DoD Architecture Framework
Version 2.0
Draft

Volume 1: Introduction, Overview, and Concepts

Management Volume

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DOD ARCHITECTURE FRAMEWORK VERSION 2.0

EXECUTIVE SUMMARY

The DoD Architecture Framework (DoDAF), Version 2.0 serves as the overarching, comprehensive framework and conceptual model enabling DoD managers at all levels to make key decisions more effectively through organized information sharing across Department, Joint Capability Areas (JCAs), Mission, Components and Program boundaries. DoDAF serves as one of the pillars that support the responsibilities of the Department of Defense Chief Information Officer (DoD CIO) in development and maintenance of architectures required under the Clinger-Cohen Act. It also reflects guidance from OMB Circular A-130, and other Departmental directives and instructions. This version of the Framework provides extensive guidance on development of architectures supporting the adoption and execution of Net-centric services within the Department.

DoD managers, as process owners, specify the requirements, and control the development of architectures, as described in this volume, within their areas of authority and responsibility. In that role, they select an architect, and an architecture development team to create the architecture in accordance with the requirements defined by the manager (process owner). As described in Volume 1, architecture concentrates on those data that correspond to architecture requirements.

The duties of the architect, and the architecture team that create the architecture, are further described in Volume 2 of DoDAF. The architect supervises development of the architecture, and ensures that the requirements and visual representations of the architecture meet process owner requirements.

DoDAF 2.0 focuses on architecture data, rather than on developing individual products. Data can be collected, organized, and stored by a wide range of architecture tools developed by commercial sources and organized using the DoDAF Meta-model (DM2)... A 'Data Capture Method' for each data group of the DM2 is provided in Volume 2 to guide architects in collecting and organizing the necessary architecture data.
The framework enables architecture content to be built that is “Fit for Purpose”, defined and described in Volume 1 as architecture, which is consistent with specific project or mission objectives. Because architecture can be applied at myriad levels of an enterprise, the purpose or use of architecture at each level will be different in content, structure, and level of detail. In order to ensure that architecture meets program and mission objectives, the approach to architecture development must be tailored to address a specific, well-articulated, and understood purpose. This will help to ensure that necessary data collection, to an appropriate level of detail, is undertaken, completed, and supportive of specific decisions or objectives.

DoDAF also serves as the principal guide for development of integrated architectures as defined in DoD Instruction 4630.8, which defines an integrated architecture as “An architecture consisting of multiples views or perspectives facilitating integration and promoting interoperability across capabilities and among integrated architectures”. The term integrated means that data required in more than one instance in architectural views is commonly understood across those views.

The DoDAF Meta-model provides information needed to collect, organize, and store data in an easily understandable way, and the presentation description of various types of views in Volumes 1 & 2 provide the guidance on how to develop graphical representations of that data that will be useful in defining acquisition requirements under the DOD Instruction 5000-series.

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The DoDAF Meta-model (DM2) replaces the Core Architecture Data Model (CADM) which supported previous versions of the DoDAF. DM2 is a data construct that facilitates reader understanding of the use of data within an architecture document. CADM can continue to be used in support of architectures created in previous versions of DODAF.

DoDAF 2.0 is a marked change from earlier versions of either C4ISR or DoDAF, in that architects now have the freedom to create enterprise architectures to meet the demands of their customer requirements. The central core of DoDAF v2.0 is a data-centric approach where the creation of architectures to support decision-making is secondary to the collection, storage, and maintenance of data needed for efficient and effective decisions. The architect and stakeholders select views to ensure that architectures will explain current and future states of the process or activity under review. Selecting architecture views carefully ensures that the views adequately explain the requirement and proposed solution in ways that will enhance audience understanding.

DoDAF 2.0 provides two types of views. **DoDAF-described Views** are created from the subset of data for a particular purpose and are fully explained in DoDAF. These views are useful as examples for presentation purposes, and can be used as described or modified as needed. **Fit-for-Purpose Views** are user-defined views of a subset of architecture data created for some specific purpose. While these views are not described or defined in DoDAF, they can be created, as needed, to ensure that presentation of architecture data is easily understood within an agency. This enables agencies to use their own established presentation preferences in their deliberations.

DoDAF 2.0 provides, but does not require, a particular methodology in architecture development. Volume 1 contains numerous examples of how to utilize the DoDAF methodology either alone, or in conjunction with other methods. Volume 1 provides guidance and suggestions on how to ensure that other proposed methods can be adapted as needed to meet the DoD requirements for data collection and storage. Similarly, the views presented in DoDAF are examples, intended to serve as a possible visualization of a particular view. DoDAF 2.0 also continues to provide support for views (i.e. ‘products’) developed in previous versions of the Framework. These views do not require any particular graphical design by toolset vendors.
DoDAF 2.0 is composed of three volumes, along with an electronic DoDAF Journal hosted on Defense Knowledge Online, https://www.us.army.mil/suite/page/454707. Together, these volumes provide a resource that enables users to access the DoD’s entire body of knowledge associated with architecture.

- **Volume 1** provides general guidance for development, use, and management of DoD architectures. This volume is designed to help non-technical users understand the role of architecture in support of major decision support processes. Volume 1 provides a six-step methodology (Section 7) that can be used to develop architectures at all levels of the Department, and a Conceptual Data Model (CDM) (Section 9) for organizing data collected by an architecture effort.

- **Volume 2** describes the construct of architectures, data descriptions, data exchange requirements, and examples of their use in developing architectural views in technical detail, to include the development and use of service-oriented architectures in support of Net-centric operations. Volume 2 provides a Logical Data Model (LDM), based on the CDM, which describes and defines architecture data; further describes the methods used to populate architecture views, and describes how to use the architecture data in DoDAF-described views, or in developing Fit-for-purpose Views that support decision-making.

- **Volume 3** relates the CDM structure with the LDM relationships, associations, along business rules described in Volume 2 to introduce a Physical Exchange Specification (PES), which provides the constructs needed to enable exchange of data among users and COIs. **NOTE: DoDAF 2.0 does NOT prescribe a Physical Data Model (PDM), leaving that task to software developers who will implement the principles and practices of DoDAF in their own software offerings.**

- **The DoDAF Journal**, https://www.us.army.mil/suite/page/454707, is the electronic interface for DoDAF support. The DoDAF Journal provides a place for submitting future change requests to DoDAF or the DM2 (Section 9); provides examples referenced in the various DoDAF volumes, and includes descriptions of other best practices, lessons learned, and reference documents that supplement the information contained in the three volumes of DoDAF V2.0, including:
  - DoDAF Architecture Development Process for the Models
  - DoDAF Product Development Questionnaire Analysis Report
  - DoDAF V2.0 Meta-model Data Dictionary

In DoDAF 2.0, examples provided lean heavily on the major areas of change within the Department, including the Joint Capabilities Integration and Development System (JCIDS), the Defense Acquisition System (DAS), Systems Engineering (SE), the Planning Programming, Budgeting, and Execution (PPBE) Process, and Portfolio Management (PfM). These major processes produce far-reaching change across all Military Departments, Agencies, The Joint Staff, and other Departmental functions. Architectures developed utilizing the guidance in
DoDAF demonstrate how change is documented and executed through an architecturally based approach that:

- Establishes and documents scope and boundaries.
- Documents best practices.
- Defines and describes generic performance metrics.
- Documents and describes potential solutions for management review and approval.

DoDAF 2.0 is organized to facilitate the organization, and maintenance of data collected in an architectural development effort. This approach responds to Departmental programs, such as BTA, JCIDS, and other major functions with significant impact throughout the Department that have developed requirements for multiple, custom views beyond the customary operational, systems, and technical views contained in previous versions of DoDAF, and is also consistent with DODI 4630.8 requirements for integrated architectures. These customized views, and the models that utilize the data, enable the architecture information to be communicated to, and understood by, stakeholders in diverse functional organizations. Products developed under previous versions of DoDAF continue to be supported, as described in Volume 2.

DoDAF data can be collected, organized, and stored by a wide range of architecture tools developed by commercial sources. Visualization of views in DoDAF 2.0 is for illustration purposes only. There may be multiple techniques that can be employed create architectural models in differing views.
VOLUME 1 – INTRODUCTION, OVERVIEW, AND CONCEPTS

1. INTRODUCTION

DoDAF Version 2.0 is the overarching, comprehensive framework and conceptual model enabling DoD managers at all levels to make key decisions more effectively through organized information sharing across Department, Joint Capability Areas (JCAs), Components and Program boundaries. DoDAF 2.0 focuses on architecture data as information required by key DoD decision makers, rather than on developing individual products. The framework also enables architecture content to be built that is 'Fit for Purpose', as defined and described in Section 1.4. DoDAF is one of the pillars that support the responsibilities of the Department of Defense Chief Information Officer (DoD CIO) in development and maintenance of architectures required under the Clinger-Cohen Act. It also includes guidance from OMB Circular A-130, and appropriate Departmental directives and instructions; This version of the Framework also provides guidance on the development of architectures supporting the development of Net-centric services within the Department.

DoDAF also serves as the principal guide for development of integrated architectures, as defined in DoD Instruction 4630.8\(^2\), which states: “An architecture consisting of multiples views or perspectives facilitating integration and promoting interoperability across capabilities and among integrated architectures”. The term integrated means that data utilized in more than one instance in the architectural views is commonly understood across those views.

The Office of Management and Budget (OMB) annually evaluates agency efforts to improve performance in strengthening the quality and usefulness of information technology investments requested by agencies through well-organized strategic decisions relating to investments and portfolio management. This process evaluates the use of enterprise and segment architectures, discussed in Section 3 of this document, as a principal means of ensuring that mission requirements are met, while savings and cost avoidance goals are achieved. Each agency is required to adopt an architecture framework—either existing or created within the agency for that purpose. DoDAF is the designated architecture framework with the DoD for architecture development.

The DoDAF Meta-model (DM2) is a data model that provides information needed to collect, organize, and store data or derived information in an easily understandable way. The descriptions of DoDAF-described Views in Volumes 1 & 2 provide guidance on how to develop graphical representations of that data and derived information that will be useful in defining acquisition requirements under the DoD Instruction 5000-X series.

DoD managers, as process owners and/or decision-makers, specify the requirements, and control the development of architectures, as described in this volume, within their areas of authority and responsibility. In that role, they select an architect, and an architecture development team to create the architecture in accordance with the requirements defined by the manager (process owner). As described in Volume 1, the architecture concentrates on those data that correspond to architecture requirements.

The duties of the architect and the architecture team that create the architecture are supported through Volume 2 of DoDAF. The architect supervises development of the architecture, and ensures that the requirements and visual representations of the architecture meet process owner requirements.

1.1 Vision for DoDAF 2.0. The vision for utilization of DoDAF is to:

- Provide an overarching set of architecture concepts, guidance, best practices, and methods to enable and facilitate architecture development in support of major decision support processes across all major Departmental programs, Military components, and Capability areas that is consistent and complementary to Federal Enterprise Architecture Guidance, as provide by OMB.

- Support the DoD CIO in defining and institutionalizing the Net-Centric Strategy of the Department, to include the definition, description, development, and execution of Net-Centric Directory Services (NCDS) and Net-Centric Support Services (NCSS) through introduction of Service-oriented Architecture Development.

- Focus on architecture data as information required for making critical decisions rather than emphasizing individual architecture products. Enable architects to provide visualizations of the derived information through combinations of DoDAF-described Views, and Fit-for-purpose Views commonly used by decision-makers, enabling flexibility to develop those views consistent with the culture and preferences of the organization.

- Provide methods and suggest techniques through which information architects and other developers can create architectures responsive to and supporting Departmental management practices.

1.2 DoDAF 2.0 Organization and Intended Audience

DoDAF 2.0 is presented in three volumes, along with an electronic DoDAF Journal, https://www.us.army.mil/suite/page/454707. Together, these volumes provide a resource that enables users to understand and access DoD’s entire body of knowledge associated with architecture.
DoDAF Volume 1 – Introduction, Overview, and Concepts. [Primary audience: Executives, Project Directors, & Managers] Volume 1 introduces DoD architecture concepts and provides general guidance for development, use, and management of DoD architectures. This volume is intended to help non-technical users understand the role of architecture in support of major decision support processes. Volume 1 provides a six-step methodology (Section 7) that can be used to develop architectures at all levels of the Department, and a Conceptual Data Model (CDM) (Section 9) for organizing data and derived information collected by an architecture effort.

Volume 1 contains the following resources:
- An Overview and Vision for DoDAF (Section 1)
- Defining ‘Fit for Purpose” Architectures (Section 2)
- An overview of the Framework, DoDAF-based architecture development guidelines, and the historical background for DoDAF (Section 3)
- An Introduction to Enterprise Architecture, Federated Architecting, and Architecture enterprise Services, and an introduction to the Federal Enterprise Architecture published by the Office of Management and Budget (OMB) (Section 4)
- An overview for architecture planning (Section 5)
- Addressing Customer requirements in architecture development (Section 6)
- Methodology for architecture development (Section 7)
- Presentation methods and graphical views (Section 8)
- The DoDAF Meta-model Conceptual View (Section 9)
- Analytics in support of architecture-based management analysis (Section 10)
- Guidance on configuration management of architectures, and the CM process for DoDAF (Section 11)
- Inter-relationships among DODAF and other architecture frameworks (Section 12)

DoDAF Volume 2 – Architecture Data & Views. [Primary Audience: architects, program managers, portfolio managers, and other technically oriented architecture users] Volume 2 describes the Meta-model data groups, and their associated views, introduced in Volume 1, from a technical viewpoint.

Volume 2 is organized as follows:
- Introduction (Section 1)
- Meta-model Data Groups (Section 2). Twelve data groups are described in Volume 2, and each is defined by the following attributes:
  - Associated Data
  - Data Collection Method
  - Use
- DoD Architecture Framework Viewpoints and Views (Section 3)
Appendices contain acronyms, DoDAF Model Support, and references. Volume 2 references the DoDAF Journal for the “DoDAF V2.0 Meta-model Data Dictionary” which describes the DoDAF Logical Data Model (LDM), and the “DoDAF Architecture Development Process for the Models”. The LDM provided introduces the relationships and associations needed by data modelers and technical designers.

DoDAF Volume 3 – DoDAF Meta-model Physical Exchange Specification. Volume 3 relates the CDM structure, LDM relationships, associations, and business rules as described in Volume 2 to introduce a Physical Exchange Specification (PES), which provides the constructs needed to enable exchange of data and derived information among users and COIs.

NOTE: DoDAF 2.0 does NOT prescribe a Physical Data Model (PDM), leaving that task to the software developers who will implement the principles and practices of DoDAF in their own software offerings.

DoDAF Journal. The DoDAF Journal, https://www.us.army.mil/suite/page/454707, is the electronic interface for DoDAF support, provides a place for submitting future change requests to DoDAF or the DoDAF Meta-model, and provides the examples referenced in the various DoDAF volumes. The Journal also includes descriptions of other best practices, lessons learned, and reference documents that supplement the information contained in the three volumes of DoDAF 2.0. The Journal has two parts:

- **Part 1** describes the DoDAF Configuration Management Process, and provides the means to submit, review, and comment on the adjudication of formal changes to DoDAF. This part is intended to apply to all audiences who would like to propose changes to and keep up to date with the details of the DoDAF.

- **Part 2** is a reference of best practices, examples, and templates, which can be used in projects where DoDAF is used to develop and execute process change through architecture development. This part is geared to architects, developers, program managers, and portfolio managers. Part 2 is organized in the same structure as the Volumes of DoDAF.

A quick reference guide and tutorial on the use of DoDAF and the DoDAF Journal is also under development.

1.3 **Purpose and Scope**

The DoDAF provides the guidance needed to establish a common vocabulary for architecture development, for the exchange of architecture information, and for facilitating interoperability between architecture descriptions.” Architectures are created for a number of reasons. From a compliance perspective, DoD development of architectures is compelled by law and policy (i.e., Clinger-Cohen Act, Office of Management, and Budget (OMB) Circular A-130). From a practical perspective, the management of large organizations employing sophisticated systems, technologies, and services in pursuit of often complex joint missions demands a structured
repeatable method for evaluating investments and investment alternatives, as well as the ability
to implement organizational change effectively, create new systems, deploy new technologies,
and offer services which add value to management decisions and practices.

Guidance provided by DoDAF 2.0 applies to all architectures developed, maintained, and used
within the DoD. The DoDAF also provides the foundational constructs to support the concept of
architecture federation at each tier, and enables the sharing of all pertinent architecture
information. This in turn permits creation of the federated version of the DoD Enterprise
Architecture. DoDAF 2.0 provides guidance in all areas of architecture lifecycle, consistent with
both DoD and OMB Guidance (i.e. Development, Maintenance, and Use of Architectures).3

DoDAF 2.0 also supports the concept of Service-oriented Architecture (SOA) development.
Volume 1 provides management guidance on development of architecture views, based on
service requirements. Volume 2 provides technical information needed, data views, and other
supporting resources for development of SOA-based architectures.

1.3.1 Developing Architectures. Careful scoping and organization of the architecture
development effort focuses on areas of change desired by executives and managers in support of
their stated goals and objectives. A data-centric, rather than product-centric, architecture
framework ensures concordance across architecture views (i.e. architecture integration), enables
the federation of all pertinent architecture information, and provides full referential integrity
through the underlying data to support a wide variety of analysis tasks. Architecture integration
thus becomes a critical ‘property’ of architectures of all types as described more fully below, and
must be included in architecture planning and development actions.

DoDAF 2.0 describes several types of architectures that contribute to the DoD Enterprise
Architecture. Each of these architectures serves a specific purpose, as described briefly below,
and in more detail in Section 4 of Volume 1. Architecture types correspond to the tiers defined
in the DoD Architecture Federation Strategy.

Department-level Architecture is that type of architecture that describes processes applicable to
the Department and Joint Staff as a whole. These architectures include the Global Information
grid Architecture (GIG), the DoD Information Enterprise Architecture (DOD IEA).

Capability Architectures are those types of architectures that define and describe specific
capabilities required by the Department for business, procurement, and tactical operations. The
capability architecture is considered segment architecture, as defined in OMB Circular A-130.

Component Architectures are that type of architecture that describe and define the military
services and their internal business and operational functions.

Executive Office of the President., Office of Management and Budget. The current version can be found at:
http://www.whitehouse.gov/omb/circulars/a130/a130trans4.html#2
Solutions Architectures are those type of architecture that define a particular project to create, update, revise, or delete established activities in the Department. Solution architecture may transcend one or more of the other architecture types. A Solution Architecture is the most common type of architecture developed in the Department. Solution architectures include those service-oriented architectures (SOA) developed in support of specific data and other services solutions.

Architecture data and derived information can be collected, organized, and stored by a wide range of tools developed by commercial sources. Creation of various views using these architecture tools is the typical way an enterprise architect initially captures and represents important architecture data. Both DoDAF-described views, and Fit-for-purpose views (e.g. dashboards, composite, or fusion presentations) created as a part of the architecture development process, which visually render the underlying architecture data, act to facilitate management decisions.

The Views described in DoDAF, including those that are legacy views from previous versions of the Framework, are provided as pre-defined examples that can be used when developing presentations of architecture data. DoDAF does not prescribe any particular views, but instead concentrates on data as the necessary ingredient for architecture development. However, other regulations and instructions from both DoD and CJCS have particular presentation view requirements. These views are supported by DoDAF 2.0, and should be consulted for specific view requirements.

1.3.2 Maintaining and Managing Architectures. Embedding the architecture development process in routine planning and decision-making institutionalizes the practice and makes its maintenance more automatic. Architectures are maintained and managed within the Department through tiered accountability. Tiered accountability is the distribution of authority and responsibility for development, maintenance, configuration management, and reporting of architectures, architecture policy, tools, and related architecture artifacts to all four distinct tiers within the DoD. DoDAF 2.0 supports four tiers: Department, Joint Capability Area (JCA), Component, and Solution. These tiers support the federated approach to architecture development and maintenance described more fully in the DoD Architecture Federation Manual.

1.3.3 Using Architectures. Architectures are used to support DoD decision-making processes including JCIDS, DAS, PPBE, SE, and PfM processes. Other major Departmental processes supported are business process reengineering, organizational development, research and development, operations support, and service-oriented solutions. Architecture data and other

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derived information, based on process-owner or stakeholder input and review, provides decision makers with information necessary to support specific decisions in those processes.

1.3.4 DoDAF Conformance. DoDAF conformance is achieved when the content of a described architecture is defined according to the DM2 Concepts, Associations, and Attributes for the appropriate DoDAF Views. The mapping of the DM2 Concepts, Associations, and Attributes to each DoDAF View is listed in Table B-2, "DM2 Concepts (Classes, Aliases, and Composite Terms) Mapping to DoDAF Views" in Volume 2, Appendix B, "DoDAF View Support".

1.4 What is New in Volume 1.

The major changes for DoDAF Version 2.0 Volume 1 are:

- The major emphasis on architecture development has changed from a product-centric process to an information-centric process designed to provide decision-making data organized as information for the manager.
- The three major views of architecture described in previous version (e.g. Operational, technical, and System) have been changed to more specific views that relate to the collection of architecture-related data that can be organized as useful information for the manager in decision-making.
- ‘Products’ have been replaced by ‘views’ that represent specific types of presentation for architecture data and derived information.
- The Department initiatives for Architecture Federation and Tiered Responsibility have been incorporated into Version 2.0.
- Requirements for sharing of data and derived information in a Federated environment are described.
- Specific tiers of architecture within the Department have been identified and described (e.g. Department, Segment/Capability, Component and Solution).
- The DoD Enterprise Architecture is defined and described.
- Linkages to the Federal Enterprise Architecture are defined and described.
- Architecture constructs originally described in the Ministry of Defense (UK) Architecture Framework (MODAF), the NATO Architecture Framework (NAF), and the Open Group Architecture Framework (TOGAF) are adopted for use within DoDAF.
- A New DoDAF Meta-model (DM2), containing a Conceptual Data Model, a Logical Data Model, and a Physical Exchange Specification has been created.
- Examples of graphical representations (DoDAF-described Views) have been provided as examples to assist managers in determining how architecture data and other derived information can be utilized in decision-making. Information is also provided on development of Fit-for-purpose Views, which are user-defined views representing specific desired presentations.
- Approaches to service-oriented architecture development are described and discussed.
1.5 What DoD Managers and Executives Need to Know about DoDAF.

