DoD Architecture Framework

Version 2.03

Volume 1: Overview and Concepts

Manager's Guide

NORMATIVE

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Executive Summary

The Department of Defense Architecture Framework (DoDAF) is the overarching, comprehensive framework and conceptual model for architecture descriptions developed within the DoD. This framework helps Department of Defense (DoD) managers at all levels make effective decisions by sharing information across the Department, Joint Capability Areas (JCAs), missions, components, and programs. The DoDAF helps the DoD Chief Information Officer (CIO) develop and maintain architectures required by the Clinger-Cohen Act. It also supports guidance from the Office of Management and Budget (OMB) and other Departmental directives and instructions.

The DoDAF supports DoD's core decision-making processes, 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, Capabilities Portfolio Management (CPM), and Operations (OPS).

DoD Components are expected to conform to the DoDAF when they develop architectures within the Department.

The DoDAF allows architectural artifacts to be *fit-for-purpose*, that is, to be defined and described as an architectural description that is consistent with specific project or mission decision-making needs. Because architectural descriptions are employed at many levels, contexts, and purposes within the DoD, architectural descriptions vary in content, structure, and level of detail. Tailoring the architectural description development to address specific, well-articulated, and understood purposes is done to ensure the necessary data is collected at the appropriate level of detail to support specific decisions.

The DoDAF focuses on architectural data rather than architecture artifacts. The DoDAF identifies, defines, and specifies the information needed to describe architectures in DoD. Data can be collected, organized, and stored by a wide range of architecture tools developed by commercial sources. The focus on data supports production of fit-for-purpose models tailored to multiple uses and the analysis and simulation of architectural descriptions produced across Components to support DoD's core decision making processes. Consequently, tools should use the DoDAF Meta Model (DM2) specifications to exchange architectural data.

Visualizing architectural data is accomplished through models. A model, which can be displayed as diagrams, narrative text, matrices, tables, dashboards, or other representations, serves as a template for organizing and displaying data in format appropriate for a decision-maker. Thematic collections of models are referred to as viewpoints. A viewpoint focuses on data within the scope of some concern, such as capabilities, systems, or standards. A set of viewpoint models, accompanied by useful definitions of the terms they use, is an architectural description.

The DoDAF specification comprises three normative volumes and one informative volume.

- Volume 1, the manager's volumne, is normative and provides general guidance for development, use, and management of DoD architectures. This volume explains the role of architecture within core DoD processes. Key DoD architecture concepts are identified and defined in this Volume.
- Volume 2, the architect's volume, is normative and 1) defines architectural viewpoints and models, and 2) specifies the DM2 at a logical level, as an elaboration of the key concepts identified and defined in Volume 1. Models are created from a subset of architectural data within a viewpoint. Once a viewpoint is populated with data, models associated with the viewpoint can present these data. The DoDAF specifies over 50 standard models within eight viewpoints; these models can be used as specified. In addition, the DM2 can be used to create custom, fit-for-purpose models to present architectural data within or across viewpoints for specific stakeholders and their specific needs.
- Volume 3, the developer's volume, is normative and discusses the ontologic foundation for DM2 and specifies the physical level format for the exchange of DoDAF-compliant architectural data. This volume is intended for developers of architectural description analytics, tools, databases, repositories, and simulations.
- Volume 4 publishes descriptions of other best practices, lessons learned, and reference documents that supplement the information contained in the three normative volumes of the DoDAF, including a discussion of the DoDAF OWL exchange specification. This volume is provided as information only and is not part of DoDAF conformance.

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1 INTRODUCTION

The Department of Defense Architecture Framework (DoDAF) is the overarching, comprehensive framework and conceptual model for architecture descriptions developed within the DoD. This framework helps Department of Defense (DoD) managers at all levels make effective decisions by sharing information across the Department, Joint Capability Areas (JCAs), missions, components, and programs. The DoDAF focuses on architectural data as information required by DoD decision makers, rather than on developing individual models. Architects may use the standard models described in this Volume and specified in Volume 2 to obtain and visualize data requirements. However, the framework also allows architects to build other, fit-for-purpose products for an architecture description.

The DoDAF supports the Department of Defense Chief Information Officer (DoD CIO) efforts to develop and maintain architectures as required by the Clinger-Cohen Act. The DoDAF also serves as the principal guide for development of integrated architectures, as defined in DoD Instruction 4630.8, which states: "An architecture consisting of multiple views or perspectives facilitating integration and promoting interoperability across capabilities and among integrated architectures". The term *integrated* means that data used in one architecture description is commonly understood within other architecture descriptions using the same concepts.

The executive 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 PfM. This process evaluates the use of enterprise and segment architectures as a principal means of ensuring mission requirements are met, while achieving savings and cost avoidance goals. Each agency is required to adopt an architecture framework—either existing or created within the agency for that purpose. The DoDAF is the designated architecture framework within the DoD for architecture development.

The DoDAF metadata model (DM2) is an ontological model that specifies a minimal set of architectural data required to support the core DoD decision-making processes. The specifications of standard models in Volume 2 provide guidance on the content of models that the DoD architecture community has found to be useful over many years.

A DoD manager, as a process owner, specifies requirements for and controls development of architectures, as described in this volume, within the areas of the manager's authority and responsibility. In that role, the manager selects an architect and an architecture development team to create an architecture description to satisfy requirements expressed by the process owner. As described in Volume 1, architecture concentrates on data that correspond to architecture requirements.

Volume 2 specifies the viewpoints and standard models used by DoD architects to create an architectural description.

