# Asset Library Open Architecture Framework – Sharing Reusable Assets

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**Abstract**

Reuse, along with software engineering environments and processes, is one of the primary software technical areas being addressed within the STARS (Software Technology for Adaptable, Reliable Systems) program. Under the envisioned paradigm called *mega-programming* by DARPA/SISTO program director Barry Boehm, applications will be built using a component based approach, rather than constructing them a line at a time. The chosen components will be reused and/or constructed from existing systems, rather than created from scratch. And the components used in the application construction will be based on domain-specific architectures and open interface standards. The STARS Asset Library Open Architecture Framework (ALOAF) addresses the exchange of reusable assets among diverse libraries, and the definition of an asset library platform upon which portable reuse tools may be constructed.

**Keywords:** library, architecture, software engineering environment, standards, services, data model

## Introduction

A reuse-based approach to software engineering places the emphasis on the reuse and integration of existing software components and systems, rather than the creation of software components from scratch. To support this approach, automated reuse libraries have been, and are being, created. The concept of reuse of components is applicable to reuse libraries themselves. Reuse libraries consist of a set of components that are suitable candidates for reuse and sharing. These include the components (or assets) stored within a library as well as the components that make up an automated library system and reuse library tools.

The STARS (Software Technology for Adaptable, Reliable Systems) Asset Library Open Architecture Framework (ALOAF) addresses the exchange of reusable assets among diverse libraries, and the definition of an asset library platform upon which portable reuse tools may be constructed. Asset interchange and asset service interfaces are critical elements in achieving a broader objective—asset libraries which interoperate to such an extent that the boundaries between individual libraries become invisible to the end user. In general terms, this is the STARS vision of "seamless" library interoperation.

# Why ALOAF

The ability to make effective use of previously created assets, be they software components, design artifacts, textual documents, etc., is viewed as a critical factor in the reduction of application development and maintenance costs, along with improved reliability. Many efforts both within and external to the STARS program have addressed the development and establishment of asset libraries (also referred to as reuse repositories, software depositories, ...). Each of these reuse projects has its respective merits and unique qualities. The ALOAF does not seek to stifle the creativity nor inventiveness being exhibited in the development of new reuse methods, environments, and tools. Rather, the purpose of the ALOAF is to allow reuse projects to benefit cooperatively from each other's work. Examples of such cooperative benefit are:

> Assets stored within one asset library may be interchanged with a completely different asset library, with descriptive asset information being exchanged as well. This allows diverse, heterogeneous asset libraries to share assets, enabling the construction of applications which may make use of the best and newest components that are available.
>
> A reuse tool created for one asset library system may be easily ported to another asset library system when the reuse tool and the asset library systems conform to the ALOAF service model interface. This allows asset library systems to be easily enhanced with additional reuse-based tools.

Thus, reuse technology, methods, and assets as a whole may rapidly expand and facilitate a shift to reuse-based development and engineering.

The ALOAF focuses on the needs of STARS asset libraries, as well as other DoD-related asset/reuse systems with which STARS asset libraries will interoperate. Past, current, and near-term anticipated work related to the asset library systems of the STARS program serve as a primary basis for the ALOAF. It is beyond the scope of the initial work of the ALOAF to address and consider all reuse issues associated with every existing and potential asset/reuse library. In future work, the scope of the ALOAF will be broadened to encompass additional relevant and appropriate asset/reuse libraries.

## STARS Reuse

Reuse, along with software engineering environments and processes, is one of the primary software technical areas being addressed within the STARS program. The vision of the STARS program

[?] is that "Software-intensive system development will evolve to a process-driven, domain-specific reuse-based, technology-supported paradigm." The element of the STARS vision that explicitly applies to the ALOAF is *domain-specific reuse-based.* Under this envisioned paradigm, applications will be built using a component based approach, rather than constructing them a line at a time. The chosen components will be reused and/or constructed from existing systems, rather than created from scratch. And the components used in the application construction will be based on domain-specific architectures and open interface standards.

In order to support DoD needs, a key STARS technology objective is the construction of engineering environments from commercially available environment frameworks and tools. Asset library systems contain elements of both reuse frameworks and reuse tools. The desire within STARS is the construction of modular reuse tools and frameworks that conform with an open architecture, hence the formulation of the asset library *open architecture* framework. Environment assemblers may then pick and choose from a variety of commercial-off-the-shelf or company-proprietary tools and systems that conform to the STARS ALOAF, with the knowledge that all of these ALOAF-conformant components will interoperate and be plug-compatible. The resultant engineering environments are standards-driven and standards-based systems, which are tailorable, adaptable, and reliable.