Architecture development is a management tool that supports the decision-making process. A Process owner (An executive responsible for a specific process or program) has the direct responsibility for ensuring that a particular process or program works efficiently, in compliance with legal and departmental requirements, and serves the purpose for which it was created. Periodically this means that review and evaluation of the efficiency of the program or process is required. Those requirements for review, to include those detailed in legislation such as the Clinger-Cohen Act and OMB Directive A-130, include the need to create or update an information architecture supporting any budget requests for funding of those projects and processes.

While a manager or executive may delegate the responsibility for creation of the architecture to an architect with the professional qualifications needed, along with an architecture development team. However, that delegation of authority does not alter the continuing responsibility of the executive or manager As described throughout this volume, the decision-maker needs to be actively involved in the architecture development process and support architecture description development. Active Involvement means that the decision-maker:

- Identifies the Purpose and Scope for the Architecture. The 6-Step Architecture Development Process (depicted in Section 7.1.1. "6-Step Architecture Development Process") provides a structure for development of scope and purpose.
- Transmits to the Architect and Development Team the scope and purpose of the architecture effort, along with those goals and objectives that support the need.
- In conjunction with the Architect, identifies the general data categories needed for architecture development; assist in data collection and validation
- Determines desired views and presentation methods for the completed architecture
- Meets frequently with the Architect and Development Team to ensure that the development effort is on target (i.e. is ‘Fit for Purpose’) and provides new direction, as required to ensure that the development effort meets established requirements.

**Figure 1.5-1** is a more detailed view of the 6-Step Architecture Process, and depicts the sub-steps that the decision-maker needs to perform in coordination with the Architect within the Six-Step Architecture Development Process described in Section 7. In each step, the ‘Meta-model Groups’ referred to by the step is that data in the Meta-model Groups in DM2 described in this volume, and more technically in Volume 2.

**Figure 1.5-1: What the decision-maker needs to do**
The detailed steps for the decision-maker are:

- Step 1: Review the Purpose and Scope with the Architect. In order for the architecture to be “Fit-for-purpose”, the decision-maker needs to provide the list of data needed and the usage of the data (use-cases) to the Architect. The decision-maker, not the Architect, is the subject matter expert for the problem to be solved, the decision to be made, or the information to be captured and analyzed. The architect is the technical expert who translates the decision-maker’s requirements into views representing proposed solutions. Determining the data needed and the use-cases (requirements) to be applied is an important responsibility for the decision-maker and cannot be delegated to the Architect.

- Step 2: Review the Views, Concepts, Associations, and Attributes the Architect has determined that meets the data requirements and use-cases. The Models, Concepts, Associations, and Attributes required are determined in the Architect’s detailed process (Step 3.2) described in Section 1.6 of Volume 2.
• Step 3: Assist with data collection, or provide the data needed using the architecture
collection method described in the Architect’s detailed process (Step 3.5) found in
Section 1.6 of Volume 2. In that step, the Architect determined the appropriate collection
methods for the “Fit-for-Purpose” needs. Section 2 of Volume 2 contains a “Method”
subsection for each of the Meta-model groups, which provides potential collection
methods. Step 3 includes those actions taken to ensure that data integration occurs
across all views created as a part of the architecture development effort.

• Step 4: Verify that the data collected meets the need described in use-cases to support the
analysis that will be performed in Step 5 of the 6-Step Architecture Development Process
The Architect has collected the architecture data that will meet the decision-maker’s
purpose (“Fit-for-Purpose”) and support the decision review processes. Section 2 of
Volume 2 contains a “Use” subsection for each of the Meta-model groups, which
provides example uses. .

• Step 5: Determine the appropriate views for the “Fit-for-Purpose” needs and support to
decision deliberations. Volume 2, Section 3 contains a “DoD Architecture Framework
Viewpoints & Views” subsection which describes each of the DoDAF-described Views.
This step results in presentation creation in Step 6 of the 6-Step Architecture
Development Process.

Working with the Architect and team, the decision-maker has a critical role in ensuring that the
architecture not only supports the creation of executable requirements that will achieve the
desired outcome, but also that senior executives and managers can view the desired solution in
an understandable and logical manner.

2. SCOPING ARCHITECTURES TO BE “FIT FOR PURPOSE”

Establishing the scope of an architecture is critical to ensuring that its purpose and use are
consistent with specific project goals and objectives. The term “Fit for Purpose” is used in
DoDAF to describe an architecture (and its views) that is appropriately focused (i.e. responds to
the stated goals and objectives of process owner, is useful in the decision-making process, and
responds to internal and external stakeholder concerns. Meeting intended objectives means those
actions that either directly support customer needs or improve the overall process undergoing
change. At each tier of the DoD, goals and objectives, along with corresponding issues that may
exist should be addressed according to the established scope and purpose, (e.g. Departmental,
Capability, Systems Engineering, and Operational), as shown in the notional diagram in Figure
2-1.
Figure 2-1: Establishing the scope for architecture development

Establishing a scope for an architecture effort at any tier is similarly critical in determining the architecture boundaries (Purpose and Use expected), along with establishing the data categories needed for analysis and management decision-making. Scope also defines the key players whose input, advice, and consensus is needed to successfully architect and implement change (i.e. Stakeholders, both internal and external). Importantly, scope also determines the goals and objectives of the effort, consistent with both boundaries and stakeholders; since goals and objectives define both the purpose for architecture creation and the level of the architecture.

Establishing the scope of an effort also determines the level of complexity for data collection and information presentation.

Architecture development also requires an understanding of external requirements that may influence architecture creation. An architecture may be developed for an internal agency purpose, and be consistent with and mappable to the DoD EA. To do so, consideration must be given in data collection and graphical presentation to satisfaction of other external requirements, such as upward reporting and submission of architecture data and models for program review, funding approval, or budget review due to the sensitivity or dollar value of the proposed solution.

Volume 2 contains guidance on data collection for specific views required by instruction, regulation, or other regulatory guidance (i.e. Exhibit 43/53, or 300 submission; interoperability requirements, etc.).
Architecture scoping must facilitate alignment with, and support the decision-making process and ultimately mission outcomes and objectives (Figure 2-2). Architecture data and supporting views created from organizing raw data into useful information should enable domain experts, program managers, and decision makers to utilize these architectures to locate, identify, and resolve definitions, properties, facts, constraints, inferences, and issues both within and across architectural boundaries that are redundant, conflicting, missing, and/or obsolete. DoDAF 2.0 provides the either flexibility to develop Fit-for-Purpose Views (User-developed Views) or DoDAF-described Views to maximize the capability for decision-making at all levels.

Analysis also uncovers the effect and impact of change (“what if”) when something is redefined, redeployed, deleted, moved, delayed, accelerated, or no longer funded. Having a disciplined process for architecture development in support of analytics will produce quality results, not be prone to misinterpretations, and therefore, be of high value to decision makers and mission outcomes.

**Figure 2-2: Mission Outcomes Supported by Architectures**
3. **DoDAF VOLUMES AND JOURNAL OVERVIEW**

Section 3 provides an overview of DoDAF 2.0, both the volumes, and the electronic Journal, and describes the primary reasons for developing and publishing a new version, while addressing fundamental principles and guidelines that should be followed when an architecture development effort is initiated. A graphical representation of the breadth and depth of information, users, concepts, and artifacts that can assist in describing an architecture for executives, managers, and other non-technical reviewers and users is also provided.

### 3.1 DoDAF Overview

DoDAF is the structure for organizing architecture concepts, principles, assumptions, and terminology about operations and solutions into meaningful patterns to satisfy specific DoD purposes. DoDAF offers guidance, principles and direction on communicating business, mission needs and capabilities to managers, architects, analysts, and developers who are responsible for developing and building the necessary services, applications and infrastructure to meet stakeholder needs and to manage their expectations.

Architecture frameworks support change in organizations through building and utilization of architectures that:

- Enhance decision making processes by leveraging knowledge and opportunities for reusing existing information assets
- Respond to stakeholder, customer, and client needs for effective and efficient processes, systems, services, and resource allocation
- Provide mechanisms to manage configuration of the current state of the enterprise and maintain validity of the expected performance
- Facilitate the design of future states of the enterprise

In DoDAF 2.0, examples provided lean heavily on the major areas of change within the Department, including the Joint Capabilities Integration and Development System (JCIDS), the Defense Acquisition System (DAS), Systems Engineering (SE), the Planning Programming, Budgeting, and Execution (PPBE) Process, and Portfolio Management (PfM). These ‘key’ processes produce far-reaching change across all Military Departments, Agencies, The Joint Staff, and other Departmental functions. Architectures developed utilizing the guidance in DoDAF demonstrates how change is documented, and executed through an architecturally based approach that:

- Establishes and documents scope and boundaries.
- Documents best practices.
- Defines and describes generic performance metrics.
- Documents and describes potential solutions for management review and approval.

Data, organized as information, is the critical element of architecture development. DoDAF 2.0 provides conceptual and logical data models, along with a Physical Exchange Specification for use by data managers, tool vendors, and others to facilitate:
• Establishment of areas of discourse and a shared vocabulary.
• Support for data overlap analysis.
• Define and encourage the use of shared information.
• Provide a target for architecture data integration.

The framework is consistent with, and supports DoD policy directives that require programs and components (a) to ensure that their architectures meet stated objectives and Departmental requirements, and, (b) provide the information necessary to support defined decisions at higher tiers. These policies also require consistency across horizontal architecture boundaries within a tier. The guidance and information contained in these volumes also ensures that, when followed, architecture development is consistent with OMB Enterprise Architecture Guidance.

This version of the DoDAF is written to support the Departmental preference for federated architecture development in a tiered environment (Section 4.3). To enable federation and facilitate tiered responsibility and accountability, the framework provides data structures to ensure appropriate touch-points can be compared for consistency across architecture boundaries. Utilization of these data structures ensures that higher tiers have access to data from lower tiers in a form that supports their decision needs. The Framework also includes aids to architects in supporting net-centricity in their architectures and structures that define the management of net-centric architectures (Volume 2).

DoDAF 2.0 also facilitates creation of Service-oriented Architectures (SOA) that define solutions specifically in terms of services that can be discovered, subscribed to, and utilized, as appropriate, in executing departmental or joint functions and requirements.

### 3.2 DoDAF Background

#### 3.2.1 Authority: Law, Policy, and Historic Perspective.

The Federal Government has established the importance of using architecture through law, policy, and guidance. Federal law and policies (Table 3.2.1-1), such as the Clinger-Cohen Act of 1996, the E-Government Act of 2002, and OMB Circular A-130, along with other guidance, have expressed the need for architectures in support of business decisions.

<table>
<thead>
<tr>
<th>Policy/Guidance</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Clinger-Cohen Act of 1996</td>
<td>Recognizes the need for Federal Agencies to improve the way they select and manage IT resources and states, “information technology architecture, with respect to an executive agency, means an integrated framework for evolving or maintaining IT and acquiring new IT to achieve the agency’s strategic goals and information resources management goals.” Chief Information Officers are assigned the responsibility for “developing, maintaining, and facilitating the implementation of a sound and integrated IT architecture for the executive agency”.</td>
</tr>
<tr>
<td>E-Government Act of 2002</td>
<td>Calls for the development of Enterprise Architecture to aid in enhancing the management and promotion of electronic government services and</td>
</tr>
<tr>
<td>Office of Management and Budget Circular A-130</td>
<td>“Establishes policy for the management of Federal information resources and calls for the use of Enterprise Architectures to support capital planning and investment control processes. Includes implementation principles and guidelines for creating and maintaining Enterprise Architectures.”</td>
</tr>
<tr>
<td>OMB Federal Enterprise Architecture Reference Models (FEA RM)</td>
<td>Facilitates cross-agency analysis and the identification of duplicative investments, gaps, and opportunities for collaboration within and across Federal Agencies. Alignment with the reference models ensures that important elements of the FEA are described in a common and consistent way. The DoD Enterprise Architecture Reference Models are aligned with the FEA RM.</td>
</tr>
<tr>
<td>OMB Enterprise Architecture Assessment Framework (EAAF)</td>
<td>Serves as the basis for enterprise architecture maturity assessments. Compliance with the EAAF ensures that enterprise architectures are advanced and appropriately developed to improve the performance of information resource management and IT investment decision making.</td>
</tr>
<tr>
<td>General Accounting Office Enterprise Architecture Management Maturity Framework (EAMMF)</td>
<td>“Outlines the steps toward achieving a stable and mature process for managing the development, maintenance, and implementation of enterprise architecture.” Using the EAMMF allows managers to determine what steps are needed for improving architecture management.</td>
</tr>
</tbody>
</table>

### 3.2.2 Historical Evolution of DoDAF

The Command, Control, Communications, Computers, and Intelligence, Surveillance, and Reconnaissance (C4ISR) Architecture Framework v1.0, dated 7 June 1996, was created in response to the passage of the Clinger-Cohen Act. It replaced the Technical Architecture for Information Management (TAFIM) and ensured that a DoD-wide effort to develop a better means and process for ensuring that C4ISR capabilities were interoperable and met the needs of the war-fighter. Version 2.0 of the C4ISR Framework was published on 18 December 1997.

The DoD Architecture Framework (DoDAF) v1.0 30 August 2003 restructured the C4ISR Framework v2.0 and broadened the applicability of architecture tenets and practices to all Joint Capability Areas (JCAs) rather than just the C4ISR community. DoDAF v1.0 addressed usage, integrated architectures, DoD and Federal policies, value of architectures, architecture metrics, DoD decision support processes, development techniques, analytical techniques, and moved towards a repository-based approach by placing emphasis on architecture data elements that

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6 Federal Enterprise Architecture (FEA). Executive Office of the President, Office of Management and Budget E-Gov Initiative. The current version of the FEA, and its associated reference models can be found at: http://www.whitehouse.gov/omb/egov/a-2-EAModelsNEW2.html

comprise architecture products. DoDAF v1.0 was supported by a Core Architecture Data Model (CADM) which provided for data organization and sharing.

DoDAF v1.5, 23 April 2007, was a transitional evolution of the DoDAF v1.0, provided additional guidance on how to reflect net-centric concepts within architecture descriptions, included information on architecture data management and federating architectures through the Department, and incorporated the pre-release CADM v1.5, a simplified model of previous CADM. DoDAF 1.5 provided support for net-centricity concepts within the context of the existing set of architecture views and architecture products.

DoDAF 2.0 expands the framework to capture architecture information about net-centricity, support Departmental net-centric strategies, and describe service-oriented solutions that facilitate the creation and maintenance of a net-centric environment. DoDAF 2.0 will continue to be updated in the future as it improves its support for the increasing uses of architecture data and its derived information to meet the growing needs of decision makers in a Net-Centric Environment (NCE).

3.2.3 DoDAF Version 2.0 – The Need for Change. Over time, and as experience with architecture has grown within the Department, it has become obvious that there are two types of architectures. The first and most traditional type is the Program Level Architecture. This architecture has been required, defined, and supported by major Departmental processes for solution evaluation, interoperability, and resource allocation. Enterprise Architecture, the second type of architecture, provides a roadmap for change as well as a context and reference for how and where programs “fit” within a larger ‘enterprise’ picture. Because of the complex structure and function of the DoD, an enterprise can be defined at the Department level, the JCA level, and the Component level. These ‘tiers’ need architecture content at their level to guide and direct their lower level mission requirements. The JCA and Component tiers are critical to address the high-level capabilities and semantics of a specific JCA or Component within the enterprise so that federation of individual architecture data is possible.

An architecture can represent either a current (i.e. ‘as-is’ or ‘baseline’) viewpoint, or a future, desired (i.e. ‘to-be’) viewpoint. When the architecture is a baseline viewpoint, it should illustrate the enterprise, or a portion of it, as it exists. The future state architecture depicts the changes that are desired (whether operational, system/service-centric, or technology-driven), and the strategies, programs and projects that are employed to achieve the desired transformation. The future view extends beyond details or summaries of operational and systems solutions, and includes program plans, programmatic status reporting, financial and budget relationships, and risk management assessments, along with a transition plan.

DoDAF v2.0 supports the development and use of both program and enterprise-wide architectures to illustrate the context for solutions at the capability and component level, and/or the interdependencies among the components. Future updates and revisions to DoDAF will

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8 Derived from OMB Circular A-130 that an enterprise architecture consists of a baseline architecture, a target architecture, and a transition strategy.
extend beyond the solution space to provide standard mechanisms for communicating program
plans, financial information, and project status. These future updates will more fully support the
ability of managers and executives to evaluate and direct their programs. Without such
standards, interdependent programs and projects will continue to be evaluated separately, and
managed as individual budgets and consequently as stovepipe solutions. Such an advance in
enterprise architecture would facilitate portfolio management as a whole, help ensure that
program direction is coordinated and accountable, and address impact and alternative analysis
across programmatic boundaries.

3.2.3.1 Architecture Focus. DoDAF 2.0 focuses on the use of architecture throughout the
various tiers of the department as they relate to operational and transformational decision-making
processes. Working directly with process owners, through a set of comprehensive workshops, to
validate and extend architecture data content, and provide meaningful and useful architecture
views for their decision-making, DoDAF 2.0 provides better harmonization of architecture
content and process requirements. Additionally, these tailored architectures can be shared and
provide insight into best practices that benefit programs, architects, and process owners.
Architecture data content also includes data defining generic performance metrics, capabilities,
and the relevant portfolio management data, all of which are analytically useful to process
owners and systems engineers.

3.2.3.2 Shifting from Product-Centric to Data-Centric Focus. Both the C4ISR and earlier
DoD versions of the Architecture Framework have emphasized reusable and interoperable data.
DoDAF 2.0 places maximum emphasis on utilizing architecture data to support analysis and
decision-making. With appropriate architecture data, it is possible to support innovative and
flexible presentation of the architecture data in a meaningful, useful, and understandable manner
through the views described in Volumes 1 and 2.

3.3 Assumptions. Development of DoDAF 2.0 is guided by several assumptions. These are:

- The DoDAF will continue to evolve to meet the growing needs of decision makers in a Net-
  Centric Environment (NCE).
- As capability development continues, and Infrastructure continues to mature, architectures
  will increasingly be a factor in evaluating investments, development, and performance at the
  various portfolio levels.
- As the DoD increases its use of architecture data and its derived information for decision-
  making processes, architects will need to understand how to aggregate the data as useful
  information for presentation purposes at the enterprise level.
- The DoDAF plays a critical role in the development and federation of architectures. It will
  continue to improve its support for the increasing uses of semantically linked and aligned
  architecture data.
- Architecture data described in DoDAF is not all-inclusive. Architectures may require
  additional data, and it is expected that architecture developers at all levels will extend the set
  of architecture data as necessary.
Prescription of required architect data sets or views to be included in an architecture is a decision made by process owners based on the purpose of the architecture. Some specific minimum architecture data will be described in DoDAF for the exchange of architecture data in the federated environment, and will be included in the architect data set supporting products required by the process owners.

3.4 DoDAF Structure and Views

DoDAF 2.0 is organized around data and views. This approach responds to Departmental programs, such as Business Transformation (BT), JCIDS, and other major functions with significant impact throughout the Department that have developed requirements for multiple, custom views. These views use information based on authoritative data, beyond the operational, systems, and technical views of previous versions of DoDAF, and is consistent with DoD Instruction (DODI) 4630.8 requirements for integrated architectures. These customized views enable the information contained in an architecture to be communicated to, and understood by, stakeholders in diverse functional organizations. The products developed under previous versions of DoDAF continue to be supported, as described in Volume 2.

A view is a representation of a related set of information. A viewpoint describes data drawn from one or more perspectives and organized in a particular way useful to management decision-making. More specifically, a viewpoint definition includes the information that should appear in individual views; how to construct and use the views (by means of an appropriate schema or template); the modeling techniques for expressing and analyzing the information; and a rationale for these choices (e.g., by describing the purpose and intended audience of the view).  

3.4.1 Architecture Data. Architecture data provides for more efficient and flexible use and reuse of the architecture, enabling broader utility for decision makers and process owners. This version of DoDAF emphasizes the collection, organization, and maintenance of architecture data and derived information, as opposed to development of products in previous versions. A technical description of the underlying data can be found in DoDAF Volume 2.

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9 The Open Group Architecture Framework (TOGAF), Version 8.1. The current version can be found at: http://www.opengroup.org/architecture/togaf/
3.4.2 Architecture Viewpoints. An architecture viewpoint is composed of a selected set of architecture data that has been organized to facilitate visualization in an understandable way. An architecture can be visualized in a number of formats, such as dashboard, fusion, textual, composite, or graphics, which present data and derived information collected in the course of architecture development. A viewpoint is only a presentation of a portion of the architecture data, in the sense that a photograph provides only one view of the object within the picture, not the entire representation of that object. Figure 2.5-1 provides a graphical representation of the architecture viewpoints in DoDAF 2.0.
3.4.2.1 **ALL Viewpoint (AV)**. Some overarching aspects of an architecture relate to all the views. The AV products provide information pertinent to the entire architecture, such as the scope and context of the architecture. The scope includes the subject area and time frame for the architecture. The setting in which the architecture exists comprises the interrelated conditions that compose the context for the architecture. These conditions include doctrine; tactics, techniques, and procedures; relevant goals and vision statements; concepts of operations (CONOPS); scenarios; and environmental conditions.

3.4.2.2 **The Capability Viewpoint (CV)**. The CV captures the enterprise goals associated with the overall vision for executing a specified course of action, or the ability to achieve a desired effect under specific standards and conditions through combinations of means and ways to perform a set of tasks. It provides a strategic context for the capabilities described by an architecture, and an accompanying high-level scope, more general than the scenario-based scope defined in an operational concept diagram. The views are high-level and describe capabilities using terminology, which is easily understood by decision makers and used for communicating a strategic vision regarding capability evolution.

3.4.2.3 **The Data and Information Viewpoint (DIV)**. The DIV captures the business information requirements and structural business process rules of the architecture. It describes
the information that is associated with the information exchanges of the architecture, such as attributes, characteristics, and inter-relationships. Data is described fully in Volume 2.

3.4.2.4 The Operational Viewpoint (OV). The OV captures the organizations, tasks, or activities performed, and information that must be exchanged between them to accomplish DoD missions. It conveys the types of information exchanged the frequency of exchange, which tasks and activities are supported by the information exchanges, and the nature of information exchanges.

3.4.2.5 The Project Viewpoint (PV). The PV captures how programs are grouped in organizational terms as a coherent portfolio of acquisition programs. It provides a way of describing the organizational relationships between multiple acquisition programs, each of which are responsible for delivering individual systems or capabilities.