1.1 Vision for the DoDAF

The vision for use of the DoDAF is to:

- Provide architecture concepts to guide development of architectures that support the decision processes of departmental programs, military components, and capability areas. This guidance is to be consistent with federal enterprise architecture guidance provided by OMB.
- Focus on architectural data as information required for making critical decisions and de-emphasize individual architecture models. Allow architects to visualize architectural information using both standard models and fit-for-purpose models that are consistent with the culture and preferences of an organization.

1.2 DoDAF Volume Organization and Intended Audience

The DoDAF is presented in three normative volumes and one informative volume.

1.2.1 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 describes the DoDAF conceptual mode (CDM) that identifies the minimal information needed to adequately describe an architecture.

Volume 1 contains the following resources:

- An overview and vision for DoDAF.
- An overview of the framework.
- Defining fit-for-purpose architectures.
- Introduction to the DoDAF metadata model and the conceptual data model the DM2 supports.

1.2.2 Volume 2 — Architectural Data and Models

Primary audience: architects, program managers, portfolio managers, and other technically oriented architecture users

Architects, modelers, and technical designers need to know what sorts of things can be modeled and the sorts of relationships among those things. Volume 2 describes the DoDAF meta-model, meta-model data groups, DoDAF viewpoints, and standard DoDAF models. The DoDAF meta-model specifies the sorts of things that can be modeled and the relationships among those things. Appendices to Volume 2 contain the DoDAF Glossary and references.

1.2.3 Volume 3 — DM2 PES & DM2 OWL

Volume 3 introduces the DoDAF Meta-model Physical Exchange Specification (DM2 PES) and the DM2 OWL-DL schema for the exchange of architectural data. These technical tools provide different ways to exchange architectural information among stakeholders.

1.2.4 Volume 4 — Informative Articles

Volume 4 is the informative volume of the DoDAF. Volume 4 includes descriptions of best practices, lessons learned, reference documents, and other information that supplements the three normative volumes of the DoDAF.

1.3 Purpose and Scope

The DoDAF establishes a common vocabulary for architecture development and for the exchange of architecture information. Architectures are created for a number of reasons.

From a compliance perspective, federal law and policy (i.e., Clinger-Cohen Act, OMB Circular A-130) require architectures to support investment decisions. From a practical perspective, an organization that pursues complex ends with sophisticated people, systems, services, and technologies needs comparably complex architectures to evaluate and compare investments. Such an organization also uses architectures to build new systems, deploy new technologies, offer new services, and guide change to the organization itself.

Guidance provided by the DoDAF applies to all architectures developed, maintained, and used within the DoD. The DoDAF is also the basis for tiered architecture federation, shared architecture information, and a federated enterprise architecture describing the Department.

1.3.1 Developing Architectures

Careful scoping and organization by managers of the architecture development effort focuses on areas of change indicated by policy or contract in support of the stated goals and objectives. A data-centric, rather than product-centric, architecture framework ensures concordance across architectural views (i.e., that data in one view is the same in another view when talking about the same exact thing , such as an activity), enables the federation of all pertinent architecture information, and provides full referential integrity (that data in one view is the same in another view when talking about the same exact thing , such as an activity) through the underlying data to support a wide variety of analysis tasks. Logical consistency of the data thus becomes a critical 'property' of architectures of all types as described more fully below. The objective of achieving concordance across the architectural view must be included in architecture planning and development actions.

The DoDAF describes two major types of architectures that contribute to the DoD enterprise architecture, enterprise-level architecture and solution architecture. Each of these architectures serves a specific purpose:

- An enterprise architecture is a strategic information asset of an organization. This asset defines the mission of the organization, the behaviors and information necessary to perform the mission, the resources necessary to perform the mission, and the processes for transforming the organization and its resources to satisfy changing mission needs. An enterprise architecture includes a baseline architecture representing the current organization, a target architecture representing the future organization, and a plan for moving from the present into the future.

- A solution architecture is an asset that describes a system or other asset that an organization uses to carry out its mission. This architecture type is not a part of the DoD enterprise architecture, but solution managers use these architectures to create, update, revise, or remove resources that are called for by the organization's enterprise architecture. Solution architectures are the most common type of architecture developed in the Department.

1.3.2 Maintaining and Managing Architectures

Embedding architecture development process in routine planning and decision-making institutionalizes the practices of architecture and the maintenance of architectural data, models, and viewpoints. 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. The DoDAF supports four tiers: Department, JCA, component, and solution (i.e., program or project-level solutions development). These tiers support the federated approach for architecture development and maintenance.

1.3.3 Using Architectures

Architecture supports major DoD decision-making processes, including JCIDS, DAS, PPBE, SE, and PfM processes. Architecture also supports business process reengineering, organizational development, research and development, operations support, and service-oriented solutions. Architectural data gives decision makers data they need to make informed decisions in those processes.

1.3.4 DoDAF Conformance

The Department of Defense expects DoD architecture descriptions to conform to the DoDAF to the maximum extent possible. Conformance ensures that reuse of information, architecture artifacts, models, and viewpoints can be shared with a shared understanding of the underlying data. Both classified and unclassified architecture descriptions are to conform to the DoDAF.

DoDAF conformance is assessed at four levels. Higher levels of conformance build upon lower levels of conformance.

Level 1 — Conceptual conformance

- The architecture description uses normative DoDAF terms as defined in the DoDAF Glossary to identify concepts. The architecture description uses these normative DoDAF terms to describe the architecture. The AV-2 model, which is the glossary of the architecture description, appropriately defines additional terms used to describe the architecture. The AV-2 model complies with the DoDAF Glossary Style Manual guidance for writing definitions.
- DoDAF standard models within the architecture description satisfy the specifications given in Volume 2.
- DoDAF fit-for-purpose models within the architecture description are validated by stakeholders who use those models.

