Introduction to DoD Architecture Framework (DoDAF)

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What is this paper?

This paper, "Introduction to the DoD Architecture Framework (DoDAF)", is an ultra-brief overview of DoDAF. The intent is to provide potential users a quick overview of DoDAF and related architecture products. DoDAF provide a framework to completely describe system specifications, design processes, trade parameters, etc.

What is DoDAF?

Modern day warfighting operations involve complex sets of hardware, software, and users. In describing the development and integration of such complex systems, it is necessary to provide a *common and consistent* approach to describe the systems and processes. DoDAF provides guidance for describing architectures for warfighting operations, business operations, and processes. [1] Utilizing this framework provides a common approach for architecture description, development, presentation, and integration.

Before going further in describing this common approach, it is necessary to understand the term "architecture" which is frequently used, and often misused. IEEE 610.12 defines architecture as the *organizational structure of a system and component*. Based on this definition, the DoD Integrated Architecture Panel defines architecture as the *structure of components, their relationships, and the principle and guidelines governing their design and evolution over time*. IEEE STD 1471-2000 also states "*An architecture is the fundamental organization of a system embodied in its components, their relationships to each other, and to the environment, and the principles guiding its design and evolution*." From this definition, we can further expand the description of the architecture framework as *a tool which should describe a method for designing an information system in terms of a set of building blocks, and for showing how the building blocks fit together*. It should contain a set of tools and provide a common vocabulary. It should also include a list of recommended standards and compliant products that can be used to implement the building blocks.

Where is the beef?

How does DoDAF help us describe a system or a process? First of all, DoDAF defines the perspectives from which a system is described. Figure 1 depicts three views. A system can be described from the operational perspective. The product generated from the operational perspective is termed **Operations View**. The OV describes the tasks, activities, operational elements, and information exchanges required to accomplish a DoD mission. The **System View** (SV) describes an architecture in terms of systems and interconnections to accomplish a DoD mission. The **Technical View** (TV) is a set of rules and standards governing the arrangement, interaction, and interdependency. The TV provides a set of rules and standards to promote efficiency and interoperability in TV-1 and to ensure that developers can adequately plan for evolution in TV-2. The **All View** (AV) describes the overarching aspects of the architecture that are pertinent to all the views but are not specific to a single view. The complete set of the views is delineated in Table 1. As shown in the table, there are many products that constitute the DoDAF views.

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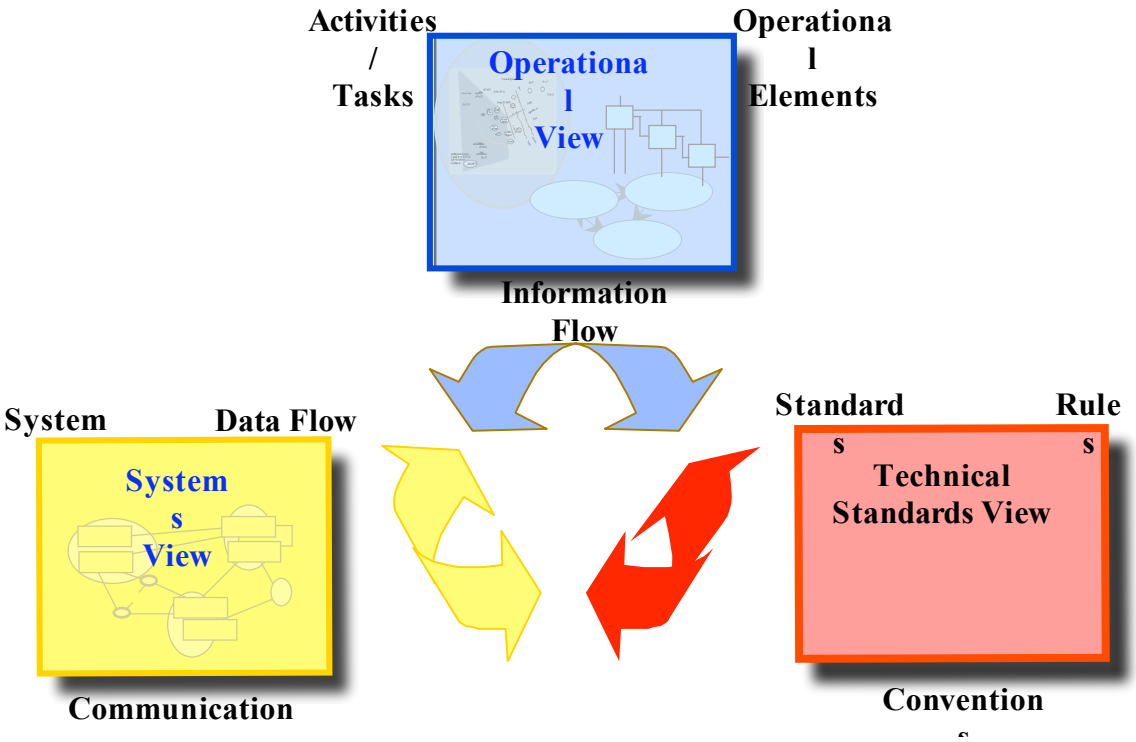