3.4.2.6 The Services Viewpoint (SvcV). The SvcV captures system, service, and interconnection functionality providing for, or supporting, operational activities. DoD processes include warfighting, business, intelligence, and infrastructure functions. The SvcV functions and service resources and components may be linked to the architecture artifacts in the OV. These system functions and service resources support the operational activities and facilitate the exchange of information.

3.4.2.7 The Standards Viewpoint (StdV). The TV is the minimal set of rules governing the arrangement, interaction, and interdependence of system parts or elements. Its purpose is to ensure that a system satisfies a specified set of operational requirements. The StdV provides the technical systems implementation guidelines upon which engineering specifications are based, common building blocks established, and product lines developed. It includes a collection of the technical standards, implementation conventions, standards options, rules, and criteria that can be organized into profile(s) that govern systems and system or service elements for a given architecture.

3.4.2.8 The Systems Viewpoint (SV). SV captures the information on supporting automated systems, interconnectivity, and other systems functionality in support of operating activities.

3.5 DoDAF Development Guidelines

DoDAF 2.0 provides comprehensive and practical guidance for the creation of architectures that provide added value for decision-making at whatever level of the DoD they are produced. To this end, the framework offers guiding principles in the development of architectures that transcend the tier, level, or purpose of the architecture development, and a logical method for executing architecture development for supporting critical decisions within key DoD management and change management processes. The Framework also offers flexibility in approach, toolset utilization, and techniques (such as structured analysis, object-oriented, and service-oriented).

3.5.1 Guiding Principles. Guiding principles are high-level concepts, which provide a general roadmap for success in architecture development under DoDAF 2.0. The principles are:
Architectures should clearly support the stated objective(s) (“Fit for Purpose”). The framework offers general direction in the development of architectures so that they can support critical decisions within key DoD management and change management processes. While DoDAF 2.0 describes a number of views, based on collected data, diligent scoping of a project and any guiding regulations, instructions, or standard procedures will determine the specific visualization requirements for a particular architectural effort.

Architectures should be simple and straightforward, but still achieve their stated purpose. Architectures should reflect the level of complexity defined by the purpose for their creation. Scoping of a project, as described in Section 7.0 Methodologies, will ensure that the resulting architecture data and derived information, and the views created are consistent with their original purpose.

Architectures should facilitate, not impede communications in decision processes and execution. Architecture creation is meant to support decision processes and facilitate improvement of procedures and/or technology in the enterprise. Collection of architecture data and creation of views supports the decision-making process, and provide a record to explain critical choices to technical and non-technical managerial staff.

Architectures should be relatable, comparable, and capable of facilitating cross-architecture analysis. Most architectures, except perhaps those at the highest levels of DoD or an organization, relate on their boundaries to other external processes and operations. When several processes and/or operations are evaluated, compared, or cross-referenced, it should be clear how, where and why data passes among them in similar form.

Architectures should articulate how data interoperability is achieved among federated architectures. To enable federation, the framework will provide structures to ensure that horizontal touch-points can be compared for consistency across architecture boundaries. Other mechanisms will ensure that higher tiers have access to data from lower tiers in a form that supports their decision needs. DoDAF utilizes the DoDAF Meta-model, and particularly the Physical Exchange Specification described in Volume 3, as a resource for interoperability. A key element in ensuring interoperability is the effort taken to plan for integration of data across views, architecture boundaries, and is consistent between tiers.

Architectures should be data centric and tool-agnostic. The framework assists in the design of structures that meet specific needs depending on the priorities of individual organizations. In particular, the framework calls for the development of integrated, searchable, structured architecture data sets that support analysis targeted to critical decisions.

Architecture data should be organized, reusable, and decomposed sufficiently for use by architecture development teams. Collecting and organizing architecture data for use in decision processes should not be ‘over done’, that is the depth and breadth of data collected should be sufficient to capture the major processes actions, and not be so broad that the original intent of the architecture project becomes clouded. Whenever possible, data common to other architectures should be used. New data should be created utilizing the structures described in Volume 2 and Volume 3 so that, when stored in the DoD Metadata Registry, it becomes available to others with similar requirements.
• Architecture development should be guided by the principles and practices of net-centricity to facilitate and support the Net-Centric Strategy of the Department.

Architectural guiding principles enable and facilitate validation and verification activities that will determine the success of the project, and the ability of the resulting architecture to serve the purpose for which it was created. Guiding principles support the more specific goals and objectives of a project as a roadmap.

3.5.2 Multiple Techniques and Toolsets, including Structured and Object Oriented Analysis.

The framework allows architects to select techniques and toolsets to meet specific needs. While the framework provides examples of the application of both Structured Analysis and Design (SADT) and Object-Oriented Analysis & Design (OOAD) techniques, it mandates neither. The framework explicitly permits any technique that meets the needs of the organization, provides the appropriate architecture data, adheres to the architecture data requirements of parent tiers described further in Section 3, and is capable of producing data that can be shared in a federated environment. A brief section on essential toolset attributes desirable for creation of architectures utilizing DoDAF are contained below in Section 3.5.3.

3.5.3 Essential Toolset Attributes

While DoDAF is toolset agnostic, allowing architects, and architecture development teams to utilize any toolset they desire to create architectures, there are some basis attributes of a toolset needed to ensure that architectures, once registered, are discoverable, sharable, and their data useful to others with similar or derived needs in their own architecture development. These attributes are:

- Capable of utilizing the Physical Exchange Data Specification described in Volume 3 to collect, organize, store, and share architecture data
- Capable of XML data transfer to/from the DoD Metadata Registry (DMR), and other resources, such as the DoD Architecture Registry System (DARS) for registering architecture data

3.6 Architecture Resources

A number of architecture resources exist which serve as sources for guidelines that must be consulted while building architecture products. Some of these architecture resources are briefly described below with their architectural uses, and their URLs. Additional information is contained in the individual URLs. Some architecture resources may require SIPRNET access.
## Architecture Resources

<table>
<thead>
<tr>
<th>Resource</th>
<th>Description</th>
<th>Architecture Use</th>
<th>URL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Department of Defense Information Enterprise Architecture (DoD IEA)</td>
<td>Defines the key principles, rules, constraints and best practices to which applicable DoD programs, regardless of Component or portfolio, must adhere in order to enable agile, collaborative net-centric operations.</td>
<td>The DoD IEA provides the guidelines and rules that the architect must keep in mind in the architecture development effort.</td>
<td><a href="http://www.defenselink.mil/cio-nii/cio/diea/">http://www.defenselink.mil/cio-nii/cio/diea/</a></td>
</tr>
<tr>
<td>DoD Architecture Registry System (DARS)</td>
<td>DARS is the DoD registry and repository of segment and solution architectures comprising the federated DoD enterprise architecture</td>
<td>To discover architectures that exist, or may be in development. Depending on the purpose and scope, an architect may search and discover Architectures that overlap the scope and purpose of the architecture effort. To register metadata about architectures that are being developed, or currently exist.</td>
<td><a href="https://dars1.army.mil">https://dars1.army.mil</a></td>
</tr>
<tr>
<td>DoD Information Technology Portfolio Repository (DITPR)</td>
<td>The official unclassified DoD data source for FISMA, E-Authentication, Portfolio Management, Privacy Impact Assessments, the inventory of MC/ME/MS systems, and the registry for systems under DODI 5000.2</td>
<td>The Systems metadata from the Architecture can be used to populate DITPR with new or updated information. DITPR can also populate the architecture’s Systems metadata, particularly on systems that interface with systems described in the architecture, but are not part of the scope of the architecture.</td>
<td><a href="https://www.dadms.navy.mil/">https://www.dadms.navy.mil/</a></td>
</tr>
<tr>
<td>DoD Information Technology Standards and Profile Registry (DISR)</td>
<td>Online repository for a minimal set of primarily commercial IT standards</td>
<td>The DISR can be used to populate the Standards models (StdV-1 and StdV-2) of the Architecture. Conversely, the Standards Models can identify additional or new standards that need to be added to DISR.</td>
<td><a href="https://disronline.disa.mil">https://disronline.disa.mil</a></td>
</tr>
</tbody>
</table>

Figure 3.6-1 Architecture Resources
## Architecture Resources

<table>
<thead>
<tr>
<th>Resource</th>
<th>Description</th>
<th>Architecture Use</th>
<th>URL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Joint C4I Program Assessment Tool (JCPAT)</td>
<td>Formally assess systems and capabilities documents (Initial Capabilities Document, Capability Development Document, and Capability Production Document) for Joint Staff interoperability requirements certification and is the ITS/NSS Lifecycle Repository and the archives</td>
<td>The ICD, CDD, and CPD contain architecture information. As the architecture development progresses, the collected architecture information can be extracted and reported in the ICD, CDD, and the CPD. In addition, the architecture information can be exchanged with the E-ISP tool which is part of JCPAT.</td>
<td><a href="http://jcpat.ncr.disa.smil.mil/JECOweb.nsf">http://jcpat.ncr.disa.smil.mil/JECOweb.nsf</a></td>
</tr>
<tr>
<td>Joint Common System Function List</td>
<td>A standard taxonomy for terms of the system functions based on the Universal Joint Task List</td>
<td>Use the taxonomy to align or extend system functions within the architecture being developed</td>
<td>TBD</td>
</tr>
<tr>
<td>Knowledge Management/Decision Support (KM/DS)</td>
<td>The KM/DS tool will be used by DOD components to submit documents and comments for O-6 and flag reviews, search for historical information, and track the status of documents.</td>
<td>Supporting the JCIDS approval process, the documents that are necessary for Milestone Decisions have architecture information. As the architecture development progresses, the collected architecture information can be extracted and reported in the required documents.</td>
<td><a href="https://jrockmds1.js.smil.mil">https://jrockmds1.js.smil.mil</a> /guestjrcz/gbase.guesthome.</td>
</tr>
<tr>
<td>Metadata Registry</td>
<td>The DoD Metadata Registry and Clearinghouse provides software developers access to data technologies to support DoD mission applications. Through the Metadata Registry and Clearinghouse, software developers can access registered XML data and metadata components, database segments, and reference data tables and related metadata information</td>
<td>The Resource Flows and Physical Schemas from the Architecture can be used to populate the Metadata Registry.</td>
<td><a href="http://metadata.dod.mil">http://metadata.dod.mil</a></td>
</tr>
</tbody>
</table>

Figure 3.6-1 Architecture Resources (Cont.)
# Architecture Resources

<table>
<thead>
<tr>
<th>Resource</th>
<th>Description</th>
<th>Architecture Use</th>
<th>URL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Navy Architecture Elements Reference Guide (NAERG)</td>
<td>A standard terms of reference for the Navy and Marine Corp. The Architecture Elements represent the critical taxonomies requiring concurrence and standardization for an integrated architecture. They comprise the lexicon for the three views of the architecture framework, the operational (OV), system (SV) and technical standards (TV) views.</td>
<td>The use of the critical taxonomies is a step to ensuring integration of systems within a system of systems and alignment of information technology (IT) functionality to mission and operational needs. The data contained in each element of the Architecture list shall be used for overall architecture framework development, programmatic research, development, and acquisition activities, and related integration and interoperability and capability assessments. It will be updated through review periods to support DoN Program Objective Memorandum (POM) efforts and to reflect changes mandated by DoD, technology improvements, and other factors.</td>
<td><a href="https://stalwart.spawar.navy.mil/naerg/">https://stalwart.spawar.navy.mil/naerg/</a></td>
</tr>
<tr>
<td>Service Registry</td>
<td>The Service Registry provides enterprise-wide insight, control and leverage of an organization’s services. It captures service descriptions and makes them discoverable from a centrally managed, reliable, and searchable location.</td>
<td>The Services metadata from the Architecture effort can be used to populate the Service Registry in the process of developing the solution.</td>
<td></td>
</tr>
<tr>
<td>Universal Joint Task List (UJTL)</td>
<td>The Universal Joint Task List (CJCSM 3500.04C) serves as a common language and common reference system for joint force commanders, combat support agencies, operational planners, combat developers, and trainers to communicate mission requirements. It is the basic language for development of a joint mission essential task list (JMETL) or agency mission essential task list (AMETL) that identifies required capabilities for mission success.</td>
<td>Use the taxonomy to align or extend operational activities within the architecture being developed</td>
<td><a href="http://www.dtic.mil/doctrine/jel/cjcsd/cjcsm/m350004c.pdf">http://www.dtic.mil/doctrine/jel/cjcsd/cjcsm/m350004c.pdf</a></td>
</tr>
</tbody>
</table>

Figure 3.6-1 Architecture Resources (Cont.)
4. ENTERPRISE ARCHITECTURE

"Today, the encouraging coalescence among leaders is that many enterprise systems have the same architectural approach—although not all express it in the same way. A similar convergence addresses the kinds of techniques, pattern, and designs that are independent of specific application domains, and that enable effective production of responsive, scalable, flexible, and unifiable enterprise applications."\(^{10}\)

Within DoD, Enterprise Architecture (EA) has been seen for many years as providing product-oriented insight into a wide range of data, programs, and activities, organized through Communities of Interest (COI). The data-centric approach to DoDAF version 2.0 is designed to facilitate the reuse and sharing of COI data. Since DoDAF provides the conceptual, logical, and physical exchange specifications but does not otherwise prescribe the configuration of the product composition, architects and stakeholders are free to create their views of data that best serve their needs.

4.1 Introduction and Overview

An architecture is a strategic information asset that describes the current and/or desired relationships between an organization’s business, mission and management processes, and the supporting infrastructure. Architectures define a strategy for managing change, along with transitional processes needed to evolve the state of a business or mission to one that is more efficient, effective, current, and capable of providing those actions needed to fulfill its goals and objectives. Architectures may illustrate an organization, or a part of it, as it presently exists; any changes desired (whether operational or technology-driven); and the strategies and projects employed to achieve the desired transformation. An architecture also defines principles and goals and sets direction on issues, such as the promotion of interoperability, intra-, and interagency information sharing, and improved processes, that facilitate key DoD program decisions.

Such support extends beyond details or summaries of operational and systems solutions, and includes program plans, programmatic status reporting, financial and budget relationships, and risk management. In addition to detailed views of individual solutions, the framework supports the communication of enterprise-wide views that illustrate the context for those solutions, and the interdependencies among the components. Beyond the solution space, standard mechanisms for communicating program plans, financial information, and project status are established so that executives and managers can evaluate and direct their programs.

Enterprise Architecture (EA) is the architecture described by the DoD Architecture Reference Models representing the major business areas of the Department, along with the implementing guidance, standards, and descriptions of Department-wide processes mapped to the Federal Enterprise Architecture. The DoD EA is shown in Figure 3.1-1. The DoD EA is composed of a "baseline architecture" describing the 'segment' architectures for each major Departmental business area (Consistent with the Federal EA Architecture described in OMB A-130). It also

includes a "target architecture" that includes proposed changes to the baseline architecture along with the rules, standards, services and systems life cycle information needed to optimize and maintain a process, or part of a process that a self-sufficient organization wants to create and maintain by managing its IT portfolio. EA provides a strategy that enables the organization to support its current operations while serving as the roadmap for transitioning to its target environment. Transition processes include an organization's PfM, PPBE, and EA planning processes, along with services and systems life cycle methodologies. Architectures created by Military Components, joint activities, agencies, and other organizations, at any level or tier of the Department are mappable to the DoD EA.

Figure 4.1-1\textsuperscript{11} presents the high-level elements of the DoD EA and the relationship among them. The DoD Architecture Baseline describes the current DoD environment and the existing Department of Defense Information Environment (DoD EI) capabilities that support operations and services in today’s environment. The DoD Transition Strategy includes an enterprise-level transition plan built from JCAs and DoD Component portfolio transition plans. The JCA portfolios describe future, required operational, warfighting, business, and Defense intelligence capabilities, together with the systems and services required. The description of the future DoD operating environment and associated capability requirements represent the target architecture of the DoD EA. These are time-phased as determined by functional owners and JCA developers.

\textsuperscript{11} This figure reflects the use of enterprise architectures as defined in OMB Circular A-130.
Migration in a net-centric operating environment from the “As-Is” to the “To-Be” requires that the DoD Information Environment Architecture (DoD IEA) and the Net-Centric strategies act as uniform references for, and guide the transition sequence. The DoD Architecture Federation Strategy\textsuperscript{12} describes the DoD EA structure and its relationship to federated, supporting architectures.

4.2 Transition Planning

As discussed above, one major impetus for creating and using architectures is to guide acquisition and development of new enterprises, capabilities and systems or improvements to existing ones. Earlier versions of DoDAF addressed this need exclusively using “As-Is” and “To-Be” architectures, along with a Systems and/or Services Technology Forecast. The “As-Is” and “To-Be” concepts are time-specific snapshots of DoDAF artifacts and products that initially served as the endpoints of a transition process. However, this transition strategy has several

\textsuperscript{12} Global Information Grid (GIG) Architecture Federation Strategy, 1 August 2007. Office of the Assistant Secretary of Defense (Networks & Information Integration) (NII)/DoD Chief Information Officer (DoD CIO).
potential pitfalls, to include the difficulty in accurately representing the “As-Is” starting point where legacy systems are sometimes poorly documented, and processes are largely undefined. There is also the consideration that long-term goals are often very flexible, resulting in flux in the “To-Be” version.

Since the “As-Is” and “To-Be” architectures are time-specific versions of similar sets of data with contrasting viewpoints, transition planning is able to chart an evolutionary path from the “As-Is” to its corresponding “To-Be” architecture given a clear understanding of the expected outcomes or objectives through some future (perhaps undefined) future point. It is expected that the ‘To-be’ architecture will change over time as Departmental priorities shift and realign. More comprehensive discussions of the ‘As-is’ and ‘To-be’ architecture, including transition requirements, are contained in Volume 2, and the DoDAF Journal, https://www.us.army.mil/suite/page/454707.

4.3 Federated Approach to DoD Architecture Management
The Department has adopted a federated approach to distributed architecture data collection, organization, and management among the Services, Agencies and COIs as its means of developing the "DoD Enterprise Architecture", with a virtual rather than physical data set described through supporting documentation and architecture views. This approach provides increased flexibility while retaining significant oversight and quality management services at the Departmental level. Detailed guidance on the DoD Federation Strategy is contained in DOD 8210-11-M, DoD Federation Strategy.

4.4 Tiered Accountability. Tiered Accountability (TA) is the distribution of authority and responsibility to a DoD organization for an element of the DoD EA. Under TA, DoD is defining and building enterprise-wide capabilities that include data standards, business rules, enabling systems, and an associated layer of interfaces for Department, specified segments of the enterprise (i.e. Joint Capability Areas (JCA), DoD Components), and Programmatic solutions. Each tier – Enterprise, Capability, Component, and Solution – has specific goals, as well as responsibilities to the tiers above or below them. The DoD-established JCAs are consistent with the Segment Architectures defined in the OMB Practice Guidance and the OMB Exhibit 53 and Exhibit 300 reporting requirements.

DoD Component and Solution architectures are categorized when developed to facilitate alignment (mapping and linking), cataloging, navigating, and searching disparate architecture information in a DoD registry of holdings. The TA Strategy, shown in Figure 4.4-1, identifies the three major levels of the DoD EA, along with a ‘solutions’ tier that provides specific programmatic solutions for any level of the enterprise. All architectures developed by the tiers are federated, as described in the DoD Federation Strategy.
Alignment in the tiers is required for the DOD EA to be discoverable, shareable, and interoperable. Architecture can also support many goals within the tiers, each of which may imply specific requirements for structure, content, or level of detail. Alignment decisions must balance the interdependence of architectures with the need for local flexibility to address local issues. Alignment describes the minimum constraints needed to ensure consistency across architecture levels. Architectures often relate at some ‘touch point’ to other architectures on the same level, level(s) above, or level(s) below, and should be discovered and utilized in architecture development to ensure that appropriate linkages are created and maintained. The need to plan for them implies that each architecture sharing a touch-point should be available to architects on both sides. The DoD Metadata Registry (DMR) for data and the Defense Architecture Registry System (DARS) for architecture registration facilitate the ability to discover and utilize architecture data, with the caveat that any touch-points within the purview of an established COI adhere to COI guidance.

4.5 **DoD Architecture Enterprise Services.** The next generation of DoD Enterprise Architectures will be constructed by employing a set of DoD Architecture Enterprise Services

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(DAES)\textsuperscript{14} for registering, discovering, aligning, translating, and utilizing architecture data, and derived information to support key DoD decision processes through implementing the concepts of the DoD Net-Centric Strategies.\textsuperscript{15} DAES will be implemented using Web Services, in which specific content and/or functionality is provided by one user for others, many of whom may be unknown to the provider. An Operational Resource Data Flow Description (A redesigned Operational Viewpoint 2 (OV-2) DoDAF-described View) has been retained in DoDAF 2.0 to describe those services that can be discovered and subscribed from one or more specific sources and delivered to one or more known or unknown subscribers.

Registration of architectures, one of the goals of the Net Centric Data Strategy (NCDS)\textsuperscript{16}, is the first step toward enabling discovery of architecture metadata. DAES includes a registration service to register the metadata (Through the DoD metadata Repository), and a method to describe the purpose and scope of an architecture (Through DARS). The registration service will enable cataloging of architectures in federated repositories, and, once complete, architectures are ‘available’ for discovery. When an architecture is discoverable, it can be aligned to, linked to, or re-used by other architectures. The discovery service enables users to execute a federated search for architecture holdings meeting specified search parameters.

4.6 Alignment to the Federal Enterprise Architecture (FEA)

The Office of Management and Budget (OMB) established the Federal Enterprise Architecture (FEA) program in 2003 to build a comprehensive business-driven blueprint of the entire Federal government. OMB’s Circular A-11 requires that Cabinet-level agencies, including the DoD, link their budget submissions to the FEA, and annually evaluates those submissions through the Enterprise Architecture Assessment Program, which establishes an evaluation score for overall agency progress.