Level 2 — Logical conformance

- The architecture description demonstrates conceptual conformance.
- The AV-2 model within the architecture description complies with the DoDAF Glossary Style Manual guidance for constructing glossary entries and producing a glossary.
- The architecture description uses types, relationships, and properties defined by the DoDAF meta-model to describe the architecture. The architecture description correctly introduces and defines additional concepts, relationships, and properties used to describe the architecture as subtypes of DoDAF meta-model concepts, relationships, and properties.

Level 3 — Physical conformance

- The architecture description demonstrates logical conformance.
- The architectural data expressed by the architecture description is correctly produced and consumed using a specified format to exchange architectural data. A successful DM2 PES exchange satisfies this requirement; alternatively, architecture efforts within

recognized Business Capability Lifecycle (BCL) programs may satisfy this criterion by successful DM2 OWL-DL exchanges.

Level 4 — Semantic conformance.

- The architecture description demonstrates physical conformance.
- The architecture description correctly uses and expresses the ontological semantics of the DoDAF meta-model.

1.4 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, complies with legal and departmental requirements, and serves the purpose for which it was created. Legislation such as the Clinger-Cohen Act and implementing directives such as OMB Directive A-130 require periodic review and evaluation of the maturity and effectiveness of programs and processes. These requirements call for information architectures to support requests to fund those projects and processes.

A manager or executive may delegate the responsibility for creation of the architecture to a qualified architect working 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 architectural description development. Active involvement means that the decision-maker:

- Identifies the purpose and scope for the architecture.
- 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, and assists 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.

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 solution in an understandable and logical manner.

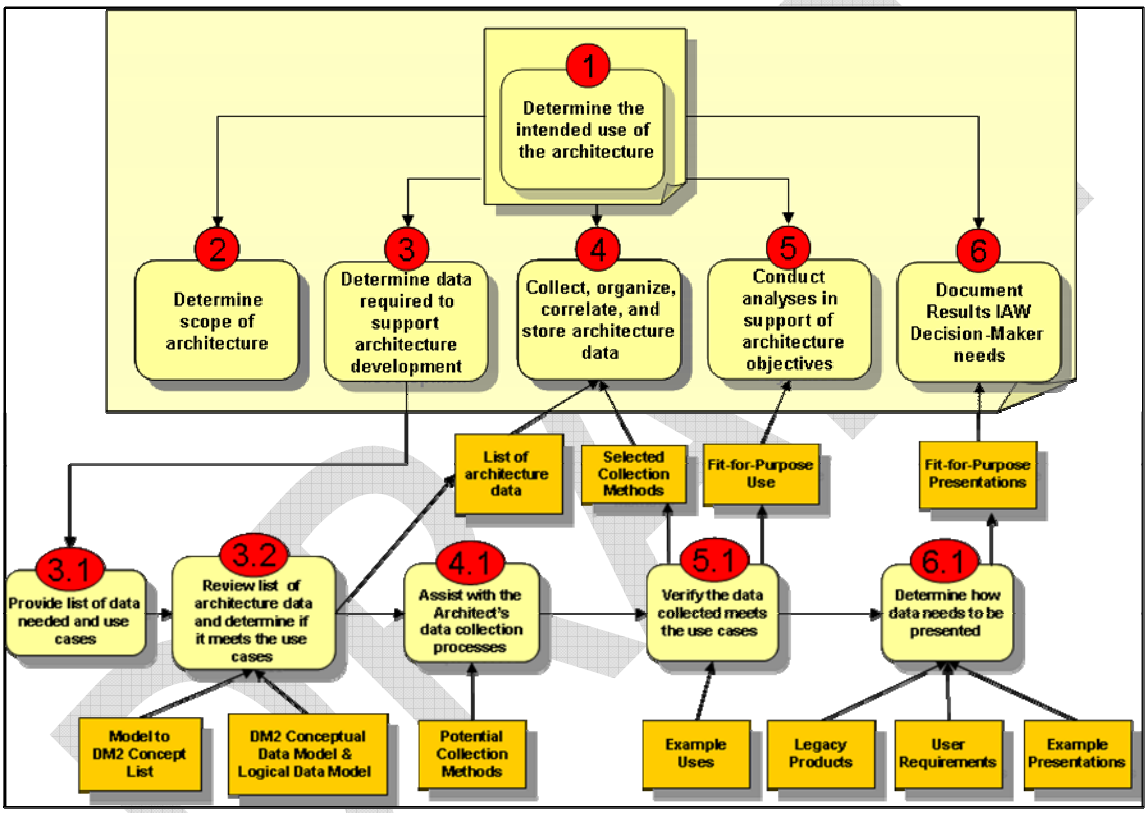

Figure 1. What the Decision-Maker Needs to Do

2 OVERVIEW OF THE DODAF VOLUMES

Section 3 provides an overview of the DoDAF Volumes. This section also addresses fundamental principles and guidelines that managers should follow for an architecture development effort.

2.1 DoDAF Overview

The DoDAF is the structure for organizing architecture concepts, principles, assumptions, and terminology about operations and solutions into meaningful patterns to satisfy specific DoD purposes. The 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 using 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 to maintain validity of the expected performance.
- Analyze designs for future states of the enterprise.
- Establish baseline architectures for solutions under development.

In DoDAF Volume 4, examples 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 following DoDAF guidance demonstrate how change is documented and managed through an architecturally based approach that:

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

Data, organized as information, is the critical element of architecture development. The DoDAF provides the DM2, CDM, LDM, and the PES and OWL exchange specifications for data managers, tool vendors, and others to help:

- Establish areas of discourse and a shared vocabulary.
- Support data overlap analysis.
- Define and encourage the use of shared information.
- Provide a target for architectural data integration.

