ATS Framework Working Group

Framework Definition Procedures Guide

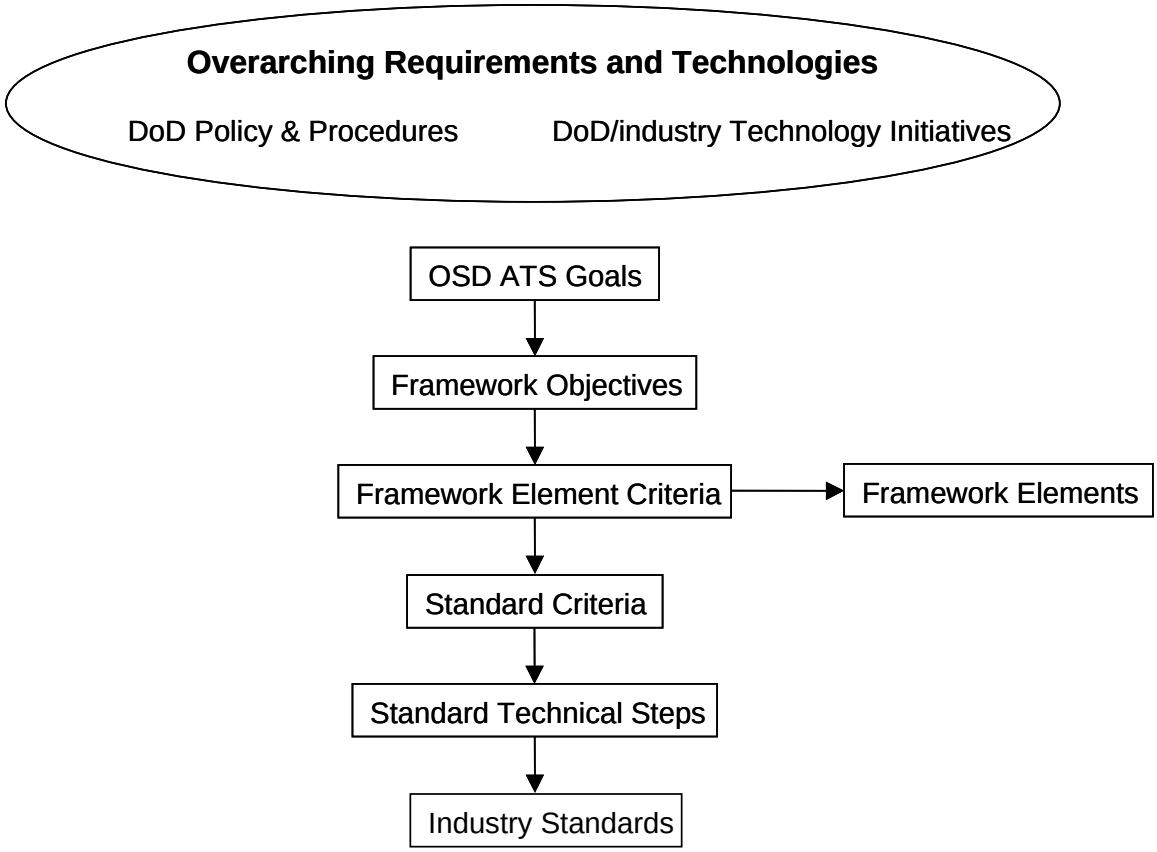
October 2019

INTRODUCTION

This document was created by the ATS Framework Working Group (formerly known as the ATS R&D IPT - ARI) under the DoD NxTest IPT and serves as a guide to define the DoD ATS Framework. The ARI was directed to address the goals of the ATS Management Board (AMB), which are listed below. The ARI developed the initial ATS Framework to meet these goals. A Framework Working Group has been created to further define the Framework and identify standards that meet the key elements in the Framework. This document covers the criteria used for the Framework elements and the steps to recommend industry standards that satisfy each element. Furthermore, this document provides the environment that directs and impacts the Framework.

DIAGRAM

The following diagram demonstrates the relationships between the various guides that impact the Framework. Each of these guides is described in the sections below.



OVERARCHING REQUIREMENTS AND TECHNOLOGIES

The Framework must consider the following policies and initiatives in order to keep up with advances in DoD direction and industry technologies. These requirements and technologies are defined outside the scope of the Framework Working Group and ATS Executive Directorate, but often have impact on the activities of the Framework Working Group since they influence the Framework.

DoD Policy and Procedures

- DoD Acquisition Policy (DoD 5000.2-R, DoD Acquisition Deskbook)

DoD/Industry Technology Initiatives

- NetCentric Warfare
- Synthetic Instruments
- Condition-Based Maintenance (CBM+)

OSD GOALS

The ATS Executive Directorate has defined the following goals for DoD Automatic Test Systems. These goals provide direction for all Framework efforts. These goals may not be changed at the Framework Working Group level.

