The National HPCC Software Exchange Software Review Framework

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1 Purpose of the Framework

The purpose of the NHSE Software Review Framework (SRF) is to provide a systematic way for reviewers of high performance software to describe their evaluation methods and results and for users to access this information. The framework includes a high-level set of criteria that are expected to be applicable to all HPC software. The NHSE expects that domain experts will refine the high-level framework by adding additional domain-specific criteria, as well as descriptions of specific evaluation properties, methods, and tools. The NHSE intends for refinement of the framework to be carried out by maintainers of domain-specific repositories who do some level of evaluation as part of their repository development efforts, and by independent expert reviewers, such as authors of of *NHSE Review* articles [1]. Once the framework has been refined for a particular domain, software authors, users, and independent reviewers and testers will be able to use it to contribute to a growing body of evaluation data and information for software in that domain. The framework will enable users to selectively search this information for evaluation results related to particular criteria or properties that are of concern.

[1] http://nhse.cs.rice.edu/NHSEreview/

2 Structure of the Framework

The structure of the NHSE SRF is based heavily on the Reuse Library Interoperability Group's Asset Certification Framework (ACF) [?], adapted to the interdisciplinary, interagency, and interorganizational context and research culture of the high performance computing community. Although the NHSE SRF uses somewhat different terminology from the RIG ACF, the SRF is compatible with the ACF in that SRF descriptions of review policies and results can be translated into the ACF data model for interoperable interchange of this information with software repositories that use the ACF.

The SRF includes the following two templates:

1. the Policy Template for describing a domain-specific review policy,
2. the Result Template for describing review results in the context of a particular review policy.

A tabular view of the Policy Template is shown in Figure 1. Increasing review levels are expected to represent increasing confidence in the software, as well as increasing evaluation time, effort, and expertise. Review criteria are high level criteria such as completeness, correctness, and reliability. Evaluation properties define features or characteristics that may be assessed as being true or false, or that may be measured. Evaluation methods are documented techniques, which may involve compilation, static analysis, inspection, testing, formal verification, benchmarking, or application of a particular tool. The element type is the type of object to which the method is applied – e.g., algorithm, source code, executable, user documentation, etc.

The Result Template is shown pictorially in Figure 2. The review abstract summarizes the review information that is available for a software package under a particular review policy. Software that has been evaluated under different policies would have multiple review abstracts, one for each policy. A single review abstract may summarize the results from multiple reviewers, and these reviewers may each have supplied one or more review artifacts that describe their evaluation activities and results.

Review Level	Evaluation Criteria	Evaluation Property		Element Type
		Description	Method	
Level 1				
Level 2				
Level n				

Figure 1: Software Review Policy Template

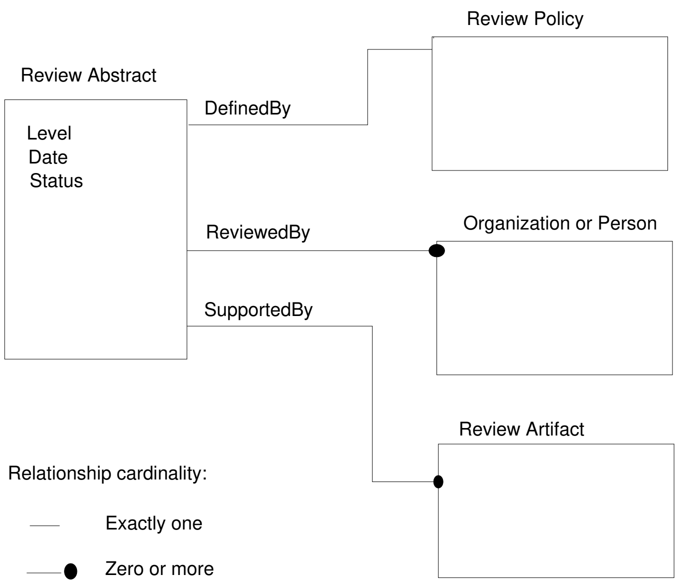

Figure 2: Software Review Results Template

3 High Level NHSE Review Policy

The high level NHSE software review policy defines three review levels:

1. **Unreviewed**. The software has not yet been reviewed by the NHSE for conformance with the partial review guidelines. This classification is for unreviewed software available on an "as is" basis.