The framework is consistent with, and supports DoD policy directives that require programs and components to (a) 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 guidance on enterprise architecture.

This version of the DoDAF is written to support the departmental preference for federated architecture development in a tiered environment. To enable federation and support tiered responsibility and accountability, the framework provides data structures to ensure appropriate touch-points can be compared for consistency across architecture boundaries. Use of these data structures ensures that higher tiers have access to data from lower tiers in a form that supports their decision needs.

The DoDAF also helps architect develop SOA-based architectures that define solutions specifically in terms of services that can be discovered and used in executing departmental or joint functions and requirements.

2.2 DoDAF Structure

The DoDAF is organized around data, viewpoints, and models. This approach responds to departmental programs, such as business transformation, 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 DoDI 4630.8

requirements for integrated architectures. The standard models are templates for identifying and collecting specific data within the data groups discussed in Volume 2. Fit-for-purpose models may be defined by users to explain specific data to specific audiences.

2.2.1 Architectural Data

Architectural data provides efficient and flexible use and reuse of architectural descriptions for decision makers and process owners.

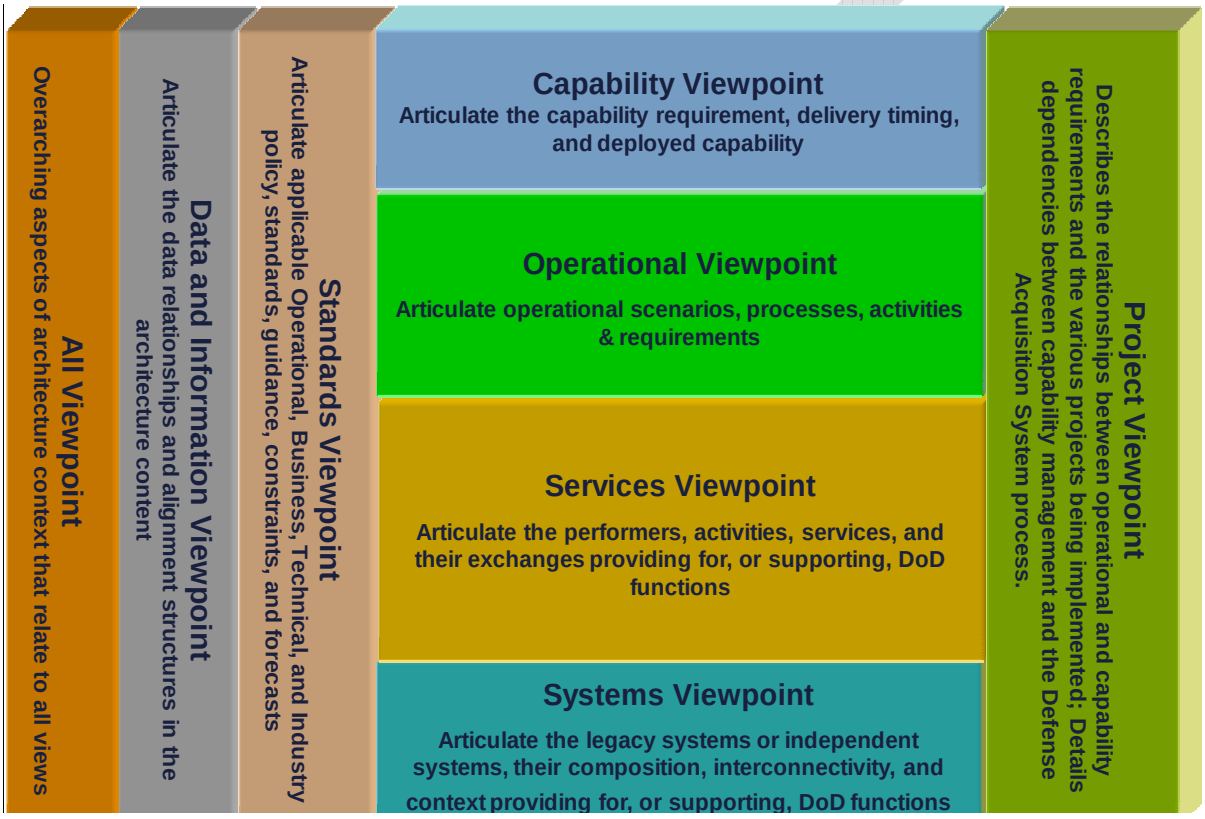

Figure 2. Architecture Viewpoints in the DoDAF

2.2.2 Architecture Viewpoints and DoDAF-described Models

An architecture viewpoint is a selected set of architectural data that has been organized around some central concept. An architectural description can be presented in many ways. A model, regardless of its form, is a representation of some portion of the architectural data, in the sense that a still photograph shows only one view of a subject within a picture. Figure 2 provides a graphical representation of the architecture viewpoints in the DoDAF.

2.2.2.1 All Viewpoint

Some overarching aspects of an architectural description relate to all models. The All Viewpoint (AV) models provide information about the entire architectural description, such as its scope and context. The scope includes the subject area and time frame of the architectural description. The setting in which the architectural description exists comprises the interrelated conditions that compose the context for the architectural description. These conditions include doctrine; tactics, techniques, and procedures; relevant goals and vision statements; concepts of operations (CONOPS); scenarios; and environmental conditions.

2.2.2.2 Capability Viewpoint

The Capability Viewpoint (CV) describes a vision for performing specified activities to achieve desired resource states under specified standards and specified conditions by applying specified guidance and specified performers to those tasks. This viewpoint provides a strategic rationale for the described architecture.

2.2.2.3 Data and Information Viewpoint

The Data and Information Viewpoint (DIV) describes information needs, data requirements, and the implementation of data elements within an architectural description. This viewpoint includes information associated with information exchanges in the architectural description, such as the attributes, characteristics, and inter-relationships of exchanged data.