The core principles of the FEA program are:

- business-driven approach
- promote collaboration of effort and reuse
- improve efficiency and effectiveness of business operations through the use of enterprise architecture for the capital investment process
- Demonstrate cost savings and cost avoidance through improved core processes, and cross-agency sharing and mutual investment

DoD leverages the FEA construct and core principles to provide the Department with the enterprise management information it needs to achieve its own strategic transformation goals and respond to upward reporting requirements of OMB. The primary objective is to improve DoD performance, using EA, by providing a framework for cross-mission analysis and identification

\textsuperscript{14} Formerly called the GIG Architecture Enterprise Services (GAES)

\textsuperscript{15} For additional details about the services, please review Section 11, “GIG Architecture Enterprise Services (GAES) — Making the GIG Architecture Visible, Accessible, and Understandable” of the “Global Information Grid (GIG) Architecture Federation Strategy,” Version 1.2, 1 August 2007

\textsuperscript{16} Department of Defense Net-Centric Data Strategy, 9 May, 2003. Office of the Assistant Secretary of Defense (Networks & Information Integration) (NII/DoD Chief Information Officer (DoD CIO)).
of gaps and redundancies; and by developing transition plans and target architectures that will help move DoD to the net-centric environment.

Several Federal and DoD-specific EA artifacts exist that describe enterprise-level management information. These include:

- The President’s Management Agenda.
- OMB A-11 Exhibit 300 submissions
- OMB FEA Practice Guidance
- OMB EA Assessment Guide
- OMB FEA Reference Models
- DoD EA Reference Model (RM) Taxonomy
- DoD EA Consolidated RM
- DoD EA Transition Strategy
- DoD Segment Architectures
- DoD EA Self-Assessment
- DoD Architecture Federation Strategy

These artifacts facilitate the alignment with the FEA, contribute to a broader understanding of architecture alignment, provide a basis for federated architectures, promote a more efficient and effective use of assets, and ultimately lead to better decision-making.

When developing architectures, particularly at the Departmental and Component levels, alignment with the FEA is accomplished by utilizing the FEA-RM documents together with DoD documents and references as a basis for defining processes, data, services, and technical standards. As an example, when a process owner determines that an architecture is needed for some specific purpose, the first references to use are as shown below in Figure 4.6-1.
<table>
<thead>
<tr>
<th>Action</th>
<th>Reference(s)</th>
<th>Usage</th>
</tr>
</thead>
</table>
| Determine processes Involved  | DoDAF FEA Business Reference Model (BRM)                                     | (DoDAF) Determine techniques and notation to be used  
(FEA BRM) Determine FEA business processes to align to; use taxonomies in BRM to name processes                                                                                                      |
| Identify and Define data      | DoDAF Meta-model (DM2) FEA Data Reference Model (DRM)                        | (DM2) Data Group and metadata structures  
(DRM) Existing Government-wide metadata for linkage to architecture                                                                                                                   |
| Document Architecture         | DoDAF DoD Metadata Registry (DMR) DoD Architecture Registry System (DARS) Toolset OMB EA Guidance OMB EA Assessment Guide | (DoDAF) provides described views, and guidance on creating ‘Fit-for-purpose Views’ for presentation purposes  
(DMR) Provides existing metadata to use in conjunction with DMR to create data required  
(DARS) provides registration services for architecture discovery  
(Toolset) provides automated notation method for creating views  
(OHM EA Guidance) provides information on required format and content of EA for OMB 53/300 process  
(OBM EA Assess. Guide) provides guidance on evaluation of architectures submitted to OMB for review                                                                                   |
| Publish Architecture          | DoD Architecture Federation Strategy Agency Repository DARS                 | (DoD Fed. Strategy) provides guidance on architecture data discovery  
(Agency Repository) stores EA Data  
(DARS) Providers EA contact information                                                                                                                                                                    |

Figure 4.6-1. References to Architecture Development
4.7 Addressing Security Issues in DoDAF-conformant Architecture Development

Security continues to be a critical concern within the DOD, and architecture development efforts at any level need to ensure that appropriate security concerns are addressed clearly, so that any decisions made that rely on the architecture are valid and useful. Security concerns are routinely addressed through the risk assessment process described in Section 10 of Volume 1, and Appendix C of Volume 2.

Each of the individual views described in detail in Volume 2 provides the architect and development team with a set of data for collecting, documenting, and maintaining security data. These data support physical, procedural, communications Security (COMSEC), TEMPEST, and Information Security (INFOSEC) concerns.

5. ARCHITECTURE PLANNING

5.1 Defining the Enterprise
In a generic sense, an ‘enterprise’ is any collection of organizations that has a common set of goals and/or a single bottom line. An enterprise, by that definition, can encompass a Military Department, DoD as a whole, a division within an organization, an organization in a single location, or a chain of geographically distant organizations linked by a common management or purpose. An enterprise today is often thought of as an extended enterprise where partners, suppliers, customers, along with their activities and supporting systems are included in the architecture.

Government agencies may comprise multiple enterprises, and there may be separate enterprise architecture projects. However, the projects often have much in common about the execution of process activities and their supporting information systems, and they are all linked an enterprise architecture. The DoD Enterprise Architecture is described in Section 3.1. Architecture development in conjunction with the use of a common architecture framework, which describes the common elements of architecture, lends additional value to the effort, and provides a basis for the development of an architecture repository for the integration and re-use of models, designs, and baseline data.

5.2 The Enterprise-level Architecture. Enterprise-level architectures in DoD are generally created under the responsibility and authority of a senior-level official within the Department, Component, Organization, Agency, or the program office responsible for development of JCAs. As an enterprise-level effort, it is expected that all of the major processes are documented and described, even if a specific project involves only a more limited subset of processes or activities. That way, subsequent architecture efforts can build on previous efforts to ensure the integration and extension of the enterprise is not compromised.

Enterprise-level architectures usually exhibit breadth rather than depth. Since this architecture is the ‘capstone’, or highest level of an architecture, on which others will build, it is especially important that processes, which relate to each other, either through interaction of activities, or the use of data by internal and external stakeholders, are identified or documented.
5.3 The Solution-Level Architecture. The solution-level architecture is scoped to include all major activities that are executed by a specified program in response to a specific requirement, and contain links to other programs, which require the data and/or outputs produced by the specified program. A solution-level architecture may represent activities within a specified functional area, cross-functional areas, or even extend to other organizations, agencies, Federal, state and local activities who may have an interest or participate in Departmental programs.

5.4 Architecture Management

Architectures are designed to describe the data on an organization or program/capability that will support continuing managing decision-making over time. Creation of architectures and their management follow an established life cycle that is similar to those other resources that have well-described life cycles. OMB Circular A-130\(^\text{17}\) describes the life cycle as:

- Develop
- Use
- Maintain

For consistency, that structure is followed in this volume as well. These phases recognize discreet actions that occur at various times, all designed to ensure that architecture data can be collected and later reused for management decision-making and reporting.

5.4.1 Architecture Development. Architectures are developed to represent either the state of an activity at a specified time (i.e., Baseline architecture) or the results of change in an activity that will occur over some future time (i.e., ‘to-be’ or future architecture). Enterprise architectures (Departmental, Capability/Segment, and Component) are initially created to create a common context needed to understand the organization and operations of high-level processes under their control.

Program-level architectures collect data that is specific to their program or capability, and data necessary to link to both the higher-level architecture with which they share common parentage, and any lower-level architectures, which describe in more detail particular aspects of the program or JCA.

Visualization of data provides a unique perspective of data from the viewpoint needed for decision-making. That may be a commander/director, action officer, system developer, data administrator, user, or anyone else executing some part of the architected process. More discussion of data collection and visualization is contained in DoDAF Volume 2.

5.4.2 Architecture Utilization. The ultimate success of an architecture effort lies in the ability to use architecture-related data to support management decisions for change within the

organization. While architecture development is generally accomplished as an project, accomplished through a team trained for that purpose, the results of the architecture development, to be effective over the longer term, need to be adopted as the common, normal mode of performing the organization’s business.

The enterprise architecture, as a corporate asset, should be managed like any other asset, and reinforced by management as a key part of the formal program that results in decision-making. Achieving that level of acceptance occurs only when architectures are created that reflect reality (e.g. baseline), or planned change/growth (e.g. to-be, or target).

Successful execution of the EA development process in an agency-wide endeavor requires management direction and support, allocation of resources, continuity, and coordination. Creating an EA program calls for sustained leadership and strong commitment. This degree of sponsorship and commitment needs the buy-in of the agency head, leadership by the CIO, and early designation of a chief architect. These leaders and the supporting EA team are the first level of support for institutionalizing the results of the effort.

5.4.3 Architecture Maintenance. Changes in an organization supported by architecture development will achieve institutionalization only when the senior leadership agrees with, supports, encourages, reinforces, and adopts the results of the architecture effort. Ideally, a member of the senior leadership team should be designated as the ‘champion’ of the change effort, and should work with the process owner to ensure that institutionalization occurs.

Employees, who actually perform the daily activities described in the architecture, must be represented in the architecture development team and contribute to the overall data collection and view creation.

5.4.4 Architecture Utilization. Architecture views must be easy-to-understand at all levels of the organization—and described in such a way that they become roadmaps for activity. When architecture data and views are constructed and organized in a way that they are understood, accepted, and utilized in daily activities, they facilitate management decision-making.

Architecture views, and data must meet standards that facilitate reuse by others whose activities border on, or replicate activities, services and systems already documented by architecture data and products. To that end, data collection must adhere to the standards set by the COI, or other recognized authority so that the data can be registered for, and used by others.

5.4.5 Architecture Compliance Reviews. Architecture compliance reviews are a key part of the validation & verification (V&V) process ongoing throughout the architecture development effort. A compliance review is a type of review that analyzes whether architecture developers are progressing according to the specifications and requirements developed for the architecture effort by the process owner. The goals of an architecture compliance review include:
Identifying errors in the architecture early to reduce the cost and risk of changes required later in the project. These error-catching actions will reduce cost and schedule slips, and realize business objectives quicker.

- Ensuring the application of best practices to architecture work.
- Providing an overview of the compliance of architecture to mandated enterprise standards.
- Identifying and communicating significant architectural gaps to product and service providers.
- Communicating to management the status of technical readiness of the project.

Utilization of architecture compliance reviews as an integral part of the development process ensures that utilization of architecture views and products later will be in conformance with applicable requirements. A more in-depth discussion of the compliance review process is contained in the DoDAF Journal, https://www.us.army.mil/suite/page/454707.

5.4.5.1 OMB Architecture Assessment. The Office of Management and Budget (OMB) requires departments and independent agencies to submit a self-assessment of their enterprise architecture programs in February of each year. For DoD, this applies at the Department level. The self-assessment is performed in three EA capability areas: completion of the EA, use of the EA and results, and utilization of the OMB Federal Enterprise Architecture program EA Assessment Framework. Specifics of the DoD/OMB architecture self-assessment are described in the DoDAF Journal, https://www.us.army.mil/suite/page/454707.

5.4.5.2 GAO Architecture Assessment. The Government Accountability Office (GAO) periodically requires all departments and independent agencies to submit a self-assessment of the maturity of the management of their EA programs. In addition, GAO may perform their own review and assessment of architecture efforts associated with large-scale programs. In certain cases, GAO expects an agency to establish an independent quality assurance process for a large-scale architecture to determine whether it meets quality criteria such as those identified earlier in this section. Specifics of the DoD/GAO architecture self-assessment are described in the DoDAF Journal, https://www.us.army.mil/suite/page/454707.

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5.4.6 **User Support.** User support is the service that each enterprise unit provides its users, both internally and externally to the enterprise, as described in the architecture documents.

5.4.7 **Training.** It is the responsibility of agency executive management to institutionalize the control structures for the EA process as well as for the agency CPIC and Shelf Life Code (SLC) processes. For each decision-making body, all members should be trained, as appropriate, in the EA, the EA process, the relationship of the EA to the Agency’s mission, DoDAF, and the FEA. Specific training, at various levels of detail, should be tailored to the architecture role of the personnel.

Architecture development training for team members is provided by the team leader and Chief Architect during the course of team operations. Training for team members includes sessions on group interactions, toolset operations, data collection, and creation of models and views.

5.4.8 **Communications Planning.** Communication management is the formal and informal process of conducting or supervising the exchange of information to all stakeholders of enterprise architecture. Communication planning is the process of ensuring that the dissemination, management, and control of critical stakeholder information is planned and executed in an efficient and effective manner.

The purpose of communications planning is (1) to keep senior executives and business units continually informed, and (2) to disseminate EA information to management teams. The CIO’s staff, in cooperation with the Chief Architect and support staff, defines a marketing and communications plan consisting of:

- constituencies
- level of detail
- means of communication
- participant feedback
- schedule for marketing efforts
- method of evaluating progress and buy-in.

The CIO’s role is to interpret the Agency Head’s vision, and recognize innovative ideas (e.g., the creation of a digital government) that can become key drivers in the EA strategy and plan. In turn, the Chief Architect is the primary technical communicator with the community(ies) of interest involved in an architecture effort.

At the Process Owner level, the communications plan is similar to that described above for the CIO. As with the CIO at the enterprise, the process owner is the manager of architecture efforts, supported by an architect and development team. The process owner must clearly define the purpose and scope of an architecture effort (i.e., ‘Fit-for-Purpose’) and communicate those goals and objectives for the architecture effort to the architect and team. In turn, as development of the architecture progresses, the architect provides feedback to the process owner, participates in validation and verification activities, and provides revisions, as required to the original development plan.
5.4.9 **Quality Planning.** Quality management is the process of organizing activities involving the determination of quality requirements, establishing quality policies, objectives, performance metrics, and responsibilities, and ensuring that these policies, objectives, and metrics will satisfy the needs within the enterprise. The quality management system executes policies, procedures, and quality planning processes, along with quality assurance, quality control processes, and continuous process improvement activities to improve the overall health and capability of the enterprise. The primary input into the quality management process is quality planning.

Quality planning for architecture development identifies which quality standards are relevant to creation of the architecture and determines how to satisfy them. Quality requirements are stated in the Project Scope Statement, further defined in the Program Management Plan and other guidance, such as that provided by the methodology being applied to the development effort. Guidance also includes other enterprise environmental factors, such as Governmental agency regulations, rules, standards, and guidelines specific to the application area. Information needed during quality planning is generally collected during architecture development, and represented in architecture products and views as controls, resources, inputs, and outputs, as appropriate. A more comprehensive discussion of quality planning is provided online in the DoDAF Journal, https://www.us.army.mil/suite/page/454707.

5.4.10 **Risk Management.** Risk management is the act or practice of dealing with risk. It includes planning for risk, assessing risk issues, developing risk handling strategies, and monitoring risk to determine how they have changed. Risk management planning is the process of deciding how to approach and conduct the risk management activities for the enterprise, program, and projects.

Architectural risk assessment is a risk management process that identifies flaws in architecture and determines risks to business information assets that result from those flaws. Through the process of architectural risk assessment, risks are identified and prioritized based on their impact to the business; mitigations for those risks are developed and implemented; and the architecture is reassessed to determine the efficacy of the mitigations.

Risk management planning should be initiated early during development of the scope for the architecture effort. Mitigation of risk is crucial to success of the overall effort. Inputs to the risk management planning process include a review of existing enterprise environmental factors, organizational process assets, the proposed scope statement, and the program management plan. *Enterprise environmental factors* are the attitudes toward risk and the risk tolerance of the organizations and people involved in the organization that exert influence over change. Risk attitudes and tolerances may be expressed in policy statements or revealed in actions. *Organizational process assets* are tools and techniques, which normally predefine organizational approaches to risk management such as established risk categories, common definitions of concepts and terms, standard templates, roles and responsibilities, and authority levels for decision-making.

A comprehensive discussion of Risk management can be found online in Section __ of the DoDAF Journal, https://www.us.army.mil/suite/page/454707.
6. CUSTOMER REQUIREMENTS

In a large organization such as DoD, there are myriad decisions made each day. These decisions require facts (i.e. valid information) for successful execution. Two things affect the ability to make decisions. First, needed information must be available; second, a decision support process must exist to frame how the decision, once made, can be executed. Decision support can be as simple as an established procedure or rule for execution, or a more complex, integrated set of actions to assure that a decision is executed properly.

Within DoD are a number of very complex, overarching, decision support services that provide a framework for execution on DoD’s most critical program activities. These key DoD change management decision support processes include JCIDS, DAS, systems engineering, PPBE, and PfM. The following paragraphs discuss how these key decision support processes impact management decision making in DoD using architecture data.

6.1 Tailoring Architecture to Customers’ Needs

Architectures collect information about an organization that is relevant to a requirement. This information frequently includes processes, supporting systems, needed or desired services, interfaces, business rules, and other details that can be organized to facilitate a decision. From this perspective, Architecture applies a method for tailoring information collection to a specific local need with a clear understanding of the decisions the architecture must support, how those decisions should be made, and what information they require. Responding to the organization’s requirements generally requires the following information in order to apply the methodology described in Section 7, or another selected by the architect:

- Detail on specific implementations of the basic processes, including explicit identification of critical decisions mandated or implied.
- Identification of performance measures that can be used to judge the effectiveness of each process (including any mandated by the authoritative documents), taking special note of those that sample the effectiveness of architecture support (the DoDAF Journal, https://www.us.army.mil/suite/page/454707, includes a tutorial on a relatively painless method for performance engineering).
- For each critical decision, identification of at least one method (and optionally several alternatives) for making that decision, identifying analyses to perform and questions to answer.
- For each analysis or question, identification of needed information.
- Creation of additional business objects/elements and attributes as needed to capture information in the architecture repository.
- Process and information definitions for utilization in architecture development.
The architect simplifies the architecture design by eliminating unneeded objects and attributes through a ‘best sense of opportunity’ approach, whereby interaction with the customer provides normal and expected needs that generally satisfies the majority of information needs for architecture development. Architecture views should be created to reflect, as closely as possible, the normal ‘culture’, and preferred presentation design of the agency.

### 6.2 Key Decision Support Processes

Organizations within the DoD may define local change management processes, supportable by architecture, while adhering to defined decision support processes mandated by the Department, including JCIDS, the DAS, systems engineering, PPBE, and PiM. These key support processes are designed to provide uniform, mandated, processes in critical decision-making areas, supplemented by individual agency operations, defined by architectures tailored to support those decisions-making requirements.

#### 6.2.1 Joint Capability Integration and Development System.

The primary objective of the JCIDS process is to ensure warfighters receive the capabilities required to execute their assigned missions successfully. JCIDS defines a collaborative process that utilizes joint concepts and integrated architectures to identify prioritized capability gaps and integrated joint DOTMLPF (i.e. Doctrine, Organization, Training, Materiel, Leadership, Personnel, Facilities) and policy approaches (materiel and non-materiel) to resolve those gaps. JCIDS implements an integrated, collaborative process to guide development of new capabilities through changes in joint DOTMLPF and policy.

The JCIDS process owners recognized the need for architecture and wrote policy to support architecture requirements (i.e., specific product sets required in specific documents, such as the Information Support Plan, Capability Planning Document, and Capability Design Document) that permits components and lower echelon commands to invoke the JCIDS process for requirements at all levels. JCIDS description of the Functional Solution Assessment (FSA) step specifically includes both DOTMLPF analysis and business process improvement and re-engineering. A more comprehensive discussion of JCIDS is contained in the DoDAF Journal, https://www.us.army.mil/suite/page/454707.

#### 6.2.2 Defense Acquisition System.

The Defense Acquisition System (DAS) exists to manage the nation’s investments in technologies, programs, and product support necessary to achieve the National Security Strategy and support employment and maintenance of the United States Armed Forces. The DAS uses Joint Concepts, integrated architectures, and DOTMLPF analysis in an

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21 Chairman of the Joint Chiefs of Staff (CJCS) Instruction 3170.01E, Joint Capabilities Integration and Development System (JCIDS), 11 May 2005. A copy of the current version of the instruction and its accompanying Manual can be found at: https://acc.dau.mil/CommunityBrowser.aspx?id=42776


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Content is Pre-Decisional Material
integrated, collaborative processes to ensure that desired capabilities are supported by affordable systems and other resources.\textsuperscript{23}

DoD Directive 5000.1 provides the policies and principles that govern the defense acquisition system. In turn, DOD Instruction 5000.2, Operation of the Defense Acquisition System establishes the management framework for translating mission needs and technology opportunities, based on approved mission needs and requirements, into stable, affordable, and well-managed acquisition programs that include weapon systems and automated information systems (AISs).\textsuperscript{24} The Defense Acquisition Management Framework\textsuperscript{25} provides an event-based process where acquisition programs advance through a series of milestones associated with significant program phases.

The USD (AT&L) leads the development of integrated plans or roadmaps using integrated architectures as its base. DoD organizations use these roadmaps to conduct capability assessments, guide systems development, and define the associated investment plans as the basis for aligning resources and as an input to the Defense Planning Guidance (DPG), Program Objective Memorandum (POM) development, and Program and Budget Reviews.\textsuperscript{26}

6.2.3 Systems Engineering (SE). DoD Acquisition policy directs all programs responding to a capabilities or requirements document, regardless of acquisition category, to apply a robust SE approach that balances total system performance and total cost with the family-of-systems, and system-of-systems context. Programs develop a Systems Engineering Plan (SEP) for Milestone Decision Authority (MDA) that describes the program’s overall technical approach, including activities, resources, metrics, and applicable performance incentives.

Systems engineering processes are applied to allow an orderly progression from one level of development to the next detailed level using controlled baselines. These processes are used for the system, subsystems, and system components as well as for the supporting or enabling systems used for the production, operation, training, support, and disposal of that system. Execution of technical management processes and activities, such as trade studies or risk management activities may point to specific requirements, interfaces, or design solutions as non-


optimal and suggest change to increase system-wide performance, achieve cost savings, or meet scheduling deadlines. Architecture supports systems engineering by providing a structured approach to document design and development decisions based on established requirements.

6.2.4 Planning, Programming, Budgeting, and Execution (PPBE). The PPBE process allocates resources within the DoD and establishes a framework and process for decision-making on future programs. PPBE is a systematic process that guides DoD’s strategy development, identification of needs for military capabilities, program planning, resource estimation, and allocation, acquisition, and other decision processes. JCIDS is a key supporting process for PPBE, providing prioritization and affordability advice.

DoDAF 2.0 supports the PPBE process by identifying the touch points between architecture and the PPBE process, identifying the data to be captured within an architecture description, facilitating informed decision-making, and identifying ways of presenting data to various stakeholders/roles in the PPBE decision process.

6.2.5 Portfolio Management. DoD policy requires that IT investments be managed as portfolios to ensure IT investments support the Department’s vision, mission, and goals; ensure efficient and effective delivery of capabilities to the warfighter; and maximize return on investment within the enterprise. Each portfolio must be managed using the architecture plans, risk management techniques, capability goals and objectives, and performance measures. Capability architecting is done primarily to support the definition of capability requirements. Portfolio management uses the architecture to analyze decisions on fielding or analysis of a needed capability.

