapid pace and more holistic scales.

### **1.2.2 Risk Areas**

Loss of Local Control. It has historically been the case in many government agencies that a great deal of control over the method of execution for ongoing activities, staffing, and standards has been located at the program level. Program managers and staff become used to this and enjoy being able to have a significant say in how things are done in their area. EA brings organization-wide standards and methods to an agency, which runs counter to the historical norm of local control. Accordingly, program managers and staff are likely to resist the loss of control over standards and methods.

Exposure of Inefficiencies. EA promotes agency-wide inventories of business and technology processes, resources, and capabilities. This includes programs, systems, personnel, and spending. Analysis of inventories often reveals gaps and overlaps in resources and capabilities, such as multiple instances of records management systems, procurement and contracting groups, data warehouses, and office automation software. The identification (exposure) of these gaps and overlaps – and the prospect that the agency will act on these inefficiencies – is often not welcome by affected program offices who can expect that changes will occur in responsibilities and resources.

Cultural Change. Government agencies are staffed with people who usually perform their roles as part of groups that have norms which form over time in response to internal and external influences. This includes State-wide and agency policies, formal and informal authority structures, trust relationships, methods to deal with conflict, beliefs, reward structures, the personalities/styles of individuals, and historical failures and successes of the group. EA promotes a culture of cooperative achievement that is focused on attaining the agency's most important goals through a combination of enterprise- and program-level solutions and resources. The change from a group-centered culture to an enterprise-centered culture may be resisted by groups and individuals who feel that they are being marginalized and/or long-held beliefs and hard-won authorities are being done away with.

Resource Constraints. Agencies have limited resources (financial, people, skills, equipment, time, facilities, etc.). An EA program will need to compete for these resources and to do this successfully, EA must show that the value being produced exceeds the direct, indirect, and opportunity costs. EA should be able to do this as capability gaps/overlaps are closed.

The both cases (areas of value and risk), the best way to ensure that the agency EA program will be successful is to have an engaged senior executive who is the policy and results champion, hire an experienced Chief Enterprise Architect to lead the program, involve stakeholders from the outset, and promote frequent communication between all of them regarding the EA approach that will be adopted, what each role will be, how methods and resources may change, and that there can flexibility in the pace of adoption and the order of the program areas that will be effected.

## 2.0 Program Authority and Oversight

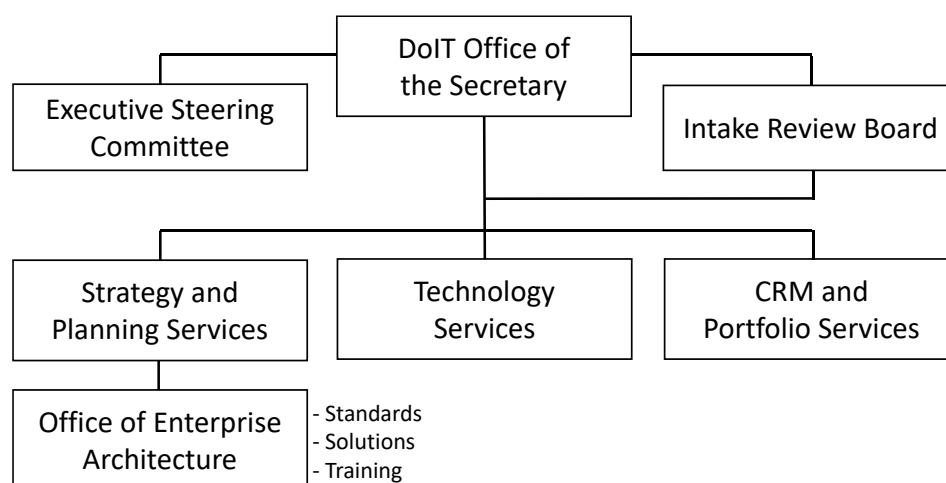
The term “governance” refers to a process that provides oversight and decision-making capabilities over some area of agency activity. In the case of an agency’s Enterprise Architecture program it is important to position the program and governance bodies at a level that has enterprise-wide authority and can affect strategic, business, and technology planning, standards, methods, and resources. The following are additional considerations in establishing and executing EA governance bodies and procedures.

**2.1 Authorities.** Maryland State Finance and Procurement Code, Annotated, Sections 3A-202 and 301-309. This section of State law gives the Department of Information Technology (DoIT) the responsibility for oversight of major IT projects throughout State government, as well as to be a provider of State-wide IT services and standards.

**2.2 Policy.** DoIT maintains an online IT Policy Catalog ([www.doit.gov/policy](http://www.doit.gov/policy)) that provides Secretary-approved procedures and standards for State Agencies to follow in providing or consuming IT products/services within their agency and with other agencies. One of these policies covers the DoIT EA Program Office and associated procedures/products.

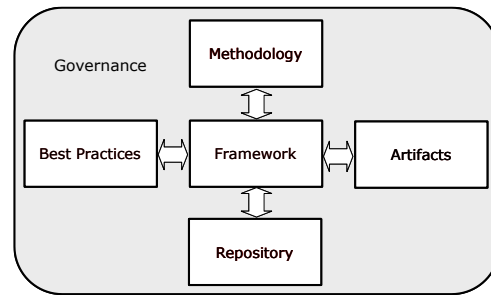
**2.3 Standards.** The Maryland State Enterprise Architecture (MSEA) approach that is presented in this Handbook is consistent with the concepts/methods of the Federal EA Framework (v2), NASCIO’s EA Toolkit (v3), and industry best practices, including the TOGAF, ITIL, and TBM. DoIT develops, promulgates, and updates IT-related standards and reusable solutions for State Agencies to use, doing so in a collaborative manner through the IT Policy, Intake Request, and service processes.

**2.4 Bodies.** The primary DoIT governance body is the Executive Steering Committee (ESC), whose members include all executives at the Secretarial and Director level. The ESC meets bi-weekly and members participate in several planning and decision-making processes including the Agency Request Intake Working Group that meets weekly, the Major IT Development Oversight Process that reviews agency major IT project status’ monthly, and the IT Policy Review Board that meets bi-weekly. ESC members also participate in the oversight of DoIT service teams in nearly a dozen areas including infrastructure, telecommunications, the State-wide radio network, web content management, user help desk, hardware/software acquisition, cyber security, enterprise architecture advisement, and IT program management. The following is a high-level organization chart for DoIT governance bodies.



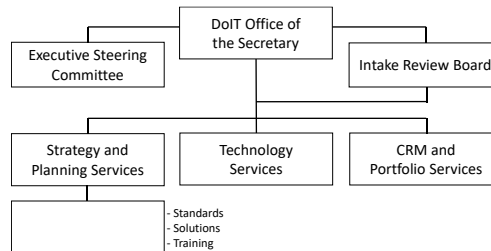
### 3.0 Architecture Approach

The Maryland State Enterprise Architecture (MSEA) approach has six core elements: governance, framework, methodology, artifacts, an online repository, and associated best practices. The following are summary descriptions of each element, followed by more detailed information. Appendices provide analysis taxonomies and documentation (artifact) examples.



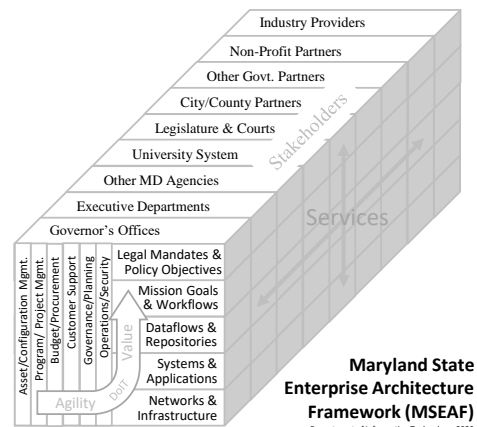
#### 3.1 Governance.

The term “governance” refers to a process that provides oversight and decision-making capabilities over some area of agency activity. In DoIT, the EA Program Office is located in the Strategy and Policy Services area, with oversight being provided by the Office of the Secretary and the Executive Steering Committee.



#### 3.2 Framework.

The EA framework is a model that graphically shows the parts (sub-architecture domains) of the holistic architecture. By defining what parts of the enterprise are included in the EA, the framework defines the scope of the architecture. The geometry of the framework also indicates the relationship of the parts. The MSEA Framework is shown to the right and has eight domains: five hierarchical sub-architectures (strategy, business, data, systems, and infrastructure) and three “threads” (security, skills, and standards) that have touchpoints to each hierarchical domain.



#### 3.3 Methodology.

The EA methodology (method) is a 4-phase, 20-step process to establish the EA Program, development of current/future views in each domain, a transition plan, and utilization activities with EA projects and agency governance bodies.

- Phase 1. Establish the EA Program
  - Phase 2. Documentation Preps
  - Phase 3. Establish Current/Future Views
  - Phase 4: Maintain and Use EA Products
- (see Appendix A for methodology steps)

#### 3.4 Artifacts.

Artifacts are various types of documentation that support EA analysis and design activities. Each area of the framework has recommended artifacts that are widely accepted, use standard notation sets and methods, and can be developed/updated by readily available modelers who are trained in that artifact.

##### Artifact ID Codes

Strategic Domain (S)	Nets/Infra Domain (NI)
Business Domain (B)	Security/Privacy Thread (SP)
Data Domain (D)	Standards Thread (ST)
System/App Domain (SA)	Workforce Skills Thread (W)

(see Appendices B & C for example artifacts)

### 3.5 Online Repository.

An online EA repository is an artifact storage and retrieval site located on the agency's internal network. To ease navigation, the repository uses a web browser interface and presentation matrix that is consistent with the parts of the framework and allows users to select the area they are interested in. Artifacts that have a logical relationship are linked and can be accessed together. Some artifact modeling tools some with frameworks and a repository.

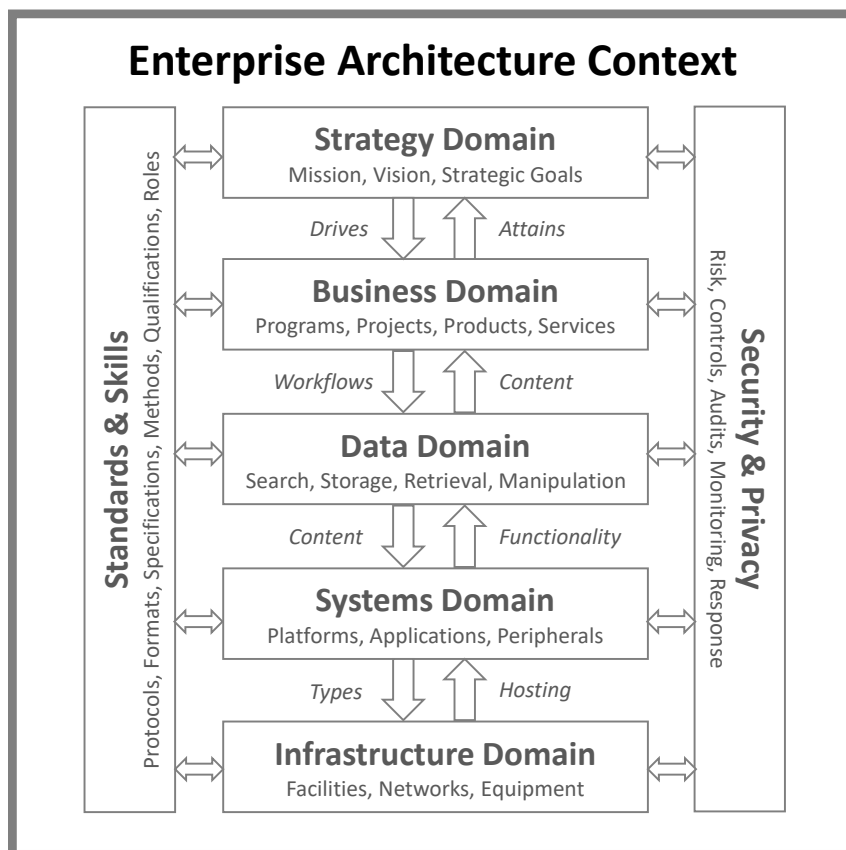
EA Management Plan	Future EA Views	EA Standards	EA Program	EA Tutorial	Site Map	
Enterprise Architecture Repository						
Current EA Views	Goals & Initiatives	Products & Services	Data & Information	Systems & Applications	Networks & Infrastructure	Security Solutions
High Level View	Strategic Plan	Business Plan	Knowledge Warehouse	Business Systems	Wide Area Network	Security Program
Mid Level View	Goals & Initiatives	Business Processes	Information Flows	Support Systems	Local Area Network	System Certifications
Detailed View	Performance Measures	Investment Portfolio	Data Dictionary	Application Inventory	Buildings & Equipment	Data Privacy

### 3.6. Associated Best Practices.

A best practice is an established method in the public and/or private sector which helps organizations improve their performance. EA does not compete with best practices, instead, EA provides context and standards for locating where and when a best practice is to be used within and between agency operating units. Example best practices for each domain and thread areas are shown to the right.

Strategic Domain: SWOT, Balanced Scorecard, KPIs  
 Business Domain: BPI, BPR, BPMN Flowchart, TBM  
 Data Domain: ERD, DFD, Data Dictionary  
 System Domain: Interface Diagram, Inventories  
 Infrastructure Domain: Network Maps, TCP/IP  
 Security Thread: Controls List, ATO, SOC-2  
 Standards Thread: NIST, IEEE, ISO, NASCIO, ANSI  
 Skills Thread: Position Descriptions, KSA list

Enterprise Architecture not only incorporates established best practices, but it also provides the context and relationships for the sub-architecture domains as is illustrated below.



## 4.0 Implementation

Implementing an agency-wide Enterprise Architecture centers on two things: (1) establishing an ongoing capability; and (2) creating/maintaining a coordinated set of domain views using various artifact types. The ongoing capability is best done through a dedicated EA Program Management Office (EA-PMO) and the artifacts should be made available through an internal online repository. The following is a summary of the EA implementation phases and steps (Appendix A provides additional details).

### Phase 1. Establish the EA Program

- Step 1: Establish the EA Management Program and identify a Chief Architect.
- Step 2: Establish an EA implementation methodology.
- Step 3: Establish EA governance and links to other management processes.
- Step 4: Develop an EA Communication Plan to gain stakeholder buy-in.

### Phase 2. Prepare to Document

- Step 5: Select an EA documentation framework.
- Step 6: Identify EA Lines of Business/Crosscuts and the order of their documentation.
- Step 7: Identify the EA components to be documented framework wide.
- Step 8: Select documentation methods appropriate for the framework.
- Step 9: Select software applications/tools to support automated EA documentation.
- Step 10: Select and establish an on-line EA repository for documentation and analysis.

### Phase 3. Establish Current and Future Views

- Step 11: Evaluate existing business and technology documentation for use in the EA.
- Step 12: Document current views of existing EA components in all framework areas.
- Step 13: Develop several future business/technology operating scenarios.
- Step 14: Identify future planning assumptions for each future scenario.
- Step 15: Use the scenarios and inputs to drive documentation of future EA components.
- Step 16: Develop an EA Management Plan to sequence planned changes in the EA.

### Phase 4: Maintain and Use EA Products

- Step 17: Use EA information to support planning and decision-making.
- Step 18: Regularly update current and future views of EA components.
- Step 19: Maintain an EA Repository for modeling and analysis products.
- Step 20: Release annual updates to the EA Management Plan.

These are generalized phases and steps, therefore it's expected that agencies will adjust implementation activities to address situations that are particular to that agency. This could include more definition on roles, responsibilities, domain ownership; additional change management actions, specifics on vendor alignment, coordination with external agency partners, or agency history/cultural considerations.

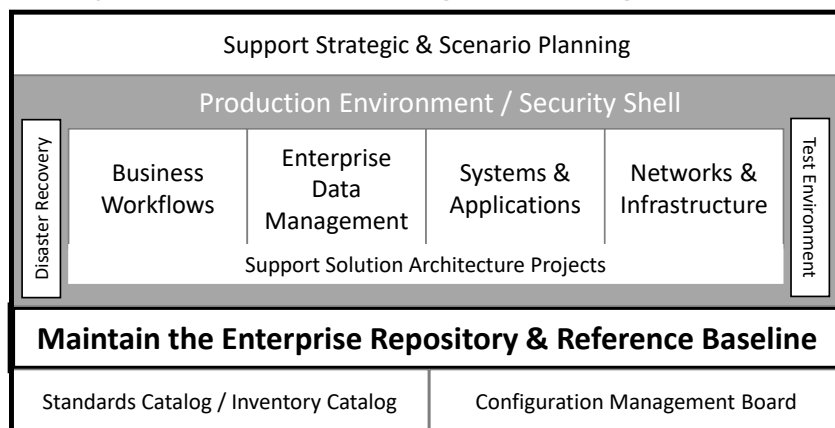
### 4.1 Program Management Office

The purpose of the EA Program Management Office (EA-PMO) is to provide a focal point for establishing and maintaining an agency-wide EA capability and documentation set. The EA-PMO should be led by an experienced Chief Enterprise Architect who reports to the primary executive sponsor of the EA program. There are several possible approaches to how an EA-PMO operates: advisory only, does all EA work itself, loans architects to project teams, or a hybrid of these. In that EA provides context and standards for all agency operating domains, it is easy to overwhelm an EA-PMO if it is tasked to do all EA analysis



and design work itself – even if significant resources are provided (trained people, funding, equipment, offices, etc.). Accordingly, agencies should consider making the EA-PMO a coordination and advisement group, wherein they maintain the agency-wide architecture baseline, the online EA repository, support the Configuration Control Board, and “loan” appropriately-skilled enterprise and/or domain-specific architects to business and technology project teams throughout the agency. As with any ongoing agency program, the EA-PMO will require the aforementioned resources, strong executive support, and the understanding and cooperation of stakeholders during the 8-12 months that it often takes for staffing, initial inventories, and alignment of solutioning with the agency project management process. The following is a graphic depiction of the functions of the EA-PMO:

### Enterprise Architecture Program Management Office



#### 4.2 Reference Baseline

One of the agency EA program primary roles should be to develop and maintain an authoritative and accurate inventory and configuration model of current business and technology processes and systems, as well as to collaboratively identify legal requirements and industry standards that must be followed. Collectively, these inventories, models, and lists form a “Reference Baseline” that should be used by planning and decision-making functions throughout the agency (e.g., capital planning, configuration control, asset management, security, logistics, and mission operations). This EA Reference Baseline should be viewed as a dynamic artifact that is maintained by the EA-PMO with stakeholder input as part of a regularized schedule of major EA updates (bi-annual or a major change).

#### 4.3 Analysis Projects

Of the two general categories of EA activities (analysis and design), the analysis projects usually focus on the development of new categorization methods, conducting inventories using existing methods, or assessing data, information, and/or models to identify patterns, confirm status, or validate options. Categorization methods include the use of taxonomy artifacts, also called “Reference Models”. The Maryland State EA approach that is described in this Handbook includes a set of Domain Reference Models whose taxonomies are provided in Appendix B. These Reference Models can be changed as part of the normal EA artifact update process and input from stakeholders in various agencies is encouraged. The agency EA-PMO should be trained in EA analysis project methods (DoIT can provide this training).