2.2.2.4 Operational Viewpoint

The Operational Viewpoint (OV) describes organizations, activities they perform, and resources they exchange to fulfill DoD missions. This viewpoint includes the types of information exchanged, the frequency of such exchanges, the activities supported by information exchanges, and the nature of information exchanges.

2.2.2.5 Project Viewpoint

The Project Viewpoint (PV) describes how programs are grouped in organizational terms as a coherent portfolio of acquisition programs. This viewpoint provides a way of describing the

organizational relationships between multiple acquisition programs, each of which is responsible for delivering systems or capabilities.

2.2.2.6 Services Viewpoint

The Services Viewpoint (SvcV) describes services that provide or support operational activities. This viewpoint traces service activities and resources to the requirements established by the Operational Viewpoint.

2.2.2.7 Standards Viewpoint

The Standards Viewpoint (StdV) describes the minimal set of rules governing the arrangement, interaction, and interdependence of systems and system parts. The purpose of this viewpoint is to ensure that a system satisfies a specified set of operational requirements. The Standards Viewpoint identifies the technical systems implementation guidelines upon which engineering specifications are based, common building blocks established, and product lines developed. This viewpoint 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 in a given architectural description.

2.2.2.8 Systems Viewpoint

Systems Viewpoint (SV) describes system activities and resources that support operational activities. This viewpoint traces system activities and resources to the requirements established by the Operational Viewpoint.

2.2.2.9 Standard Models

The table, DoDAF Standard Models, list the standard models provided by the DoDAF for the eight DoDAF viewpoints.

Table 1. DoDAF Standard Models

Model	Describes…
AV-1: Executive Summary	Project visions, goals, objectives, plans, activities, events, conditions, measures, effects (outcomes), and produced objects.
AV-2: Glossary	Definitions of ontic terms used in an architecture description.
CV-1: Capability Effects	The overall vision for transformational endeavors, which provides a strategic context for the capabilities described and a high-level scope.
CV-2: Capability Hierarchies	A hierarchy of capabilities which specifies all the capabilities that are referenced throughout one or more architectural descriptions.
CV-3: Capability Schedules	The planned achievement of capability at different points in time or during specific periods of time. The CV-3 shows the capability phasing in terms of the activities, conditions, desired effects, rules complied with, resource consumption and production, and measures, without regard to the performer and location solutions.
CV-4: Capability Dependencies	The dependencies between planned capabilities and the definition of logical groupings of capabilities.
CV-5: Capability Deployments	The fulfillment of capability requirements shows the planned capability deployment and interconnection for a particular capability phase. The CV-5 shows the planned solution for the phase in terms of performers and locations and their associated concepts.
CV-6: Capability Activities	A mapping between the capabilities required and the operational activities that those capabilities support.
CV-7: Capability & Services	A mapping between the capabilities and the services that these capabilities enable.
DIV-1:Conceptual Information	Information needs.
DIV-2: Data Requirements Model	Data requirements.
DIV-3: Data Implementation	The physical implementation of data elements.
OV-1: Operational Concept	The operational concept.
OV-2: Organizations & Resources	Resource flows exchanged between operational activities.
OV-3: Organizations, Activities, & Resources	Resources exchanged and the relevant attributes of the exchanges.
OV-4: Organizational Relationships	Organizational context, roles, and other relationships among organizations.

Model	Describes…
OV-5a: Operational Activity Hierarchy	Capabilities and operational activities organized in a hierarchal structure.
OV-5b: Operational Activities	The context of capabilities and operational activities and the relationships among activities, inputs, and outputs.
OV-6a: Operational Rules	Rules that constrain operational activities.
OV-6b: Operational State Transitions	Activity responses to other activities.
OV-6c: Operational Activity Sequences	Activities in a scenario, a specified sequence of activities.
PV-1: Projects & Organizations	The dependency relationships between the organizations and projects and the organizational structures needed to manage a portfolio of projects.
PV-2: Project Schedules	A schedule of activities and their resources with the key milestones and dependencies.
PV-3: Projects & Capabilities	A mapping of programs and projects to capabilities to show how the specific projects and program elements help to achieve a capability.
SvcV-1 Services	Services, service items, and their interconnections.
SvcV-2 Services Interfaces	Resource flows among services.
SvcV-3a Services & Systems	relationships among or between systems and services in a given architectural description.
SvcV-3b Service Relationships	Relationships among services in a given architectural description.
SvcV-4 Services Functions	Activities performed by services and the service resource flows among service activities.
SvcV-5 Services & Operational Activities	A mapping of service activities to operational activities.
SvcV-6 Services, Activities, & Resources	Service resource flow among between services and the attributes of those resources.
SvcV-7 Service Measures	Measures of services for interesting periods of activity.
SvcV-8 Services Evolution	Planned incremental steps to migrate from current services to future services.
SvcV-9 Service Technologies & Skills	Emerging resources, standards, and skills that planners expect to be available for future service development.
SvcV-10a Services Rules	Rules that constrain service activities.
SvcV-10b Services State Transitions	Service activity responses to other activities.
SvcV-10c Services Activity Sequences	Activities in a scenario, a specified sequence of service activities.
StdV-1 Standards Profile	Current standards constraining activities that produce solution resources.
StdV-2 Standards Forecast	Future standards that will constrain activities that produce