Figure 1. DoDAF Views (Reference [1])

[Note: Reference [1] does not show the AV's in Figure 1.]

Each view product is inter-related to other view products to provide a complete picture of a system. *For example, the SV-5 relates operational activities from the OV-5 to system functions from SV-4; the SV-4 system functions are related to systems in the SV-1; thus bridging the operational and systems views. The high-level operational concept should drive the OV; the OV in turn drives the SV to identify shortfalls and systems requirements, and the SV requirements drive the TV to address a common set of applicable standards. To be internally consistent and integrated, an architecture description must provide explicit linkages among its various views. [1]* It is important to note that it is possible use a subset of these views to completely describe a system or a process. It is up to the architects to define a set of appropriate views for the intended use of the architecture.

How do we generate the views?

Each view is generated with graphics, tables, or text to completely describe the specified objective of the view. Reference [1] provides a general guideline of 5 steps for building architecture descriptions. They are:

Step 1: Determine the intended use of the architecture description.
Step 2: Determine the architecture description's scope, context, environment, and any other assumptions to be considered.
Step 3: Determine what information the architecture description needs to capture based on the intended use.
Step 4: Determine products to be built.
Step 5: Gather the architecture data and build the requisite products.

For each view, the architecture of interest is described from that perspective. OVs should provide information about the operational node (who is responsible for the process) and information flow among the operational nodes. The SVs identify what the systems are, how they are connected, and what they do. As an example, the OVs can describe how organizations and people work together to accomplish a mission. The SVs can describe what specific systems are utilized to accomplish the mission. The TVs describe a set of specifications of the relevant technologies that are exiting (TV-1) and forecasted (TV-2).

These architectural products are graphical or textual representations of the data sets which define various attributes of the architecture. Since a given data element will frequently occur in more than one products, it is crucial to build a consistent set of data elements. For example, a data element table can define data attributes such as types and characteristics.

The notation and format to generate the views can vary depending on applications and users. However, for objective oriented (OO) applications, the Unified Modeling Language (UML) is often used as the standard method of representation. Reference [2] describes how UML is used to document OVs and SVs in detail.

When the DoDAF architecture products are being developed, it is crucial to retain the information that describes the scope and complexities of the architectural data and data relationship for visualizing and understanding. There are standard formats and automated tools available to document the views. The All-DoD Core Architecture Data Model (CADM) was developed as the DoD standard architecture data model for Framework based architecture data elements. For development of the products, DoDAF does not specify or advocate a methodology or a notation, but DoDAF provides guidance for the products to contain the required instances of data elements and relationships.

What have we done?

We at EPG have developed architecture products, per DoDAF guidance, consisting of graphical and textual items providing an architecture description of characteristics pertinent to our Test Tool Kit for C4I testing. Our architecture flows into the ATEC testing architecture to complete test and evaluation requirements.