2. **Partially reviewed**. The software has undergone a partial NHSE review to check conformance with the scope, completeness, documentation, and construction guidelines.

3. **Reviewed**. The software has been reviewed and determined to be of high quality by an expert in the appropriate field, such as the author of an article in the electronic journal NHSE Review which will begin publication in early 1996. The NHSE Review will present articles written by experts that review and compare software for particular areas of HPCC.

The software guidelines for the Partial review level consist of the following set of review criteria:

- **Scope**. Software submitted to the NHSE should provide a capability in high-performance scientific computation or in support of that discipline.

- **Completeness**. Submissions must include all routines and drivers necessary for users to run the software. Source code for widely available software used by the submission, `blas` and `lapack` for example, need not be included as part of the submission.

- **Documentation**. The software contains understandable documentation on its use.

- **Construction**. Submissions should adhere to good programming practice and, where feasible, to language standards. Software should be constructed in a modular fashion to facilitate reusability.

Recommended review criteria for the Reviewed level are the following:

- **Documentation**. The software contains complete, understandable, correct documentation on its use.

- **Correctness**. The software is relatively bug-free and works as advertised on all author provided data sets and on data sets provided by the reviewer.

- **Soundness**. The methods employed by the software are sound for solving the problem it is designed for, as described in the documentation.

- **Usability**. The software has an understandable user interface and is easy to use at the level of a typical NHSE client.

- **Efficiency**. The software runs fast enough, in that slow speed does not make it an ineffective tool.

Because the NHSE Software Review Policy is high-level, it goes only to the level of review criteria and does not specify any evaluation properties, methods, or tools. These more detailed parts of a review policy will generally be domain-specific.

4 Representation and Exchange of Review Information

To allow for exchange with and interpretation by other repositories, a review policy should be represented in the well-defined textual format specified by the SGML Document Type Definition (DTD) for the RIG BIDM and ACF. To enable interoperation with other software repositories, this representation uses the RIG ACF terminology, rather than the NHSE SRF terminology. The NHSE does not intend for review policy developers unfamiliar with SGML to have to edit the SGML files directly or for users to have to interpret the SGML files directly. Rather, the NHSE Repository in a Box (RIB) toolkit will include tools for creating and viewing these SGML files. Commercial general-purpose SGML tools may also be used. The first version of RIB is expected to be available by August 1996. In the meantime, NHSE staff will gladly assist review policy developers in translating policies into the SGML format.

For those familiar with SGML, the relevant portion of the BIDM/ACF DTD may be found in Appendix A, and the representation of the high-level NHSE Software Review Policy may be found in Appendix B.

Review results may be represented using either the RIG BIDM/ACF DTD or the RIG HTML binding. The HTML binding represents catalog information for a software package, including review information, in the form of META and LINK tags in the HEAD of an HTML document, usually the "home page" for the software [2]. The NHSE does not expect reviewers to create these representations by directly editing the SGML or HTML files. Rather, the NHSE RIB toolkit will contain tools for creating representations of review information, and for viewing this information.

The HTML source of a sample review abstract containing encoded review information for the ScaLAPACK package in Netlib may be found in Appendix C. The HTML header of the ScaLAPACK home page that contains a LINK tag pointing to this review abstract page may be found in Appendix D.