Architecture support to PfM tends to focus on the investment decision itself (although not exclusively), and assists in justifying investments, evaluating the risk, and providing a capability gap analysis.

6.2.6 Operations. In most cases, an enterprise will capture its routine or repeatable business and mission operations as architecture content. However, when the basic structure of an activity is very stable and the activity repeated often, such as military operations planning or project definition and management, the enterprise may choose to include that structure as part of the structure of the architecture itself. In this case, the architecture repository may be enhanced to include templates, checklists, and other artifacts commonly used to support the activity.

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28 Department of Defense Directive (DoDD) 8115.01, Information Technology Portfolio Management, October 10, 2005. Office of the Assistant Secretary of Defense (Networks & Information Integration)(NII)/DoD Chief Information Officer (DoD CIO). The latest copy of this directive can be found at: http://www.dtic.mil/whs/directives/corres/rtf/811501x.rtf
The JCIDS, PPBE, and DAS processes establish a knowledge-based approach, which requires program managers to attain the right knowledge at critical junctures to make informed decisions throughout the acquisition process. The DoD IT PfM process continues to evolve that approach with emphasis on individual systems and/or services designed to improve overall mission capability. Consistent with OMB Capital Planning and Investment Control (CPIC) guidance, the DoD uses four continuous integrated activities to manage its portfolios -- analysis, selection, control, and evaluation. The overall process is iterative, with results being fed back into the system to guide future decisions.\textsuperscript{29}

\textbf{6.3 Information Sharing.} Information sharing across the Department has existed for many years in various forms. The sharing of information took on new urgency following the events of September 2001, especially in the area of terrorist-related information. Since that time, new Federal legislation\textsuperscript{30} and presidential orders require that agencies develop a common framework for the sharing of information, and define common standards for how information is acquired, accessed, shared, and used within a newly created Information Sharing Environment (ISE). While initial efforts relate to terrorism-related data, the standards being set could apply, in the future, more broadly across the Department.

Importantly, an Information Sharing Environment Enterprise Architecture Framework (ISE-EAF) is under development\textsuperscript{31}, which will provide guidance for information collection and dissemination within the Information Sharing Environment (ISE). This Framework is consistent with the DoDAF, and is essential data structures will be mappable to the DoDAF Meta-model described in DoDAF Volume 2 and Volume 3. When published, that ISE document should be used in coordination with DoDAF to ensure that these specific types of data meet established Federal standards.

\textsuperscript{29} DoDD 8115.01, 10
\textsuperscript{30} Intelligence Reform and Terrorism Prevention Act of 2004 (IRTPA), PL 108-458 (December 17, 2004)
\textsuperscript{31} Information Sharing Environment Enterprise Architecture Framework (DRAFT) June, 2008. Office of the Program Manager, Information Sharing Environment
7. METHODOLOGIES.

This section introduces a methodology-based approach to architecture development in DoD, draws on the methodology originally introduced in DoDAF 1.5, and expands on that methodology to highlight its use in a data-driven, net-centric architecture development environment. The methodology contained in this section is notional, represents best practices that have evolved over time, and can be utilized in conjunction with, or as a replacement for other methodologies, as described below.

7.1 Methodology Based Approach to Architecture

The Webster’s II New College Dictionary 2001 defines methodology as 1) the system of principles, procedures, and practices applied to a particular branch of knowledge, and, 2) the branch of logic dealing with the general principles of the formation of knowledge. Generally speaking, knowledge is gained through the acquisition of, and effective use of information organized from data for a particular purpose.

An architecture development methodology specifies how to derive relevant information about an enterprise’s processes and business or operational requirements, and how to organize and model that information. Architecture methods describe consistent and efficient ways to collect data, organize the data in a particular grouping or structure, and store collected data for later presentation and use in decision-making processes. A methodology also provides a means for replicating the steps taken to create an architecture for a specific purpose later, by another person or team with the expectation of achieving similar results.

In turn, through utilization of a method, it is possible to compare architectures created under the same, or similar methods, evaluate how disparate architectures can be linked to provide a higher-level picture of a process or capability, and to analyze the impact of future change. These analyses can include:

- **Static Analyses** – which could include capability audit, interoperability analysis, or functional analysis. These analyses are often performed using simple analysis tools such as “paper-based” comparisons and database queries.

- **Dynamic Analyses** – sometimes referred to as executable models, these analyses typically examine the temporal, spatial, or other performance aspects of a system through dynamic simulations. For example, these analyses might be used to assess the latency of time sensitive targeting systems or conduct traffic analyses on deployed tactical networks under a variety of loading scenarios.

- **Experimentation** – the use of tactical capability requirements, such as the Coalition Warrior Interoperability Demonstration (CWID), sponsored annually by the JCS, and various battle labs to provide the ability to conduct human-in-the-loop simulations of operational activities. Differing degrees of live versus simulated systems can be deployed during these experiments and there is a high degree of control over the experiment variables. These can be used for a variety of purposes.

The six-step method described below is a generic, time-tested method, which can be utilized, in a wide range of architecture requirements through relatively simple adaptation. The examples
described within the steps provide information on customization of the generic method for use in
major departmental functions and operations.

NOTE: The methodology described in this section is applicable to development of service-
oriented architecture (SOA). The steps described in the methodology, together with the
requirements of the toolset, techniques and notation desired, should be considered together
when defining a SOA. Volume 2 provides specific views that are useful for services-specific
data collection, and presentation models and documents that describe services.

If another method is desired, then utilization of the information contained in this Volume,
Volume 2, the technical specifications of DoDAF, and Volume 3, the DoDAF Meta-model,
provide the information needed for use in developing an architecture. When utilizing another
method, reference to the notional methodology can ensure adherence to the principles described
in DoDAF 2.0, to maximize the potential for reuse of essential data, and also to ensure
conformance with DoDAF 2.0.

7.1.1 6-Step Architecture Development Process. The high-level, six-step architecture
development process provides guidance to the architect and architecture development team and
emphasizes the guiding principles described in section 3.5.1. The process is data-centric rather
than product-centric (e.g. it emphasizes focus on data, and relationships among and between
data, rather than DoDAF products and views). This data-centric approach ensures concordance
between views in the architecture while ensuring that all essential data relationships are captured
to support a wide variety of analysis tasks. The views created as a result of the architecture
development process provide visual renderings of the underlying architecture data and convey
information of interest from the architecture needed by specific user communities or decision
makers. Figure 7.1.1-1 depicts this six-step process.

NOTE: It is important to note in this section that the development of architecture is an iterative
process and a unique one, in that every architecture is:

- Different in that architecture creation serves a specific purpose, and is created from a
  particular viewpoint
- Serving differing requirements, necessitating different types of views to represent the
  collected data
- Representative of a ‘snapshot in time’ (e.g., the architecture may represent the current
  view or baseline, or it may represent a desired view in some future time)
- Changeable over time as requirements become more focused or additional knowledge
  about a process or requirement becomes known.

The methodology described below is designed to cover the broadest possible set of
circumstances, and also to focus on the most commonly used steps by the architecture
community.
Figure 7.1.1-1: Architecture Development Six-Step Process

7.1.1 Step 1: Determine Intended Use of Architecture. Defines the purpose and intended use of the architecture (“Fit for Purpose”); how the architecture effort will be conducted; the methods to be used in architecture development; the data categories needed; the potential impact on others; and the process by which success of the effort will be measured in terms of performance and customer satisfaction. This information is generally provided by the process owner to support architecture development describing some aspect of their area of responsibility (process, activity, etc.).

A template for collection of high-level information relating to the purpose and scope of the architecture, its glossary, and other information, has been developed for registration of that data in DARS. An electronic copy is found on the public page of DARS, and additional information is contained in the DoDAF Journal, https://www.us.army.mil/suite/page/454707.

7.1.1.2 Step 2: Determine Scope of Architecture. The scope defines the boundaries that establish the depth and breadth of the architecture and establish the architecture’s problem set, helps define its context and defines the level of detailed required for the architecture content. While many architecture development efforts are similar in their approach, each effort is also unique in that the desired results or effect may be quite different. As an example, system
development efforts generally focus first on process change, and then concentrate on those automated functions supporting work processes or activities. In addition to understanding the process, discovery of these ‘system functions’ is important to decide how to proceed with development or purchase of automation support.

Architecture development to describe services utilization within a process collect information similar in type to systems, with additional data collection of information concerning subscriptions, directory services, distribution channels within the organization, and supporting systems/communications web requirements.

Similar situations occur with architecture development for joint operations. Joint capabilities are defined processes with expected results, and expected execution capability dates. The architectures supporting the development of these types of capabilities usually require the reuse of data already established by the military services and agencies, analyzed, and configured into a new or updated process that provides the desired capability. Included are the processes needed for military service and/or agency response, needed automation support, and a clear definition of both desired result and supporting performance metrics. These types of data are presented in views further described in Volume 2.

The important concept for this step is the clarity of scope of effort defined for the project that enables an expected result. Broad scoping or unclear definition of the problem can delay or prevent success. The process owner has the primary responsibility for ensuring that the scoping is correct, and that the project can be successfully completed.

Clarity of scope can better be determined by defining and describing the data to be used in the proposed architecture in advance of the creation of views that present desired data in a format useful to managers. Early identification of needed data, particularly data about the architecture itself, the subject-matter of the proposed architecture, and a review of existing data from COIs, can provide a rich source for ensuring that architectures, when developed, are consistent with other existing architectures. It also ensures conformance with any data-sharing requirements within the Department or individual COIs, and conformant with the DoDAF Meta-model described in Section 9.

An important consideration beginning with this and each subsequent step of the architecture development process is the continual collection and recording of a consistent, harmonized, and common vocabulary. The collection of terms should continue throughout the architecture development process. As architecture data is identified to help clarify the appropriate scope of the architecture effort, vocabulary terms and definitions should be disambiguated, harmonized, and recorded in a consistent AV-2 process documented in the “DoDAF Architecture Development Process for the Models” Microsoft Project Plan.

Analysis of vocabularies across different architectures with similar scope may help to clarify and determine appropriate architecture scope. Specific examples of data identification utilizing the AV-2 Data Dictionary construct are found in the DoDAF Journal, https://www.us.army.mil/suite/page/454707.

7.1.1.3 Step 3: Determine Data Required to Support Architecture Development. The
required level of detail to be captured for each of the data entities and attributes is determined through the analysis of the process undergoing review conducted during the scoping in Step 2. This includes the data identified as needed for execution of the process, and other data required to effect change in the current process, e.g. administrative data required by the organization to document the architecture effort. These considerations establish the type of data collected in Step 4, which relate to the architecture structure, and the depth of detail required.

The initial type of architecture data content to be collected is determined by the established scope of the architecture, and recorded as attributes, associations, and concepts as described in the DoDAF meta model (DM2). A mapping from DM2 concepts, associations, and attributes to architecture models is provided that suggests relevant architecture views the architect may develop (using associated architecture techniques) during the more comprehensive and coherent data collection of Step 4. This step is normally completed in conjunction with Step 4, a bottom-up approach to organized data collection, and architecture development typically iterates over these two steps. As initial data content is scoped, additional data scope may be suggested by the more comprehensive content of architecture views desired for presentation or decision-making purposes.

This step can often be simplified through reuse of data previously collected by others, but relevant to the current effort. Access to appropriate COI data and other architecture information, discoverable via DARS and the DoD Metadata Registry, can provide information on data and other architecture artifacts and views that may provide useful in a current effort.

Work is presently underway within the Department to ensure uniform representation for the same semantic content within architecture modeling, called "Architecture Modeling Primitives". The Architecture Modeling Primitives, hereafter referred to as Primitives, will be a standard set of modeling elements, and associated symbols mapped to DM2 concepts and applied to modeling techniques. Using the Primitives to support the collection of architecture content and, in concert with the Physical Exchange Specification, will aid in generating common understanding and communication among architects in regard to architecture views. As the Primitives concepts are applied to more modeling techniques, they will be updated in the DoDAF Journal and details provided in subsequent releases of DoDAF. The full range of Primitives for views, as with the current BPMN Primitives, will be coordinated for adoption by architecture tool vendors.

**NOTE: As of the distribution of this Volume for the Community-Wide Review, comments provided by the Core Management Stakeholders have not been resolved concerning the "Architecture Modeling Primitives." It is intended to resolve the comments with the Stakeholders during the Community Review Period.**

### 7.1.1.4 Step 4: Collect, Organize, Correlate, and Store Architecture Data.

Architects typically collect and organize data through the use of architecture techniques designed to use views (e.g. activity, process, organization, and data models as views) for presentation and decision-making purposes. Terms and definitions recorded are related to elements of the DoDAF Meta-model (DM2).
Designation of a data structure for the architecture effort involves creation of a taxonomy to organize the collected data. This effort can be made considerably simpler by leveraging existing, registered artifacts registered in DARS of the DM2, to include data taxonomies and data sets. Each COI maintains its registered data on DARS, either directly or through a federated approach. In addition, some organizations, such as US Joint Forces Command (JFCOM), have developed templates, which provide the basis of a customizable solution to common problems, or requirements, which includes datasets already described and registered in the DoD Metadata Registry. Examples of this template-based approach are in the DoDAF Journal.

DARS provides more information that is specific, and guidance on retrieving needed data through a discovery process. Once registered data is discovered, the data can be cataloged and organized within a focused taxonomy, facilitating a means to determine what new data is required. New data is defined, registered in DARS, and incorporated into the taxonomy structure to create a complete defined list of required data. The data is arranged for upload to an automated repository, such as DARS, to permit subsequent analysis and reuse. Discovery metadata (i.e., the metadata that identifies a specific architecture, its data, products, and usage) should be registered in DARS as soon as it is available to support discovery and enable federation. Architects and data managers should use the DoD EA Business Reference Model (DoD EA BRM) taxonomy elements as the starting point for their registration efforts. Additional discovery metadata, such as processes and services may be required later, and should follow the same registration process.

**7.1.1.5 Step 5: Conduct analyses in support of architecture objectives.** Architecture data analysis determines the level of adherence to process owner requirements. This step may also identify additional process steps and data collection requirements needed to complete the architecture and better facilitate its intended use. Validation applies the guiding principles, goals, and objectives to the process requirement, as defined by the process owner, along with the published performance metrics, to determine the achieved level of success in the architecture effort. Completion of this step prepares the architecture for approval by the process owner. Changes required from the validation process result in iteration of the architecture process (repeat steps 3 through 5 as necessary).

**7.1.1.6 Step 6: Document Results in Accordance with Architecture Framework.** The final step in the architecture development process involves creation of architecture views based on queries of the underlying data. Presenting the architecture data to varied audiences requires transforming the architecture data into meaningful presentations for decision-makers. This is facilitated by the data requirements determined in Step 3, and the data collection methods employed during Step 4.

DoDAF 2.0 provides two types of views. ‘DoDAF-described Views’ are those views described in Volume 2 that enable an architect and development team to create views whose data has already been defined and described consistent with the DoDAF meta-model. These views include those previously described in earlier versions of DoDAF, along with new views.
incorporated from the Ministry of Defense (UK) Architecture Framework (MODAF), the NATO Architecture Framework (NAF), and The Open Group Architecture Framework (TOGAF) that have relevance to DoD architecture development efforts.

The second type of views, ‘Fit-for-purpose Views’, are user-defined views that an architect and development team can create to provide information necessary for decision-making in a format customarily used in an agency. These views should be developed consistent with the DoDAF meta-model, but can be in formats (e.g. dashboards, charts, graphical representations, etc) that are normally used in an agency for briefing and decision purposes. An architecture development effort can result in an architecture that is a combination of DoDAF-described views and Fit-for-purpose Views.

DoDAF does not require specific views, but suggests that local organizational presentation types that can utilize DoDAF-created data are preferred for management presentation. A number of available architecture tools support the creation of views described in this step. The PES provides the format for data sharing.

NOTE: While DODAF does not require specific views in an architecture, several JCS and DOD publications do require specific views in response to their stated requirements. Managers and architects, in deciding what views are created in an architecture development effort, must consider those specific requirements in order to ensure that the architecture developed is useful in satisfying those requirements.

7.1.2 Accommodating Multiple Methods for Implementation. DoDAF v2.0 is designed to be flexible in development of architectures supporting all tiers, capabilities, component-level views, and specific functional or operational requirements. The method described within the Framework is generic, and can be used in conjunction with other frameworks, tools, or techniques to achieve the desired result. Specifically, the conceptual model supporting DoDAF v2.0 can be used to develop both relational and object-oriented (OO) databases in a wide variety of formats; supports both the structured analysis and Object-oriented analysis and design modeling techniques and their specific notations; and continues to support previous versions of this framework.

Many architectures are created utilizing data from architectures developed previously under another framework (i.e., MODAF, NAF, TOGAF). It is also possible, through data mapping, to link that data to the DoDAF v2.0 conceptual and logical data models, since the data models supporting these frameworks are based on either the predecessor C4ISR Framework or DoDAF, v1.0.

7.1.3 Architecture Life Cycle & Architecture Governance. Architecture development is only one phase of an overall architecture life cycle, similar to other process maturity and change life cycles. One such life cycle, the Architecture Governance, Implementation, and Maturity Cycle,
shown in Figure 7.1-1 below, is described in detail in the DoDAF Journal, https://www.us.army.mil/suite/page/454707. This life cycle relies on the commonly used Plan-Do-Check-Act (PDCA) governance method.

![PDCA Cycle](image)

**Figure 7.1-1: PDCA Cycle**

### 7.1.4 Planning for Architecture Development

Planning an architecture effort involves more than selection of a method for development. The architecture effort starts with the identification of a requirement, problem, or desired change by the process owner – the senior official responsible for the overall operation of the functional, tactical, component or JCA. The process owner selects a team leader and team members who will actively participate in the architecture effort. That team may have a varying membership, generally including an enterprise architect, and subject matter experts in the process area undergoing analysis and potential change, and will refine the process owner’s vision and/or initial requirement into a project through development of an appropriate architecture, as shown in the steps in sections 6.1.1, and in Section 10, Architecture Planning.

Managers and decision-makers are generally not technicians or information architects. They do, however, have a vital part in the decisions that need to be made early in the planning process to define the types of views they need to support their involvement in the decision-making process. Organizations differ in the type of presentation materials they prefer (i.e. dashboards, charts, tables, etc.) and these preferences need to be accommodated during architecture development. Toolsets should be selected that have the capability to provide these management views and products, along with the ability to collect and organize data consistent with the DoDAF meta-

### 7.1.5 Approaches to Architecture Development

Several methodologies, with supporting tools, techniques, and notations (i.e., a set of written symbols used to represent something such as activity, decisions, systems, applications, interfaces, etc.) exist for developing architectures. While DoDAF does not promote a specific approach, the DoDAF provides the rules, standard entities, and relationships for developing architectures in a semantically consistent and interoperable fashion. The DoDAF conceptual and logical data models, described in Volumes 1 and 2, along with the Physical Exchange Specification in Volume 3, have been designed to facilitate adoption of DoDAF by a wide range of toolsets and techniques. The DoDAF Meta-model should be used as the principal reference for creating the data structures in toolsets to ensure both interoperability and reuse capabilities. An achievable level of commonality among the notations is possible when basing architecture development on the DoDAF 2.0 conceptual and logical data models.

**NOTE:** Several commercial toolsets that are commonly used to develop architecture views still use the terms ‘model’ of ‘diagram’ to describe those views. Within this chapter, we continue to use the terms ‘model’ and ‘diagram’, as they are used by toolset vendors, in order to avoid confusion. However, a model or diagram created by a toolset, using an appropriate notation, and included in a set of views in a DoD architecture should be understood as a ‘view’ within DoDAF.

The two most common techniques—the Structured Analysis and Design (SADT) Approach and the Object-oriented Analysis & Design (OOAD) Approach—are discussed briefly below. Examples of the notation supporting these techniques are presented in examples contained within Volume 2. Either of these techniques can be used with the methodology described above, or by others, such as MODAF, NAF, TOGAF, or other Government or commercial offerings.

#### 7.1.5.1 Structured Technique Overview

Architectures developed under a structured analysis-driven approach are process-oriented and characterized by a hierarchical process decomposition. Historically, structured models generally used in DoD originated from the Integration Definition Language developed by the US Air Force, and later used to develop the Activity Modeling standard (IDEF0) [IDEF0 1993] a Federal Information Processing Standard (FIPS) published by the National Institutes for Standards & Technology (NIST). This technique evolved from an earlier, also process-driven approach, Structured Analysis and Design Technique (SADT), developed for the U.S. Air Force Materiel Command. More recently, architecture development using structured methods has also included those utilizing the Business Process Modeling Notation (BPMN), developed by the Business Process Management Initiative, and currently managed by the Object Management Group (OMG).

#### 7.1.5.1.1 Process Data Flow

A process flow diagram (PFD) is a graphical representation of the "flow" of data through a process. With a process flow diagram, users are able to visualize how the process will operate, what the process will accomplish, and how the process is executed.
normally. Process flow diagrams can be used to provide the end user with a physical idea of the resulting actions that occur on data input, and how their actions ultimately have an effect upon the structure of the whole process. Process flow diagrams also define desired or required system-level functions—the level and type of automation desired to improve the time, efficiency, and results of executing a process.

7.1.5.1.2 Process Task-Dependency Diagram. Process Task Dependency (PTD) Diagrams lay out clearly the step-by-step flow of a process by tracking the flow of material, information or a service through all its steps in a logical or required order. The PTD diagram assists an unfamiliar audience to picture the steps of a process and clarifies misconceptions about how the process actually operates, while providing a reference for the handling of corrective action or process improvement. Task-sequence notations work especially well for “uninterruptible” processes, meaning a set of steps that exhibits clear dependencies, doesn’t execute until explicitly triggered, and normally continues until it achieves a clear exit criterion. Such processes are generally low-level and detailed, and useful, among other things, for:

- Defining detailed performance metrics and metrics capture
- Establishing an information base for executable architecture/process simulation
- Defining automation functional requirements

7.1.5.1.3 Entity-Relation Model. The Entity-Relation Model describes the structure of an architecture domain’s system data types and the business process rules that govern the system data. It provides a definition of architectural domain data types, their attributes or characteristics, and their interrelationships.

7.1.5.2 Object-Oriented Technique Overview. Object-oriented architecture views are created utilizing the Unified Modeling Language (UML) architecture technique and notation, together with the DoDAF logical and Physical Exchange Specification data structures. This technique describes the operational need, places data (objects, or ‘performers’ in the DoDAF data structure) in the context of its use, and provides a traceable foundation for system and software design. It is based on the concepts of data abstraction and inheritance from a service-oriented view. The object-oriented technique provides an orderly arrangement of the parts of the business organization and includes a style and method of design through its highly developed notation style.