1. Reduce the total cost of ownership of DoD ATS
2. Provide greater flexibility to the warfighter through Joint Services interoperable ATS
3. Reduce logistics footprint
4. Improve the quality of test

FRAMEWORK OBJECTIVES

The ATS Executive Directorate has developed the following objectives for DoD ATS modernization. These objectives also must be achieved by the Framework. Consent is needed by the Executive Directorate in order to add to or modify these goals.

- Improve instrument interchange
- Make ATE more adaptable with no penalty to requirements
- Faster technology insertion
- Improve TPS rehost
- Improve TPS interoperability
- Use model based programming techniques
- Modernize test programming environment
- Define a TPS performance specification
- Greater use of commercial products
- Capture design to test data
- Use weapon system to test data
- Use knowledge based TPSs
- Define interfaces with the Integrated Diagnostics Framework

FRAMEWORK ELEMENT CRITERIA

From the general goals and objectives above, the Framework Working Group has distilled the following specific criteria for selecting Framework elements.

- **Provide opportunity to reduce life cycle costs**

    1. Product Design (specification testing)
    2. Manufacturing (factory acceptance)
    3. Depot (Maintenance – fault isolation and ready for repair)
    4. Field (End use – O and I level maintenance)
    5. Optimize logistics and support cost reduction
    6. Reduction in logistics footprint
    7. Reuse of test and/or associated information from all levels of maintenance (O, I, D, factory, OEM)

- **Enhance system scalability, upgradeability, maintainability, and usability**

    1. Scalability: For a given tester capability, the resources (real or virtual) can be configured to the tester architecture and its components to support new UUT requirements
    2. Upgradeability: The ability to enhance functionality without impacting the tester architecture and it's associated UUT supportability
    3. Maintainability: The ability to retain the system's required functions over time
    4. Usability: The ability for a user to operate and interpret output of the system

- **TPS/system implementation flexibility**

    1. Open process of translating a design into hardware components, software components, or both
        a. Model based TPS implementation
        b. Modernize test programming
        c. TPS/ATE performance
        d. Legacy system emulation

- **Improve TPS development, re-host, and interoperability**

    1. Development
        a. Reuse of standard reconfigurable test element (Technology Libraries)
    2. Re-hostability
        a. Ability to move to other test systems of equal or greater capability
        b. Can interface with testers through minimum adapter changes
    3. Interoperability
        a. Software will operate on different host systems
        b. Interoperable conditions
            i. TPS source changes or recompile not required
            ii. TPS recompiling required with some source changes

- **Support Integrated Diagnostic Framework**

Integrated Diagnostics is a process that covers the entire spectrum of diagnostic activities in all phases of weapon system acquisition. This process results in a totally testable and maintainable system design. This process will ensure complete fault isolation and detection. The process covers the "integration" of diagnostic activities (includes BIT, HSI, Reasoners, AI analysis tools, and Smart TPS) over the product's life cycle. This will result in cost effective fault detection and isolation. An integrated diagnostic framework establishes the specific test requirements for all systems, subsystems, and components based on the following criteria:

1. Ability to reuse support data from all levels of maintenance to facilitate Integrated Diagnostics.
2. Ability to support:
    - Functional Testing, which measures the effectiveness of a system to perform a set of mission objectives (functional testing ignores the system's internal components) or
    - Performance testing, which measures the capability of the subsystems to perform their specific functions (performance testing evaluates compliance with requirements) or
    - Parametric testing, which measures the specific parameters of the component used to implement subsystem functions (parametric testing verifies the device's behavior).

- **Enhance inter-Service use**

Allows each Service to exchange information in a standardized fashion through various hardware and software frameworks

FRAMEWORK ELEMENTS

The following elements have been defined based on the Element Criteria identified above. These elements may be modified or added to by the Framework Working Group. However, the ATS Executive Directorate must approve all recommendations.

- Adapter Functional and Parametric Information (AFP)
- Data Networking (NET)
- Design for Testability (DFT)
- Diagnostic Data (DIAD)
- Diagnostic Services (DIAS)
- Digital Test Format (DTF)
- Distributed Network Environment (DNE)
- Instrument Communication Manager (ICM)
- Instrument Drivers (DRV)
- Instrument Functional and Parametric Information (IFP)

- Maintenance Test Data and Services (MTDS)
- Master Conformance Index (MCI)
- Product Design Data (PDD)
- Prognostic Data (PROD)
- Prognostic Services (PROS)
- Receiver Fixture Interface (RFI)
- Resource Adapter Information (RAI)
- Resource Management Services (RMS)
- Run Time Services (RTS)
- System Framework (FRM)
- Test Program Documentation (TPD)
- Test Station Functional and Parametric Information (TSFP)
- UUT Device Interface (UDI)
- UUT Test Requirements (UTR)

CREATING / ENHANCING DEFINITIONS

The following questions should be used when creating or enhancing any element definitions.

