

IEEE Guide for Information Technology—Software Reuse— Concept of Operations for Interoperating Reuse Libraries

Sponsor

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Reuse Library Interoperability Group (RIG)

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Abstract: This document describes the concepts necessary and appropriate for Networks of Interoperating Reuse Libraries (NIRLs). The purpose is to provide a context for standardization efforts toward the goal of supporting and enhancing interoperability.

Keywords: reuse libraries; software; interoperability; networks

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Introduction

(This introduction is not part of IEEE Std 1430-1996, IEEE Guide for Information Technology—Software Reuse—Concept of Operations for Interoperating Reuse Libraries.)

Reuse libraries are an essential element in the strategy to reuse software and related information. Software reuse has taken place in the past through personal and organizational information preserving structures. Formalizing the preservation and location processes will make reuse possible for a wider range of people and activities. The reuse library is the proper center of activity for these formalized processes and the proper access point for sharable knowledge products.

The task of this document is to identify how reuse libraries can work together to create an entity greater than the sum of individual reuse libraries. The concept of software reuse is based upon the reuse of both software assets and knowledge. There are many different ways to represent and support knowledge, each providing insights that are otherwise not apparent. Reuse library operators have selected certain knowledge representations and services based on the needs of their user community. These representations and services may not be easily exchanged with other libraries. This knowledge is valuable to other user communities, and making these resources available to a wider user community is a primary driver for interoperation.

An infrastructure to promote the exchange of information will create a marketplace and establish an economic incentive for reuse. This infrastructure begins with a minimal set of common agreements and some basic technical capabilities that support the exchange of diverse products and services. In particular, the Network of Interoperating Reuse Libraries (NIRL, pronounced as “niril”) described in this document will create a marketplace based on the cooperation and capabilities of its member libraries.

There are already examples of NIRLs (some are described in an annex of this document), but they are incompatible because of a lack of standards. The concepts defining a NIRL need to be generalized so it is easy for outside libraries to “plug in” and offer expanded capabilities, products, and services to the software community. If this generalization is done in a way that reduces constraints and controls, the resulting infrastructure will be attractive to many participants, including commercial interests, thereby creating a marketplace.

Basic concepts must be implemented to create a true marketplace that supports producer and consumer transactions with integrity. These concepts include the following:

- Interoperability mechanisms which make use of standard interfaces and protocols. It must be easy to add new libraries, technologies, and tools to a NIRL.
- Packaging that includes an information exchange model and a global identification scheme.
- Availability of information describing the relationships between assets that are similar but different, due to modification, versioning, etc.
- Commercial support through standard, trustworthy licensing and accounting mechanisms, and common business agreements.
- Protection from unauthorized access by security mechanisms and nonforgeable, nonrepudiable, audit records of authorized user identification, location, and commerce, while still protecting individual privacy.
- Marketplace support through cooperative agreements among member libraries.
- Retailing through local user interfaces.
- Interoperability standards between member libraries, providing automated support for interoperability transactions and marketplace integrity.
- Training on the global capabilities and constraints of a NIRL for the staff of member libraries.

When these concepts are implemented, users of the member libraries will reach an expanding array of products and services from their own local, unique work environment. The resulting NIRL will be a nonhierarchical network providing interoperability among independently managed libraries supporting government,

commercial, and academic interests. This arrangement would not preclude independent libraries from establishing hierarchical library structures for their local user community.

The future NIRL will be more than a technology structure. The concepts of marketplace support have organizational, policy, and business implications. For example, organizations can provide the minimal services required for the network to function. These services bind autonomous member libraries into a network of interoperating reuse libraries. Such services may range from evolution of interface and protocol standards, to maintaining common business agreements for participation in the marketplace. The objective is to create an environment that is conducive to increasing the supply of software reuse products and services.

There may be services of a NIRL that are of limited use to a nonconforming library. For example, security concerns dictate that users of a NIRL are authenticated. If a particular library does not support the necessary authentication, then security related services of a NIRL will not be available. This type of nonconformance may be acceptable, since only a portion of a NIRL's services may serve the user community supported by the library.

It is expected that NIRLs, as envisioned in this document, will stimulate a large-scale change in the way the software community develops and maintains software. Software efforts can take advantage of the expertise and products of prior projects. Duplicative learning and mistakes will be reduced. Maintaining, collecting, and organizing data will become more important than creating new data. Creating new items may become more difficult to justify economically. Enhanced prototyping capabilities will result in closer relationships between engineering groups and users.

As NIRLs evolve, there will be sharing of technological, organizational, policy, and business interoperability solutions with the reuse community. The availability of this information, backed by experience, should reduce the attractiveness of point-to-point solutions for nonmember libraries that wish to interoperate with other nonmember libraries.

This guide was developed as the result of a collaboration between the Reuse Library Interoperability Group (RIG) and the Software Engineering Standards Committee (SESC) of the IEEE Computer Society. The RIG is a volunteer organization of experts from the industrial, government, and academic communities working together to create consensus-based specifications for the interoperation of software reuse libraries. Under the terms of a Memorandum of Understanding with the IEEE, the RIG develops specifications and other documents on this subject and submits them to SESC. The RIG then responds to the IEEE Sponsor Balloting process in order to improve the documents and widen the community of consensus. Following normal IEEE rules and procedures, the documents are finally published as IEEE standards.

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1. Overview

This guide is a concept of operations document that can serve as a reference for describing a software reuse marketplace achievable through the deployment of a Network of Interoperating Reuse Libraries (NIRL). The existence of NIRLs is a prerequisite for a marketplace operating under common agreements to provide software reuse products and services to customers throughout the software community.

1.1 Scope

There are many examples of large interoperability projects that have had significant impact on technology. For a software component industry to exist, reuse libraries need to exchange information (Moore [B25]¹). Successful software information exchange will require the integration and extension of existing standards, for example, library science standards, Computer-Aided Software Engineering (CASE) tool interoperability standards, and network protocol standards. Library science techniques address the identification and cataloging of information. CASE tool interoperability describes how different tools exchange information. The World Wide Web (WWW) demonstrates the effects of large-scale exchange of information. Exchange of information particular to software reuse combines aspects of each of these areas, but also introduces necessary constraints for reuse to be the end result of the exchange of information.

This guide describes the concepts necessary and appropriate for NIRLs. Annex B describes NIRLs currently in practice, and Annex C describes operational scenarios for proposed NIRLs. This guide is not a detailed NIRL design, nor is it a plan of how to implement the concept it describes.

1.2 Purpose

The purpose of this guide is to describe the context of the standardization efforts for interoperating reuse libraries. Although there is too little prior art to provide normative standards or guidance in some areas, it is possible to describe the assumptions regarding the operation of software reuse libraries that were made in the development of IEEE Std 1420.1-1995² and related documents.

¹The numbers in brackets correspond to those of the bibliography in Annex A.

²Information on references can be found in Clause 2.