7.1.5.2.1 Process – Activity Diagram, Object-Sequence Diagram. An activity diagram is frequently used in conjunction with a process flow diagram that describes the sequence and other attributes (i.e. timing) of the activities. A process flow diagram further captures the precedence and causality relations between situations and events. In object modeling, Activity diagrams address the dynamic view of the system. They are especially important in modeling the function of a system and emphasize the flow of control among objects. An object diagram shows a set of objects (i.e. performers) and their relationships. Object diagrams represent static snapshots of instances of things found in class diagrams.
7.1.5.2.2 Data – Object Class Diagram. Class diagrams offer all the UML elements needed to produce entity-relationship diagrams. Class diagrams consist of classes, interfaces, collaborations, dependency, generalization, association, and realization relationships. The attributes of these classes can be expanded to include associations and cardinality [Booch, 1999]. In terms of support to DoDAF 1.5, Classes that appear in an OV-7 class diagram correlate to OV-3 information elements and OV-5 inputs and outputs. The OV-7 class diagram is a separate diagram from the class diagrams that may be developed for other products.

7.2 System (Component, Package, Deployment) Diagram. DoDAF 2.0 provides extensive architecture support for the systems engineering process. As the process of developing the system architecture moves from the high-level concept (e.g., system interface description, system overview diagram) to more detailed views, it becomes useful to create multiple models so that specialized views of the architecture can be depicted. Three important diagrams are the Component Model, which focuses on functional features of the system; the Package Diagram, which focuses on grouping of components for specific purposes; and the Deployment/Operational Model, which focuses on the physical runtime infrastructure on which functional components will be deployed.

The value of using multiple models arises from the fact that each of these models begins to call upon different skills and knowledge sets as the level of detail increases. Since these diagrams/models are dependent upon each other, they cannot be created in complete isolation. The architecting process thus becomes an iterative process, defining portions of each of these diagrams, then evaluating how each fits with the other, and making revisions that optimize the diagrams so they support each other effectively.

7.2.1 Component Model and Package Diagram. A Component Model describes the hierarchy of functional components, their responsibilities, static relationships, and the way components collaborate to deliver required functionality. A component is a relatively independent part of an IT System and is characterized by its responsibilities, and the interfaces it offers. Components can be decomposed into smaller components or aggregated into larger components. Some components already exist, but it may be necessary to build or buy others. A component can be a collection of classes, a program (e.g., one that performs event notification), a part of a product, or a hardware device with embedded functional characteristics (e.g., a Personal Digital Assistant [PDA]). Some are primarily concerned with data storage. A more comprehensive treatment of Component Models is found in the DoDAF Journal, https://www.us.army.mil/suite/page/454707.

7.2.2 Deployment/Operational Model. The Operational Model describes the operation of the IT system, as illustrated below in Figure 7.2.2-1. This model is derived primarily from the operational requirements placed on the e-business application. Like the Component Model, the Operational Model is typically developed through a series of progressively more detailed elaborations (i.e., Conceptual, Specified, and Physical). Also like the Component model, at each level of elaboration there may be a need to create more than one view of the Operational Model so that no single view becomes overloaded by attempting to convey too much information. A

Figure 7.2.2-1: Deployment/Operational Model
8. ARCHITECTURE PRESENTATION TECHNIQUES

While information is the lifeblood of enterprise architecture, it can be overwhelming to decision makers when presented in a raw format. Likewise, the structured methodology of modeling enterprise architecture information is both necessary and useful for creating architectures that can be shared between organizations. However, many of the ‘traditional’ architecture products are unwieldy because of their format and are useful only to trained architects. Many organizations develop a “mandated” architecture but make it expensive shelf-ware instead of using it to communicate important, accurate, and relevant information to the stakeholders who need it. Architects must be able to communicate architecture information in a meaningful way to process owners and other stakeholders, or the discipline of enterprise architecture will soon meet an untimely demise.

The results of architecture-related data collection need to be presentable to non-technical senior executives and managers at all levels. Many managers are skilled decision-makers, but have not had technical training in architecture development. Since architecture development efforts are designed to provide input to the decision-making process, graphical representation of data needed is a logical extension of the overall process. This section describes these graphical representations (architects call them 'products' or 'views').

8.1 Overview. Effective presentation of business information is necessary for architects to tell the story of the architecture data with stakeholders. Since the purpose of the architecture discipline is to collect and store all relevant information about an enterprise, or some specific part of the enterprise, it can reasonably be assumed that the majority of information needed by an organization’s decision makers is contained somewhere in the architecture data. Many of the existing architecture methods are valuable for organizing architecture information, but less valuable for communicating that information to stakeholders. Presentation views are always dependent on the quality of the architecture information that is collected through the rigor of architecture methods. As figure 8.1-1 illustrates, presentation techniques pull from the architecture information store and display the data in a variety of meaningful ways to stakeholders.
The presentation techniques and best practices described here (And documented more fully in Volume 2) were developed based on the idea that business information, captured both internally and externally to an organization’s architecture in support of common user requirements, can be displayed in a way that enhances clarity and understanding, and facilitates decision-making. That often means that complex technical information must be ‘translated’ into a form for presentation that is useful to management. An ‘Information Bridge’, as shown in Figure 8.1-2 is the link between the architect and management. The bridge provides the means to take technical information, and recast that information in graphical or textual terms that consistent with the culture of the organization.

DoDAF, Version 1.0 and Version 1.5 defined a set of ‘products’ for visualizing, understanding, and assimilating the broad scope and complexities of an architecture description through graphic,
8.2 Choosing an Appropriate Presentation Technique. In any given business process, decisions must be made at multiple levels of the organization. Whether one is a senior level executive, a process owner, or a system developer, he or she will need to make judgment calls based upon the available data. Each level of decision maker, in turn, has both a unique purpose and understanding of architecture, making it important to tailor the data in order to maximize its effectiveness. The presenter, with the help of an experienced architect, must determine the audience of a presentation before choosing the type of presentation technique to use. Figure 8.2-1, based on the Zachman Framework,\textsuperscript{32} summarizes the multiple levels of decision makers within a typical organization that make up an audience.

![Figure 8.2-1 Levels of Decision-Makers](image)

Each level has differing requirements for presentation of data. Level 1 Planners may find a graphical wall chart more useful in making decisions, whereas a Level 4 Builder will most likely require a more technical presentation, one relating more directly to the architecture. Level 5 subcontractors are the workers who will perform the work required, and generally required varying levels of technical data and other information to accomplish their task.

Narrowing down the type of presentation required is done by asking the following question: What information does the decision maker need in order to make a data-supported decision? For each decision level there is a data set that can be manipulated using a presentation technique. After analyzing the audience and type of information, the presenter should consider the various


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Content is Pre-Decisional Material
types of techniques discussed in this section. Figure 8.2-2 is a simplified representation of the presentation development process.

It is imperative to realize that when choosing how to present data sets, there is no limit on what views to use. There are countless ways to display information to decision makers, and it is up to the presentation developer to determine the most effective way to accomplish this task. This section describes a base of view development techniques to start from, each created to serve its own unique purpose. Details are provided on five different presentation techniques that have proven to be useful in engaging various audiences.

A more detailed discussion of DoDAF Meta-model Groups is provided in Volume 2, Section 2, that includes a description and purpose for each group, the data capture method, and the use of each group. There are the DoDAF-described Views that derive from and conform to the DoDAF Meta-model. Additionally, within each view are a number of described presentation views that present differing sets of possible representations, with their associated data.

Alternatively, user-defined views, called Fit-for-purpose Views can be created, utilizing DoDAF-conformant data that provide other forms of graphical presentation. These use presentation that are more common to briefings and decision analysis. The five techniques commonly used are:

- **Composite Products**: Display multiple pieces of architecture in formats that are relevant to a specific decision maker (Section 8.3)
- **Dashboards**: Integrate abstracted architecture information for a given business context (Section 8.4)
- **Fusion Products**: Display multiple pieces of architecture and incorporate disparate pieces of information that are not captured within the architecture (Section 8.5)
- **Graphics**: Visually represent manipulated data (Section 8.6)
- **Reference Models**: Capture the elements of the architecture products and translate those elements into text (Section 8.7)

Fit-for-purpose Views provide wide flexibility for the architect and process owner to create architecture views easily understood and useful to management for decision-making purposes. Each of these types of views is described below.

### 8.3 Composite Views

A composite view displays multiple pieces of architecture in formats that are relevant to a specific decision maker. By drawing information from numerous sources, this presentation technique provides a holistic view for the audience. Contrasting two or more snapshots next to each other, composite products allow for an easy comparison. As seen in Figures 8.3-1, and 8.3-2, below. These views will be comprised of related architecture products that directly support each other (i.e., system functions in an SV-4 that support activities in an OV-5). The view can be graphically displayed in three dimensions to tie the pieces of architecture together.

#### 8.3.1 Purpose and Audience

Composite views allow decision makers to view important relationships in data without reading through large pieces of architecture. Most business owners are interested only in their particular business area and its immediate interconnections. By placing relevant parts of architecture directly in front of the audience, it is easier to gain a comprehensive understanding of the data in an efficient manner. The audience that will find these products most useful are:

- **Process Owners** who have direct staff oversight or technical systems expertise and require high level conceptual briefings
- **Designers**—implementers of the initiative, who require information detailing specifics of implementation
- **Builders**—System architects who require details on how to implement and use products.

#### 8.3.2 Examples

Figure 8.3.2-1 illustrates a simplified example of a Composite View. The activity Determine Accession Type is supported by the system function Maintain Candidate Data via User Interface. The information to support this system function includes Accession Type Information and Other Candidate Information. The activity is carried out by a Human Resource Specialist.
Figure 8.3.2-1: Example Composite View

Figure 8.3.2-2 illustrates a final version of a different Composite View. Four architecture samples are displayed, and a three-dimensional Capability label lets the audience know the common tie.

Figure 8.3.2-2: Another Composite View

Composite views are ideal for explaining interconnections between architectures. The audience will more easily understand relationships in data by viewing manageable slices of mappings all at once. The developer of this product can interchange architectures easily, highlighting the most important parts for the audience. Composite views are neither wordy, nor oversimplified. Additionally, they can be used by a wide range audience.

8.4 Dashboard Views. Dashboards integrate abstracted architecture information for a given business context and are generally geared to displaying information required by a specific
stakeholder. A well-constructed dashboard consists of a status, trend, or a variance to a plan, forecast, or budget (or combination thereof). Dashboards are generally user friendly, providing easy access to enterprise data to enable organizations to track performance and optimize decision-making. High-level decision makers generally like dashboards because dashboards are frequently used in other business contexts besides enterprise architecture, and decision makers have a familiarity with this presentation tool. In addition, the dashboard is formatted so key stakeholders can review valuable, insightful information at a glance to manage their organization’s performance goals effectively.

8.4.1 Purpose and Audience. The visual qualities of a dashboard allow executives and managers to identify which of their business areas are successful and which are problem areas that need immediate attention. Like all enterprise architecture presentation techniques, the dashboard must be designed with the stakeholder audience in mind and should be geared towards the audience’s specific goals. One of the most important goals in creating a dashboard is to deliver a highly intuitive tool that yields greater business insight for decision makers.

Since dashboards display highly aggregated and abstracted information, they are typically targeted to senior decision makers. However, they are also a great tool to share with junior architects to ensure they understand key business drivers and concepts as they take a deeper dive into their respective areas.

8.4.2 Examples. Table 8.4.2-1 illustrates various visualization techniques that can be used to create a dashboard.

<table>
<thead>
<tr>
<th>Visualization Technique</th>
<th>Description</th>
<th>When to Use</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pie Chart</td>
<td>Pie charts can be used for representing small sets of information. However, they are generally considered poor data visualization for any data set with more than half a dozen elements. The problem with pie charts is that it is very difficult to discern proportional differences with a radically divided circle, except in the case of a small data set that has large value differences within it. Pie charts also pose a problem for labeling, as they are either dependent on a color or pattern to describe the different data elements, or the labels need to be arranged around the perimeter of the pie, creating a visual distraction.</td>
<td>Pie charts should be used to represent very small data sets that are geared to high-level relationships between data elements. Pie charts present summary level relationships, and should be used carefully for detailed analysis.</td>
</tr>
</tbody>
</table>
| Bar Chart               | Bar charts are an ideal visualization for showing the relationship of data elements within a series or multiple series. Bar charts allow for easy comparison of values, share a common measure, and are easily compared to one another. | Bar charts are best suited for categorical analysis but can also be used for short duration series analysis (e.g., the months of a year.) A presenter needs to be aware of the risks in using bar charts if there is a data set that has one element with a
large outlier value; this will render the visualization for the remaining data elements unusable. This chart scale is linear, and will not clearly represent the relationships between the remaining data elements.

**Line Charts**
Time series line charts are most commonly used with the time dimension along the X-axis and the data being measured along the Y-axis.

Use line charts when you would like to see trends over time in a measure, versus a side-by-side, detailed comparison of data points. Line charts are ideal for time series analysis where you want to see the progress of one or more measures over time. Line charts also allow for comparative trend analysis as you can stack multiple series of data into one chart.

**Area Charts**
Area charts can be considered a subset of the line chart, where the area under or above the line is shaded or colored.

Area charts are good for simple comparisons with multiple series of data. By setting contrasting color hues you can easily compare the trends over time between two or more series.

**Tables and Lists**
Tables and lists contain large amounts of data that can be categorized into a list or divided into a table but cannot be easily compiled into a visual or numerical analysis tool.

Tables and lists are best used for information that either contains large lists of non-numeric data, or data that has relationships not easily visualized or does not lend itself to easy numeric analysis.

**Figure 8.4.2-1** illustrates the use of these techniques to create a dashboard.
A dashboard is effective in demonstrating the number of systems supporting an Activity or modifying a data element. It can provide data from a variety of sources to create a multi-disciplined and multi-dimensional performance feedback. It combines standard components and building blocks to create an executive dashboard that meets particular needs.

**8.5 Fusion Views.** A fusion view is very similar to a composite view in that it displays multiple pieces of architecture in formats that are relevant to a specific decision maker. However, a fusion view also incorporates disparate pieces of information that are not captured within the architecture. Fusion views are frequently used to display information that is sensitive in nature and that is viewed only by certain stakeholders making specific decisions. For example, fusion views could be used to display funding information regarding a program or system.

**8.5.1 Purpose and Audience.** Fusion views serve as a single location for viewing disparate pieces of information from within and outside of the context of the architecture. A fusion view can be used to bridge the gap between an enterprise architecture analysis, other analysis, and transformation processes. It is frequently used when making a decision that incorporates information that has been deliberately not included in the architecture.

Fusion views can be used by all members of the development team (i.e. Planners, Owners, Designers, Builders, and Subcontractors). Planners use them to review portfolio choices within the context of the architecture and to determine how choices compare to the portfolio as a whole, as well as against an individual system or group of systems. Owners use fusion views to review current progress against planned goals, which may include cost and schedule data or to address capability gaps within the architecture. Designers, Builders, and Subcontractors can use a more detailed fusion view to review implementation impacts associated with the development of a particular system and to show the complexity of the information involved.

**8.5.2 Examples.** Figure 8.5.2-1 incorporates financial data and support information into an analysis. The outside information commonly consists of financial data gathered from authorized sources or scheduling information and constraints gathered from a Work Breakdown Structure (WBS) or similar reporting mechanism. This can be tailored so that the user can use any data that is relevant to their needs.
A similar Fusion view is shown in Figure 8.5.2-2 that does not include the financial data.
A fusion view is a powerful tool with the ability to portray accurately the relationships between different types of information. A fusion view can be used to provide a 360-degree view of a system, validate systems against architectures, show availability of services, or provide a perspective of a current environment (e.g. a viewpoint) that can be used in decision-making discussions.

8.6 Graphics Views. A graphic is a representation (as a picture, map, or graph) used especially for illustration of concepts. In the case of enterprise architecture, graphics views are used for the pictorial representation and manipulation of data. In other words graphics provide a visual representation of business information and processes. Graphics views can be of tremendous benefit in representing multiple concepts in a clean, simple design.

8.6.1 Purpose and Audience. Graphics views provide a visual depiction of the information and are therefore targeted at visually oriented learners. When properly executed, a graphical view allows the intended audience to view the information in an uncluttered, easy to understand, and precise design. Additionally, graphical views can attract attention and cause interest. Most people understand pictures faster and easier than they do text or model-based documents. Graphical views provide the presenter with literally unlimited options for displaying their business concepts and for tailoring their product to the targeted audience.

Because of the lack of underlying complexity, a graphic view tends to be more abstract and is usually presented to high-level audiences. The identification of the target stakeholder level and the intended message is the first step in determining whether a graphic view is the appropriate tool for information delivery. The appropriateness of graphical views can only be determined
once the message and stakeholder level have been identified. Graphical depictions of data and business processes can be tailored to any stakeholder level as long as the intended message and information can be represented in a logical, reader-friendly form. All levels of decision makers will find graphical views useful for high-level analysis.

8.6.2 Examples. The use of graphical views is a common practice in DoD and non-DoD organizations. Because graphical views do not usually show the underlying complexity, it is important to remember that they are tied to details within the architecture. As with dashboard views, if a stakeholder does not understand where the information came from, or if they lack faith in the detailed architecture information, then the graphic view will essentially be meaningless to them. It is also critical to emphasize the underlying architectural information when briefing the graphic to senior decision makers. An OV-1, for example, provides a high-level concept description of a business, and is usually the first, and can be the only architecture product a senior decision maker sees. In order for an OV-1 to have an impact, a decision maker must be able to see a direct correlation from the graphic view to the detailed aspects of the business. Figure 8.6.2-1 and Figure 8.6.2-2 illustrate this concept. Each part of the graphic view corresponds to a detailed area of the overall business, which will be represented and composed of a complex set of architecture products. The graphical views are also used to show the relationships between the business areas which come together to form a complete picture.

Figure 8.6.2-1: Non-prescriptive, Illustrative High-level Concept Description (OV-1)
Graphical views enable the efficient communication of complex quantitative ideas. In a society that is fascinated with visual stimulation, the use of graphical views provides an attractive and efficient communications tool. When effectively designed, graphical views can facilitate understanding and recognition; promote analysis; and support learning and sharing of ideas.

8.7 Reference Models. Reference models provide textural extractions of underlying architectural data. As Figure 8.7-1 illustrates, reference models capture the elements of the architecture products, and translate those elements into text. This reference model provides a framework for describing important elements of the Federal Enterprise Architecture (FEA) in a common and consistent way. The FEA consists of five reference models: Performance Reference Model (PRM), Business Reference Model (BRM), Service Component Reference Model (SRM), Data Reference Model (DRM), and the Technical Reference Model (TRM). Through the use of this common framework and vocabulary, IT portfolios can be better managed and leveraged across the Federal Government.\(^{33}\)

8.7.1 Purpose and Audience. Reference models are designed to facilitate cross-agency analysis, through the development of a common taxonomy and ontology for describing the business operations of Federal agencies, independent of any specific agency. Cross-agency analysis is used by planners and process owners to identify duplicate investments, gaps, and opportunities for collaboration within and across agencies. Collectively, the reference models comprise a framework for describing important elements of the Federal Enterprise Architecture (FEA) in a common and consistent way. Through the use of this common framework and vocabulary, IT portfolios can be better managed and leveraged across the Federal government.  

8.7.2 Examples. One example of a reference model is the FEA Business Reference Model (BRM). The BRM provides an organized, hierarchical construct for describing the day-to-day business operations of the Federal government. While many models exist for describing

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Figure 8.7-1: A Notional Reference Model

organizations - org charts, location maps, etc. - this model presents the business using a
functionally driven approach. The Lines of Business and Sub-functions that comprise the BRM
represent a departure from previous models of the Federal government that use antiquated, stove-
piped, agency-oriented frameworks. The BRM is the first layer of the Federal Enterprise
Architecture, and it is the main viewpoint for the analysis of data, service components, and
technology (See Figure 8.7.2-1).³⁵

The BRM is broken into four areas: Services for Citizens, Mode of Delivery, Support Delivery
of Services, and Management of Government Resources. The model’s four Business Areas are
decomposed into 39 Lines of Business. Each business line includes a collection of Sub-functions
that represent the lowest level of granularity in the BRM. For example, the Environmental
Management Line of Business encompasses three Sub-functions: (1) Environmental Monitoring
and Forecasting; (2) Environmental Remediation; and (3) Pollution Prevention and Control.
Within each Sub-function are the agency-specific business functions, processes, and activities
(see Figure 8.3.4-2).³⁶

³⁵ Federal Enterprise Architecture - Business Reference Model. The current version can be found at:
http://www.whitehouse.gov/omb/egov/a-3-brm.html
President, Office of Management and Budget. A current version of the profile can be found here:
Federal agencies are currently using the FEA reference models to plan and develop their annual budgets and set strategic goals. Agencies’ annual budget submissions to OMB for IT must describe how these investments “align” to the business, performance, service component, and technical reference models. In practical terms, this means that agencies must describe their IT investments in terms of the business operations they will support, the functional capabilities they intend to deliver, the supporting technologies used to build or deliver the capabilities, and performance impacts.\(^{37}\)

By providing a common language to describe the relationship between Federal business operations, technology, and information, the FEA enables the Government to identify opportunities to leverage technology which:

- Reduce unnecessary redundancy
- Facilitate intergovernmental information sharing
- Establish a direct relationship between IT and agency performance to support citizen centered, customer-focused Government
- Maximize IT investments to better achieve mission outcomes\(^{38}\)

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\(^{38}\) *Federal Enterprise Architecture Records Management Profile,*
9. DODAF META-MODEL

Note: This section describes the DoDAF Meta-model (DM2), which replaces the Core Architecture Data Model referenced in previous versions of DoDAF.

The DM2 provides a high-level view of the data normally collected, organized, and maintained in an architecture effort. It also serves as a roadmap for the reuse of data under the federated approach to architecture development and management. Reuse of data among communities of interest provides a way for managers in any level or area of the Department to understand what has been done by others, and also what information is already available for use in their architecture, and management decision-making efforts.

The DM2 has several levels, each of which is important to a particular viewer of Departmental processes. A conceptual level or Conceptual Data Model (CDM) is described in this volume and defines the high-level data constructs from which architectures are created in non-technical terms, so that executives and managers at all levels can understand the data basis of architecture.