#### 4.4 Design Projects

The other general category of EA activities is design projects, which usually focus on gathering stakeholder requirements for a new capability and identifying viable business and technology solutions

that are consistent with State legal/policy requirements, agency standards, and industry best practices. Design activities can include modeling workflows, dataflows, applications, systems, networks, and facilities. The EA Reference Baseline provides context and standards that solutions need to consider. Examples of models and related artifacts are provided in Appendix C. The agency EA-PMO should be trained in EA design project methods (DoIT can provide this training).

#### **4.5 Solution Architecture**

The term “Solution Architecture” is normally used to refer to EA design projects that are focused on solving a business (mission) problem with some form of IT enablement (also called “digitization”). Agile approaches to project management and solution development are also frequently used, including identifying a scrum master, requirements scrums with stakeholders, development sprints, a minimum viable product, and rapid/frequent iteration of the product with key stakeholders. The use of agile methods and maintaining a focus on agency/user requirements will hopefully produce more useful solution in a shorter time span, perhaps even with lower costs. Modern EA methods seek to support solution delivery timespans in hours/days/weeks instead of months/years.

#### **4.6 Best Practice Incorporation**

One of the unique aspects of modern, holistic EA methods is that established best practices from government and industry are not only recognized but are recommended for use in the appropriate domain area(s). EA’s function has evolved to provide a context (Reference Baseline) and to show how methods are or aren’t related (e.g., linking workflows and dataflows to application and storage stacks). Rather than compete with mature, proven best practices – holistic EA seeks to identify where, how, and when those practices should be used by the agency. The following are examples of best practices that agencies commonly use, but may not have been de-conflicted and aligned where possible:

- Strategic Planning, Balanced Scorecard, SWOT Analysis
- Business Process Re-engineering, Capital Planning/Business Cases
- Robotic Process Automation, Workflow Modeling, Agile Projects
- Object-Oriented Data and Systems Design, Reusable Object Library
- Enterprise Data Management, Data Migration Methods
- Business Intelligence, Big Data Modeling, High-Performance Computing
- Enterprise Service Bus, Open-Source Software, Open APIs
- E-Commerce Channels, Online Service Delivery Web Portal
- Converged/Virtualized Storage & Compute Stacks, User Machines
- Unified Endpoint Management, Smart-Device Integration
- Remote User Channels, Standardized Worker Mobility Kits
- Converged Voice, Data, Video, Mobile, Satcom Network
- Digitized End-to-End Asset Tracking and Logistical Support
- Cloud Service Insourcing/Outsourcing (IaaS, PaaS, SaaS, DaaS)
- Continuous Cybersecurity Monitoring, Detection, Response
- Process Quality Control, Continuous 3<sup>rd</sup> Party Auditing

Without EA providing standards and a baseline to be the overarching context and “broker”, the three-dozen best practice areas listed above are often found to compete or create gaps and overlaps in the agency’s capabilities, which lowers mission effectiveness and increases operating costs. Use EA to improve the agency’s selection, implementation, use, and retirement of a “catalog” of best practices.

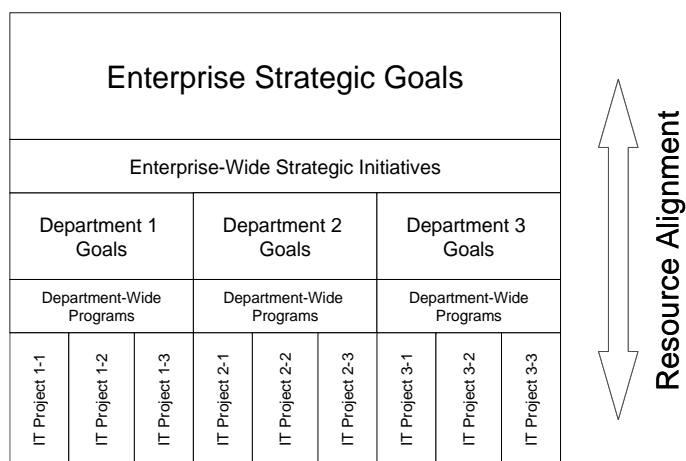
## 5.0 Utilization

### 5.1 Organizational Transformation

Agency-wide transformation requires an enterprise-level view of mission activities, programs, and supporting resources. Enterprise Architecture, when practiced holistically can provide the context for moving operating units forward in a coordinated manner while incorporating new methods and technologies. Normally, transformation (the introduction of significantly different concepts and methods) is pursued in selected business units and may not affect the entire organization, but the agency should still utilize its EA baseline as the authoritative reference for making changes.

### 5.2 Strategic Planning

Agency strategic planning activities include the update of goals, resource allocations, master IT plans, ongoing program plans, and time-specific project plans. The alignment of these plans to the achieving agency and Administration goals is one of the most important aspects of strategic planning.



### 5.3 Digital Enablement / Transformation

Digital enablement is a fancy term for the use of IT to move a paper-based process to an online electronic process, as well as the further improvement of electronic (automated) processes. Many of the mission and support activities in every State Agency already have some level of digital enablement, which usually results in more flexibility, lower costs, and higher production output (e.g., number of cases handled, inquiries answered, information articles disseminated). Digital transformation is the IT component of Organizational Transformation (see Section 5.1 above). This is a higher-level transformative activity which looks beyond individual processes to entire agency business units with a goal of making significant changes in functions and IT-based methods. The results of digital transformation efforts can include the incorporation of new lines of business, new technologies, new strategic partners, new customer groups, and new mission areas. Agencies that are experienced in digital enablement and transformation initiatives are able to make these changes more rapidly and with better results. Agencies should be mindful of new costs associated with needed IT resources and services (footprint) that underpin the digital enablement or transformation effort, especially when there is an expansion of the footprint. Some of the additional IT costs can be offset by savings that are realized as a process is digitized, which includes fewer facility, infrastructure, and personnel costs.

## **5.4 Enterprise Resource Planning**

As State Agencies use EA to view the organization holistically, the requirement for enterprise-wide IT solutions is likely to grow. These solutions are often referred to as Enterprise Resource Planning (ERP) systems and they include both mission and support solutions for case management, supply chain management, finance and accounting, human resources, and general administration. ERP solutions usually address a broad range of related activities and therefore must meet dozens of agency requirements that arise from legal and policy mandates, customer needs, and industry best practices. Agencies can achieve higher levels of productivity at lower levels of cost per transaction if they use mature large-scale ERP systems from experienced vendors. It is rare that public sector organizations are able to create and maintain ERP systems with the reliability, functionality, and cost efficiency of mature commercial products that have been produced by vendors who specialize in common ERP areas. Accordingly, State Agencies should use EA as a way to maintain control of their IT baseline as ERP products with large footprints come and go, which they will do. A good planning and contracting target for an ERP product or service lifespan is 5-7 years.

## **5.5 Portfolio Management**

State Agencies deliver services through programs that depend on a number of resources such as trained personnel, IT systems, funding, and facilities. When similar types of resources are managed as a group it is called Portfolio Management. In particular, IT systems are most effectively managed when hardware and software products are selected and implemented with overall agency needs in mind so there can be shared utilization among programs. Examples include records management, data storage and analysis, web content management, project management, and online collaboration. EA promotes this type of enterprise-level planning, management, and utilization.

## **5.6 Systems Integration**

An important aspect of managing the agency-wide IT systems portfolio is to promote hardware, software, and data interoperability. This is accomplished by selecting products that utilize open standards for equipment connectivity, application interfaces, and data formats. Acceptable open standards are those which are non-proprietary, mature, endorsed by government and industry groups, and related skills are widely available. If products do not use open standards, middleware may be available that allow IT systems to connect, share workflows, and exchange data.

## **5.7 Data Sharing**

Most State Agencies are “data centric” in that data and information are a core element of the products and services they provide to customers. These data and information products need to be available, accurate, properly protected, and useable. Accordingly, it is important for Agencies to develop and maintain an effective Enterprise Data Management (EDM) program that uses open standards, a comprehensive set of security and privacy controls, and takes a total lifecycle approach to managing data entities and information collections at various levels of scale and complexity. The goal of the EDM program is to maximize the usefulness of data/information assets and balancing sharing vs safeguarding.

## **5.8 Vendor Alignment**

Each State Agency is responsible for the operation and protection of the IT systems and data assets that they own and operate. The exception to this are the systems and services that the Agency contracts to use from external public and private sector providers. Given that it is normal for external providers to want to maximize their market share and revenue, it is important for Agencies to utilize EA and an agency-wide IT baseline/reference architecture to ensure that contractor products and services are

selected and consumed in as an integrated part of the baseline and in conformance with State law, policy, and standards. This means that the Agency's architecture provides the context and standards for selecting and using vendor products and services. Proprietary products and service methods may occasionally be contracted for if there is a compelling mission need, but absent that, Agencies must follow State standards and vendors must align with these standards and ensure fit with the Agency EA.

## **5.9 Security & Privacy**

The Agency's Risk Management and EA programs should provide the context and standards for the cybersecurity and data privacy program methods. Effective cyber security and data privacy capabilities center on the implementation and use of a comprehensive set of security controls that achieve the right level of protection and a balance between the sharing and safeguarding of data/information. The DoIT EA approach to cyber security and data privacy is described in the *Maryland State Security Manual* that incorporates standards and methods from the NIST FIPS and SP-800 series of publications, as well as the AICPA industry best practice of SOC-2 system and program audits.

## **6.0 Architecture Principles**

The following are general principles that underpin the DoIT EA approach:

1. Agencies will subscribe to DoIT IT services unless there is a compelling mission need otherwise.
2. Agencies will follow DoIT standards when requesting, consuming, or providing IT services.
3. Use open standards and shared service approaches to promote interoperability and re-use.
4. Don't jump to a solution before fully identifying the requirement(s) using plain language.
5. Understand the data and information aspects of requirements at the agency and system levels.
6. Contract for IT products and services unless there is a mission need for the Agency to provide it.
7. Utilize a standardized method for solution architecture to conduct new capability projects.
8. Ensure that essential IT knowledge and skills are maintained within the Agency.
9. IT operations and security should be separate groups to maximize objectivity and effectiveness.
10. Maintain accurate inventories of hardware, software, and data.
11. Maintain narrative and visual depictions of the Agency IT Baseline.
12. Maintain a properly secured EA Repository on the Agency internal network or with DoIT.
13. Eliminate single points of failure in systems, skills, and procedures.
14. Treat data and information as a key Agency resource.
15. Domain-specific best practices are encouraged, in the context of the holistic EA.
16. Utilize the Technology Business Model approach to develop IT cost models for services.
17. Define and practice methods for IT disaster recovery at the system and enterprise levels.

## 7.0 Solution Architecture Method

The enterprise-wide architecture provides the context and standards for conducting a wide range of solution architecture projects in each sub-architecture domain (strategy, business, data, systems, networks, and security). The purpose of these projects is to identify a solution to an agency business or technology requirement, which are often inter-related. The solution can consist of an available turnkey service from an external provider or a custom-developed workflow and software application that will be owned and operated by the agency.

It is important for the agency to use a standardized method for conducting solution architecture projects in order to ensure that important considerations are not overlooked. The solutioning method included in the DoIT Enterprise Architecture approach is compliant with State law and policy, is non-proprietary, and includes a number of proven concepts and activities, which are summarized as follows. Appendix E provides several Use Case Solutioning examples.

### **DoIT Solution Architecture Method**

#### *Requirement – Checks – Build/Buy – Test/Operate Solution*

1. Identify and articulate an agency business and/or technology requirement (in plain language).
2. Submit a solution request to DoIT, notifying the Portfolio Officer (PO) using the Intake process.
3. DoIT assigns a solution architect (SA) from one of the service teams who will work with the PO and an agency-assigned subject matter expert (SME).
4. The SA and SME confirm requirements and conduct a market survey for available solutions.
5. If viable solutions are available, the SA and SME work with the PO and the agency's budget and procurement staffs to determine the best way to obtain the solution (usually a service).
6. If viable solutions are not available, the SA and SME work with agency and DoIT service and technology leads to determine the best design for the development of a new IT resource.
7. The SA and SME co-lead an IT development team using agile methods to address the following domain considerations:
  - a. Workflows and End Users
  - b. Data and information sharing and safeguarding
  - c. Application and system functions, hosting, and security
8. The SA and SME ensure that the solution meets requirements, conforms to legal mandates and standards, incorporates proper levels of security, and is tested prior to being introduced into the DoIT or agency production environment.
9. The IT solution is checked by the State Chief Information Officer (and staff) for proper levels of security and if it passes, is then approved by the DoIT Secretary for implementation.

## Abbreviations

ADM	Architecture Development Method
ANSI	American National Standards Institute
ARM	Application Reference Model
AI	Artificial Intelligence
ATO	Approval to Operate
BA	Business Analyst
BPI	Business Process Improvement
BPR	Business Process Re-engineering
BRM	Business Reference Model
CEN	Comité Européen de Normalisation
CMMI	Capability Maturity Model Integration
DBA	Database Administrator
DODAF	Department of Defense Architecture Framework
DoIT	Department of Information Technology
DRM	Data Reference Model
EA	Enterprise Architecture
EAAM	Enterprise Architecture Audit Method [EA6]
EA6	Enterprise Architecture Cube [Framework]
FEAF	Federal Enterprise Architecture Framework
IaaS	Infrastructure-as-a-Service
IEEE	Institute of Electrical and Electronic Engineers
IPv4	Internet Protocol version 4
IPv6	Internet Protocol version 6
ISO	International Standards Organization
ITIL	Information Technology Infrastructure Library
JAD	Joint Application Design
NASCIO	National Association of State Chief Information Officers
OSI	Open Systems Interconnection [Model]
PaaS	Platform as a Service
RPA	Robotic Process Automation
QA	Quality Assurance
SaaS	Software-as-a-Service
SDLC	System Development Life Cycle
SOA	Service-Oriented Architecture
SOC-1	Service Organization Controls [Systems]
SOC-2	Service Organization Controls 2 [Security]
SRM	Systems Reference Model
TBM	Technology Business Model
TCPIP	Transmission Control Protocol Internet Protocol
TOGAF	The Open Group Architecture Framework
TRM	Technology Reference Model
VOIP	Voice Over Internet Protocol
VM	Virtual Module

## **References**

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Federal EA Framework, version 2.0 (2013).

Information Technology Infrastructure Library, version 4 (2019).

Maryland Department of Information Technology, 2020 Master IT Plan.

NASCIO EA Toolkit, version 3.0 (2004).

Technology Business Model, version 2.0 (2018).

The Open Group Architecture Framework, version 9.2 (2018).

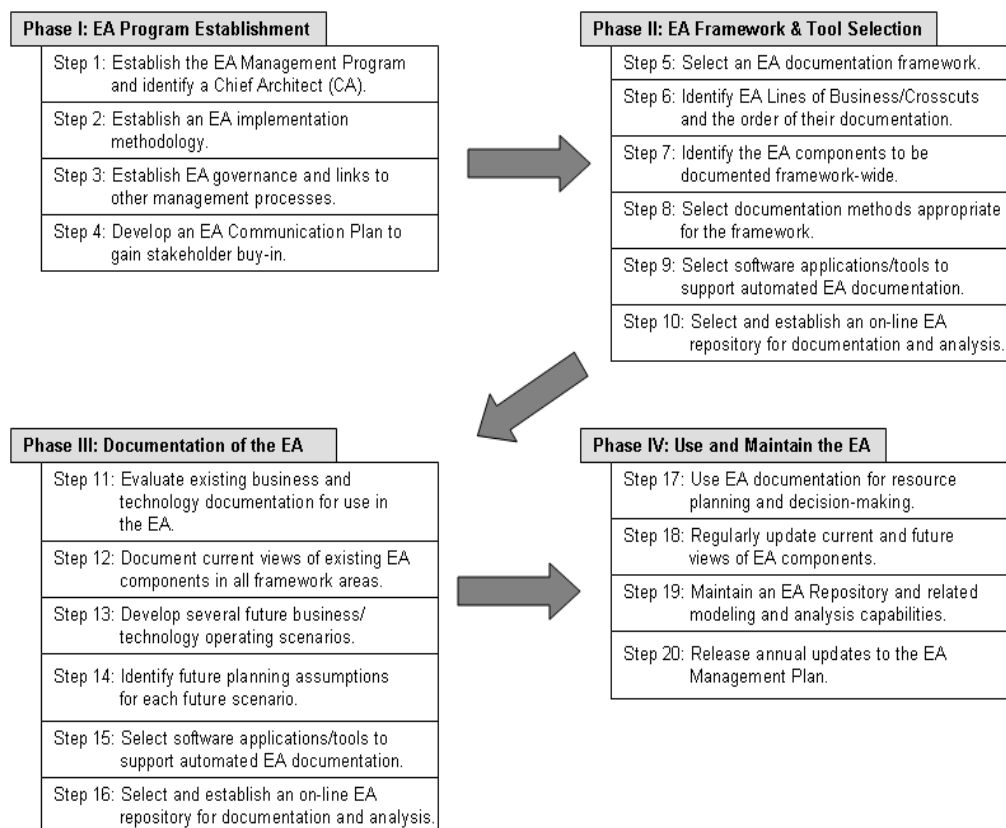


## Appendices

### Appendix A.

## Implementation Methodology

An EA methodology is a detailed, step-by-step description of how the EA program is to be established and run, and how the documentation of the EA is to be developed, maintained, and used. This example is a generalized example, customization by agencies is expected. There are four phases and twenty steps in this example and it is worth noting that the first two phases are designed to create a new EA Program Management Office (EA-PMO) or strengthen an existing EA-PMO.



It is important to develop an EA methodology as one of the first steps in establishing or strengthening an agency's EA program, because it forces the organization to 'think through' the following considerations:

- Which areas of the enterprise the EA will cover (scope)
- The approach to EA governance (e.g., centralized or decentralized)
- The types of EA documentation (known as artifacts) that will be needed to support business and technology resource planning and decision-making
- The EA documentation framework that best supports the needs of the enterprise
- The methods and techniques for gathering or developing EA documentation
- The software modeling tools, web applications, and databases that will be needed to automate documentation techniques and enable future scenario modeling

- How EA users will access and share EA documentation (e.g. an online EA repository)
- How often EA documentation will be updated

Specifics on the phases and steps of this example implementation methodology are as follows:

### **Phase I: Program Establishment**

Phase I activities are designed to get the EA program initially started, identify key players, and communicate the EA Implementation Plan to the executive sponsor and other stakeholders in order to gain buy-in and support. These pre-documentation activities are important to ensuring that the EA program has clear goals, remains focused, and is accepted throughout the agency.

#### **Step 1: Executive Ownership.**

The critical first step is for the organization's most senior leadership to formally designate the executive who will be responsible for and champion the EA Program. The designation document should signal the importance of the program and require support and alignment from all business units.

#### **Step 2: Establish Governance.**

The second step is for the executive sponsor and Chief Architect to co-develop an approach to architecture oversight (governance) that enables effective policy, planning, and decision-making within the program. This approach to governance should include links to other key oversight processes (e.g., strategic planning, capital planning, project management, security, and workforce planning).

#### **Step 3: Launch the EA Program.**

The third step is for the executive sponsor to establish an EA program and hire a qualified Chief Enterprise Architect to lead the EA Program. The EA Program's establishment activity begins as a start-up project that becomes an ongoing program when the team is hired and a schedule of forthcoming projects is established. The executive sponsor must provide the Chief Architect with enough resources (e.g., budget, personnel, hardware/software, and facilities) and have the authority to establish the EA program. The Chief Architect should be accountable for EA program resources and results. Another of the Chief Architect's first actions should be to determine with the executive sponsor what the operating model for the EA Program Office will be. The options are: (1) for the office to only do audits and promulgate standards; (2) do limited design and analysis work in support of business unit projects; (3) conduct architecture projects themselves; or (4) a mix of these options – sometimes advising, sometimes doing it all themselves.