Other STARS, reuse-related activities include the STARS Reuse Concept of Operations and STARS' participation in the Reuse Library Interoperability Group (RIG). The STARS Reuse Concept of Operations [?] articulates STARS concepts and expectations with respect to reuse of software related assets across system and software life cycles. Specifically, the document communicates the joint STARS perspective on such topics as the reuse vision, the goals for reuse, and reuse processes. The ALOAF concurs with and confirms these joint STARS perspectives put forth within the Concept of Operations. The purpose of the RIG is to facilitate the interoperability of government-sponsored software reuse libraries [?]. As STARS is a member of the RIG, relevant portions of the ALOAF will be put forward as suitable candidates for consensual standardization within the RIG.

## Standards Activities

One aspect of an open system is the adherence to and conformance with standards relevant to the technical application domain. A goal of the Asset Library *Open* Architecture Framework is the adoption of existing and/or emerging standards that are relevant to asset library systems. Standards activities that are relevant to the goals of the ALOAF are currently being tracked and analyzed. Those standards activities that have direct bearing or possible secondary effects on the goals of the ALOAF will be seriously considered for adoption and incorporation into the ALOAF. It is not the intent of the ALOAF to duplicate or reinvent work that has already been completed or is in progress.

The specification and promulgation of new and emerging standards is just as important as, if not more important than, the conformance to standards. Reuse technology is one area in which there are relatively few existing standards. A primary purpose of the ALOAF is the development and shaping of future reuse-based standards. A role of the ALOAF is to serve as initiator and catalyst in building and shaping consensus on reuse technology standards among asset library developers.

## ALOAF Objectives

The primary objectives of the STARS ALOAF are to facilitate the interchange of assets between asset libraries, and facilitate the construction of reuse tools that are portable between asset libraries. The asset-interchange objective focuses the STARS ALOAF upon the information needed to systematically organize and describe assets stored within an asset library. The ALOAF addresses the interchange of assets and their associated asset descriptions and model information through the ALOAF Data Modeling and Asset Interchange Specification. The portable-reuse-tools objective focuses the STARS ALOAF upon the asset library services and standard interfaces needed by reuse-based library tools. The ability to create portable reuse-based library tools is addressed by the ALOAF Service Model along with their ALOAF Programmatic Interfaces.

### Data Modeling Concepts and Asset Interchange Specification

An asset library can contain a large amount of data. This data may include the library's assets, descriptions or related information about the assets, as well as the organization of the assets and the manner in which the organization is described. The ALOAF Data Modeling Concepts address all of these constituent pieces of data via three layers: a data layer, a model layer, and the meta-model layer. Data modeling is necessary in order to specify a common asset interchange mechanism, as well as a uniform set of services (the ALOAF Service Model) which operates upon the data.

The ALOAF Asset Interchange Specification supports the interchange of assets and asset descriptions among diverse asset libraries. The emphases within asset interchange are upon the exchange of the asset descriptions and their organizational representation, and upon an open, non-restrictive interchange mechanism.

The STARS ALOAF Asset Interchange Specification provides a standard technique for representing library data models, a format for library data models, and a format for asset library data. The Asset Interchange Specification is not dependent upon any particular library data model and may be used to represent the data models and data of a wide range of asset libraries. The Asset Interchange Specification includes a Common Data Model. The Common Data Model describes a basic data model that allows asset libraries to interchange a common subset of asset descriptions. The Common Data Model encompasses information that is typically maintained by asset libraries.

### Service Model

The ALOAF Service Model describes a collection of services that asset library implementors are encouraged to provide to support interoperability among geographically dispersed, heterogeneous asset libraries and to support portability of tools across libraries. The Service Model categorizes framework services and describes the interrelationship between categories and between individual services within and across category boundaries. Individual services are described in terms of service protocol descriptions that are independent of implementation language. The service protocols consist of abstract functional interfaces and data exchange specifications intended to meet requirements common to all language bindings to the ALOAF services. STARS asset libraries will be required to conform to the ALOAF. Conformance descriptions and criteria for asset libraries will be specified as an extension of the ALOAF Service Model.

### Programmatic Interface

The ALOAF Programmatic Interface comprises a set of Ada package specifications defining interfaces to the services described in the ALOAF Service Model. In particular, the Ada specifications provide an Ada instantiation of the implementation-language-independent service protocol descriptions articulated in the Service Model. The Ada programmatic interface is only one of many potential language-specific instantiations of the service protocols and is provided by STARS as a recommended Ada standard interface. However, ALOAF conformance is not predicated on provision of ALOAF services through Ada interfaces.

## ALOAF Evolution

The ALOAF effort began in early 1991 with participation from all three STARS Prime participants – Boeing, IBM, and Unisys. The ALOAF is the result of the cooperation and confluence of reuse efforts of the three Primes, their subcontractors, and other STARS program participants.

The initial ALOAF addresses the reuse goals of STARS asset libraries with both short term and long term solutions. The short term solutions drive toward the immediate sharing of assets between the many diverse reuse libraries that are coming on-line in increasing numbers. The long term solutions strive for the far reaching goals of interoperable heterogeneous asset libraries, able to share assets and asset descriptions, as well as the portability of a broad and rich set of library tools which operate within asset library systems.

## 1 About the Authors

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