The Logical Data Model (LDM) adds technical information, such as attributes to the CDM and, when necessary, clarifies relationships into an unambiguous usage definition. The Logical data Model is described further in Volume 2.

A Physical Exchange Specification (PES) is described in Volume 3, and consists of the Logical Data Model with general data types specified and implementation attributes (e.g., source, date) added, and then generated as a set of XSD’s, one schema per DoDAF-described View, except for the OV-1.

The DM2 defines architecture data elements and enables the integration and federation of architectures. It establishes a basis for semantic (i.e. understanding) consistency within and across architectures. In this manner, the DM2 supports the exchange and reuse of architecture information among Joint Capability Areas (JCAs), Components, and Federal and Coalition partners, thus facilitating the understanding and implementation of interoperability of processes and systems. As the DM2 matures to meet the ongoing data requirements of process owners, decision makers, architects, and new technologies, it will to a resource that more completely supports the requirements for architecture data, published in a consistently understandable way, and will enable greater ease for discovering, sharing, and reusing architecture data across organizational boundaries.

In order to facilitate the use of information at the data layer, the DoDAF describes a set of views for visualizing data through graphic, tabular, or textual means. These views are contained in eight (8) data groups, each of which contribute to more specific views that respond to requirements for producing an architecture.

a. 9.1 The DoDAF Conceptual Data Model. The CDM defines concepts involving high-level data constructs from which architectures are created, enabling executives and managers at all levels to understand the data basis of architecture. The CDM also
describes the relationships among data constructs in relatively non-technically and easily understood terms. Figure 9.1-1 is a graphical representation of the CDM. Definitions for the CDM are in Appendix B. Underlying the CDM is a foundation the utilizes common data modeling constructs that facilitate the reuse of common data patterns.

The top-level foundation elements are:

a. **Thing**, similar to other model’s “object”
b. **Individual**, a “thing” that exists as an indivisible whole, or as a single member of a category.
c. **Type**, a set of individuals or classes of other sets or classes
d. **Tuple**, ordered places of “things” (e.g. a block in a spreadsheet or a table)

These foundation elements are similar to many other foundation high-level data constructs that exist in the industry. The common patterns that are reused are:

a. **Composition** (or whole-part)
b. **Super/Sub Type** (or generalization/specialization, e.g. tank or main battle tank)
c. **Before/After**, for “things” that have time-related relationships in their Type
d. **Interface**, for “things” that can exchange other things that are parts of themselves

Composition and Super/Sub Type apply to almost all architecture concepts. Before/After is frequently used to model before/after situations, while Interface applies to few concepts, limited at this time to the pattern describing Activity.
Figure 9-1: DoDAF Conceptual Data Model
10. ARCHITECTURE-BASED ANALYTICS

Architecture-based analytics includes all of the processes that transform architecture data into useful information in support of the decision making process. Various types of analysis are described below (static vs. dynamic), along with descriptions of desirable characteristics for the overall architecture data set needed for successful and accurate analysis capability. Architectures are an ideal construct to use in decision-making since they represent the most current, and accurate information about a program or mission requirement.

10.1 Analytics Context

DoDAF 2.0 has been designed to facilitate collection of data usable through quantitative, repeatable, analytical processes to support decisions at all levels of enterprise and/or system engineering. Architecture views (formerly ‘products’) are no longer the end goal, but are described solely to facilitate useful access to information in the architecture database. All views are tailorable. The requirements for data completeness and self-consistency within the data schema are more critical than the view chosen at any particular time by a particular user. Analytics, properly conducted, represent a powerful tool for the decision-maker, ensuring that the most appropriate and current, as well as valid data is used for decision-making.

Figure 10.1-1 below, an adaptation of Figure 1.3-1, from Section 1, illustrates the overall architecting process. More specifically, it illustrates that analytics, the process of doing analysis with and on architecture data, is central to successful decision-making. Analysis defines and describes potential courses of action (i.e. alternatives) that can be considered when considering a mission or program decision.

![Figure 10.1-1: Analytics Process, Central to transforming architectural data into usable forms to support decision-makers](figure)
Architecture development is an iterative process, evolved over time. Analyses developed from
architecture data remain valid only as long as the processes and information do not change, and
management decision-making remains focused on the same problem for which the architecture
data was collected. When any of these variables (i.e. architecture purpose, process steps,
information, or management direction) change, then previous analyses should be reviewed to
determine if the previous analysis needs to be redone, based on the newly provided information.
Constant feedback and examination needs to be understood as natural in an environment where
program direction and priorities are constantly in flux.

The need for an iterative analytical capability points towards tool-assisted and tool-supported
analyses whenever possible. Process steps, such as re-running analyses, that are difficult or time
consuming to perform will likely not be performed unless automated. The iterative approach (as
depicted in Figure 10.1-2) of build a little, use a little, build a little, … enables architectures to
achieve incremental, reachable goals early and throughout the entire architecture life-cycle
process.

10.2 Architecture Analytics is a process that uses architecture data to support decision-
making through automated extraction of data from a structured dataset. Automated extraction
may be nothing more than results from a query into a database. Architectures well designed, and
consistent with the purpose for which they were created, are also well suited to the analytics
process.

10.3 Types of Architecture Analysis
There are two categories of analytical activity. These are:

- Static Analyses: Those analyses, which are based on making a value judgment, based on
data extracted from the architecture. For example, analysis of the weather patterns and
measurements for the last 50 years to determine trends and correlations would be static
analyses.

- Dynamic Analyses: Those analyses, which are based on “running” an executable version of
the architecture to observe the overall behavior of the model. For example, the construction
and execution of a dynamic weather prediction model to determine the possible future
weather trends is an example of dynamic analysis.
10.4 Examples of Analytics

Analytics can be used in conjunction with many aspects of the architecting process. Examples of analytical support can be found within DOTLMPF, as shown in Table 10.4-1, below. DOTLMPF is the analysis of who (people, organization, leadership) perform what operations (doctrine) at which locations (facilities) using (training) which system resources (material) to produce and consume information and data. DOTLMPF analysis leads to better definitions of warfighting capabilities by being able to anticipate effects and assess impact of change on domains and by examining usage (who/what affects something) and references (who/what is affected by something). DOTLMPF domains map to DoDAF architecture elements with the following analytical support activities.

<table>
<thead>
<tr>
<th>DOTMLPF Domains</th>
<th>DoDAF Architecture Elements</th>
<th>Analytical Support Activities</th>
</tr>
</thead>
<tbody>
<tr>
<td>Doctrine</td>
<td>Functions, Performers, Assets, Locations, Nodes</td>
<td>Examine Tactics, Techniques and Procedures</td>
</tr>
<tr>
<td>Organization</td>
<td>Performers, Org Units</td>
<td>Examine organizational structure</td>
</tr>
<tr>
<td>Training</td>
<td>Functions, Performers, Assets</td>
<td>Train personnel on their activities and the systems they use</td>
</tr>
<tr>
<td>Leadership</td>
<td>Org Units, Performers, Assets</td>
<td>Examine leadership issues</td>
</tr>
<tr>
<td>Materiel</td>
<td>Functions, Material, Data, Information, Location, Assets, Performers</td>
<td>Examine materiel solutions – a new system?</td>
</tr>
<tr>
<td>Personnel</td>
<td>Performers</td>
<td>Examine personnel solutions – new personnel or personnel with better qualifications</td>
</tr>
<tr>
<td>Facilities</td>
<td>Locations</td>
<td>Examine fixing, building or modifying facilities</td>
</tr>
</tbody>
</table>

It is not the intent for DoDAF to prescribe all possible analytical activities. The list above is only a partial listing of potential activities that relate to DoDAF architecture elements useful to the DOTMLPF Domains. As more demands are placed on architecture, and as industry spawns more automation, the flexibility described in DoDAF will encourage further innovation from architects and from tool vendors.

10.5 Principles of Architecture Analytics

The five key foundational principles of architecture analytics are described below. These principles help in maintaining quality architecture and foster further innovation for spawning new analytical activities in the future.

10.5.1 Information Consistency. Information consistency means that data (and its derived information) within the architecture descriptions is consistent with an overarching metadata structure (called a ‘schema’). In addition to adhering to the explicit syntax rules of the schema, data also needs to be consistent with any additional rules specified for the project. Information consistency is often checked to some degree by commercial architecture tools, and additional checking capabilities can be implemented to help assure a more reliable architecture product.

Information consistency also refers to whether the data in one section of the architecture description agrees with the data in another section. For instance, if a specific Activity is assigned...
to a role in one place, yet in another portion of the architecture, that role is shown as not having
responsibility for that activity, this would be a information inconsistency. This is normally
because the underlying architectural data is found in two or more places. In this case, the tool
itself or some configurable process must perform rule-based checks for redundancy to ensure the
data in multiple places is consistent. Consistency also involves architecture integration where
the underlying architectural data is stated only once—one fact, one place—and the architectural
views are projections of a single, inherently consistent model.

10.5.2 Data Completeness. Data completeness refers to the requirement that all required
attributes of data elements are specified. For example, a set of system functions where only
some of the functions have associated textual descriptions would not be data complete. Data
completeness also refers to the property of having all necessary data to perform certain analyses, view (product/artifact) generation, and/or simulations or executable architectures.

Analytics demands that the architecture data be understandable. Not every analytical procedure
will need to examine every part of the architecture. However, no analytical procedure can
analyze an architecture that it cannot sufficiently understand, so the architecture’s structured
dataset must be complete enough to support required analytics, thus making it essential that the
structured dataset support and define all aspects of the architecture. The architectural model, the
projections of the model, and the transformations of the model should, to the extent possible, be
based upon open standards. Open standards allow analytics choices.

10.5.3 Transformation. Many decisions require the use of data contained in datasets created
by different toolsets. Utilizing the data for analysis may require a transformation of the data into
an alternative structure, which in turn may be accessed by another tool. Transformation allows
the intellectual capital invested in the architecture to reach beyond the set of tools used in
creating it.

10.5.4 Iteration. Analysis must support an iterative architecture refinement and decision
process (refer to Figure 10.1-2). Analysis that takes too long in any iteration will quickly
become irrelevant to the overall process. Rather, small iterative steps or modules should be
created that will produce reliable, trustable results.

10.5.5 Lack of Ambiguity. An architecturally structured dataset must make clear the
meaning of each defined element. If there are semantically variable architectural constructs, they
cannot be accurately analyzed by multiple analysis tools. This limits the scope and effectiveness
of analytics and therefore limits the usefulness of the architecture itself. Semantic specificity is
essential to gain the full benefit of analytics.
11. CONFIGURATION MANAGEMENT OF THE DODAF ARCHITECTURE

Configuration management (CM) provides an orderly way to facilitate change, based on a documented requirements baseline, and utilizing best practices in the change management process. This is intended to ensure that expectations are fully understood and realized in an efficient manner, including proper consideration of all potential impacts on customers and resources. CM is a necessary and critical process to assure an orderly and stable evolution of any architecture and also to ensure that the DoDAF remains current in the face of evolving methods and techniques of architecture creation and management.

This section provides a summary overview of the two primary aspects of configuration management of DoD enterprise architecture efforts:

- Configuration management guidance to developers of specific instance architectures prepared within DoD in accordance with the DoDAF.

These CM activities are complementary with existing DoD CM processes for the DoD Architecture Registry System (DARS), the DoD Information Technology Standards Registry (DISR), and the Metadata Registry (MDR). A more comprehensive description of the overall CM Process is found online in the DoDAF Journal, https://www.us.army.mil/suite/page/454707.

11.1 Configuration Management Authority

The Configuration Management Authority for the contents of the DoDAF document is The Chief Information officer (CIO), OASD (NII).

11.2 Configuration Management Guidance for Program Managers

There are many benefits to the Department gained by adhering to a CM Program in the production of architecture data, thus providing consistency to the creation and utilization of presentation views, while still allowing flexibility in graphical presentation. These include:

- Utilization of the DM2 (Conceptual, Logical and Physical Exchange Specification) in architecture data collection, organization, storage, and documentation.
- Utilization of DoDAF technical guidance (Contained in Volume 2, and the DoDAF Journal, https://www.us.army.mil/suite/page/454707) in the creation and graphical representation of views, based on architecture data and a desired viewpoint. This is accomplished by:
  - DoDAF definition of attributes for common architecture views. Thus, there is a known basis for making change to architecture views, and a means for evaluating the effectiveness of that change according to the chosen viewpoint.
  - DoDAF representation of a common vocabulary and grammar for documenting architectures thus facilitating common understanding among DoD components, ensuring
interoperability in exchanging architecture data and federation of individual architectures within a higher tier enterprise view.

- **Traceability of Requirements.** Architectural data can more easily be associated with baseline requirements, and, as requirements change, the associated impacts on present and future actions can more easily be evaluated, and more accurately reflect the change requirement.

- **Configuration Identification.** Utilization of DoDAF data elements allows a consistent identification of Configuration Items (CIs), which are currently defined as:
  - **The “Vocabulary”** - The Elements (e.g. process, system function, Capability, etc.) and Views (AV, OV, SV, TV, etc.) that describe the behavioral, tabular, mapping, ontological, and structural representations of an architecture.-The metadata (e.g. Information about data in the architecture).
  - **The “Grammar”** - The formal conceptual and logical relationships between elements and products of the “Vocabulary” – The Conceptual and Logical Data Model.
  - **The Presentation Guidelines** – “Fit for Purpose” view points, dashboards, decision views, etc.—The “Architecture Results”
  - **Methods and Process Guidelines**
  - **The DoDAF Document** - The narrative volumes comprising the DoDAF.

- **Organized Process.** Change activity is controlled through a known, documented, and organized process.

- **Improved Change Management.** Architecture data can be better managed to produce stable and consistent requirements to guide the development of interoperable systems, processes, and procedures.

- **Improved Analysis and Trades.** Analyses that better reflect customer need through common understanding and explicit documentation of architecture baselines and change evolution.

### 11.2.1 Configuration Management Implementation

Each architecture effort must establish a configuration management process and document it in a CM plan. This plan is submitted when each version or update to the architecture is submitted to DARS for registration and discovery. In developing CM processes for architectures it is recommended that “best practices” be adopted such as those outlined in EIA Standard EA-649. This a flexible, but well-defined standard employed most often at the ‘enterprise’ level. Its flexibility lies in the ability to provide CM practices that can be selectively applied to the degree necessary for each of the areas to be covered under this plan.

### 11.2.2 Evaluating Architecture Changes

Appropriate evaluation criteria should be developed in the CM Plan and applied according to the scope and tier of the architecture effort. The evaluation criteria must include factors that test compliance with the Net-Centric Reference Architectures and the DoD IE as outlined in Section 3.0 of the DoDAF and the Net-Centric Guidance contained in Volume 2. The results of architecture evaluations should be used to guide

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decisions for approving proposed changes, as well as in planning future extensions or updates to
the architecture.

11.2.3 The DARS Registration Process. Consistent with the federated architecture approach
described in Section 3, essential architecture information must be registered with DARS so that
discovery of reusable architecture data can be accomplished throughout the Department.
Generally, and as further described in the instructions on registration contained online in the
DARS, this consists of the Overview and Summary Information (AV-1) which can be completed
online, and the Configuration Control Plan (CCP) that describes how the organization intends to
manage and periodically update its information. Individual data entities and other artifacts are
similarly registered in the DoD Metadata Registry.

11.3 Configuration Control Board (CCB). The DoD Architecture Configuration Control
Board (CCB) provides an organized management review process to ensure validity, currency,
and timeliness of architecture data described over time. The board provides configuration
management and control carefully scoped and administered to reduce the burden and complexity
of architecture sharing and maintenance, as well as update, while providing flexibility to the
DoD community in the continued management of their architectural products and associated
data. The CCB Consists of members appointed by the Deputy DoD CIO, and includes
representatives of the Joint Staff, OSD, The Military Services, Combatant Commands, and
Defense Agencies.

11.4 Technical Working Groups (TWGs). The CCB may, from time to time, establish
technical working groups (TWG), as required, to oversee, review, and make recommendations to
the board on specific technical aspects of the CM Program, or configuration items. TWGs
provide the subject-matter expertise necessary to ensure that documents, database schemas, and
other products under configuration control of the CCB are maintained in a responsible manner.
TWGs, when tasked by the CCB, provide detailed and comprehensive technical review of
proposed changes and recommendations to the CCB on action(s) to be taken that result from
recommended changes. Both permanent members of the CCB and members of all technical
working groups are notified about all CCB meetings and all scheduled TWG sessions, as are the
Combatant Commands and Defense Agencies.
12. RELATIONSHIPS TO OTHER ARCHITECTURE FRAMEWORKS/
REFERENCE DOCUMENTS

DoDAF is designed to align, map, and socialize with industry, allies with their own national
frameworks, and other reference documents required for interoperability, reuse, and operational
purposes. The DoDAF approach to alignment is to incorporate relevant concepts into DoDAF
from other frameworks and reference documents and understand, integrate and describe the
differences.

12.1 Frameworks

12.1.1 Federal Enterprise Architecture (FEA) Program

The FEA promotes shared development for common Federal processes, interoperability, and
sharing of information among the Agencies of the Federal Government and other Governmental
entities through the use of a set of reference models and practices that apply to all Federal
agencies in the Executive branch. The FEA Practice Guidance uses a segment architecture
approach that allows critical parts of the overall Federal Enterprise, called architectural
segments, to be developed individually, while integrating these segments into the larger
Enterprise Architecture. The DoDAF leverages the FEA construct and core principles to provide
the Department with the enterprise management information it needs to achieve its strategic
transformation goals, while ensuring that upward reporting and review can be accomplished
against the FEA.

The current version of the FEA can be found at the E-Gov Website:
http://www.whitehouse.gov/omb/egov/a-1-fea.html

12.1.2 The Zachman Framework

The Zachman Framework provides a formal and highly structured way of defining an enterprise.
It is based on a two-dimensional classification model, displayed as a matrix, which utilizes 6
basic communication interrogatives (What, How, Where, Who, When, and Why) and
intersecting 6 distinct model types which relate to stakeholder groups (Planner, Owner, Designer,
Builder, Implementer and Worker) to give a holistic view of the enterprise. Decomposition of
the matrix allows for several diagrams of the same data sets to be developed for the same
architecture, where each diagram shows an increasing level of detail. DoDAF v2.0 supports the
needs of various stakeholders’ perspective by supporting various levels of abstraction and
granularity.

The Zachman Framework can be found at the Zachman International Website:
http://zachmaninternational.com/index.php/the-zachman-framework/26-articles/13-the-zachman-
framework-a-concise-definition.

12.1.3 The Open Group Architecture Framework (TOGAF)
TOGAF is a comprehensive architecture framework and methodology, which enables practitioners to design, evaluate, and build an appropriate architecture for the organization. The TOGAF Architecture Development Method (ADM) supports the TOGAF architecture development approach for architectures that meet business needs. TOGAF’s ADM prescribes methodology, not products, or modeling notation, and should be used with other architecture frameworks as appropriate. TOGAF evolved from the DoD Technical Architecture Framework for Information Management (TAFIM). DoDAF v2.0 and TOGAF both provide a practical, design agnostic method for creating enterprise architectures. The DoDAF v2.0 “Fit for Purpose” approach for developing views, presentations, or generated reports are based on TOGAF’s business, data, application, and technology views.

The latest version of TOGAF can be found at the Open Group Website:
http://www.opengroup.org/architecture/togaf/

12.1.4 The Ministry of Defense Architecture Framework (MODAF)

MODAF is based on the DoDAF version 1.0 baseline, which it represents through the MODAF Meta Model (M3). MODAF retains compatibility with US modeling initiatives, but is specifically designed to support architecture modeling for the UK Ministry of Defense (MOD) business. MODAF uses aspects of the existing DoDAF with additional viewpoints (acquisition, capability) that are required to support MOD processes, procedures, and organizational structures. The additional viewpoints provide a rigorous method for understanding, analyzing, and specifying capabilities, systems, System of Systems (SoS), business processes, and organizational structures. DoDAF v2.0 incorporates the data elements from MODAF required to support an acquisition and capability views in Version 2.0.

The latest version of the MODAF can be found at the MODAF Website:
http://www.modaf.org.uk/

12.1.5 NATO Architecture Framework (NAF)

The NAF provides the rules, guidance, and product descriptions for developing, presenting, and communicating architectures across NATO and other national boundaries. Earlier versions of NAF were tightly coupled to the DoDAF. NAF’s new features include a capability, service-oriented, and program view. DoDAF v2.0 has adopted the capability and program views described in NAF as defined by NAF.

The NATO Architecture Framework can be found at the NATO Website (Requires User Registration)

12.2 Other Reference Documents

12.2.1 DoD Information Enterprise Architecture Reference (DoD IEA)  [Add in DoD IEA Info]
TBD
APPENDIX A ACRONYMS

This is the integrated DoDAF v2.0 acronyms and their definitions. Some have more than one definition depending on their usage; they could have a specific meanings in Architecture as well as generic English language usage.