#### **Step 4: Create the EA Team.**

In step four, the Chief Architect hires, or contracts for EA team members in key skill areas (e.g., business process analysis, systems design, data architecture, web applications, network engineering, security controls). How many there are depends on the operating model. Some team members are organizational employees, while others may come from outside organizations (e.g., consultancies) or be independent contractors.

#### **Step 5: Architecture Program Implementation Plan.**

The Architecture Program Implementation Plan (Plan) articulates the EA development method and a schedule for establishment and projects. The Plan should be written in plain language to gain stakeholder buy-in from non-technical executives, line of business managers, support staff, and other potential end users of EA documentation. The Plan should include statements about the purpose and vision of the EA, examples of how the EA will bring value to the enterprise, where EA documentation will

be available for access, a summary of the methodology used, and the general principles that will be used for EA development.

## **Phase II. Preparation to Conduct Projects**

Phase II activities solidify the EA team's readiness to start providing architecture services (audits, standards, analysis, and design). This begins with team and stakeholder training, then moves to confirming the artifact documentation methods and tools appropriate for the framework and finishes with the establishment of an on-line repository for documentation and an update of the Architecture Implementation Plan to set the order of analysis and design projects throughout the agency.

### **Step 6: Conduct Training.**

This step focuses on training to get the EA Program Office ready to offer services and inform customers and other agency stakeholders. The training covers EA Program objectives, schedule, and approach, including the areas of the agency that the EA will focus on first. For example, the training should summarize the scope and relationships of the framework areas by identifying the five sub-architecture domains and three 'thread' areas, what the lines of business are (from the org chart) and how they relate to the business and technology components (e.g., data, systems, processes, equipment, facilities).

### **Step 7: Select Documentation Methods.**

The next step is for the agency to select the methods (or follow the DoIT method) that will be used to gather and develop EA documentation artifacts. For example, the following are methods for modeling in the eight sub-architecture domain areas of the framework (five levels and three threads). The following are examples of EA artifacts that are used in each area:

Strategic Level:	Strategic Plan, Scenarios, Balanced Scorecard
Business Level:	IDEF-O Diagrams, Flowcharts, Swim Lane Charts
Data Level:	Data Models, Object Diagrams, Data Dictionary
Systems Level:	System Diagrams, Web Service Models, APIs
Network Level:	Voice/Data/Video Network Diagrams/Documents
Vertical Threads:	Security Diagrams, Standards, Workforce Skills

It is important to choose documentation techniques that will provide the information that is needed for resource planning and decision-making. Therefore, the agency's Chief Architect should consult with EA stakeholders and the EA team in selecting the methods for artifact development and what type of information will need to be gathered to be able to create artifacts.

### **Step 8: Tool Selection.**

Select the software applications (tools) that enable EA analysis and design. Once the lines of business and components are known, EA documentation and artifact modeling requirements can be established. For example, if object-oriented methods are being used to develop artifacts at the data level of the framework, then a modeling tool that uses the Unified Modeling Language (UML) is needed. Software tools in the current (legacy) operating environment may use a variety of old and new programming languages, including COBOL, Java, C, C++, Ruby, PERL, Visual Basic, PHP, SQL, and Pascal (see Tiobe or GitHub for a list). Tools will also be needed to model processes, databases and flows, networks, and facilities. Office automation tools are also needed, including graphics, spreadsheets, and word processing. Consideration should be given to obtaining a robust architecture documentation suite of tools to enable the automated "rippling" of changes among linked models and databases.

**Step 9. Establish the Architecture Repository/Standards Catalog.**

The EA Repository is the place on the agency's internal network (private cloud) where architecture models, analyses, standards, policies, and project information are stored and made available to those who need them. A significant element of the repository is a listing of business and IT policies and standards. Begin by selecting a document management and storage application/database. Then determine what the archiving taxonomy (categories) will be, including file tags and metadata. The agency is then ready to upload content and promote its use to support planning and decision-making.

**Step 10: Identify the EA Components to be Documented.**

Identify the EA components that will have to be documented in each area of the framework (strategy, business, information, services, networks, and vertical threads). Each of these areas represents a distinct set of activities and resources across the agency, which are represented by EA components. EA components are plug-and-play goals, processes, measures, projects, data, services, and IT resources in the various functional areas. An EA component therefore is unique in the capability and resources that it represents within the EA framework. Each EA component is documented using information gathering methods and modeling techniques that are appropriate for the type of things that are contained in the EA component. For example, at the strategic level the agency's strategic goals, activities, and outcome measures are the primary items to be documented. At the business level, the line-of business services and associated measures are documented. At the information level, the flows of information, databases, knowledge warehouses, and data standards are documented. At the services and applications level, the various web services, office automation services, and software applications are documented. At the technology infrastructure level the voice, data, and video networks, as well as associated cable plants and equipment facilities are documented. For the vertical threads, IT security information, IT standards, and IT workforce information are gathered for associated activities and resources in each of the five other functional areas.

**Phase III. Documentation of the Agency Enterprise Architecture.**

Phase III activities are where the actual development of the EA occurs in the form of documentation artifacts. This involves analyzing and documenting the current strategy, business, information, services, and infrastructure of the enterprise. It also involves the development of artifacts that reflect changes in resources in the short-term and the development of a group of long-term future scenarios to identify possible courses of action and resource changes that would be needed in response to different internal and external influences. The activities in this phase of the EA documentation methodology conclude with the development of an Architecture Transition Plan that summarizes the current and future views of the architecture and provides a transition and sequencing plan for short- and long-term changes.

**Step 11: Harvest and Assess Existing Documentation.**

The first step of Phase III is the beginning of actual EA documentation activities. Preceding activities established what would be documented, how it would be documented, and who would do the documentation. The current view of EA components is what is now being documented through the identification of what the EA components are at each level of the framework and then using existing and new artifacts to document the EA components that currently exist. In many ways this activity is like taking an "inventory" of the components (strategic goals, business services, measures, data, services, and IT resources) that already exist in the enterprise and mapping them to existing documentation.

**Step 12: Document Current views of Existing EA Components.**

The second step of Phase III is the development of new artifacts to complete the documentation of all existing components. The documentation methods and tools identified in Step 8 are used to gather and

standardize existing artifacts, as well as to develop new artifacts. These documentation artifacts are organized by levels of the framework and stored in the EA repository that was established in Step 10.

**Step 13: Develop Future Business and Technology Operating Scenarios.**

Prior to developing future views of EA components, it is helpful to gain a high-level understanding of the possible future directions that the agency could take, depending on how it responds to internal and external influences. Three or more future scenarios should optimally be developed with EA and line of business (program) stakeholders to reflect what may occur if (1) the status quo is maintained; (2) an optimal business and technology operating environment is encountered; and (3) a high threat survival situation. There are several beneficial outcomes from the development of the scenarios. First, the agency is more prepared and organized to handle future situations and plan needed resources. Second, a number of planning assumptions are identified in each scenario that reveal what the priorities of the agency might be if that scenario is pursued. Third, the planning for future capabilities is more coordinated, as opposed to simply gathering separate inputs from line of business managers and technology managers. Separate inputs are known to perpetuate stovepipe capabilities.

**Step 14: Identify future planning assumptions for scenarios.**

Each future scenario describes, in story form, a possible business/technology operating environment that the agency might pursue or face. In this step, the key elements of each future scenario are analyzed to reveal what things are important to the agency and what changes have to occur for the scenario to become reality. For the purposes of the EA, these key elements become the planning assumptions that can then be grouped together to represent changes in each of the functional areas of the framework. One of the benefits of having the scenario and planning assumptions is that they were developed with stakeholder buy-in, which will help when future changes are implemented.

**Step 15: Use Scenarios to Drive the Design of Future Components.**

This step involves the documentation of changes to EA components in the near term (1-2 years) and the longer term (3-5 years). These changes should be derived from the input by the leadership team (CXOs) via the operating scenarios' planning assumptions, and from program and project managers who know what the future business requirements are, as well as planned system implementations, upgrades, and retirements. In this way, changes are more coordinated and aligned with the strategic direction of the agency. Future views of EA components should be developed using the same techniques that were used to develop the current views. This helps to identify what the changes are in each of the functional levels (domains) of the framework, which helps in planning and decision-making.

**Phase IV: Use and Maintain the EA**

This phase focuses on the implementation and use of the architecture as a whole by all stakeholders and establishes an annual cycle for updates. This is where the value of the agency EA Program is realized as planning and decision-making throughout the organization are supported. This value is maintained through the development and maintenance of an Architecture Transition Roadmap, the regular updates of the current and future views of the architecture. Value is also gained in the maintenance of the EA repository and the maintenance of all associated software licenses for modeling and archiving.

**Step 16: Develop the Architecture Transition Roadmap.**

The first step in this final phase is the development of the Architecture Transition Roadmap. The Roadmap serves to articulate how the EA was developed and provides a synopsis of the current and future views. The Roadmap also provides a transition and sequencing sub-plan for the near-term

changes, which may already be in the project pre-implementation stage. Also, a long-range sequencing sub-plan is provided that covers the potential changes associated with the future scenarios.

**Step 17: Use the EA to Support Planning and Decision-Making.**

During Phase III activities, current and future views of the architecture were stored in the EA repository and are ready to be used by the agency to support planning and decision-making. These stored artifacts become a baseline of reference information that can be used in a wide variety of leadership and staff activities. When this is done, a greater level of understanding is developed of capabilities and performance gaps among a wider group within the agency. Further, by having the EA documentation in an on-line repository, this information can be called up and referred to in meetings, which reduces the time it takes to convey an idea, increases comprehension, and reduces interpretation errors among meeting participants. For example, if in a planning meeting, one of the participants wanted to show needed improvements in information exchange within a particular line of business, EA documentation on the current and possible future views of that information flow could be called up from the repository and projected at the meeting. This, along with information on the associated business services, support applications, and networks can be referenced meaningfully. The time to convey the ideas is significantly reduced when diagrams and text are being shown to everyone at the meeting. This can stimulate more productive discussions and informed decisions.

**Step 18: Update Current and Future Views of EA Components.**

The information in the EA repository is valuable for planning and decision-making only as long as it is comprehensive and accurate. Therefore, it is important to regularly update the current and future views of EA components in all areas of the framework. Further, it is helpful to users of EA information if the updates are made on a regular schedule: once or twice a year. Also, it is important to maintain version control in between updates, so that all of the users of the EA information know that they are conducting planning and decision-making activities based on the same information. Since what is planned in the future EA views will eventually become the current architecture (at least some of it), it should be recognized that EA updates are ongoing activities that do not cease. Future EA plans will continue as an organization grows and changes. Consider a time when the agency no longer needs changes in future capabilities and resources. If so, the EA program transitions from focusing on the establishment of the EA to maintaining the EA and seeing that it continually brings value to the agency.

**Step 19: Maintain the EA Repository and Modeling Capabilities.**

The Chief Architect and EA team need to ensure that the EA repository and support applications/tools are kept current in terms of licensing and functionality. The requirements for archiving and modeling should be reviewed annually, and new products should be regularly reviewed to ensure that the EA team has the right application support capability. The team should be on the lookout for new improvements in tool functionality so that these improvements can be applied to the advantage of the agency. The costs for software purchases and license renewals should be part of the EA program budget.

**Step 20: Release Updates to the Transition Roadmap.**

The Chief Architect needs to regularly inform EA stakeholders about the status of the architecture. This is done through the annual release of an updated Architecture Transition Roadmap that discusses changes that were made to the current and future views of the EA during the past year. The communication should provide a transition and sequencing plan for changes anticipated during the coming year. Also, the ongoing value of the EA needs to be communicated through the citation of examples of where EA documentation supported planning and decision-making, helped reduce duplicative capabilities, saved costs, improved alignment, and increased communication.

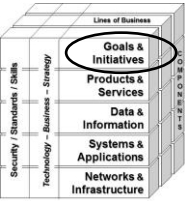
## Appendix B.

### Design Artifact Examples

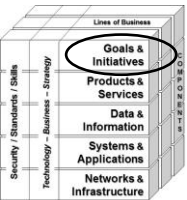
An EA artifact is a type of design or analysis documentation. This can include models, specsheets, spreadsheets, tables, narrative documents, charts, diagrams, pictures, videos, maps, and other depictions of a component in the agency's architecture. The DoIT EA approach includes the following group of artifacts for agencies to use in their EA projects. There is at least one "core" artifact at each sub-architecture domain level and these are indicated with an asterisk. The core artifacts are essential to understanding needs, current capabilities, and future options. The other artifacts from this or other EA approaches may be useful in providing additional understanding of requirements and solutions.

Framework Area	Artifact ID #	Artifact Name (* Core)
<b>Strategic Goals &amp; Initiatives</b> (S)	S-1	Enterprise Strategic Plan
	S-2	SWOT Environmental Analysis
	S-3	Future Capability Scenario
	S-4	Capability Overview Diagram *
	S-5	Balanced Scorecard Goals & Measures
<b>Business Products &amp; Services</b> (B)	B-1	Reference Baseline Overview Diagram *
	B-2	Solution Overview Diagram *
	B-3	Node Connectivity Diagram
	B-4	Swim Lane & Detailed Process Diagrams *
	B-5	Supply Chain Matrix
	B-6	Use Case Narrative & Diagram
	B-7	Investment Business Case
<b>Data &amp; Information</b> (D)	D-1	Enterprise Data Management Plan
	D-2	Information Exchange Matrix
	D-3	Logical Data Models (OO, ERD, DFD) *
	D-4	Physical Data Model
	D-5	Activity/Entity (CRUD) Matrix
	D-6	Data Dictionary / Object Library *
<b>Systems &amp; Applications</b> (SA)	SA-1	Technology Overview Diagram
	SA-2	Enterprise Service Bus Overview Diagram
	SA-3	Systems Evolution Overview Diagram
	SA-4	Systems Connectivity Diagram *
	SA-5	System Performance Specifications
<b>Networks &amp; Infrastructure</b> (NI)	NI-1	Network Connectivity Diagram *
	NI-2	Network Inventory
	NI-3	Capital Equipment Inventory
	NI-4	Building Blueprints
	NI-5	Network Center Diagram
	NI-6	Cable Plant Diagram
	NI-7	Rack Elevation Diagram
<b>Security</b> (SP)	SP-1	Security and Privacy Plan
	SP-2	System Accreditation Document
	SP-3	Continuity of Operations Plan
	SP-4	Disaster Recovery Procedures
<b>Standards</b> (ST)	ST-1	Technical Standards Profile
	ST-2	Technology Forecast
<b>Workforce</b> (W)	W-1	Workforce Skills Management Plan
	W-2	Organization Chart
	W-3	Knowledge and Skills Profile

The following pages provide examples of each type of artifact:

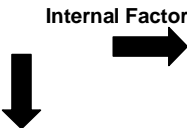
Framework Area	Artifact ID & Name
	<p><b>S-1: Strategic Plan</b></p> <p>A Strategic Plan is a high-level policy and planning document that an enterprise uses to document its direction, competitive strategy, most important goals, and the enabling programs and projects (strategic initiatives). The Strategic Plan covers a future period, usually 3-5 years.</p>
Description & Example	
<p>A Strategic Plan is a narrative and graphical artifact that should guide the enterprise's direction over a 3-5 year period in the future by providing the following items:</p> <ul style="list-style-type: none"> <li>• Mission Statement and a Vision Statement that succinctly captures the purpose and direction of the enterprise.</li> <li>• Statement of Strategic Direction that fits the enterprise's purpose, ensures survivability, allows for flexibility, and promotes competitive success. This statement is a detailed description of where the enterprise intends to go.</li> <li>• Summarize the results of a SWOT Analysis that is based on the statement of strategic direction and which identifies the enterprise's strengths, weaknesses, opportunities, and threats. The full SWOT analysis is artifact S-2.</li> <li>• Summarize the situation and planning assumptions for several 'Concept of Operations' CONOPS Scenarios that support the enterprise's strategic direction. This summary should include one current scenario that describes at a high-level the coordination of ongoing activities in each line of business, as well as several future scenarios that account for different combinations of internal and external drivers identified through the SWOT Analysis. The complete scenarios are artifact S-3.</li> <li>• CONOPS Diagram that in a single picture captures the essence of and participants in the current operating scenario. This graphic is artifact S-4.</li> <li>• General Competitive Strategy for the enterprise that incorporates the current and future CONOPS scenarios and moves the enterprise in the intended strategic direction in a way that and address internal/external drivers such as culture, line of business requirements, market conditions, competitor strategies, and risk.</li> <li>• Strategic Goals that will accomplish the competitive strategy and specify the executive sponsors who are responsible for achieving each goal.</li> <li>• Strategic Initiatives and resource sponsors for the initiatives, which are the ongoing programs or development projects that will accomplish each Strategic Goal.</li> <li>• Outcome Measures for each Strategic Goal and Initiative, using the Balanced Scorecard™ or similar approach. The full scorecard is artifact S-5.</li> </ul>	



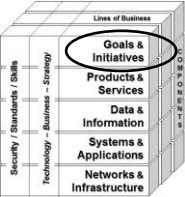
Framework Area	Artifact ID & Name
	<b>S-2: SWOT Analysis</b>  The Strength, Weakness, Opportunity, and Threat (SWOT) Analysis takes a holistic look at the enterprise by identifying internal and external factors which when mapped can reveal areas for improvement and focus.

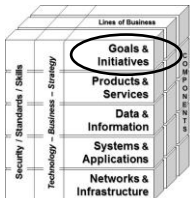
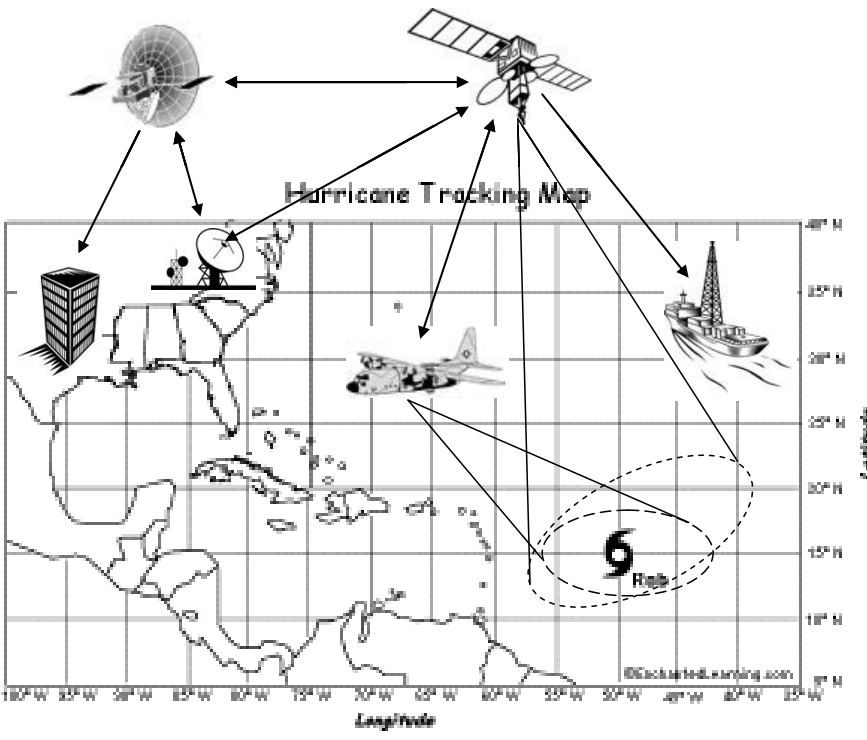
### Description & Example


One of the earliest activities the enterprise performs in developing a strategic plan is a ‘Strength, Weakness, Opportunity, Threat’ (SWOT) Analysis. This analysis looks at internal and external factors to determine areas that the enterprise should focus on to increase its survivability and success, as well as areas that the enterprise should avoid, or decrease its exposure to. The results of the SWOT Analysis should be summarized in the Strategic Plan along with the matrix table illustrated below, and the full SWOT Analysis is archived in the EA Repository as a separate primitive artifact (S-2). The following is an example of a way to summarize a SWOT Analysis.