Where do I get more information?

There are two main volumes of DoD Architecture Framework Version 1.0. These volumes are available on the web www.defenselink.mil/nii/doc/. Also, there are many publications and classes available to learn about DoDAF.

References:

[1] DoD AF Vol 1, Definitions and Guidelines, 9 February 2004.
[2] DoD AF Vol 2, Production Description, 9 February 2004.

Framework Product	Applicable View	Framework Product Name	General Description
AV-1	**All Views**	Overview and Summary Information	Scope, purpose, intended users, environment depicted, analytical findings
AV-2	**All Views**	Integrated Dictionary	Architecture data repository with definitions of all terms used in all products
OV-1	**Operational**	High-Level Operational Concept Graphic	High-level graphical/ textual description of operational concept
OV-2	**Operational**	Operational Node Connectivity Description	Operational nodes, connectivity and information exchange needlines between nodes
OV-3	**Operational**	Operational Information Exchange Matrix	Information exchanged between nodes and the relevant attributes of that exchange
OV-4	**Operational**	Organizational Relationships Chart	Organizational, role, or other relationships among organizations
OV-5	**Operational**	Operational Activity Model	Capabilities, Operational Activities, relationships among activities, inputs and outputs. Overlays can show cost, performing nodes, or other pertinent information
OV-6a	**Operational**	Operational Rules Model	One of the three products used to describe operational activity—identifies business rules that constrain operation
OV-6b	**Operational**	Operational State Transition Description	One of three products used to describe operational activity—identifies business process responses to events
OV-6c	**Operational**	Operational Event-Trace Description	One of three products used to describe operational activity—traces actions in a scenario or sequence of events
OV-7	**Operational**	Logical Data Model	Documentation of the system data requirements and structural business process rules of the Operational View.
SV-1	**Systems**	Systems Interface Description	Identification of systems nodes, systems, and system items and their interconnections, within and between nodes
SV-2	**Systems**	Systems Communications Description	Systems nodes, systems, and system items, and their related communications lay-downs
SV-3	**Systems**	Systems-Systems Matrix	Relationships among systems in a given architecture; can be designed to show relationships of interest, e.g., system-type interfaces, planned vs. existing interfaces, etc.
SV-4	**Systems**	Systems Functionality Description	Functions performed by systems and the system data flows among system functions
SV-5	**Systems**	Operational Activity to Systems Function Traceability Matrix	Mapping of systems back to capabilities or of system functions back to operational activities
SV-6	**Systems**	Systems Data Exchange Matrix	Provides details of system data elements being exchanged between systems and the attributes of that exchange
SV-7	**Systems**	Systems Performance Parameters Matrix	Performance characteristics of systems view elements, for the appropriate timeframe(s)
SV-8	**Systems**	Systems Evolution Description	Planned incremental steps toward migrating a suite of systems to a more efficient suite, or toward evolving a current system to a future implementation
SV-9	**Systems**	Systems Technology Forecast	Emerging technologies and software/hardware products that are expected to be available in a given set of timeframes, and that will affect future development of the architecture
SV-10a	**Systems**	Systems Rules Model	One of three products used to describe systems functionality—identifies constraints that are imposed on systems functionality due to some aspect of systems design or implementation
SV-10b	**Systems**	Systems State Transition Description	One of three products used to describe systems functionality—identifies responses of a system to events
SV-10c	**Systems**	Systems Event-Trace Description	One of three products used to describe systems functionality—identifies system-specific refinements of critical sequences of events described in the operational view
SV-11	**Systems**	Physical Schema	Physical implementation of the Logical Data Model entities, e.g., message formats, file structures, physical schema
TV-1	**Technical**	Technical Standards Profile	Listing of standards that apply to systems view elements in a given architecture
TV-2	**Technical**	Technical Standards Forecast	Description of emerging standards and potential impact on current systems view elements, within a set of timeframes

Table 1. DoD AF Products

APPENDIX 1

Electronic Proving Ground DoDAF Products