[2] `http://www.rig.org/TC7/html-binding.html`

Appendix A. Certification Policy Portion of the RIG BIDM/ACF SGML DTD

```
<!ENTITY   %  CertificationPolicy.attributes
                      "PolicyEffectiveDate?, PolicyReference*" >

<!ENTITY   %  CertificationPolicy.relationships
                      "Defines*" >

<!ENTITY   %  CertificationLevel.attributes
                      "Description?" >

<!ENTITY   %  CertificationLevel.relationships
                      "ByAssessing*, Certifies*" >

<!ENTITY   %  CertificationProperty.attributes
                      "PropertyDescription, CertificationMethod,
                       ElementType, ToolApplied?" >

<!ENTITY   %  CertificationArtifact.relationships
                      "IsProducedFromCertifying*" >

<!ELEMENT  Certificate - - (%RIGObject.attributes;,
                            %Certificate.attributes;,
                            %Certificate.relationships;) >

<!ELEMENT  CertificationPolicy - - (%RIGObject.attributes;,
                                    %CertificationPolicy.attributes;,
                                    %CertificationPolicy.relationships;) >

<!ELEMENT  CertificationLevel - - (CertificationQualityFactor |
                                   (%RIGObject.attributes;,
                                    %CertificationLevel.attributes;,
                                    %CertificationLevel.relationships;)) >


<!ELEMENT  CertificationArtifact - - (%RIGObject.attributes;,
                                      %Element.attributes;,
                                      %CertificationArtifact.relationships;) >

<!ELEMENT  CertificationQualityFactor - - (%RIGObject.attributes;,
                                 %CertificationLevel.attributes;,
                                 %CertificationLevel.relationships;) >
```

```
<!ELEMENT  CertificationProperty - - (%RIGObject.attributes;,
                                     %CertificationProperty.attributes;) >

<!ELEMENT  CertificateDate - - (%n.Date;) >

<!ELEMENT  CertificateStatus - - (%n.Text;) >

<!ELEMENT  CertificateLevel - - (%n.String;) >

<!ELEMENT  DefinedBy - - (%n.Identifier; | CertificationPolicy) >

<!ELEMENT  PolicyEffectiveDate - - (%n.Date;) >

<!ELEMENT  PolicyReference - - (%n.Text;) >

<!ELEMENT  Description - - (%n.Text;) >

<!ELEMENT  ByAssessing - - (%n.Identifier; | CertificationProperty) >

<!ELEMENT  Certifies - - (%n.Identifier; | CertificationQualityFactor) >

<!ELEMENT  PropertyDescription - - (%n.Text;) >

<!ELEMENT  CertificationMethod - - (%n.Text;) >

<!ELEMENT  ToolApplied - - (%n.Text;) >

<!ELEMENT  SupportedBy - - (%n.Identifier; | CertificationArtifact) >

<!ELEMENT  Defines - - (%n.Identifier; | CertificationLevel) >

<!ELEMENT  CertifiedBy - - (%n.Identifier; | Organization) >
```

Appendix B. SGML Representation of the NHSE Software Review Policy

```
<!DOCTYPE RIGOBJECT SYSTEM "BIDM.dtd" [
]>
<RIGObject>
<CertificationPolicy>
  <Name>NHSE Software Review Policy</Name>
  <PolicyReference>
    http://www.netlib.org/nhse/software_submit/review.html
  </PolicyReference>
  <Defines>
    <CertificationLevel>
      <Name>Unreviewed</Name>
      <Description>
      The software has not yet been reviewed by the NHSE for conformance
      with partial review guidelines and is available on an "as is" basis.
      </Description>
    </CertificationLevel>
  </Defines>
  <Defines>
    <CertificationLevel>
      <Name>Partially reviewed</Name>
      <Description>
      The software has undergone a partial NHSE review to check
      conformance with the scope, completeness, documentation, and
      construction guidelines.
      </Description>
      <Certifies>
        <CertificationQualityFactor>
           <Name>Scope</Name>
           <Description>
           Software submitted to the NHSE should
        provide a capability in high performance scientific
        computation or in support of that discipline.
           </Description>
        </CertificationQualityFactor>
      </Certifies>
      <Certifies>
        <CertificationQualityFactor>
           <Name>Completeness</Name>
           <Description>Submissions must include all routines and
```

```
                drivers necessary for users to run the software.
                Source code for widely available software used by the
                submission, blas and lapack for example, need not be
                included as part of the submission.
           </Description>
        </CertificationQualityFactor>
      </Certifies>
      <Certifies>
        <CertificationQualityFactor>
           <Name>Documentation</Name>
           <Description>The software contains understandable
           documentation on its use.
           </Description>
        </CertificationQualityFactor>
      </Certifies>
      <Certifies>
        <CertificationQualityFactor>
           <Name>Construction</Name>
           <Description>Submissions must adhere to good
                programming practice and, where feasible,
                to language standards. Software should be constructed
                in a modular fashion to facilitate reusability.
           </Description>
        </CertificationQualityFactor>
      </Certifies>
    </CertificationLevel>
  </Defines>
  <Defines>
    <CertificationLevel>
      <Name>Reviewed</Name>
      <Description>
      The software has been reviewed and determined to be of high quality
      by an expert in the appropriate field.
      </Description>
    </CertificationLevel>
  </Defines>
</CertificationPolicy>
</RIGObject>
```