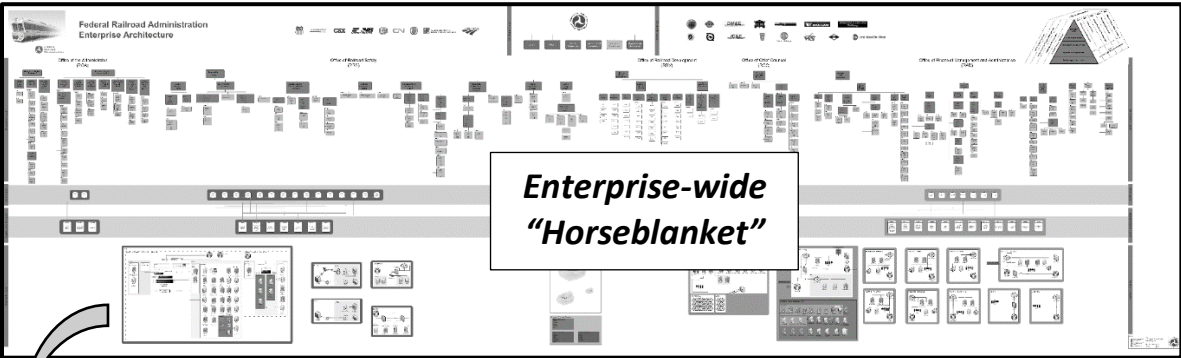
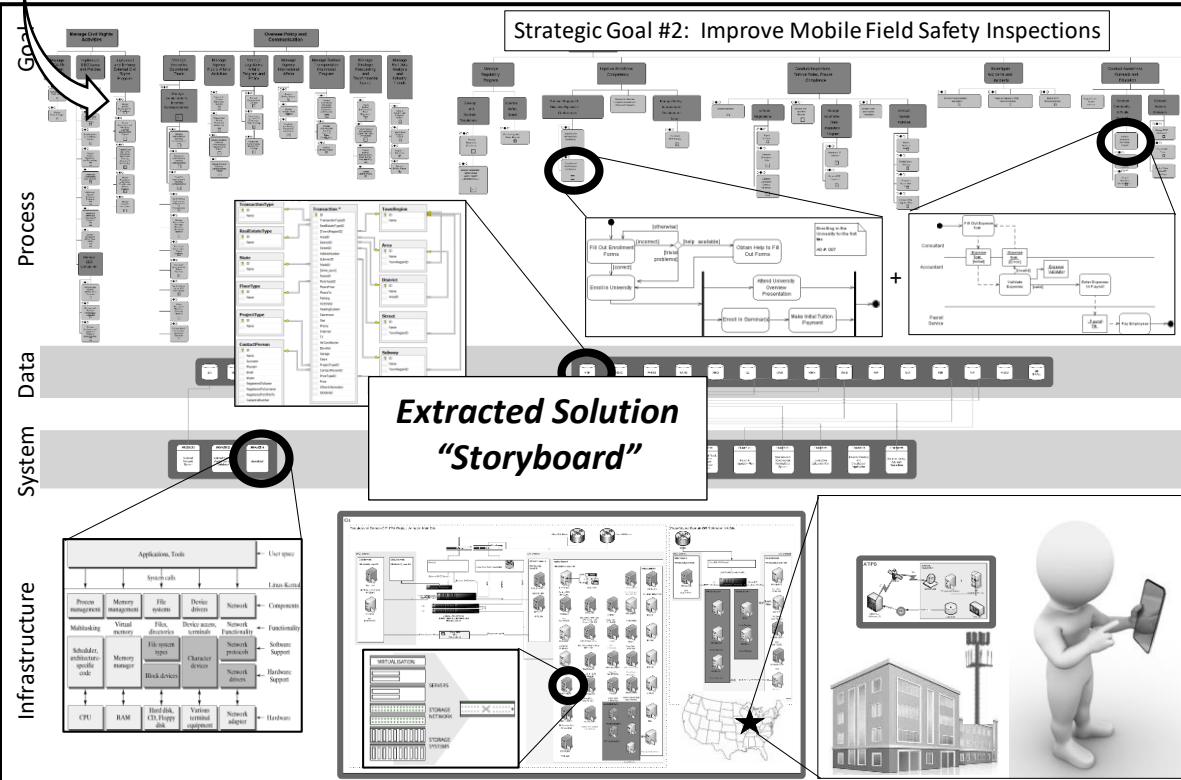
<b>External Factors</b>  <div style="text-align: center;"> <b>Internal Factors</b>   </div>	<b>Internal Strengths (S)</b> <b>S1.</b> <u>User Community</u> <b>S2.</b> <u>Relationships</u> <b>S3.</b> <u>Involved Leadership</u> <b>S4.</b> <u>In-house Technology</u> <b>S5.</b> <u>Legacy Architecture</u> <b>S6.</b> <u>Training Budget</u> <b>S7.</b> <u>Culture</u>	<b>Internal Weaknesses (W)</b> <b>W1.</b> <u>Policy / Regulations</u> <b>W2.</b> <u>Governance Value</u> <b>W3.</b> <u>IT Skills – Systems</u> <b>W4.</b> <u>Enterprise Architecture</u> <b>W5.</b> <u>IT Skills – Process</u> <b>W6.</b> <u>Low Usability/Implementation</u>
<b>External Opportunities (O)</b> <b>O1.</b> <u>Contracting</u> <b>O2.</b> <u>Government</u> <b>O3.</b> <u>New Technology</u> <b>O4.</b> <u>Partnerships</u>	<b>SO</b>  <b>S5/O3:</b> Legacy Web Portals <b>S1/O3:</b> Security	<b>WO</b>  <b>W4/O4:</b> EA Sharing
<b>External Threats (T)</b> <b>T1.</b> <u>Funding</u> <b>T2.</b> <u>Market Drivers</u> <b>T3.</b> <u>Merger</u> <b>T4.</b> <u>Advanced Technology</u> <b>T5.</b> <u>IT Adoption Rate</u>	<b>ST</b>  <b>S1/T2:</b> FED Requirements <b>S6/T5:</b> IT Training <b>S1/T5:</b> IT Awareness	<b>WT</b>  <b>W4/T1:</b> Funding Data


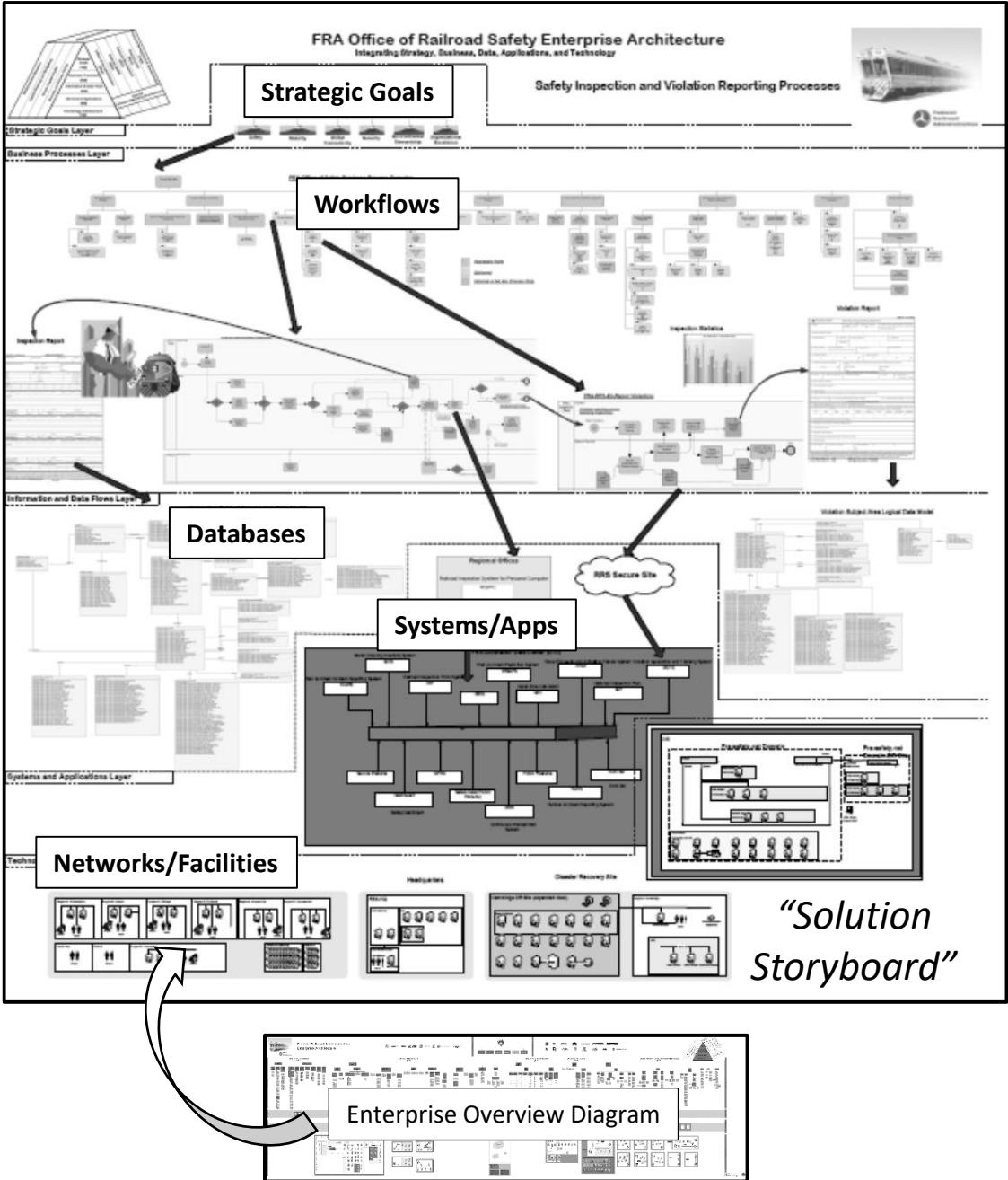
From the identification of Internal Strengths (S), Internal Weaknesses (W), External Opportunities (O), and External Threats (T) for the enterprise, a matrix arrangement like the example above can help to reveal internal and external areas to focus on. This SWOT Analysis is also used to help enterprise architects and strategic planners to develop Concept of Operations (CONOPS) scenarios that detail current and future operating environments.


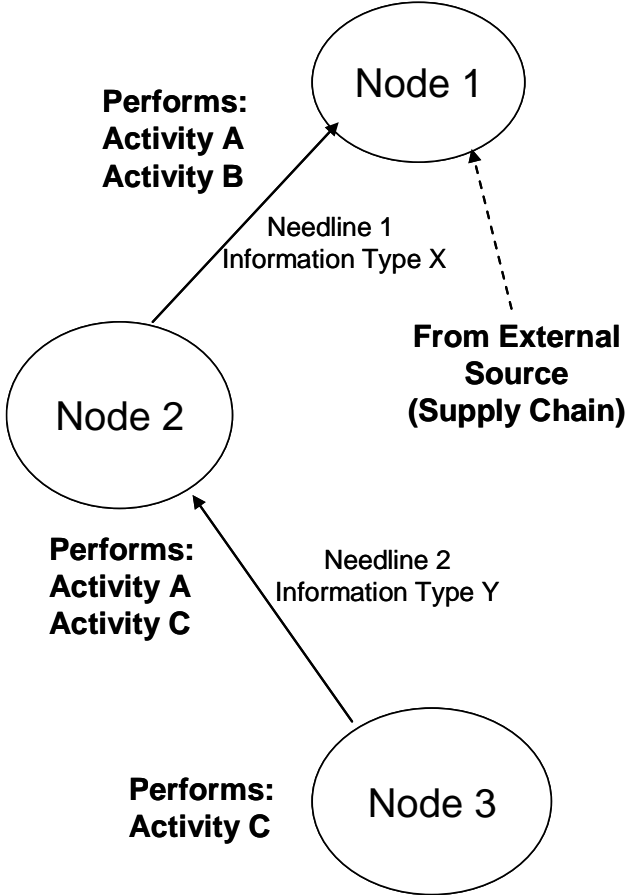
Framework Area	Artifact ID & Name
	<p><b>S-3: Future Capability Scenario</b></p> <p>A Future Capability Scenario is a narrative document that describes how part or all of the organization will operate several years in the future given certain stated internal and external factors identified in the SWOT and EA analyses. The scenario is footnoted with planning assumptions that identify changes in processes, resources, and skills that have to happen for the scenario be achieved</p>
Description & Example	
<p><u>Planning Assumptions</u></p> <ol style="list-style-type: none"> <li>1. New Video Teleconferencing capability.</li> <li>2. Product rollouts at National conferences.</li> <li>3. Need to hold detailed product discussions on short notice, globally.</li> <li>4. 24x7 work availability.</li> <li>5. Increased suburban commuting and telecommuting.</li> <li>6. Tracking of Govt. reports to anticipate product needs.</li> <li>7. Changing population demographics, driving new product development.</li> <li>8. Increased cost benefit of solar powered lighting.</li> <li>9. Additional product features to attract customers</li> <li>10. Global use of PDAs for employee communication.</li> <li>11. Integration of sales, marketing, and production information.</li> <li>12. Accurate customer quotes on the fly.</li> </ol>	<p>Jeff Linder, Vice President of Industrial Sales for Danforth Manufacturing Company (DMC) had just finished a presentation at the 2008 National Highway Safety Conference along with Richard Danforth, DMC's CEO, who had teleconferenced in on the big display screen behind the podium.<sup>1</sup> As Jeff was leaving the main conference room, Andrea Newman, Director of Safety and Transportation for the State of Tennessee, asked Jeff if they could talk about the new line of solar-powered highway lights he had just given a presentation on.<sup>2,3</sup></p> <p>"Thanks for taking a minute to talk Jeff. I want to tell you about a situation we have in Tennessee and see if your new product line can help" said Andrea as they found a table in the refreshment area.<sup>4</sup> "No problem, thanks for asking" Jeff said. Andrea pulled up a document on her tablet computer and said "Jeff, here is a report that shows an increasing number of serious accidents in rural areas of Tennessee involving passenger cars and agricultural equipment or commercial trucks. We've attributed it to the growth of suburban communities further out in the countryside that then depend on two-lane country roads for commuting into the city.<sup>5</sup> When you put slow tractors and trucks together with cars that are in a hurry at all hours to get somewhere, you have a recipe for disaster." "Isn't this problem being seen in other places around the country?" asked Jeff. "Yes, and one of the contributing factors that is consistently coming out of investigations of the night-time accidents is the lack of good lighting on these country roads.<sup>6</sup> I am thinking that your highway grade solar lighting can help us provide more night visibility on high-risk rural roads without needing electrical infrastructure."<sup>7,8</sup></p> <p>Jeff thought for a minute before responding. "You know, the new line of highway lights has options to incorporate 911 emergency call boxes and Global Positioning System (GPS) equipment that can connect to both State and local level first responders.<sup>9</sup> This might be useful in also improving response times should an accident occur in spite of the improved lighting." Andrea nodded and said, "Yes, I doubt that better lighting will solve the entire problem, but it will help people see each other better, and these other options can improve accident response times. What is the pricing on these units?"</p> <p>Jeff pulled his Personal Digital Assistant (PDA)<sup>10</sup> out of his pocket and connected to DMC's marketing and sales database at headquarters via a satellite Internet link.<sup>11</sup> "Andrea, these units are \$11,300 each, including the GPS and 911 features." Andrea took notes and responded, "If I can get permission to conduct a pilot test in a couple of months can you provide the lights?" Jeff asked, "How many miles of road?" "About four miles in the particular area I'm thinking of" said Andrea. "Ok, the suggested density for the new unit is 18 per mile, so that would be 72 units total. I can give you our 10 percent early-adopter discount, so the total would be \$732,240. Let me check what the shipping time would be."</p> <p>Jeff sent a high priority email to Bob Green, Vice President of Manufacturing. Bob was in the factory when he received Jeff's email on his PDA, and after checking the DMC Production Scheduling System, responded two minutes later that a special order for 72 units could be completed and shipped 35 days from when the order is received. Jim relayed this information to Andrea, who said, "Wow, that's fast. I have all the information I need to propose the project, I'll get back to you next week"<sup>12</sup></p>

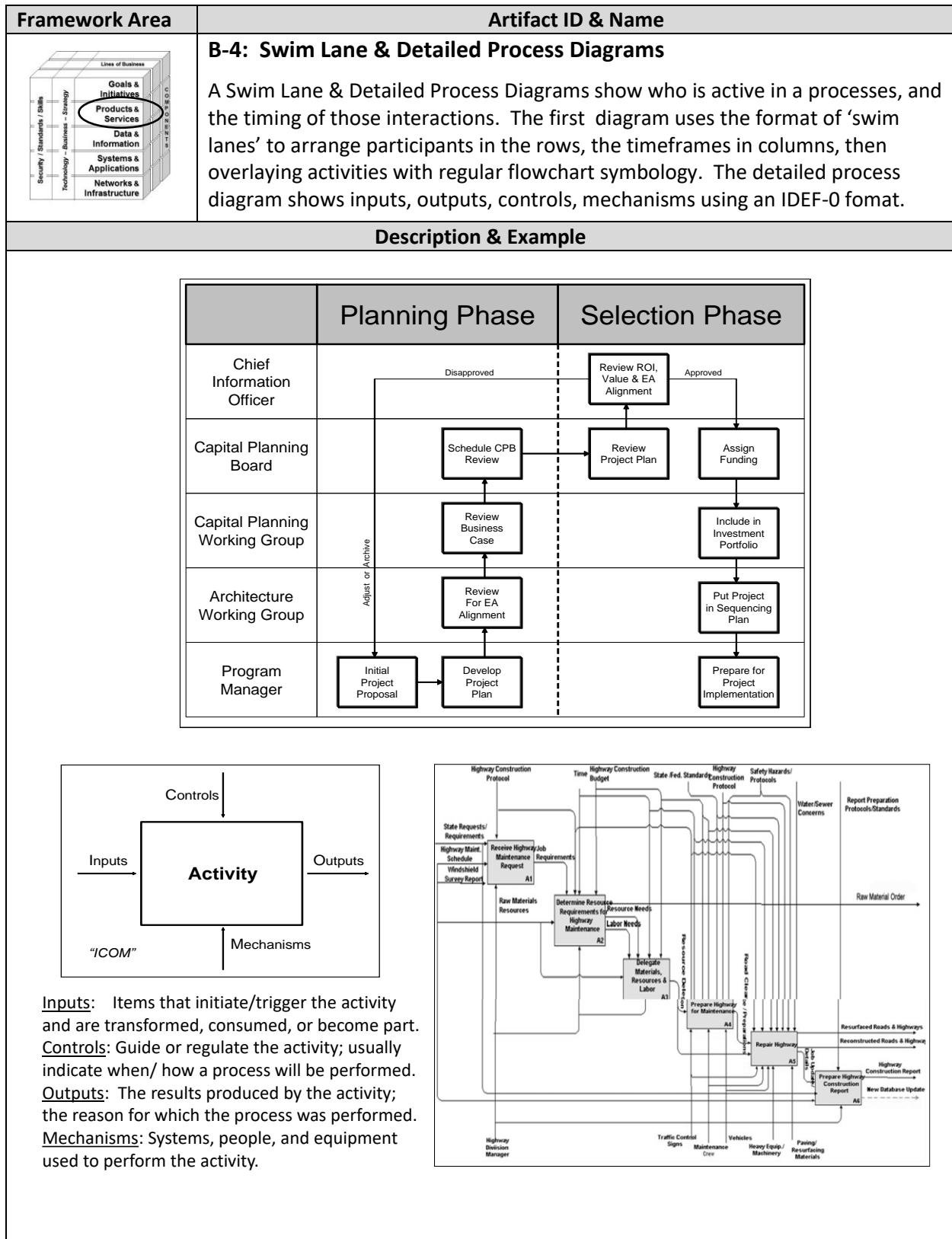
Framework Area	Artifact ID & Name
	<p><b>S-4: Capability Overview Diagram</b></p> <p>A Capability Overview Diagram is a high-level graphical depiction of a mission or support capability within the agency or between several agencies and external partners. The objective of this artifact is to provide a simple picture of what is trying to be achieved through an EA or solution architecture project.</p>
Description & Example	
<p>The example of this type of diagram shows at a high level how a fictitious system called the ‘Hurricane Warning System’ would conduct its primary mission of providing a coordinated weather surveillance and reporting capability using land-based, sea-based, airborne, and space-based resources.</p> 	