1. Does an element currently exist that fulfills, or could fulfill with modification, the perceived need?
2. Does the expressed need exist within current systems or practices?
3. Does the expressed need exist within emerging systems entering concept demonstration or system design and development (acquisition)?
4. Where is the element positioned; in the ATE, TPS, or UUT framework area?
5. How does the new element definition affect conformance of an ATS that does/doesn't implement or supply these services, interfaces, and data?

STANDARD CRITERIA

Each industry standard must meet one or more of the following criteria in order to satisfy a Framework element. These criteria were defined by the Framework Working Group and may be modified or added to by the Framework Working Group. However, the ATS Executive Directorate must approve all recommendations.

- Scope should not be limited
- Must be commercially accepted
- Must be applicable across Services
- Must meet the requirements of the corresponding element

STANDARD TECHNICAL STEPS

The following steps have been identified to ensure that the industry standards selected for recommendation would comply with the Standard Criteria above. These steps should be followed for each element to complete the ATS Framework. However, certain steps may be skipped based on the availability and maturity of commercial standards to satisfy the

requirements of the component. Note that more than one standard may be needed to satisfy an element.

1. Develop a requirements definition for the key element.
2. Search for relevant standards in the same technological domain. If no standard(s) is found, work to produce a standard(s), preferably through an industry standards body, or through the Framework Working Group as a last resort.
3. Prepare or obtain a copy or draft of the standard(s).
4. Ensure commercial acceptance of the standard(s) effort, if not already established. Note that 100% commercial acceptance is not required.
5. Review ability of the standard(s) to satisfy all the requirements of the key element and document deficiencies if they exist.
6. Conceptually demonstrate the ability of the standard(s) to meet all the requirements of the key element.
7. Physically demonstrate the ability of the standard(s) to meet all the requirements of the key element. Note that the need for demonstrations will be determined on a case-by-case basis (availability of required resources, potential for leveraging from associated development efforts, or industry wide-spread use).
8. Document deficiencies in the standard(s) and facilitate their resolution.
9. Locate and secure sponsorship of the draft by a recognized standards body if required.
10. Follow the standards body process for publication if possible.
11. DoD ATS Executive Directorate recommends the use of the element when the standard(s) is complete or can be partially recommended for architectural needs. The recommendations are included in Executive Directorate Notices.

INDUSTRY STANDARDS

Below is the current list of recommended industry standards. This list will be added to by the Framework Working Group as the Standard Technical Steps are implemented for new industry standards. However, the Executive Directorate must approve all recommendations.

- AFP; IEEE 1671.5 ATML Test Adapter
- DIAD; IEEE 1232-2010 Artificial Intelligence Exchange and Service Tie to All Test Environments (AI-ESTATE)
- DIAS; IEEE 1232-2010 Artificial Intelligence Exchange and Service Tie to All Test Environments (AI-ESTATE)
- DFT; IEEE 1149.1 Test Access Port and Boundary-Scan, 1149.4 Mixed Signal Test Bus, and 1149.6 Boundary-Scan Testing of Advanced Digital Networks
- DRV; VPP Instrument Drivers 3.x and/or IVI 3.1, IVI 3.2, IVI 3.3, IVI 3.4, and 3.14
- DTF; IEEE 1445 Digital Test Interchange Format (DTIF)
- FRM; VPP-2 System Frameworks Specification and IEEE 1671 ATML
- ICM; VPP Instrument Communication Manager 4.3
- IFP; IEEE 1671.2 ATML Instrument Description
- MCI; IEEE 1671.4 ATML Test Configuration

- MTDS; IEEE 1636.1 Software Interface for Maintenance Information Collection and Analysis (SIMICA): Test Results and IEEE 1636.2 Maintenance Action Information (MAI)
- NET; Internet Engineering Task Force (IETF) RFC0791 and RFC0793
- PDD; IEEE 1671.3 ATML UUT Description
- RAI; IEEE 1641 Annex K, Standard for Signal and Test Definition
- RTS; IEEE 1671 ATML-2010 Annex D
- TPD; IEEE 1671.1 ATML Test Description
- TSFP; IEEE 1671.6 ATML Test Station