Model	Describes…
	solution resources.
SV-1 Systems Composition and Interface Identification	Systems, system parts, and their relationships.
SV-2 System Interface Means	Resource flows among systems.
SV-3 System Relationships	Relationships among systems in an architectural description.
SV-4 Systems Functions	The functions (activities) performed by systems and the system data flows among system functions (activities).
SV-5a Systems & Operational Activities	The relationships of system activities to operational activities.
SV-5b Systems & Capabilities	A mapping of systems back to capabilities or operational activities (activities).
SV-6 Systems, Activities, & Resources	Provides details of system resource flow elements being exchanged between systems and the attributes of that exchange.
SV-7 System Measures	Measures of a system.
SV-8 System Evolution	The plan to upgrade a suite of systems to a more efficient suite or to evolve a current system to a future implementation.
SV-9 System Technologies & Skills	The emerging technologies, software/hardware products, and skills that are expected to be available in a given set of time frames and that will affect future system development.
SV-10a Systems Rules	Constraints on system activities.
SV-10b System State Transitions	How a system responds to events.
SV-10c System Activity Sequences	System-specific refinements of critical sequences of activities described in the Operational Viewpoint.

3 DODAF META-MODEL (DM2)

The DM2 provides a high-level view of the data in an architecture description. It also serves as a specification for the reuse of data under the federated approach to architecture development and management.

The DM2 has several levels, each of which is important to a particular viewer of departmental processes. The DoDAF conceptual data model (CDM) presents concepts shared by all DoDAF-compliant architecture descriptions. The Glossary for this volume describes the concepts of the CDM in non-technical terms; readers at all levels should understand the conceptual grounds of DoD architecture descriptions.

The DoDAF logical data model (LDM) adds technical information and, when necessary, clarifies relationships into an unambiguous usage definition. The LDM is discussed in Volume 2.

DoDAF data exchange comes in two forms, the Physical Exchange Specification (PES) and the DM2-OWL specification. The PES is discussed in Volume 3 and the DM2-OWL is discussed in Volume 4.

The DM2 defines architectural data elements and enables the integration and federation of architectural descriptions. It establishes a basis for semantic (i.e., understanding) consistency within and across architectural descriptions. In this manner, the DM2 supports the exchange and reuse of architectural information among JCAs, components, and federal and coalition partners; this helps the Department understand and build processes and systems that work well together, particularly in the sharing of information (interoperability).

3.1 The DoDAF Conceptual Data Model (CDM)

The DoDAF conceptual data model (CDM) presents concepts shared by all DoDAF-compliant architecture descriptions. Key concepts of the CDM are illustrated in Figure 3. This diagram may be read in a straightforward way:

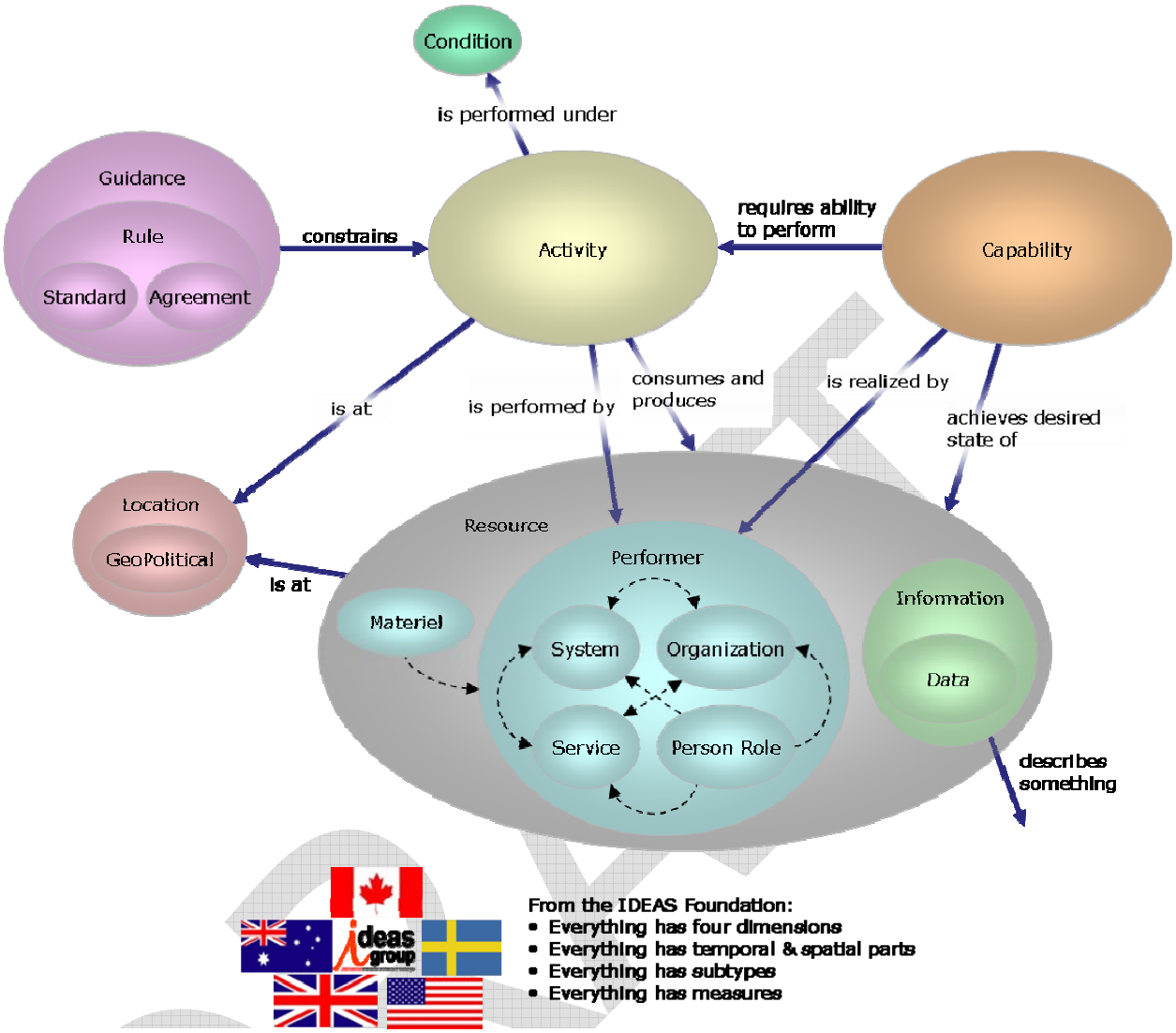

Figure 3. DoDAF Meta Model at the Conceptual Level

- An activity consumes and produces resources. An interesting activity always produces an interesting resource. In general, an interesting activity also consumes interesting resources. However, consumed resources are not necessarily architecturally interesting.
- An activity is performed by some performer.
- A performer is a sort of resource that performs an activity.
- An activity can produce a resource that performs another activity. Some activities, such as projects, are interesting just in that they produce performers that can realize capabilities.
- An activity is constrained by some guidance. Guidance forestalls random behavior. Proceeding by trial and error is not a best practice in anything we do.
- A rule is a sort of guidance.
- A standard is a sort of rule, and thus a standard is a sort of guidance.
- An agreement is a sort of rule, and thus an agreement is a sort of guidance.
- An activity is performed under some condition. Conditions affect the way a performer can carry out an activity, and conditions are seldom perfect in the real world.
- An activity is performed at some location. Locations are important for activities because they entail possible conditions.
- A resource exists at some location. Locations are important for resources because we cannot rely upon resources whose locations are unknown or unknowable.
- A geopolitical place is a sort of location.
- Materiel is a sort of resource. The DoDAF notion of materiel encompasses anything a performer uses to get a job done.
- A system is a sort of performer, and thus a system is a sort of resource.
- A service is a sort of performer, and thus a service is a sort of resource.
- An organization is a sort of performer, and thus an organization is a sort of resource.
- A person in a role is a sort of performer, and thus such a person is a resource.

- A performer can be a complex of systems, services, organizations, and persons in roles.
- A person in a role may be a part of a system.
- A person in a role may be a part of a service.
- A person in a role may be a part of an organization.
- Materiel may be a part of a performer.
- Information describes something. Specifically, information describes activities, guidance, conditions, resources, locations, and capabilities.
- Information is a sort of resource.
- Data is a sort of information, and thus data is a sort of resource. Data that is not used to describe activities, guidance, conditions, resources, locations, or capabilities is not architecturally interesting.

Further, the DoDAF conceptual data model inherits certain reasonable ideas from the IDEAS ontology.

- Everything of architectural interest has four dimensions, that is, they exist in space and time. All the pieces and parts of a described architecture must be founded upon things that are real in the world.
- Everything of architectural interest has parts. In particular, everything has both temporal parts and spatial parts. This is the basis for asserting the identity of a whole as its parts change over time.
- Everything of architectural interest is a sort of something. Indeed, any given thing can be a sort of many different things at the same time and over time.
- Everything of architectural interest has measures. Something that exists in space and time can be observed. Anything that can be observed can be measured. At a minimum, we can measure the size and the position of any real thing of architectural interest.

Together, these concepts cover the notions needed to discuss *capabilities* as defined by Joint doctrine:

A capability is the ability to achieve a desired effect under specified standards and conditions through combinations of means and ways to perform a set of tasks.

A desired effect is a measurable change in the state of resources we see in someplace in the world. Activities consume resources in one state and produce resources in another state. Performers perform activities that change the state of resources. Performers do this under conditions that affect their performance. Performers do this following guidance to perform tasks appropriately under those conditions. All this can be measured, and the performance of an activity can be assessed against standards of performance.

In architectural terms: *tasks* are activities, *ways* are guidance, *means* are performers, *conditions* are conditions, *standards* are a particular sort of guidance, and *desired effects* are changes in the states of resources.

3.2 Overview of the DM2 Foundation

The DM2 is founded on a formal ontology that applies common ontological concepts to foster the reuse of common data patterns. Figure 4 illustrates key concepts of the DM2's foundation.