Framework Area	Artifact ID & Name																																																																																																																																																																																																																																														
	<h3>S-5: Balanced Scorecard Goals &amp; Measures</h3> <p>The Balanced Scorecard™ goes beyond financial measures of success for an enterprise and establishes goals and measures in four key business views: Customer; Financial; Internal Business Processes; and Learning and Growth.</p>																																																																																																																																																																																																																																														
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<p>“The Balanced Scorecard™ suggests that people should view the enterprise from four perspectives, (not just a money perspective) and should develop metrics, collect data, and analyze the enterprise relative to each of these perspectives, as is shown in the figure to the right.”</p> <p>“The Balanced Scorecard is a management and measurement system that enables enterprises to clarify their vision and strategy and translate them into action. The scorecard provides feedback around both the internal business processes and external outcomes in order to continuously improve strategic performance and results. When fully deployed, the balanced scorecard transforms strategic planning from an academic exercise into the nerve center of an enterprise.”</p> <p>Source: Balanced Scorecard Institute</p>	<div><div><div><div><div>Financial</div><div>“To succeed financially, how should we appear to our shareholders?”</div><div><table><tr><td>Objectives</td><td>Measures</td><td>Targets</td><td>Initiatives</td></tr><tr><td></td><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td><td></td></tr></table></div></div></div><div><div>Customer</div><div>“To achieve our vision, how Should we Appear to our customers?”</div><div><table><tr><td>Objectives</td><td>Measures</td><td>Targets</td><td>Initiatives</td></tr><tr><td></td><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td><td></td></tr></table></div></div><div><div>Internal Business Processes</div><div>“To satisfy our Shareholders &amp; Customers, what Business processes Must we excel at?”</div><div><table><tr><td>Objectives</td><td>Measures</td><td>Targets</td><td>Initiatives</td></tr><tr><td></td><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td><td></td></tr></table></div></div><div><div>Learning and Growth</div><div>“To achieve our vision, how will we sustain our ability to change and improve?”</div><div><table><tr><td>Objectives</td><td>Measures</td><td>Targets</td><td>Initiatives</td></tr><tr><td></td><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td><td></td></tr></table></div></div><div><div>Vision and Strategy</div></div></div></div> <table><tr><th>Balanced Scorecard™</th><th>Strategic Initiative 1</th><th>Strategic Initiative 2</th><th>Strategic Initiative 3</th><th>Strategic Initiative 4</th><th>Strategic Initiative 5</th></tr><tr><td colspan="6">Financial Perspective</td></tr><tr><td>Strategic 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Framework Area	Artifact ID & Name
	<p><b>B-1: Enterprise Overview Diagram</b></p> <p>The Enterprise Overview Diagram provides a graphical representation of the agency's entire business and technology operating environment. Each of the framework's hierarchical domains are represented (strategic goals, workflows, data collections, applications/systems, and networks). Current vs. future capabilities can be differentiated through symbology, colors, and line hatching.</p>
Description & Example	
<p>The Enterprise Overview Diagram (called a "Horseblanket") is presented as both a 6-10' long plotter printout and a scalable electronic model, which serve as a visual architecture reference baseline.</p> <div data-bbox="224 617 1398 972">  </div> <p>Extracts support Business Process Reengineering and solution architecture (see Artifact B-2).</p> <div data-bbox="224 1037 1398 1812">  </div>	


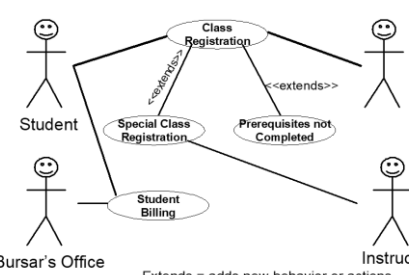
Framework Area	Artifact ID & Name
	<p><b>B-2: Solution Overview Diagram</b></p> <p>The Solution Overview Diagram (“solution storyboard”) is an extract from the B-1 Enterprise Overview Diagram. The purpose of the storyboard is to show current workflows, dataflows, systems, and networks that will be involved in a support solution architecture / business process reengineering project. Future options can also be showed using different symbols, colors, and line hatching.</p>
Description & Example	
	

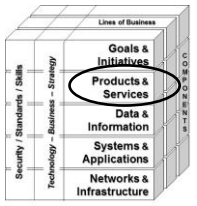
Framework Area	Artifact ID & Name
	<p><b>B-3: Node Connectivity Diagram</b></p> <p>The Node Connectivity Diagram shows the operational nodes, activities performed at each node, node-to-node relationships, and information exchanges. The purpose of this diagram is to show, at a high level, who are the operating groups in the enterprise (lines of business) and how they share information. Several modeling tools can produce this type of diagram.</p>
Description & Example	
	




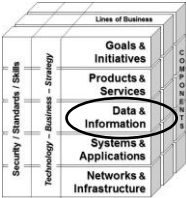



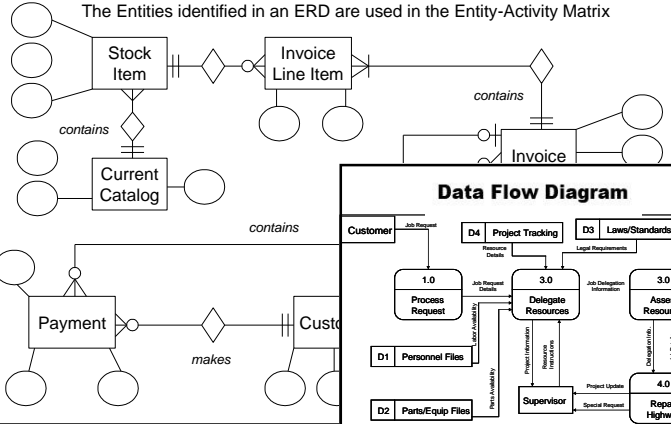
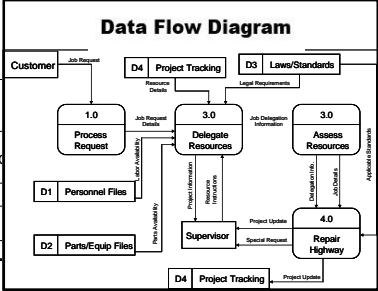
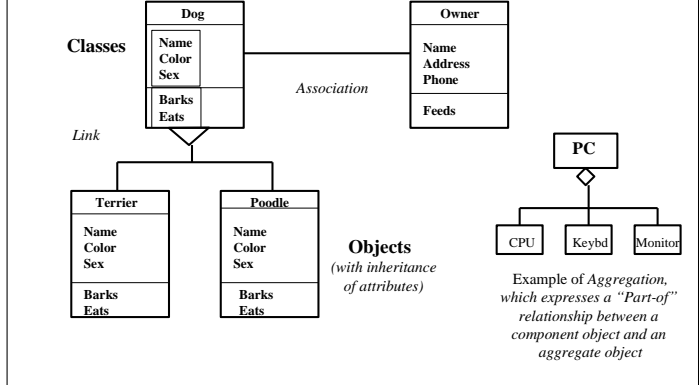
Framework Area	Artifact ID & Name																																																																																	
	<div><div>B-5: Supply Chain Matrix</div><div>The Supply Chain Matrix maps the lifecycle of tangible and service products to various programs that have a role in the development and delivery of those products (tangible items and services). This matrix highlights who is responsible for processes and products, as well as the extent of supply chains.</div></div>																																																																																	
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<table><tr><th></th><th>Line of Business A</th><th>Line of Business B</th><th>Line of Business C</th><th>Line of Business D</th><th>Line of Business E</th><th>Line of Business F</th><th>Line of Business G</th><th>Remarks</th></tr><tr><td>Business Product</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr><tr><td>Product 1</td><td>R</td><td></td><td></td><td></td><td></td><td>F</td><td>L</td><td></td></tr><tr><td>Product 2</td><td></td><td>M</td><td>W</td><td>D</td><td>S</td><td>F</td><td>L</td><td></td></tr><tr><td>Product 3</td><td></td><td>M</td><td>W</td><td>D</td><td>S</td><td>F</td><td>L</td><td></td></tr><tr><td>Product 4</td><td>R</td><td></td><td></td><td></td><td></td><td>F</td><td>L</td><td></td></tr><tr><td>Product 5</td><td></td><td>M</td><td></td><td></td><td></td><td>F</td><td>L</td><td></td></tr><tr><td>Product 6</td><td></td><td>M</td><td>W</td><td>D</td><td>S</td><td>F</td><td></td><td></td></tr><tr><td colspan="9">R = Research &amp; Develop      W = Warehouse      S = Service      L = Legal M = Manufacture              D = Distribute      F = Financials</td></tr></table>			Line of Business A	Line of Business B	Line of Business C	Line of Business D	Line of Business E	Line of Business F	Line of Business G	Remarks	Business Product									Product 1	R					F	L		Product 2		M	W	D	S	F	L		Product 3		M	W	D	S	F	L		Product 4	R					F	L		Product 5		M				F	L		Product 6		M	W	D	S	F			R = Research & Develop      W = Warehouse      S = Service      L = Legal M = Manufacture              D = Distribute      F = Financials								
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<p>The Supply Chain Matrix maps the lifecycle of each product to the line(s) of business that support one or more phases of the product lifecycle. This matrix allows the enterprise to see where the vertical and horizontal (cross-cutting) business product activities are located, as well as to help define ownership of those processes. The Matrix can then be used with various Data &amp; Information level artifacts (e.g. D-5 Activity/Entity Matrix) to further map the product lifecycle to requirements for data across the enterprise.</p> <p>The product lifecycle illustrated in this example has five sequential stages (research and development, manufacturing, warehouse storage, sales/distribution, and servicing) and two parallel administrative functions (financials and legal). Product lifecycles are different within most enterprises, and adjustments to this matrix should be made accordingly.</p>																																																																																		

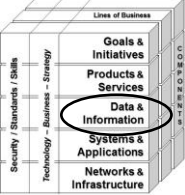
Framework Area	Artifact ID & Name																																																						
	<p><b>B-6: Use Case Narrative &amp; Diagram</b></p> <p>A Use Case utilizes Unified Modeling Language (UML) format for identifying business requirements, their context, stakeholders (actors), and business rules for their interaction with systems, services, and applications that are identified as technology solutions requiring development. The UML-based Use Case information can be coupled with a software tool to develop application code.</p>																																																						
Description & Example																																																							
<table border="1"> <thead> <tr> <th colspan="3">Member Services System</th></tr> </thead> <tbody> <tr> <td>Author (s): ①</td><td>Date: ②</td><td>Version: ③</td></tr> <tr> <td>Use-Case Name: ④ Place New Order</td><td>Use-Case Type: Business Requirements: ⑤</td><td></td></tr> <tr> <td>Use-Case ID: ⑥ MSS-BUC002.00</td><td></td><td></td></tr> <tr> <td>Priority: ⑦ High</td><td></td><td></td></tr> <tr> <td>Source: ⑧ Requirement — MSS-R1.00</td><td></td><td></td></tr> <tr> <td>Primary Business Actor: ⑨ Club member</td><td></td><td></td></tr> <tr> <td>Other Participating Actors:</td><td colspan="2"> <ul style="list-style-type: none"> <li>Warehouse (external receiver)</li> <li>Accounts Receivable (external server) ⑩</li> </ul> </td></tr> <tr> <td>Other Interested Stakeholders: ⑪</td><td colspan="2"> <ul style="list-style-type: none"> <li>Marketing — Interested in sales activity in order to plan new promotions.</li> <li>Procurement — Interested in sales activity in order to replenish inventory.</li> <li>Management — Interested in order activity in order to evaluate company performance and customer (member) satisfaction.</li> </ul> </td></tr> <tr> <td>Description: ⑫</td><td colspan="2"> <p>This use case describes the event of a club member submitting a new order for SoundStage products. The member's demographic information as well as his or her account standing is validated. Once the products are verified as being in stock, a packing order is sent to the warehouse for it to prepare the shipment. For any product not in stock, a back order is created. On completion, the member will be sent an order confirmation.</p> </td></tr> <tr> <td>Typical Course of Events: ⑬</td><td> <p><b>Actor Action</b></p> <p><b>Step 1:</b> The club member provides his or her demographic information as well as order and payment information.</p> </td><td> <p><b>System Response</b></p> <p><b>Step 2:</b> The system responds by verifying that all required information has been provided.</p> <p><b>Step 3:</b> The system verifies the club member's demographic information against what has been previously recorded.</p> <p><b>Step 4:</b> For each product ordered, the system validates the product identity.</p> </td></tr> <tr> <td>Alternate Courses: ⑭</td><td colspan="2"> <p><b>Alt-Step 2:</b> The club member has not provided all the information necessary to process the order. 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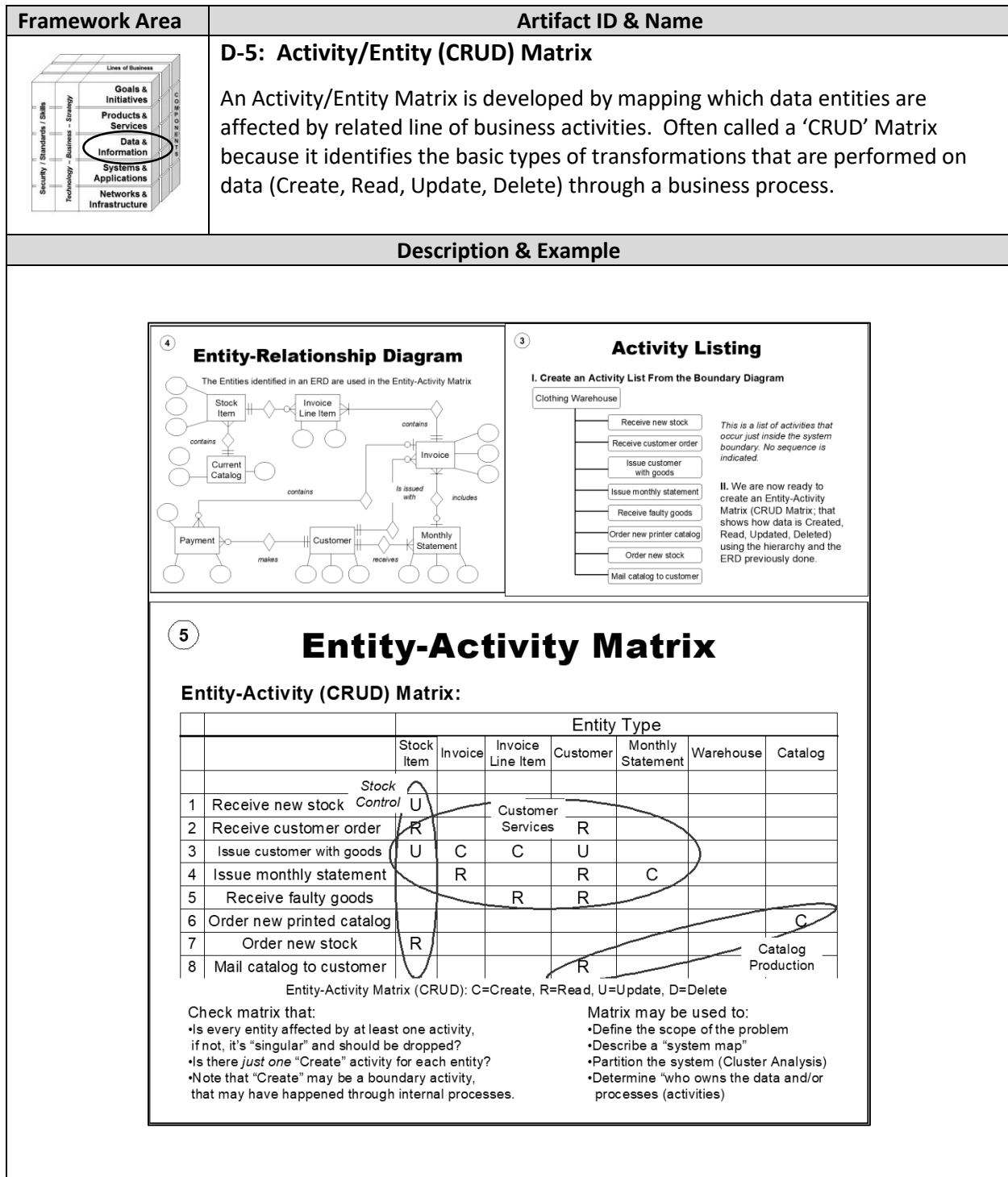
Framework Area	Artifact ID & Name
	<p><b>B-7: Investment Business Case</b></p> <p>An Investment Business Case uses a standard format to describe the value, risk, and return on investments made in technology and other resources. The Business Case also contains an alternatives analysis, program performance tracking metrics, architecture information, and security status information.</p>
Description & Example	
<ol style="list-style-type: none"> <li>1. <u>New Requirement</u>. A new requirement for resource(s) or support is identified in a program, which is brought to the EA and capital planning teams for evaluation.</li> <li>2. <u>Existing Solution Check</u>. The EA and capital planning teams determine that an existing EA component cannot meet the requirement.</li> <li>3. <u>New Solution Business Case</u>. The sponsoring program determines that the requirement is of sufficient importance to merit the cost of developing a business case: <ul style="list-style-type: none"> <li>• Business Need. Describe the requirement in terms of the gap in operational or administrative performance it represents to the program and the agency.</li> <li>• Impact if Not Resolved. Describe the impact to the enterprise if the performance gap is not resolved, including strategic, business, and technology impact.</li> <li>• Alternatives Analysis. Identify three or more viable alternative solutions.</li> <li>• Cost-Benefit Analysis. Quantify the direct and indirect costs and benefits for each alternative on a lifecycle basis, including qualitative items.</li> <li>• Return on Investment. Do a Return on Investment (ROI) calculation for each alternative.</li> <li>• Net Present Value Adjustment. Do a Net Present Value (NPV) adjustment for each ROI calculation to account for anticipated cost increases over the investment's lifecycle.</li> </ul> </li> <li>4. <u>Business Case Evaluation</u>. The business case's alternatives are evaluated by the Architecture Working Group (AWG) for the correctness of the analysis, and alignment with the EA at each level of the framework. The Capital Planning Working Group (CPWG) then reviews the business case for the correctness of the financial analysis. A coordinated recommendation is made to the executive-level Capital Planning Board (CPB) as to whether the business case should be approved or disapproved.</li> <li>5. <u>Business Case Approval</u>. The CPB reviews and approves/disapproves the business case in the context of the agency's overall investment portfolio using criteria that identify value from a strategic, business, and technology perspective.</li> <li>6. <u>Implementation</u>. If the business case is "selected" (approved) for funding by the CPB, the proposed solution becomes an implementation project that is managed by the sponsoring agency program. The project is reviewed by the CPB at key milestones and/or periodically as part of the capital planning process' oversight of all projects.</li> </ol>	