Appendix C. HTML Source for ScaLAPACK Review Abstract

```
<head>
<title>NHSE Review Abstract for Scalapack</title>
<meta name="BIDM.Certificate.CertificateLevel" content="Partially reviewed">
<meta name="BIDM.Certificate.SupportedBy.CertificationArtifact.Name"
content="Scalapack Partial Review Report"
<link rel="BIDM.Certificate.SupportedBy.CertificationArtifact.UniqueID"
href="http://www.cs.utk.edu/~rowan/nhse_partial_reviews/scalapack">
<link rel="BIDM.Certificate.DefinedBy.CertificationPolicy"
title="NHSE Software Review Policy"
href="http://www.netlib.org/nhse/software_submit/review.html">
<link rev="BIDM.asset.awardedwith.certificate"
href="http://www.netlib.org/scalapack/">
</head>
<body>
<h1>NHSE Review Abstract for Scalapack</h1>

<hr>

<dl>
 <dt>ReviewLevel
 <dd>Partially reviewed
<p>
 <dt>SupportedBy
 <dd><a href="http://www.cs.utk.edu/~rowan/nhse_partial_reviews/scalapack">
 Partial review report for Scalapack</a>
<p>
 <dt>DefinedBy
 <dd><a href="http://www.netlib.org/nhse/software_submit/review.html">
     NHSE Software Review Policy</a>
</dl>
<p>
<hr>
<address>nhse-librarian@netlib.org</address>
```

Appendix D. HTML HEAD from ScaLAPACK Home Page

```
<head>
<TITLE>ScaLAPACK</TITLE>
<meta name="BIDM.asset.name" content="ScaLAPACK">
<meta name="BIDM.asset.abstract" content="
ScaLAPACK is a library of high performance linear algebra
routines for distributed memory MIMD computers.  It is a
continuation of the LAPACK project, which designed and
produced analogous software for workstations, vector
supercomputers, and shared memory parallel computers.  Both
libraries contain routines for solving systems of linear
equations, least squares problems, and eigenvalue problems.
Most machine dependencies are limited to two standard
libraries called the BLAS, or Parallel Basic Linear Algebra Subroutines,
and the BLACS, or Basic Linear Algebra Communication Subroutines.
LAPACK and ScaLAPACK will run on any machine where the PBLAS
and the BLACS are available.">
<meta name="BIDM.asset.cost" content="free">
<meta name="BIDM.asset.targetenvironment" content="
PVM 3.3 or later; Intel distributed
memory computers; IBM SP series; Thinking Machines CM-5.">
<meta name="BIDM.asset.domain" content="numerical/linear algebra">
<meta name="NHSE.asset.contactis.organization.email" content="scalapack@cs.utk.e
du">
<meta name="BIDM.asset.keyword" content="D. Linear algebra">
<meta name="BIDM.asset.keyword" content="parallel numerical library;
distributed memory multiprocessor; MIMD machine">
<link rel="NHSE.asset.reference"
  href="http://www.netlib.org/lapack/lawns/lawn100.ps">
<link rel="BIDM.asset.UniqueID" href="http://www.netlib.org/scalapack/"
urn="urn:inet:netlib.org:scalapack">
<link rel="BIDM.asset.islocatedin.library"
title="Netlib" href="http://www.netlib.org/"
urn="urn:inet:netlib.org:netlib">
<link rel="BIDM.asset.awardedwith.certificate"
href="http://www.netlib.org/nhse/sw_catalog/num/linalg/scalapack_review.html">
</head>
```