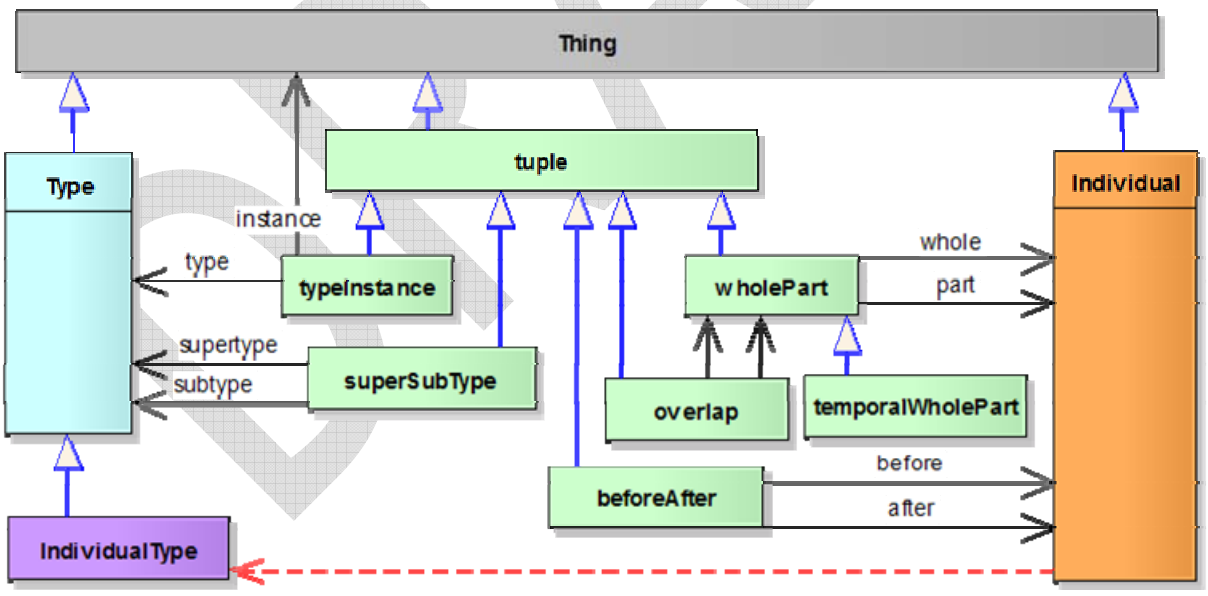

Figure 4. Overview of DM2 Ontologic Foundation

The top-level foundation elements are represented by these boxes:

- thing — anything that is an individual or a grouping of individuals.
- individual — a thing that exists in space and time.
- type — a grouping of things. Groups may be themselves grouped.
- tuple — an ordered pair of two things (i.e., a relationship).

The foundation tuples (relationships) are similar to concepts found in many ontologies, conceptual schemes, and data models. These common relationship patterns include:

- whole & part — composition. Everything has parts, and everything is part of something else.
- supertype & subtype — generalization and specialization. Everything is a sort of something.
- before & after — temporal ordering. Everything comes after something and before something else.
- overlap — four-dimensional shared extent. Everything has parts that are shared with other things. In particular, overlap is the relationship that binds a persistent whole to its changing parts.

Composition and specialization apply to all architecture concepts. Temporal ordering is needed to arrange things through time. Overlap is necessary to describe things that interface but are not necessarily contained within each other.

4 GLOSSARY

Acronym	Expansion
AV	All Viewpoint
CDM	conceptual data model
CV	Capability Viewpoint
DAS	Defense Acquisition System
DIV	Data and Information Viewpoint
DM2	DoDAF Meta-model
DoDAF	DoD Architecture Framework
IDEAS	International Defence Enterprise Architecture Specification
JCIDS	Joint Capabilities Integration and Development System
LDM	logical data model
MOD	Ministry of Defence of the United Kingdom
MODAF	Ministry of Defence Architecture Framework
NATO	North Atlantic Treaty Organization
OMB	Office of Management and Budget
OV	Operational Viewpoint
PES	Physical Exchange Specification
PPBE	Planning, Programming, Budgeting, and Execution
PV	Project Viewpoint
SE	systems engineering
SOA	service-oriented architecture
SvcV	Services Viewpoint
StdV	Standards Viewpoint
SV	Systems Viewpoint
UPDM	Unified Profile for DoDAF and MODAF

Glossary of normative terms related to the DoDAF conceptual data model. Unless otherwise noted, these terms are taken from the DoDAF Glossary[1] and their definitions are derived from the DoDAF Glossary. For more information about these terms, including their technical DM2 definitions, consult the complete Glossary. These definitions are generally stated in the singular; however, this grammar assumes that whatever applies to one also applies to many. Consult WordNet for the meaning of terms that are not defined here. The appropriate senses among those given by WordNet are noted by an index number in entries that specify a specific sense of term for DoDAF use.

activity — a transformation of some resource into another resource.

agreement — a guidance statement that records consent among performers to guidance and conditions for performing an activity.

capability — an ability to achieve a desired resource state under a specified performance standard and a specified condition through some combination of guidance and resources to perform a set of activities. ◇ *translated from*: Joint Publication X.

condition — a state of resources that affects the performance of an activity.

data — an information resource that represents states in a standard way suitable for consumption and production by activities. ● *see*: information.

desired resource state — a state of resources that is envisioned by a performer capable of responsibility. ● *see*: vision, capability, resource. ● *note*: A desired resource state is the DoDAF expression of the desired effect of a capability. In the Joint view of capability, a performer capable of responsibility is exemplified by a combatant commander.

geopolitical extent — a region of the world whose boundaries are asserted by a nation state.

guidance — an information resource that is an authoritative statement that constrains the performance of an activity.

[1] The DoDAF 2.03 Glossary is also known as the DoDAF 2.03 Data Dictionary. To access the DoDAF 2.03 Data Dictionary, see the entry for this resource in the consolidated bibliography found in Volume 4.

information — a resource that is a representation of the state of rules, conditions, activities, performers, and other resources. ● *note*: Information is often produced by one performer to be consumed by another, decision-making performer. ● example: *Information is a difference that makes a difference.* • Gregory Bateson.

location — a point or extent in space that may be referred to by coordinates or by name. ● *note*: A location is said to be a *geospatial extent*.

materiel — a resource that is some assemblage of equipment, apparatus, and supplies used by a performer to perform an activity.

measure — a quantification of the magnitude of some property of a thing.

organization — a performer that is an assemblage of persons in roles and resources that support those roles.

performer — a resource that performs an activity.

performer capable of responsibility — a person in a role that is accountable for the performance of an activity. ● *see*: person role.

person role — a performer that is a person defined by a role with respect to an activity. ● *note*: In day-to-day language, we speak of a *person in a role*.

resource — any thing that is produced or consumed by an activity. ● *note*: Performers and guidance associated with an activity are themselves products of other activities.

rule — a guidance statement that prescribes the performance of an activity.

service — a performer that enables access to the performance of a set of activities.

standard — a guidance statement that specifies criteria for the performance of an activity.

system — a performer that is an assemblage of resources.

vision — an information resource that describes a future state of resources that is to be achieved.