Framework Area	Artifact ID & Name
	<p><b>D-1: Enterprise Data Management Plan</b></p> <p>The Enterprise Data Management (EDM) Plan provides a detailed description of how knowledge, information, and data are managed throughout the agency. The EDM Plan includes models, descriptions, standards, and reusable solutions for total lifecycle data/information ownership and management.</p>
Description & Example	
<p style="text-align: center;"><b>Table of Contents Example for an Agency EDM Plan</b></p> <p style="text-align: center;">-----</p> <p style="text-align: center;">Data Governance</p> <p style="text-align: center;">Data Ownership - Roles and Responsibilities</p> <p style="text-align: center;">Types of Agency Data</p> <p style="text-align: center;">Types of Agency Information</p> <p style="text-align: center;">Types of Agency Knowledge</p> <p style="text-align: center;">Data Formats and Metadata</p> <p style="text-align: center;">Data Access and Sharing</p> <p style="text-align: center;">Data and Information Privacy</p> <p style="text-align: center;">Data and Information Re-use/Re-distribution</p> <p style="text-align: center;">Data Storage and Preservation</p> <p style="text-align: center;">Data Services and Costs</p> <p style="text-align: center;">Training Resources</p> <p style="text-align: center;">References</p> <p style="text-align: center;">Terms and Abbreviations</p> <p style="text-align: center;">Data &amp; Information Inventory</p> <p style="text-align: center;">Data Dictionary</p> <p style="text-align: center;">Object Library</p>	


Framework Area	Artifact ID & Name																																							
	<div><div>D-2: Information Exchange Matrix</div><div>The Information Exchange Matrix describes relevant attributes of data exchanges between systems. These attributes include size, logical specification of the information i.e., media, timeliness required, and the security classification and properties of the information.</div></div>																																							
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<p>Information exchanges express the relationships across four important aspects of the architecture (information, activities, locations, and times) with a focus on the specific aspects of the information flow. Information exchanges identify which business nodes exchange what information during the performance of what activities and in response to which events. Additional information on who is performing the activity can be added, if needed for security analysis. The detailed information in the Information Exchange Matrix may be hard to collect but it is necessary to fully understand the information flow in the enterprise and its security aspects.</p> <p>The matrix also identifies the event that triggers the information exchange (such as a set schedule or a user request). The matrix keys the exchange to the producing and using activities and nodes and to the need line (from the B-3 Node Connectivity Diagram) that the exchange satisfies. This Information Exchange Matrix partitions each high-level need line into its component parts, i.e., into distinct information exchanges between business nodes. An example format for this artifact is provided below. Additional characteristics may be added to the matrix based on the purpose or goals of the enterprise.</p>																																								

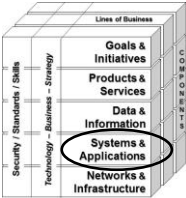
Framework Area	Artifact ID & Name
	<p><b>D-3: Logical Data Models</b> (OO, ERD, DFD)</p> <p>A semantic data model is one that describes the types and meaning of data instances (an entity or object) and can be developed using traditional structured methods and symbology (Entity Relationship Diagram, Data Flow Diagram), or object-oriented methods and symbology using the Unified Modeling Language (UML), which produces an Object Diagram and accompanying lifecycle models.</p>
Description & Example	
<div data-bbox="444 569 1177 1602"> <div data-bbox="467 590 1133 1087"> <p>④</p> <h3>Entity-Relationship Diagram</h3> <p>The Entities identified in an ERD are used in the Entity-Activity Matrix</p>  </div> <div data-bbox="802 831 1177 1119"> <h3>Data Flow Diagram</h3>  </div> <div data-bbox="444 1119 1138 1602"> <h3>Class Diagram</h3> <p>(shows the <i>static</i> structure of a system)</p>  <p><b>Classes</b></p> <p><b>Link</b></p> <p><b>Objects</b> (with inheritance of attributes)</p> <p>Example of Aggregation, which expresses a "Part-of" relationship between a component object and an aggregate object</p> </div> </div>	

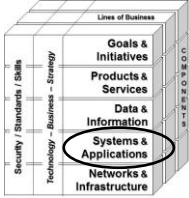
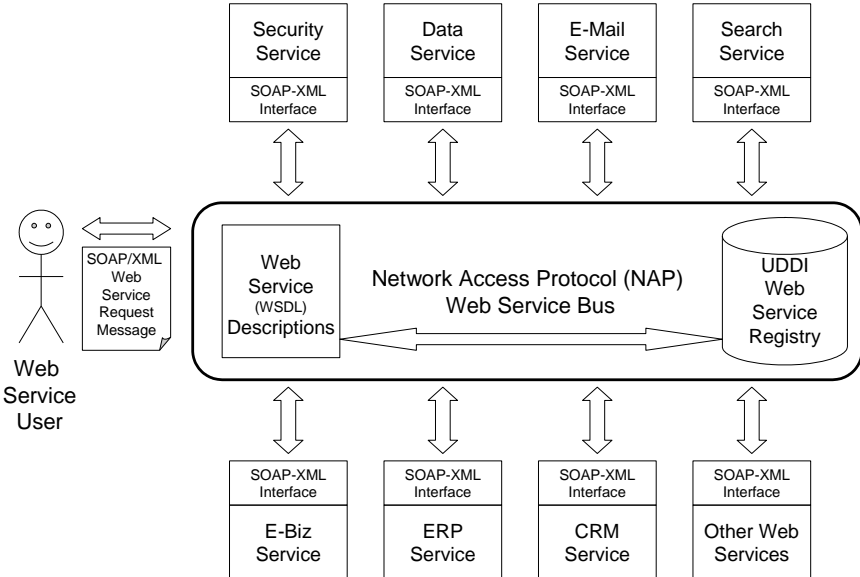
Framework Area	Artifact ID & Name
	<p><b>D-4: Physical Data Model</b></p> <p>The Physical Data Model is used to describe how the information represented in the Logical Data Model is actually implemented in an information system.</p>
Description & Example	
<p>There should be a mapping from a given Logical Data Model to the Physical Data Model (PDM). The PDM is a composite model whose components can vary greatly, as shown in the template below. For some purposes, an entity-relationship style diagram of the physical database design will suffice. The Data Definition Language may also be used in the cases where shared databases are used to integrate systems. References to message format standards (which identify message types and options to be used) may suffice for message-oriented command and control subsystems. Descriptions of file formats may be used when file passing is the mode used to exchange information. Interoperating systems may use a variety of techniques to exchange data, and thus have several distinct partitions in their PDM with each partition using a different form.</p> <p style="text-align: center;"><b>Physical Data Model Provides</b></p> <p><u>Message Format:</u></p> <ul style="list-style-type: none"> <li>- Standards Reference</li> <li>- Message Type(s)</li> <li>- Message Fields with Representation</li> <li>- Map From the Logical Data Model to the Message Fields</li> </ul> <p><u>File Structure:</u></p> <ul style="list-style-type: none"> <li>-Standards Reference</li> <li>-Record and File Descriptions</li> <li>-Map from Logical Interface Model to Record Fields</li> </ul> <p><u>Physical Schema:</u></p> <ul style="list-style-type: none"> <li>-DDL or ERA Notation with sufficient detail to generate the schema</li> <li>-Map from the Logical Data Model to the Physical Data Model with Rationale</li> </ul>	

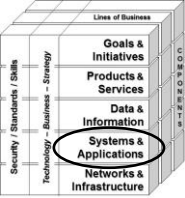
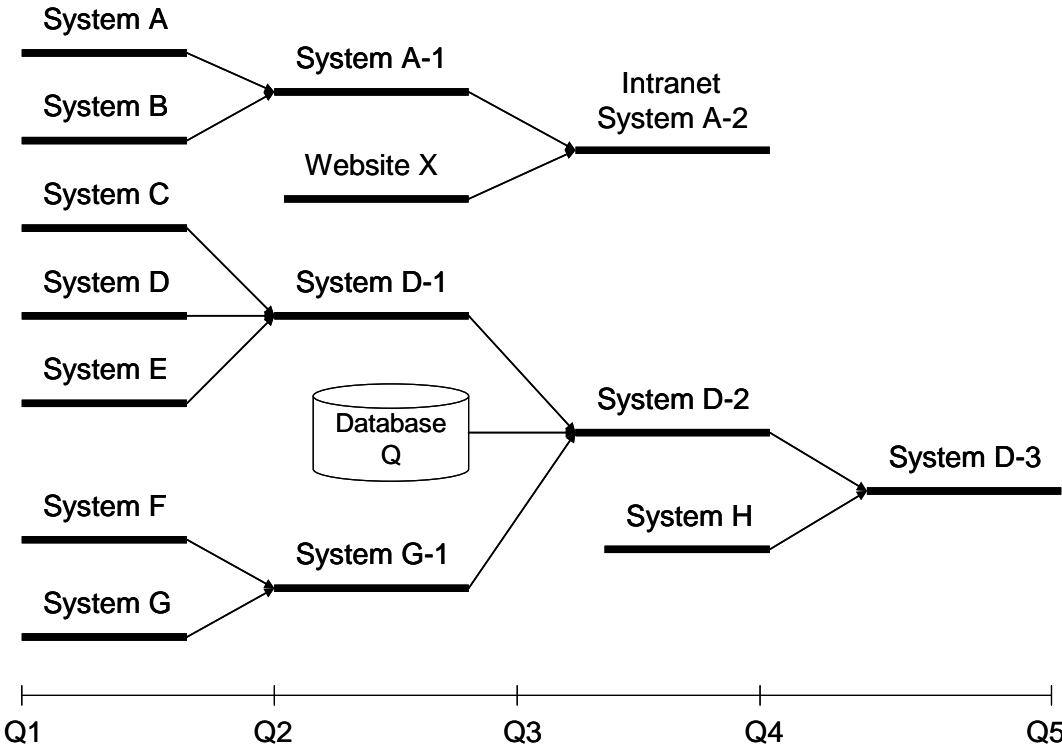


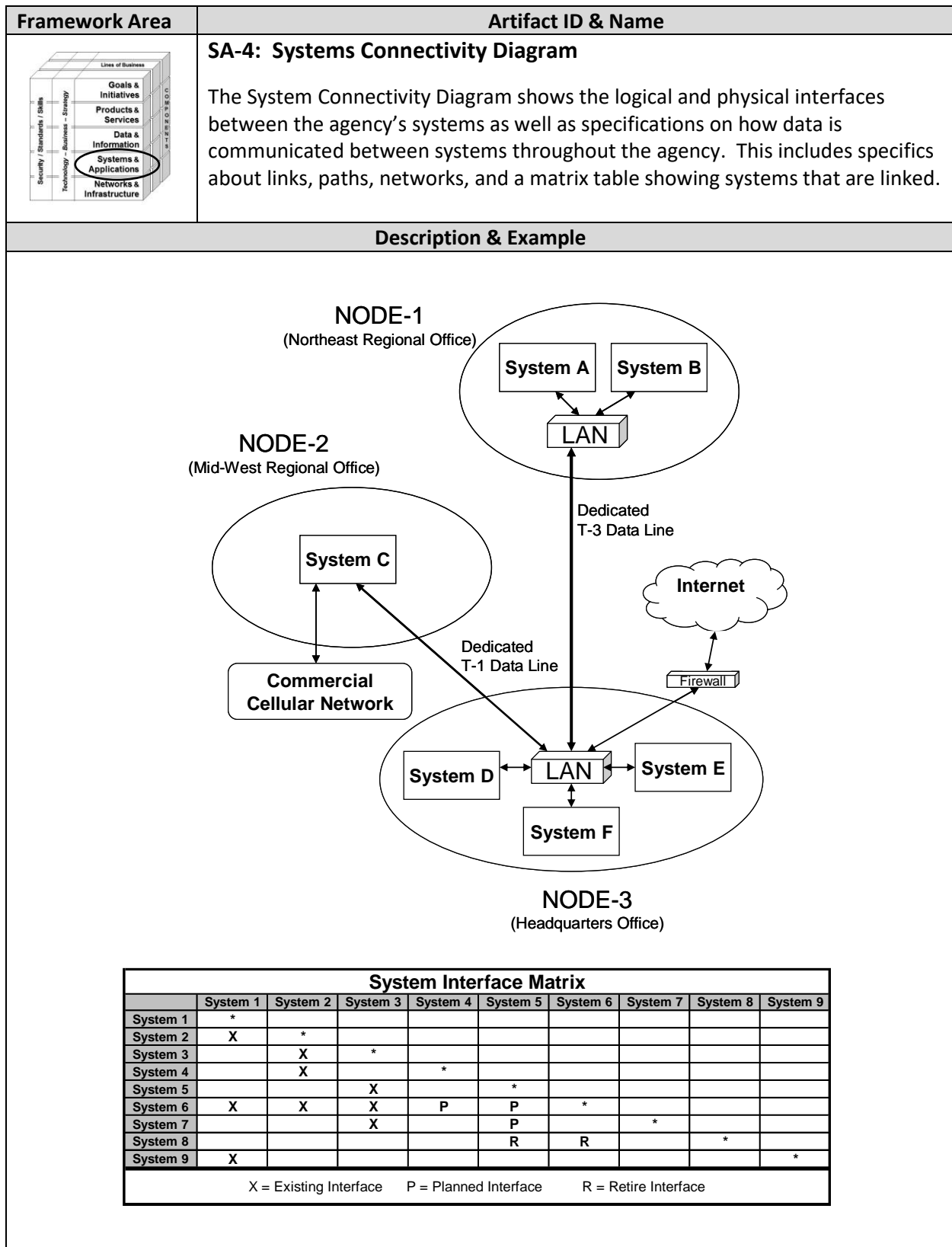


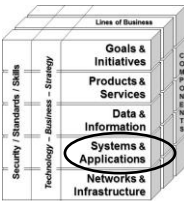
Framework Area	Artifact ID & Name																																																																																				
	<div><div>D-6: Data Dictionary/Object Library</div><div>The Data Dictionary provides a comprehensive listing of the data entities that are collected and maintained by the agency, including standards for the attribute fields, keys, and relationships. The Dictionary should also include a ‘library’ of re-useable Data Objects that uses UML methods and includes a list, and repository of the actual object software code for each object the agency owns.</div></div>																																																																																				
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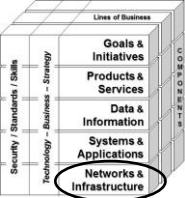
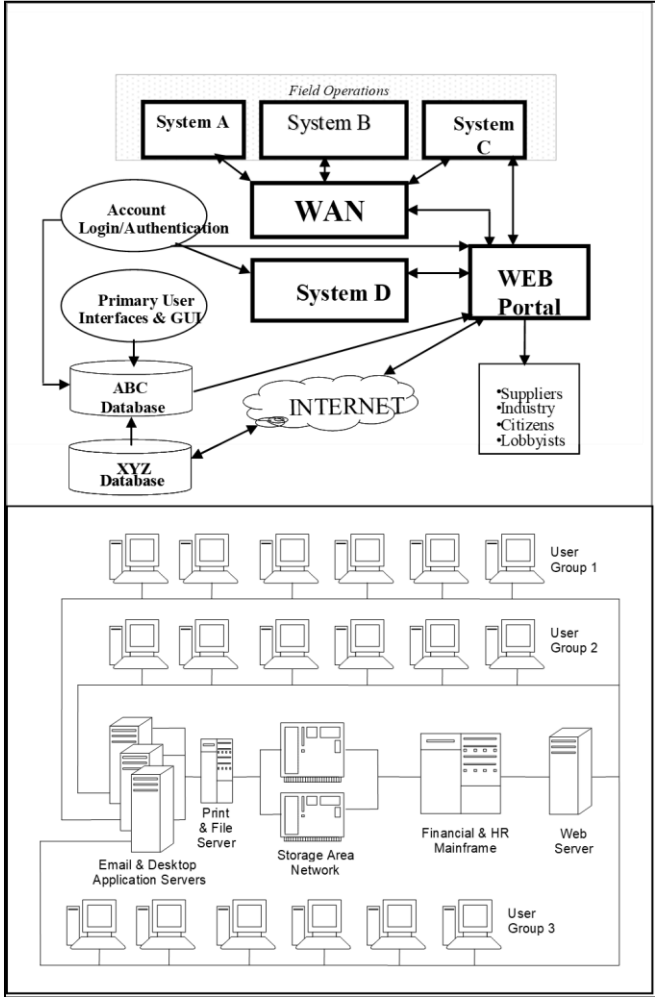
Framework Area	Artifact ID & Name									
	<b>SA-1: Technology Environment Overview Diagram</b>									
	This overview diagram shows the major types of systems and application that the agency uses as well as activity, type, and connectivity relationships.									
Description & Example										
E-Commerce Service		Supply-Chain Management Service		Public Web Portal		E-Government Service		Web Services		
HR Module		Payroll Module		Inventory Module		Sales Module				
CAD Drawing Application		Data Mining Application			Scheduling Application					
Project Tracking Application		Graphics Application	Photo Editing Application	Document Tracking Application						
Office Automation Application Suite			Web Browsers & Applications			Database Application		Back-Office Business and Office Automation Systems/Applications		
Load Balancers & Hypervisors		Enterprise Service Bus & Open APIs			Partitions & Virtual Modules					
Desktop - PC Operating System		File Server Operating System			Storage Area Network					
Print Server Operating System		Web Server Operating System			Security Firewall Operating System					
Ethernet	Frame Relay VPN, ATM	TCP/IP				VOIP	ISDN	Network Transport Protocols (voice, data, video)		

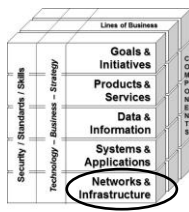
Framework Area	Artifact ID & Name
	<p><b>SA-2: Enterprise Service Bus Overview Diagram</b></p> <p>The Enterprise Service Bus (ESB) Overview Diagram shows the logical relationships between information services, that can share data via standard protocols and interfaces that promote platform-independent data interchanges.</p>
Description & Example	
	