<table>
<thead>
<tr>
<th>Term</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>A&amp;T</td>
<td>Acquisition and Technology</td>
</tr>
<tr>
<td>AIS</td>
<td>Automated Information System</td>
</tr>
<tr>
<td>ASD (C3I)</td>
<td>Assistant Secretary of Defense for Command, Control, Communications, and Computer Systems Directorate, Joint Staff</td>
</tr>
<tr>
<td>AV</td>
<td>All Viewpoint</td>
</tr>
<tr>
<td>BMM</td>
<td>Business Motivation Model</td>
</tr>
<tr>
<td>BPMN</td>
<td>Business Process Modeling Notation</td>
</tr>
<tr>
<td>BPR</td>
<td>Business Process Reengineering</td>
</tr>
<tr>
<td>BRM</td>
<td>Business Reference Model</td>
</tr>
<tr>
<td>BT</td>
<td>Business Transformation</td>
</tr>
<tr>
<td>BTA</td>
<td>Business Transportation Agency</td>
</tr>
<tr>
<td>CADM</td>
<td>Core Architecture Data Model</td>
</tr>
<tr>
<td>C3I</td>
<td>Command, Control, Communications, and Intelligence</td>
</tr>
<tr>
<td>C4ISR</td>
<td>Command, Control, Communications, Computers, Intelligence, Surveillance, and Reconnaissance</td>
</tr>
<tr>
<td>CDM</td>
<td>Conceptual Data Model</td>
</tr>
<tr>
<td>CCB</td>
<td>Configuration Control Board</td>
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<tr>
<td>CDM</td>
<td>Conceptual Data Model</td>
</tr>
<tr>
<td>CI</td>
<td>Configuration Item</td>
</tr>
<tr>
<td>CIO</td>
<td>Chief Information Officer</td>
</tr>
<tr>
<td>CJCS</td>
<td>Chairman of the Joint Chiefs of Staff</td>
</tr>
<tr>
<td>CJCSI</td>
<td>Chairman of the Joint Chiefs of Staff Instruction</td>
</tr>
<tr>
<td>CM</td>
<td>Configuration Management</td>
</tr>
<tr>
<td>COI</td>
<td>Communities of Interest</td>
</tr>
<tr>
<td>CPIC</td>
<td>Capital Planning and Investment Control</td>
</tr>
<tr>
<td>CPM</td>
<td>Capability Portfolio Management</td>
</tr>
<tr>
<td>CRM</td>
<td>Consolidated Reference Model</td>
</tr>
<tr>
<td>CV</td>
<td>Capability Viewpoint</td>
</tr>
<tr>
<td>CWID</td>
<td>Coalition Warrior Interoperability Demonstration</td>
</tr>
<tr>
<td>D</td>
<td>DoD Architecture Enterprise Services</td>
</tr>
<tr>
<td>DARS</td>
<td>Department of Defense Architecture Registry System</td>
</tr>
<tr>
<td>DAS</td>
<td>Defense Acquisition System</td>
</tr>
<tr>
<td>DDMS</td>
<td>DoD Discovery Metadata Specification</td>
</tr>
<tr>
<td>DFD</td>
<td>Data Flow Diagrams</td>
</tr>
<tr>
<td>DIE</td>
<td>DoD Information Enterprise</td>
</tr>
<tr>
<td>Term</td>
<td>Definition</td>
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<td>-------------------------------------------------------------------------------------------------------------------------------------------</td>
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<tr>
<td>DIEA</td>
<td>DoD Information Enterprise Architecture</td>
</tr>
<tr>
<td>DISR</td>
<td>DoD Information Technology Standards Registry</td>
</tr>
<tr>
<td>DIV</td>
<td>Data &amp; Information Viewpoint</td>
</tr>
<tr>
<td>DM2</td>
<td>DoDAF Meta-model</td>
</tr>
<tr>
<td>DoD</td>
<td>Department of Defense</td>
</tr>
<tr>
<td>DoD EA</td>
<td>DoD Enterprise Architecture</td>
</tr>
<tr>
<td>DoD EA BRM</td>
<td>DoD EA Business Reference Model</td>
</tr>
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<td>DoDAF</td>
<td>DoD Architecture Framework</td>
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<td>DODI</td>
<td>Department of Defense Instruction</td>
</tr>
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<td>DRM</td>
<td>Data Reference Model</td>
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<td>EA</td>
<td>Enterprise Architecture</td>
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<td>EAAF</td>
<td>Enterprise Architecture Assessment Framework</td>
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<tr>
<td>EAMMF</td>
<td>Enterprise Architecture Management Maturity Framework</td>
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<td>EIA</td>
<td>Electronic Industries Alliance</td>
</tr>
<tr>
<td>ES</td>
<td>Enterprise Services</td>
</tr>
<tr>
<td>FEA</td>
<td>Federal Enterprise Architecture</td>
</tr>
<tr>
<td>FEA RM</td>
<td>Federal Enterprise Architecture Reference Model</td>
</tr>
<tr>
<td>FEAF</td>
<td>Federal Enterprise Architecture Framework</td>
</tr>
<tr>
<td>FIPS</td>
<td>Federal Information Processing Standard</td>
</tr>
<tr>
<td>GAES</td>
<td>GIG Architecture Enterprise Services</td>
</tr>
<tr>
<td>GAO</td>
<td>Government Accountability Office</td>
</tr>
<tr>
<td>GIG</td>
<td>Global Information Grid</td>
</tr>
<tr>
<td>IDEF</td>
<td>Integration Definition (IEEE)</td>
</tr>
<tr>
<td>IDEF0</td>
<td>Integration Definition for Activity Modeling</td>
</tr>
<tr>
<td>IDEF1X</td>
<td>Integration Definition for Data Modeling</td>
</tr>
<tr>
<td>IDEF3</td>
<td>Integration Definition for Process Description Capture</td>
</tr>
<tr>
<td>ISO</td>
<td>International Standards Organization</td>
</tr>
<tr>
<td>IT</td>
<td>Information Technology</td>
</tr>
<tr>
<td>JCA</td>
<td>Joint Capability Area</td>
</tr>
<tr>
<td>JCIDS</td>
<td>Joint Capabilities Integration and Development System</td>
</tr>
<tr>
<td>JCS</td>
<td>Joint Chief of Staff</td>
</tr>
<tr>
<td>JFCOM</td>
<td>US Joint Forces Command</td>
</tr>
<tr>
<td>JP</td>
<td>Joint Publication</td>
</tr>
<tr>
<td>LDM</td>
<td>Logical Data Model</td>
</tr>
<tr>
<td>LOB</td>
<td>Line of Business</td>
</tr>
<tr>
<td>M3</td>
<td>MODAF Meta Model</td>
</tr>
<tr>
<td>MOD</td>
<td>Ministry of Defense (UK)</td>
</tr>
<tr>
<td>MODAF</td>
<td>Ministry of Defense Architecture Framework</td>
</tr>
<tr>
<td>NAF</td>
<td>NATO Architecture Framework</td>
</tr>
<tr>
<td>Term</td>
<td>Definition</td>
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</tr>
</tbody>
</table>
| NC   | Net-Centric  
<pre><code>  | Net Centric (JCA)  |
</code></pre>
<p>| NCDS | Net-centric Data Strategy  |
| NCDSWG | Net Centric Data Strategy Working Group  |
| NCE  | Net-Centric Environment  |
| NCES | Net-Centric Enterprise Services  |
| NCO  | Net-Centric Operations  |
| NCOW | Net-Centric Operations and Warfare  |
| NCOW RM | Net-Centric Operations and Warfare Reference Model  |
| NII  | Networks and Information Integration  |
| NSS  | National Security Systems  |
| OASD | Office of the Assistant Secretary of Defense  |
| OMB  | Office of Management and Budget  |
| OOAD | Object-Oriented Analysis &amp; Design Technique  |
| OSD  | Office of the Secretary of Defense  |
| OSD(NII) A&amp;I | Office of the Secretary of Defense Networks and Information Integration Architectures and Integration  |
| OV   | Operational Viewpoint  |
| PDA  | Personal Digital Assistant  |
| PDCA | Plan, Do, Check, Act  |
| PDM  | Physical Data Model  |
| PEOs | Program Executive Office  |
| PFD  | Process Flow Diagram  |
| PIM  | Portfolio Management  |
| PPBE | Planning, Programming, Budgeting, and Execution  |
| PRM  | Performance Reference Model  |
| PTD  | Process Task Dependency  |
| PV   | Project Viewpoint  |
| QA   | Quality Assurance  |
| QC   | Quality Control  |
| RM   | Reference Model  |
| SADT | Structured Analysis and Design Technique  |
| SE   | Systems Engineering  |
| SECDEF | Secretary of Defense  |
| SEI  | Systems Engineering Institute  |
| SeV  | Systems Viewpoint  |
| SLC  | Shelf-Life Code  |
| SOA  | Service-Oriented Architecture  |
| SRM  | Service Component Reference Model  |
| SrV  | Service Viewpoint  |
| StdV | Standards Viewpoint  |
| SUMO | Suggested Upper Merged Ontology  |
| SysML | Systems Modeling Language  |</p>
<table>
<thead>
<tr>
<th>Term</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>TA</td>
<td>Technical Architecture ??</td>
</tr>
<tr>
<td>TAFIM</td>
<td>Technical Architecture for Information management</td>
</tr>
<tr>
<td>TOGAF</td>
<td>The Open Group Architecture Framework</td>
</tr>
<tr>
<td>TRM</td>
<td>Technical Reference Model</td>
</tr>
<tr>
<td>TSAT</td>
<td>Transformational Communications Satellite</td>
</tr>
<tr>
<td>TTP</td>
<td>Tactics, Techniques, and Procedures</td>
</tr>
<tr>
<td>TWG</td>
<td>Technical Working Groups</td>
</tr>
<tr>
<td>UML</td>
<td>Unified Modeling Language</td>
</tr>
<tr>
<td>URL</td>
<td>Uniform Resource Locator</td>
</tr>
<tr>
<td>USD(AT&amp;L)</td>
<td>Under Secretary of Defense for Acquisition, Technology &amp; Logistics</td>
</tr>
<tr>
<td>USJFCOM</td>
<td>United States Joint Forces Command</td>
</tr>
<tr>
<td>V&amp;V</td>
<td>Validation &amp; Verification</td>
</tr>
<tr>
<td>WBS</td>
<td>Work Breakdown Structure</td>
</tr>
<tr>
<td>XSD</td>
<td>XML Schema Definition</td>
</tr>
</tbody>
</table>

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## Appendix B  Conceptual Data Model Definitions

### Table B-1: Conceptual Data Model Definitions

<table>
<thead>
<tr>
<th>Class</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Activity</td>
<td>A discrete unit of work, not specific to a single organization, weapon system, or individual that transforms inputs into outputs or changes their state.</td>
</tr>
<tr>
<td>Accuracy</td>
<td>The nearness of an functional goal to the true value</td>
</tr>
<tr>
<td>Agreement</td>
<td>A consent among parties regarding the terms and conditions of activities that said parties participate in.</td>
</tr>
<tr>
<td>Capacity</td>
<td>The amount an object can hold, receive, or absorb.</td>
</tr>
<tr>
<td>Capability</td>
<td>Capability: (n) 1. The ability to execute a specified course of action. (JP 1-02) 2. The ability to achieve a desired effect under specified standards and conditions through combinations of means and ways to perform a set of tasks. (JCIDS)</td>
</tr>
<tr>
<td>CapabilityConfiguration</td>
<td>A combination of organizational aspects (with their competencies) and equipment that combine to provide a capability.</td>
</tr>
<tr>
<td>Condition</td>
<td>A statement of the values or states needed for the execution of an action.</td>
</tr>
<tr>
<td>Constraint</td>
<td>The range of permissible states for an object.</td>
</tr>
<tr>
<td>Cost</td>
<td>1. Cost - financial: The price paid to acquire, produce, accomplish, or maintain anything. 2. Cost - general: The expenditure of something, such as time or labor, necessary for the attainment of a goal.</td>
</tr>
<tr>
<td>Data</td>
<td>Factual information used as a basis for processing, reasoning, discussion, calculation, or decision making by humans or machines.</td>
</tr>
<tr>
<td>Dependability</td>
<td>(SEI): Availability / Robustness, Reliability, Safety, Trustworthiness, Security</td>
</tr>
<tr>
<td>Effect</td>
<td>(JP 1-02) Effect: (n) the result, outcome, or consequence of an action [activity].</td>
</tr>
<tr>
<td>Event</td>
<td>Something that happens at an instant in the world that causes a process to be launched.</td>
</tr>
<tr>
<td>Facility</td>
<td>Real property, having a specified use, consisting of one or more of the following: a building, structure, or linear structure. Facilities are parts of Sites, which are parts of Installations.</td>
</tr>
<tr>
<td>ExchangeObject</td>
<td>A constraint on or dependence of, an activity on one or more outside influences, conditions, activities, triggers or events.</td>
</tr>
<tr>
<td>FunctionalStandard</td>
<td>An object that encompasses meteorological, geographic, and control features mission significance.</td>
</tr>
<tr>
<td>GeoFeature</td>
<td>Goal: An end toward which long-term, ongoing effort is directed.</td>
</tr>
<tr>
<td>Goal</td>
<td>An authoritative statement intended to lead or steer the execution of actions.</td>
</tr>
<tr>
<td>Guidance</td>
<td>An instance of knowledge or data that exists in any medium or form and can be communicated or received.</td>
</tr>
<tr>
<td>Information</td>
<td>(DODI 4165.14): A base, camp, post, station, yard, center, or other activity, including leased facilities, under the jurisdiction, custody, or control of a Performer [the Secretary of Defense or the Secretary of a Military Department or, in the case of an activity in a foreign country, under the operational control of the Secretary of Defense or the Secretary of a Military Department], without regard to the duration of operational control. An installation may include one or more sites.</td>
</tr>
<tr>
<td>Materiel</td>
<td>Equipment, apparatus, or supplies that are of military interest, without distinction as to its application for administrative or combat purposes.</td>
</tr>
<tr>
<td>Measure</td>
<td>The magnitude of some attribute of an object.</td>
</tr>
<tr>
<td>Means</td>
<td>An action or system by which a result is brought about; a method</td>
</tr>
<tr>
<td>Network</td>
<td>An interconnected or interrelated chain, group, or system.</td>
</tr>
<tr>
<td>Class</td>
<td>Definition</td>
</tr>
<tr>
<td>----------------------------</td>
<td>-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Objective</td>
<td>Objective: (n) the clearly defined, decisive, and attainable end toward which every operation is directed. An objective is a specific, time-targeted, measurable, and attainable target that an enterprise seeks to meet in order to achieve its goals.</td>
</tr>
<tr>
<td>Organization</td>
<td>An assemblage of people and other resources organized through an observable power hierarchy for an on-going purpose.</td>
</tr>
<tr>
<td>Performer</td>
<td>Any entity - human, automated, or any aggregation of human and/or automated - that performs a function, activity, or role, or provides a capability.</td>
</tr>
<tr>
<td>PersonType(Personnel)</td>
<td>A category of persons defined by the activity or activities they share.</td>
</tr>
<tr>
<td>PerformerState</td>
<td>A stage in a process of change or development.</td>
</tr>
<tr>
<td>Plan</td>
<td>(BMM Concept Catalog): Courses of Action are what the enterprise has decided to do. A Course of Action is more than simply a resource, skill, or competency that the enterprise can call upon. A Course of Action is a way of configuring some aspect of the enterprise (things, processes, locations, people, and time) to channel efforts towards Desired Results - the result of a decision by the enterprise about the best way to use its resources, skills, and competencies. A Course of Action defines what has to be done, not how well it has to be done. Measures of Performance are defined in Objectives that are supported by the Courses of Action. Definition: means that is an approach or plan for configuring some aspect of the enterprise involving things, processes, locations, people, timing, or motivation undertaken to achieve ends Note: Categories of course of action include: strategy, tactic. Dictionary Basis: a mode of action; “if you persist in that course you will surely fail”; “once a nation is embarked on a course of action it becomes extremely difficult for any retraction to take place” [<a href="http://www.dictionary.com">www.dictionary.com</a>]. Source: WordNet® 2.0 ['course of action']. Dictionary Basis: a chosen manner of conducting oneself: way of acting “our wisest course is to retreat” [MWCD 'course' (3b)]. In the Business Motivation Model, Courses of Action are categorized as Strategies and Tactics. The model does not make a hard distinction between the two. Enterprises define their own criteria.</td>
</tr>
<tr>
<td>Project</td>
<td>A planned action that represents a set of activities organized and managed to produce a specified product in a specified period of time with specified resources. (DDDS Counter (19607/1) (A)).</td>
</tr>
<tr>
<td>Rate</td>
<td>The ratio of the effective or useful output to the total input in any system.</td>
</tr>
<tr>
<td>RealProperty</td>
<td>(DODI 4165.14): Land and improvements to land (i.e., facilities), equipment affixed and built into the facility as an integral part of the facility heating systems), but not movable equipment (e.g., plant equipment, industrial buoys). In many instances this term is synonymous with real estate.</td>
</tr>
<tr>
<td>Rule</td>
<td>A prescriptive set of procedures regarding the execution of activities within an enterprise.</td>
</tr>
<tr>
<td>Site</td>
<td>(DODI 4165.14): Physical (geographic) location that is or was owned by, leased to, or otherwise possessed by a Performer [DoD Component]. Each site is assigned to a single installation. A site may exist in one of three forms: (1) Land only, where there are no facilities present and where the land consists of either a single land parcel or two or more contiguous land parcels. (2) Facility or facilities only, where the underlying land is neither owned nor controlled by the government. A stand-alone facility can be a site. If a facility is not a stand-alone facility, it must be assigned to a site. (3) Land and all the facilities thereon, where the land consists of either a single land parcel or two or more contiguous land parcels.</td>
</tr>
<tr>
<td>SoftwareService</td>
<td></td>
</tr>
<tr>
<td>Skill</td>
<td>The ability, coming from one’s knowledge, practice, aptitude, etc., to do something well.</td>
</tr>
<tr>
<td>Class</td>
<td>Definition</td>
</tr>
<tr>
<td>----------------------------</td>
<td>----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Standard</td>
<td>A ratified and peer-reviewed specification of allowed values for outputs inputs or processes.</td>
</tr>
<tr>
<td>System</td>
<td>System: Any organized assemblage of procedures and human and/or non-human resources united and regulated by interaction or interdependence to accomplish a set of specific functions.</td>
</tr>
<tr>
<td>Task</td>
<td>A action, activity or undertaking enabling missions, activities, or functions to be performed or accomplished.</td>
</tr>
<tr>
<td>Technical Standard</td>
<td>(ISE FS 200): Technical standards document specific technical methodologies and practices to design and implement.</td>
</tr>
<tr>
<td>Timeliness</td>
<td>The time from the occurrence of an event to the time required action occurs.</td>
</tr>
<tr>
<td>Trigger</td>
<td>Recommend Delete as Milestone is a type of Event and can either be subclassed or made an attribute of the class of event</td>
</tr>
<tr>
<td>Vision</td>
<td>Vision (n) An end that describes the future state of the enterprise, without regard to how it is to be achieved; a mental image of what the future will or could be like.</td>
</tr>
<tr>
<td>Individual</td>
<td>A Thing that has spatio-temporal extent. Note - this may be some that existed in the past, exists now, or may exist in some future possible world.</td>
</tr>
<tr>
<td>superSubType</td>
<td>Extends couple.</td>
</tr>
<tr>
<td>Thing</td>
<td>The union of element, type, and tuples.</td>
</tr>
<tr>
<td>Tuple</td>
<td></td>
</tr>
<tr>
<td>Type</td>
<td></td>
</tr>
<tr>
<td>wholePart</td>
<td>Extends couple. A couple that asserts one (part) Individual is part of another (whole) Individual.</td>
</tr>
<tr>
<td>TemporalType</td>
<td>Sets of (and powersets based on) individuals that have temporal relations (time dimension before/after) with themselves or others over time.</td>
</tr>
<tr>
<td>beforeAfter</td>
<td>Extends couple.</td>
</tr>
<tr>
<td>CalendarPeriod</td>
<td></td>
</tr>
<tr>
<td>Country</td>
<td></td>
</tr>
<tr>
<td>endBoundary</td>
<td></td>
</tr>
<tr>
<td>GeoPoliticalArea</td>
<td></td>
</tr>
<tr>
<td>GeoPoliticalAreaState</td>
<td></td>
</tr>
<tr>
<td>overlapPart</td>
<td>A wholePart that relates a ProperOverlap to the Individual of which it is a part.</td>
</tr>
<tr>
<td>Region</td>
<td></td>
</tr>
<tr>
<td>RegionOfCountry</td>
<td></td>
</tr>
<tr>
<td>startBoundary</td>
<td></td>
</tr>
<tr>
<td>temporalBoundary</td>
<td></td>
</tr>
<tr>
<td>temporalWholePart</td>
<td>A wholePart that asserts the spatial extent of the (whole) individual is co-extensive with the spatial extent of the (part) individual for a particular period of time.</td>
</tr>
<tr>
<td>InterfaceType</td>
<td>Sets of (and powersets based on) spatio/temporal individuals that can have a boundary (common spatio-temporal existence) with other individuals.</td>
</tr>
<tr>
<td>Interface</td>
<td>A common boundary or interconnection between systems, equipment, concepts, or human beings.</td>
</tr>
</tbody>
</table>
APPENDIX C REFERENCES/BIBLIOGRAPHY

Consolidated Reference used in this Volume

ANSI/GEIA Standard EIA 649-A National Consensus Standard for Configuration Management
American National Standards Institute. This standard is available at:
http://www.techstreet.com/cgi-bin/detail?product_id=1160265

Chairman of the Joint Chiefs of Staff (CJCS) Instruction 3170.01E, Joint Capabilities Integration and Development System (JCIDS), 11 May 2005. A copy of the current version of the instruction and its accompanying Manual can be found at:

Department of Defense Directive (DoDD) 5000.1, The Defense Acquisition System, 12 May 2003
(certified current as of November 20, 2007). A current copy of the directive can be found at:

Department of Defense Directive (DoDD) 8115.01, Information Technology Portfolio Management, October 10, 2005. Office of the Assistant Secretary of Defense (Networks & Information Integration)(NII)/DoD Chief Information Officer (DoD CIO). The latest copy of this directive can be found at:
http://www.dtic.mil/whs/directives/corres/rtf/811501x.rtf

Department of Defense Instruction 4630.8, Procedures for Interoperability and Supportability of Information Technology (IT) and National Security Systems (NSS) 30 June 2004. Office of the Assistant Secretary of Defense (Networks & Information Integration)(NII)/ DoD Chief Information Officer (DoD CIO). The current version is found at:

Department of Defense Instruction (DoDI) 5000.2., Operation of the Defense Acquisition System,(2003) Under-Secretary of Defense (Acquisition, technology & Logistics) (OUSD AT&L). A current copy of this document can be found at:

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DoD Acquisition Guidebook. Office of the Under-Secretary for Acquisition, Technology & Logistics (AT&L). A current copy of the Guidebook can be found at:
Federal Enterprise Architecture (FEA). Executive Office of the President, Office of Management and Budget E-Gov Initiative. The current version of the FEA, and its associated reference models can be found at: [http://www.whitehouse.gov/omb/egov/a-2-EAModelsNEW2.html](http://www.whitehouse.gov/omb/egov/a-2-EAModelsNEW2.html)

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Intelligence Reform and Terrorism Prevention Act of 2004 (IRTPA), PL 108-458 (December 17, 2004)


The Open Group Architecture Framework (TOGAF), Version 8.11 The current version can be found at: http://www.opengroup.org/architecture/togaf/


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Schekkerman, Jaap (2004). How to Survive in the Jungle of Enterprise Architecture Frameworks. Victoria, BC: Trafford 222. pp. This volume is particularly valuable for its chart showing the evolution of architecture frameworks