Framework Area	Artifact ID & Name
	<p><b>SA-3: Systems Evolution Overview Diagram</b></p> <p>The Systems Evolution Overview Diagram shows the evolution of a system including the relationship and timing of consolidations installations, upgrades, and retirements, sometimes shown in the context of changes to other systems, applications, websites, and databases.</p>
Description & Example	
	

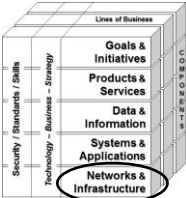


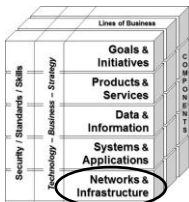
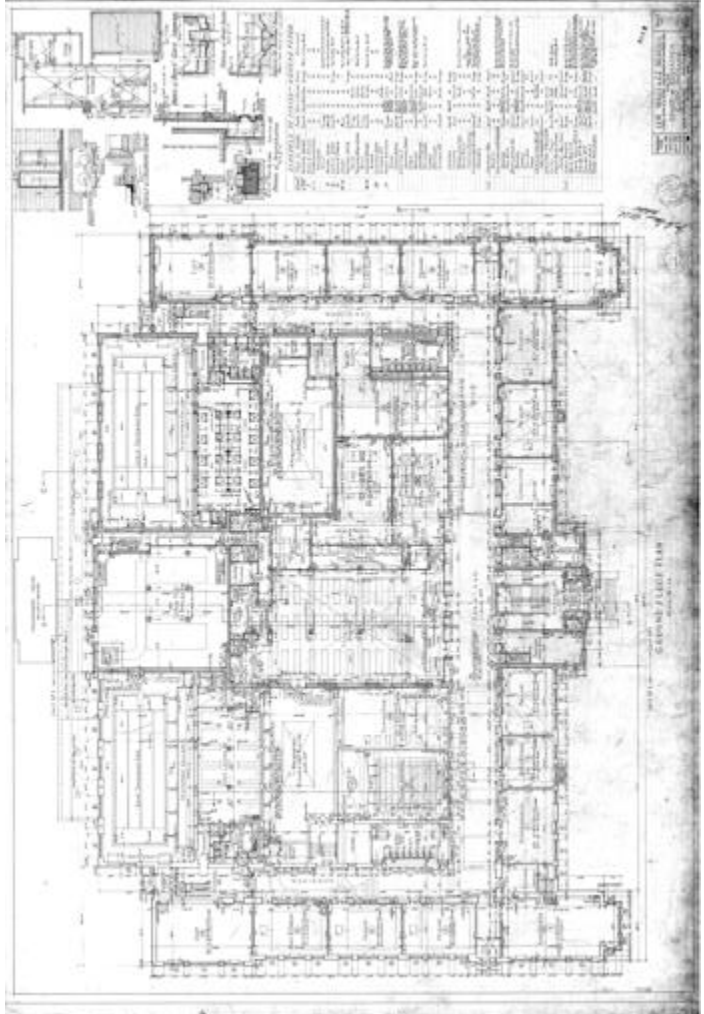
Framework Area	Artifact ID & Name																																																																											
	<div>SA-5: Systems Performance Specifications</div> <p>The System Performance Matrix lists the metrics that are important with regard to each system’s reliability, availability, and maintainability.</p>																																																																											
Description & Example																																																																												
<div><table><tr><th colspan="5">System Performance Measures</th></tr><tr><th>Measure Area</th><th>Type of Measure</th><th>Original Baseline</th><th>Current Status</th><th>Target</th></tr><tr><td>System Maintainability</td><td>Percentage</td><td>0.45</td><td>0.52</td><td>0.6</td></tr><tr><td>System Availability</td><td>Percentage</td><td>0.86</td><td>0.93</td><td>0.95</td></tr><tr><td>System Start-up (Initialization) Time</td><td>Seconds</td><td>32</td><td>23</td><td>15</td></tr><tr><td>System Restart (Re-boot) Time</td><td>Seconds</td><td>35</td><td>26</td><td>18</td></tr><tr><td>Hosted Application Start-up Time (&gt;100 MB)</td><td>Seconds</td><td>28</td><td>26</td><td>25</td></tr><tr><td>Hosted Application Start-up Time (&lt;100 MB)</td><td>Seconds</td><td>19</td><td>17</td><td>15</td></tr><tr><td>Data Throughput Capacity (# of input types)</td><td>Megabytes</td><td>100</td><td>250</td><td>500</td></tr><tr><td>Mean Time Between Hardware Failures</td><td>Days</td><td>68</td><td>69</td><td>90</td></tr><tr><td>Mean Time Between Software Failures</td><td>Days</td><td>12</td><td>14</td><td>20</td></tr><tr><td>System Settings Back-up Time</td><td>Minutes</td><td>22</td><td>21</td><td>18</td></tr><tr><td>System Data Back-up Time</td><td>Minutes</td><td>146</td><td>137</td><td>120</td></tr><tr><td>Email Outbox Transfer Rate (&lt;1MB)</td><td>Seconds</td><td>12</td><td>11</td><td>10</td></tr><tr><td>Email Outbox Transfer Rate (&lt;300KB)</td><td>Seconds</td><td>5</td><td>4</td><td>2</td></tr></table><div><div>1.</div><div>Specifies the quantitative characteristics of system:<ul style="list-style-type: none"><li>Hardware/software</li><li>Interfaces</li><li>Communication components</li></ul></div></div><div><div>2.</div><div>Identifies both current and future parameters.</div></div><div><div>3.</div><div>Includes all relevant technical performance characteristics:<ul style="list-style-type: none"><li>Mean Time Between Failure</li><li>Restart Rate</li><li>System Initialization Time</li><li>Data Transfer Rate</li></ul></div></div></div>		System Performance Measures					Measure Area	Type of Measure	Original Baseline	Current Status	Target	System Maintainability	Percentage	0.45	0.52	0.6	System Availability	Percentage	0.86	0.93	0.95	System Start-up (Initialization) Time	Seconds	32	23	15	System Restart (Re-boot) Time	Seconds	35	26	18	Hosted Application Start-up Time (>100 MB)	Seconds	28	26	25	Hosted Application Start-up Time (<100 MB)	Seconds	19	17	15	Data Throughput Capacity (# of input types)	Megabytes	100	250	500	Mean Time Between Hardware Failures	Days	68	69	90	Mean Time Between Software Failures	Days	12	14	20	System Settings Back-up Time	Minutes	22	21	18	System Data Back-up Time	Minutes	146	137	120	Email Outbox Transfer Rate (<1MB)	Seconds	12	11	10	Email Outbox Transfer Rate (<300KB)	Seconds	5	4	2
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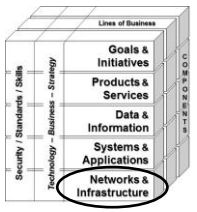
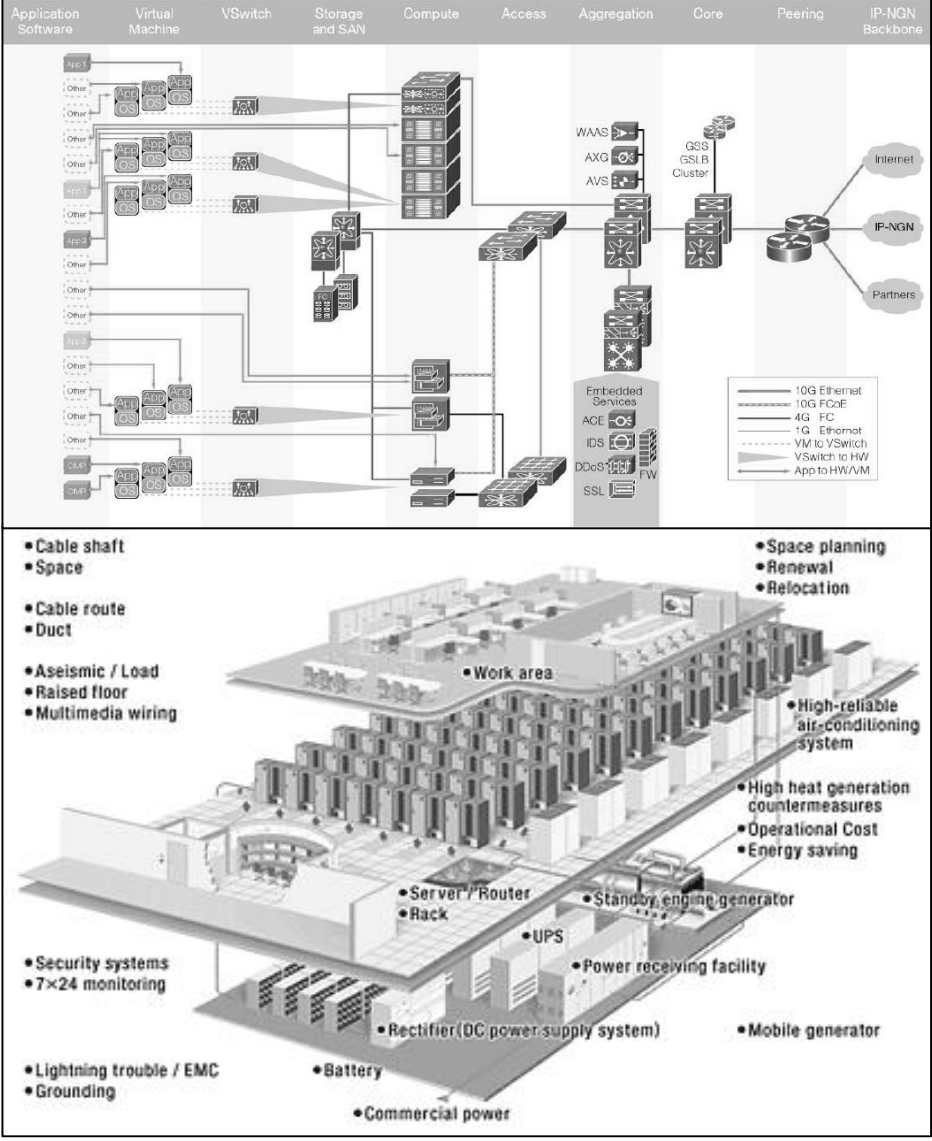
Framework Area	Artifact ID & Name
	<p><b>NI-1: Network Connectivity Diagram</b></p> <p>The Network Connectivity Diagram shows the physical connections between the agency's voice, data, video, and mobile networks that are owned or subscribed to (government or commercial cloud hosting and/or infrastructure services).</p>
Description & Example	
	

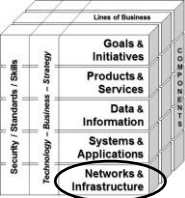
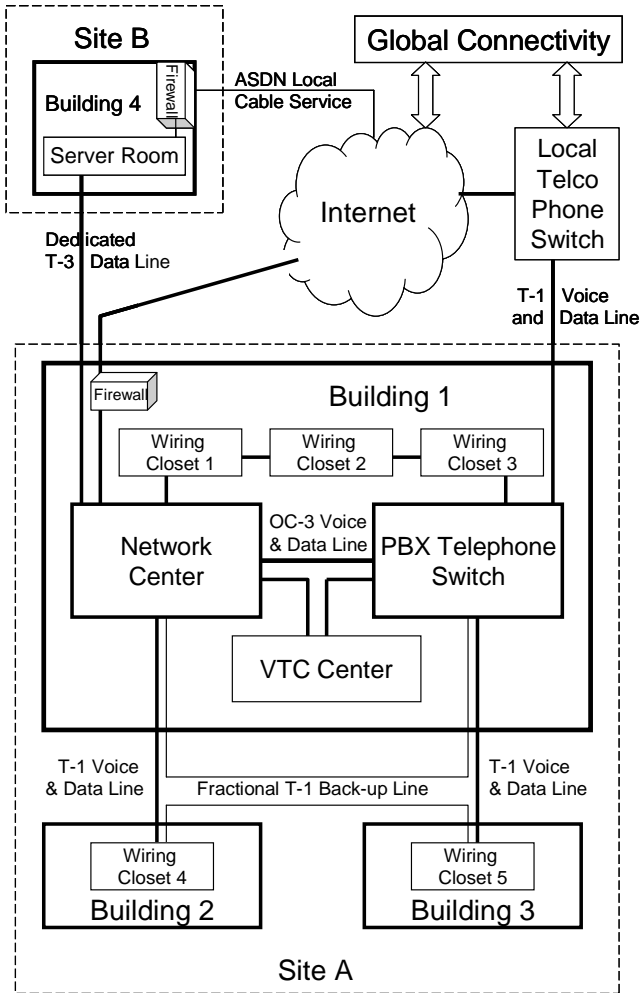
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	<h2>NI-2: Network Inventory</h2> <p>The Network Inventory lists all of the hardware and software on the enterprise’s voice, data, and video networks throughout the enterprise. The list may include bar code numbers or other unique identifiers.</p>																																																																																																																																																																																														
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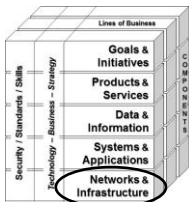
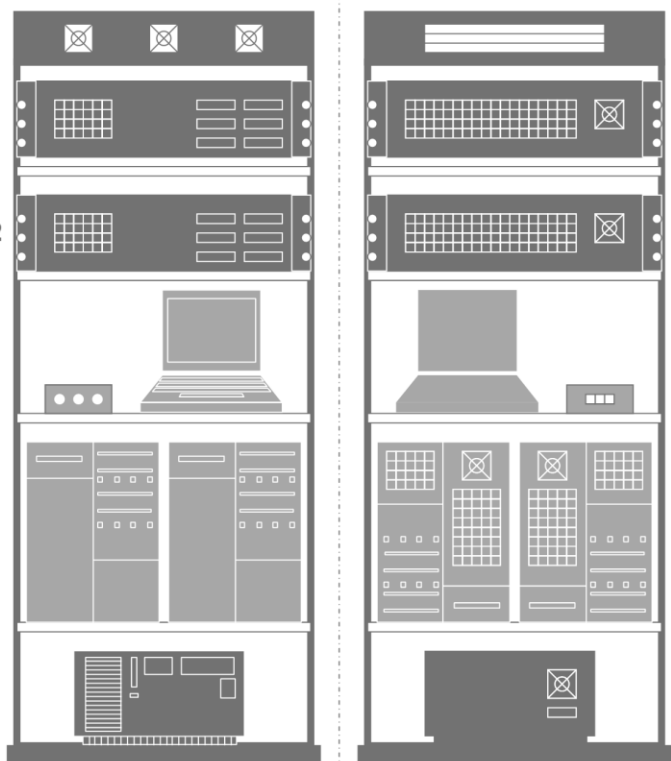


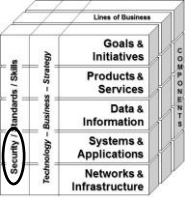
Framework Area	Artifact ID & Name																																																																																																																																		
	<div>NI-3: Capital Equipment Inventory</div> <p>The Capital Equipment Inventory lists all of the non-information technology capital (depreciable) equipment in each line of business throughout the enterprise. The list may include bar code numbers or other unique identifiers.</p>																																																																																																																																		
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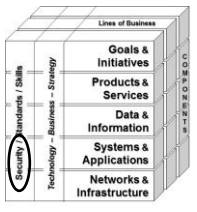
Framework Area	Artifact ID & Name
	<p><b>NI-4: Building Blueprints</b></p> <p>This artifact is a full set of electronic (preferred) or hardcopy blueprints for all of the physical buildings and rooms throughout the agency. The blueprints aid in planning and decision-making regarding the placement of workspaces, production facilities, warehouses, networks, and other agency functions.</p>
Description & Example	
	

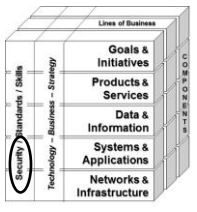
Framework Area	Artifact ID & Name
	<p><b>NI-5: Network Operations Center Diagram</b></p> <p>This is an overview diagram of the logical and physical layout of the agency's Network Operations Center (NOC). The agency may have several NOCs and there should be an overview diagram for each one as well as a model of systems connectivity using the SA-4 type of diagram.</p>
Description & Example	
 <p><b>Logical Network Diagram Components:</b></p> <ul style="list-style-type: none"> <li>Application Software</li> <li>Virtual Machine</li> <li>VSwitch</li> <li>Storage and SAN</li> <li>Compute</li> <li>Access</li> <li>Aggregation</li> <li>Core</li> <li>Peering</li> <li>IP-NGN Backbone</li> </ul> <p><b>Physical Layout Diagram Components:</b></p> <ul style="list-style-type: none"> <li>• Cable shaft</li> <li>• Space</li> <li>• Cable route</li> <li>• Duct</li> <li>• Aseismic / Load</li> <li>• Raised floor</li> <li>• Multimedia wiring</li> <li>• Work area</li> <li>• Space planning</li> <li>• Renewal</li> <li>• Relocation</li> <li>• High-reliable air-conditioning system</li> <li>• High heat generation countermeasures</li> <li>• Operational Cost</li> <li>• Energy saving</li> <li>• Server / Router</li> <li>• Rack</li> <li>• UPS</li> <li>• Standby engine generator</li> <li>• Power receiving facility</li> <li>• Rectifier(DC power supply system)</li> <li>• Mobile generator</li> <li>• Security systems</li> <li>• 7x24 monitoring</li> <li>• Lightning trouble / EMC</li> <li>• Grounding</li> <li>• Battery</li> <li>• Commercial power</li> </ul> <p><b>Legend:</b></p> <ul style="list-style-type: none"> <li>10G Ethernet</li> <li>10G FC</li> <li>4G FC</li> <li>1G Ethernet</li> <li>VM to VSwitch</li> <li>VSwitch to HW</li> <li>App to HW/VM</li> </ul>	

Framework Area	Artifact ID & Name
	<p><b>NI-6: Cable Plant Diagram</b></p> <p>The Cable Plant Diagram shows physical connectivity between voice/data/video networks throughout the enterprise and to global suppliers. The diagram should show the types of cable (fiber, CAT-6, etc.) and the bandwidth (T-3, OC-12, etc.) of each cable run between network centers, server rooms, wiring closets, user locations, and external connections.</p>
Description & Example	
 <p>The diagram illustrates the physical connectivity of a multi-site enterprise network. It shows the internal structure of three sites: Site B (Building 4), Site A (Buildings 1, 2, and 3), and Global Connectivity. Key components include firewalls, server rooms, wiring closets, network centers, PBX switches, and VTC centers. Connections are labeled with specific bandwidths and types, such as T-3, T-1, OC-3, and OC-12 lines, as well as dedicated data and voice lines.</p>	

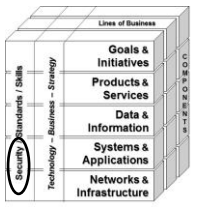
Framework Area	Artifact ID & Name
	<p><b>NI-7: Rack Elevation Diagram</b></p> <p>This diagram provides a front and rear view of each of the information technology equipment racks that go into a network center, server room, and/or wiring closet. This diagram supports the NI-5 and NI-6 diagrams and is maintained electronically to support the numerous changes that can be expected over a number of years.</p>
Description & Example	
<div style="display: flex; justify-content: space-around; align-items: flex-start;"> <div style="text-align: right; width: 20%;"> <p>Overhead Fan</p> <p>50-Port Switch #1</p> <p>50-Port Switch #2</p> <p>KVA Switch Administrator's Laptop</p> <p>File Servers (Cluster A&amp;B)</p> <p>Surge Protector and Battery Unit</p> </div> <div style="width: 60%; text-align: center;">  </div> <div style="text-align: left; width: 20%;"> <p>Rack 1 - Front</p> <p>Rack 1 - BACK</p> </div> </div>	

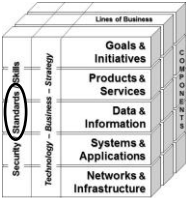
Framework Area	Artifact ID & Name
	<p><b>SP-1: Security &amp; Data Privacy Plan</b></p> <p>The Security &amp; Data Privacy Plan provides both high-level and detailed descriptions of the agency’s integrated physical, cyber, and data security program. The Plan should include physical, data, personnel, and operational elements and procedures, and example of which is provided below.</p>
Description & Example	
<p><b>1. Introduction</b>  Purpose of the IT Security Program  Principles of IT Security  Critical Success Factors  Intended Outcomes  Performance Measures</p> <p><b>2. Policy</b>  Executive Guidance  Technical Guidance  Applicable Law and Regulations  Standards</p> <p><b>3. Reporting Requirements</b>  IT Security Program Roles and Responsibilities  IT Security Program Schedule and Milestones  IT Security Incident Reporting</p> <p><b>4. Concept of Operations</b>  IT Security Threat Summary  IT Security Risk Mitigation  Integration with Enterprise Architecture  Component/System Security Plans</p> <p><b>5. Security Program Elements</b>  Information Security  Personnel Security  Operational Security  Physical Security</p> <p><b>6. Standard Operating Procedures</b>  Test and Evaluation  Risk Assessment  Certification and Accreditation  Disaster Recovery/Continuity of Operations  Records Protection and Archiving  Data Privacy</p>	

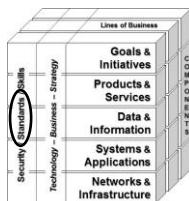
Framework Area	Artifact ID & Name
	<p><b>SP-2: System Accreditation Documentation</b></p> <p>The System Accreditation Document uses a standard format for evaluating the security status of information systems throughout the enterprise. There are a number of parts to a system security accreditation as are illustrated in the example below. Government and industry standards should be considered.</p>
Description & Example	
<p><b>1. System Security Plan.</b> This opening section of the System Accreditation Document provides an overview of the business context that the information system operates in, states the current security status of the system (last accreditation), and summarizes the contents and finding of the other accreditation documents.</p> <p><b>2. System Risk Assessment.</b> This section of the document uses a standardized format for showing areas of risk to the information system in the four primary areas security threat areas. Assigns a level of risk based on the business context for system operations and the type of system data to be protected. Provides security risk remediation strategies (how to avoid a security risk, or deal with it if a problem occurs) for each area of risk that is identified.</p> <p><b>3. System Test and Evaluation.</b> Also called a system ‘penetration test.’ The System Test and Evaluation (ST&amp;E) section of the document provides the results of a live test that attempts to enter the system through other-than-normal log-in procedures, as well as attempts to overwhelm the system (denial of service attack), or infect the system with an active virus, worm, or other type of problematic element that reduces or eliminates information system functionality.</p> <p><b>4. Remediation Plan.</b> This section of the document provides the status of corrective actions taken to fix all of the security risks found during the risk assessment/ST&amp;E.</p> <p><b>5. Approval to Operate.</b> This section of the document is the formal (signed) approval to operate the information system that is provided by the designated person in the enterprise (usually the Chief Information Officer or the IT Security Manager).</p> <p style="text-align: center;">-----</p> <p>Note: Mature government (NIST) and industry (AACPA – SOC2) standards for conducting security assessments are available and should be utilized by the agency in a manner that confirms with State law and policy.</p>	

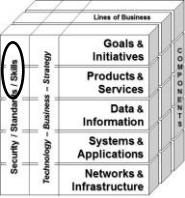
Framework Area	Artifact ID & Name
	<p><b>SP-3: Continuity of Operations Plan</b></p> <p>The Continuity of Operations Plan (COOP) uses a standard format for describing where all or part of the enterprise will relocate to if the normal operating location cannot be occupied for an extended period (more than a few days) due to a natural or man-made event.</p>
Description & Example	
<p>The activation of the COOP relocation site may have to be accomplished in the midst of a local or national disaster that makes clarity, brevity, completeness, and flexibility (backups) key to success. The following are some of the recommended elements in a COOP document:</p> <ol style="list-style-type: none"> <li><b>1. COOP Activation.</b> Conditions for Activating the COOP.</li> <li><b>2. COOP Roles and Responsibilities.</b> A matrix of the roles and responsibilities (by position) of all personnel throughout the agency who are involved in activating the COOP. Alternates are provided for each position.</li> <li><b>3. COOP Checklist.</b> A step-by-step checklist of actions for each person participating in the COOP.</li> <li><b>4. COOP Relocation Site Map and Directions.</b> How to get to the COOP site from various probable routes.</li> <li><b>5. COOP Relocation Site Activation.</b> The process for activating the COOP site, establishing internal/external communications, and reconstituting key agency functions at the COOP site.</li> <li><b>6. COOP Relocation Site Inventory.</b> An inventory of systems, equipment, and supplies at the COOP relocation site, along with the person(s) responsible for ensuring that the systems are operational and the equipment is present when needed.</li> <li><b>7. COOP Relocation Site Retirement.</b> Procedures for de-activating the COOP site and restoring it to a 'ready status' after a real relocation event or training exercise.</li> </ol> <p style="text-align: center;">Note: COOP covers an agency <u>relocation</u> scenario.</p>	

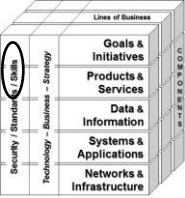
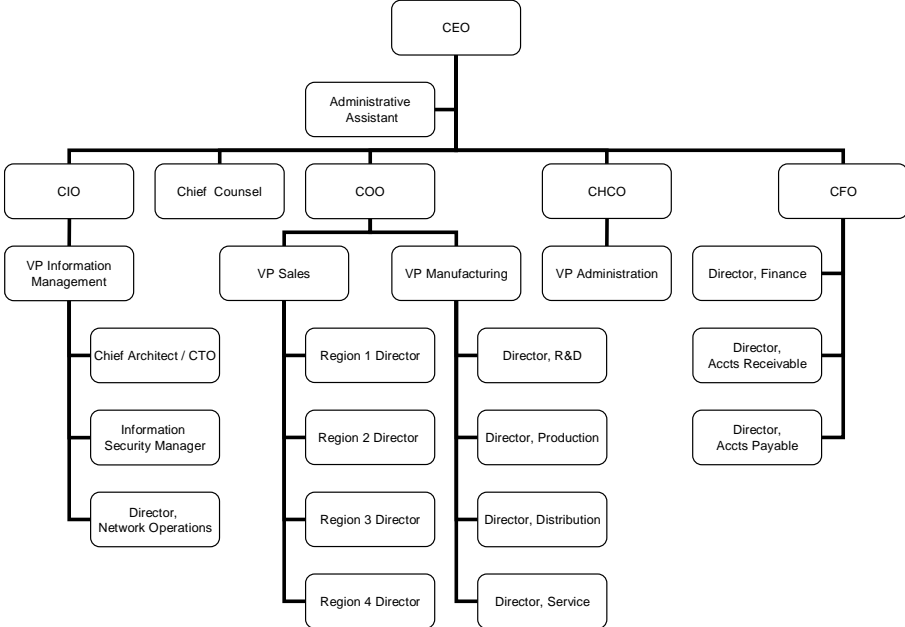


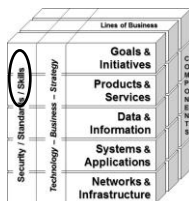

Framework Area	Artifact ID & Name
	<p><b>SP-4: Disaster Recovery Procedures</b></p> <p>The Disaster Recovery (DR) Plan is an assessment matrix and set of procedures to handle outages in various business and/or technology capabilities that do not require the enterprise to relocate its operations. Outages can be caused by natural or man-made events (e.g. fire, flood, power outage).</p>
Description & Example	
<p>The activation of the Disaster Recovery Plan may have to be accomplished in the midst of a natural or man-made disaster that makes clarity, brevity, completeness, and flexibility (backups) key to success. The following are some of the recommended elements in a Disaster Recovery Plan:</p> <ol style="list-style-type: none"> <li><b>1. Disaster Recovery Activation.</b> Conditions for Activating the DR Plan.</li> <li><b>2. On-Site Recovery Roles and Responsibilities.</b> A matrix of the roles and responsibilities (by position) of all personnel throughout the agency who are involved in activating the COOP. Alternates are provided for each position.</li> <li><b>3. Disaster Impact and Recovery Assessment.</b> A standard matrix for assessing the type and duration of the outage, as well as the systems and functions throughout the enterprise that are affected. Depending on the type of outage and the projected period of outage (minutes, hours, days), the recovery procedure may differ.</li> <li><b>4. Recovery Procedures.</b> The procedures that are used to restore the business and/or system functions that have been disrupted. Examples include: <ul style="list-style-type: none"> <li>• Electrical Outage</li> <li>• Air Conditioning/Heating Outage</li> <li>• Building or Room Damage (Fire, Flood, Earthquake, Storm, Bomb)</li> <li>• Virus Infection of Information System(s)</li> <li>• Loss of Internal or External Data Communications</li> <li>• Loss of Internal or External Telephone Communications</li> </ul> </li> </ol> <p>Note: DR covers an agency <u>non-relocation</u> scenario.</p>	

Framework Area	Artifact ID & Name																																																																																																																																																																															
	<h2>ST-1: Technical Standards Profile</h2> <p>The Technology Standards Profile is a listing of agency services and associated technologies that are accepted by the enterprise as being a primary or secondary standard. Further detail can be added regarding particular types of standards (e.g. data, telecommunications) and vendor products.</p>																																																																																																																																																																															
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Framework Area	Artifact ID & Name																																		
	<b>ST-2: Technology Forecast</b>																																		
	The Technology Forecast supports and relates to the ST-1 Technology Standards Profile. The Technology Forecast documents expected changes in any of the standards listed in the ST-1 artifact, where future changes appear to be happening or about to happen.																																		
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	A technology forecast captures expected changes in technology-related standards and conventions. Identifies critical technology standards, their fragility, and impact of changes to the agency’s overall or system-specific architectures. A forecast contains specific predictions about the availability of emerging standards, and relates to specific System/Application (SA) framework elements as follows:																																		
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Framework Area	Artifact ID & Name
	<p><b>W-1: Workforce &amp; Skills Plan</b></p> <p>The Workforce Plan provides a high-level description of how human capital is managed throughout the agency. The Workforce Plan includes strategies for hiring, retention, and professional development at the executive, management, and staff levels of the agency. An example of contents is provided below.</p>
Description & Example	
<p><b>Summary of Agency X Human Capital Management Strategy</b></p> <p><b>Executive Level Competencies and Professional Development Plans</b></p> <p><b>Management Level Competencies and Professional Development Plans</b></p> <p>Program Office A Program Office B Program Office C Program Office D</p> <p><b>Staff Level Competencies and Professional Development Plans</b></p> <p>Program Office A Program Office B Program Office C Program Office D</p> <p><b>Performance Review Standards and Process</b></p> <p><b>Salary and Benefits Standards and Programs</b></p> <p><b>Training and Tuition Assistance Program</b></p>	

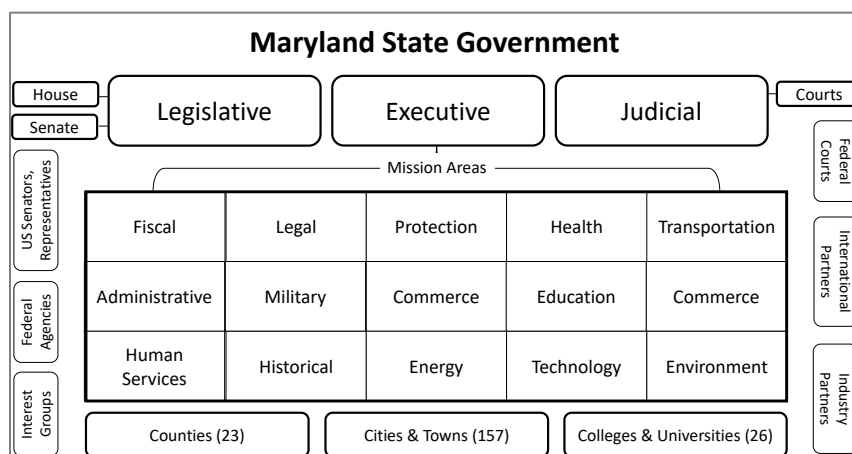
Framework Area	Artifact ID & Name
	<p><b>W-2: Organization Chart</b></p> <p>The Organization Chart shows how positions and personnel are organized in hierarchical diagrams or matrix formats. Organization Charts help to show lines of authority, working relationships, as well as ownership of resources, services, resources, and processes throughout the agency.</p>
Description & Example	
	

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<div></div>	<div><h3>W-3: Knowledge &amp; Skills Profiles</h3><p>Knowledge and Skills Profiles provide a detailed inventory of what a person should know and be able to do in a particular position within the agency. The example provided is a “Knowledge, Skills, and Abilities” List for Enterprise Architects developed and maintained by Carnegie Mellon University as part its EA training and professional certification program.</p></div>																																																																																																																																																																																																																																								
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2.1	Strategic Goals, Initiatives, and Plans	X	X	X																																																																																																																																																																																																																																					
2.2	Business Sub-Architecture	X	X	X																																																																																																																																																																																																																																					
2.3	Information and Data Sub-Architecture	X	X	X																																																																																																																																																																																																																																					
2.4	Service Sub-Architecture	X	X	X																																																																																																																																																																																																																																					
2.5	Systems Sub-Architecture	X	X	X																																																																																																																																																																																																																																					
2.6	Techology Sub-Architecture	X	X	X																																																																																																																																																																																																																																					
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2.8	Architecture Standards and Artifact Types	X	X	X																																																																																																																																																																																																																																					
3.0	EA Implementation																																																																																																																																																																																																																																								
3.1	EA Program and Project Establishment		X	X																																																																																																																																																																																																																																					
3.2	EA Requirements and Scope		X	X																																																																																																																																																																																																																																					
3.3	EA Framework and Methodology Selection		X	X																																																																																																																																																																																																																																					
3.4	EA Tool and Repository Selection		X	X																																																																																																																																																																																																																																					
3.5	Documenting the Current Architecture		X	X																																																																																																																																																																																																																																					
3.6	Documenting the Future Architecture		X	X																																																																																																																																																																																																																																					
3.7	Architecture Transition Management		X	X																																																																																																																																																																																																																																					
3.8	Architecture Configuration Management		X	X																																																																																																																																																																																																																																					
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4.2	Requirements Determination			X																																																																																																																																																																																																																																					
4.3	Project and Program Schedules			X																																																																																																																																																																																																																																					
4.4	Project and Program Budgets			X																																																																																																																																																																																																																																					
4.5	Alternatives Analysis			X																																																																																																																																																																																																																																					
4.6	Managing Risk			X																																																																																																																																																																																																																																					
4.7	Earned Value Management			X																																																																																																																																																																																																																																					
4.8	EA Team Development			X																																																																																																																																																																																																																																					

## Appendix C. Analysis Reference Models/Taxonomies

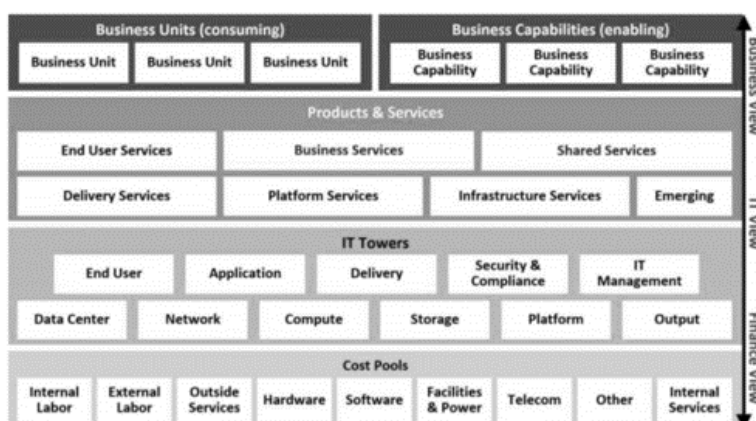
Reference models are categorization schema (taxonomies) that support analysis, design, and decision-making activities through an agency. The DoIT EA approach primarily uses two classification taxonomies to support the identification and classification of processes and resources. These two taxonomies are the Mission Services Model (MSM) and the Technology Business Model (TBM).

### Mission Services Reference Model



### Technology Business Reference Model

The Technology Business Model (TBM) is an industry and government developed best practice for categorizing an agency's business units and capabilities, mapping those to products and services, then to enabling forms of information technology (called towers), and then to financial cost center types and codes. This is important in standardizing the way that Maryland State and each agency tracks costs associated with common IT services such as data storage/retrieval, applications hosting, networking, cybersecurity protection, inventory management, and end-user support. TBM standards are maintained by an industry group called the TBM Council, with version 2.0 being the most recently released version of the TBM model (2018). The following is the current TBM concept overview diagram:



Implementation of TBM cost-tracking capabilities requires cooperation between the CIO and CFO functions in each agency, such that IT operations and financial tracking systems and processes are aligned and utilize TBM methods, tools, and standards. When implemented, an activity-based costing capability is achieved for IT services, which support planning/budgeting.

## Appendix D.

### Information Technology Policy and Standards

In accordance with State law and policy, DoIT develops and maintains standards for IT solutions using a collaborative process, overseen by an IT Policy Review Board. The policy and standards documents are available on the DoIT website in the “Policies & Guidance” section. The following is a list of the policies currently approved by the DoIT Secretary. Appendices to the policies include manuals, handbooks, specification sheets, and other standards lists. These items are developed and maintained through an ongoing ITPRB review process. As of the date of this version of the *EA Handbook*, the following are the Secretary-approved IT policies:

<u>DoIT Policy # / Name</u>	<u>Attachment(s)</u>
20-01 DoIT IT Policy Program Guidelines	Policy Development & Approval Process
20-02 MITDP Procedures	MITDP Oversight & Audit Processes
20-03 DoIT Enterprise Architecture Approach	DoIT EA Handbook
20-04 Desktop/Laptop Configuration	None
20-05 Special Request Portfolio (Intake Process)	None
20-07 IT Security Policy	DoIT IT Security Manual
20-08 Boundary Protection Baselines	None
20-09 Domain Registration & Authoritative DNS	None
20-10 IT Support for Telework	None
20-11 Communications Recordings	None
20-12 Mobile Device Management	None

This list will be updated with subsequent versions of the EA Handbook, but please refer to the DoIT Policy & Guidance webpage at [doit.maryland.gov/policies/Pages/default.aspx](https://doit.maryland.gov/policies/Pages/default.aspx) for the latest list of approved, active policies. The point of contact for DoIT policy and standards questions is the Chair of the DoIT IT Policy Review Board, who can be reached at [doit-oea@maryland.gov](mailto:doit-oea@maryland.gov).