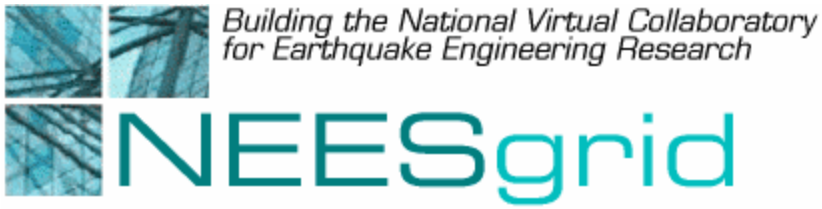

Technical Report NEESgrid-2004-12

www.neesgrid.org

(Report draft: 1.0)

Last modified: March 16, 2004

Comparison of Requirements Covered by the NEESgrid Acceptance Test Plan vs. Requirements Documented in the NEESgrid Requirements Traceability Matrix

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1 Context

The January 2004 NSF Site Visit team requested that the NEES System Integrator Awardee document the degree in which the *NEESgrid System Acceptance Test Plan*[1] covers the requirements documented in the *NEESgrid Requirements Traceability Matrix*[2]. This document summarizes the requirements coverage and details areas in which coverage is not complete.

1.1 Origin of the NEESgrid System Acceptance Test Plan

The *NEESgrid System Acceptance Test Plan*[1] was produced as a joint effort in 2003 by the NEES System Integration Team and the NEES Consortium Development Team. The test plan identifies a set of critical system requirements, a set of NEESgrid deliverables, and a procedure for demonstrating and documenting that the NEESgrid components and overall system meet those requirements. A specific set of tests to be conducted using the final NEESgrid deliverables is defined.

The requirements identified in the test plan were extracted from the *NEESgrid System Overview v2.1*[3] document written by Tom Prudhomme in October, 2002.

It should be noted that the System Overview document was written for a general audience and aimed at providing a high-level overview of the anticipated capabilities of the NEESgrid system. It was not explicitly intended to be used as a source of system requirements for NEESgrid.

1.2 Origin of the NEESgrid Requirements Traceability Matrix

The *NEESgrid Requirements Traceability Matrix*[2] was produced by personnel at the University of Michigan in reponse to a strong (and very specific) recommendation by the March 2003 Site Visit Report for the System Integration team.

According to the Traceability Matrix document, the user requirements that were used in the report were extracted from the NSF Program Solicitation[4]; the NSF Site Visit Reports from 2001, 2002 and 2003; *NEESgrid System Overview v2.1*[3], *NEESgrid User Requirements v2.0*[5], and *NEESgrid User Requirements v3.0*[6].

The Requirements Traceability Matrix considers all requirements that were proposed by the user community through the sources above and identifies the set that are met by the NEESgrid system deliverables. It is important to understand that the NEESgrid system is not intended to meet all proposed system requirements. (It is clearly not possible to meet all expectations of the user community, nor does NSF require that all expectations be met.) Instead, the NEESgrid system is intended to meet all system requirements that are within the scope of the System Integration award as defined jointly by NSF and the System Integration team.

2 Analysis

The Requirements Traceability Matrix identifies 75 system requirements that were of interest to the NEES community. Of those 75 requirements, 57 were found to be within the scope of the NEESgrid system as defined by NSF and the System Integration awardee. It is this set of 57 requirements that are considered in this analysis.

2.1 Summary

Of the 57 user requirements identified as "in scope" by the Requirements Traceability Matrix, 77% are covered by existing test plans defined in the System Acceptance Test Plan. 9% of these requirements could presumably be tested but are not within the scope of the current System Acceptance Test Plan, and 14% are too vague to be tested objectively.

Assessment of Requirements Coverage

Testable Requirements Covered by Acceptance Test Plan	44
Testable Requirements Not Covered by Acceptance Test Plan	5
Untestable Requirements Not Covered by Acceptance Test Plan	8
TOTAL	57

2.2 Requirements Covered by the Acceptance Test Plan

It is assumed that there is no need to describe requirements in this category further.

One point that is interesting to note, however, is that in addition to covering 75% of the requirements considered "in scope" by the Requirements Traceability Matrix, the Acceptance Test Plan actually covers *three requirements that were identified as "out of scope."*

These requirements cover the ability to search for people within the NEESgrid community based on their expertise and/or interests, the ability to use a shared whiteboard within the collaboration framework, and the ability to use videoconferencing services. These requirements were extracted from the *NEESgrid System Overview v2.1* document, but were not considered "in scope" during later analysis.

2.3 "Testable" Requirements Not Covered by the Acceptance Test Plan

The following five requirements were identified in the Requirements Traceability Matrix as "in scope" for the System Integrator's work, but are not explicitly covered by any Acceptance Test Plan.

- **Acquire data from field investigation**
  This capability is clearly provided by the NEESgrid system components (specifically, the data/metadata ingestion tools). The acceptance test plan includes tests that demonstrate the NEESgrid system's ability to acquire data from both physical experiments and simulation activities. However, *field investigations* are not explicitly mentioned in these test plans.
- **Acquire data from other sources (e.g., historical data or non-NEES data) (manually) for comparison/overlay of data**
  This capability is clearly provided by the NEESgrid system components (specifically, the data/metadata ingestion tools). The System Integration team has already demonstrated this capability by ingesting SAC Consortium data into the NEESgrid Central Data Repository. However, no test plan explicitly covers this capability.
- **Tools for characterizing a community/location/ structure/project (as basis for search and comparison)**
  This requirement is somewhat vague, but it seems clear that the intent is for the system to be able to handle input, search, and comparison of metadata for communities, locations, structures, and projects. The NEESgrid metadata repository can clearly be used for this purpose given an appropriate schema for each entity mentioned here, but this capability has not been explicitly demonstrated to date, and there is no acceptance test plan that will demonstrate it.
- **Video/audio recording and session playback**
  This requirement is met by the "Video as Data" feature provided by NEESgrid's data management area, in particular, the DataTurbine component. Because the System Integrator has chosen to recommend (and arrange for) use of this off-the-shelf software tool rather than develop a new services specifically for NEESgrid, there is no acceptance test planned for this capability.
- **Version control of simulation codes**
  The NEESgrid system provides three main components for simulation capabilities: the OpenSEES framework, the FedeasLab framework, and the NEESgrid Simulation Portal. The Simulation Portal does not include any simulation code itself, but instead provides a web interface to the capabilities provided by OpenSEES. Both OpenSEES and FedeasLab are code frameworks into which simulation code may be contributed and executed. Both include a set of simulation code that has previously been contributed, providing a wide range of simulation capabilities. While version control of the OpenSEES and FedeasLab code (and any simulation code contained by them) is clearly a capability provided by the source code repositories for each component, there is no acceptance test plan that explicitly demonstrates this capability.

2.4 "Untestable" Requirements Not Covered by the Acceptance Test Plan

The following eight requirements were identified in the Requirements Traceability Matrix as "in scope" for the System Integrator's work, but their wording and/or meaning is too vague to be tested by a formal, objective test plan. Analysis of whether or not the NEESgrid system meets these requirements would *by itself* exceed the scope of the

System Integrator awardee's work, due to the complexity of the required analysis. This analysis would also most likely involve subjective judgment, and thus would be inappropriate within the context of acceptance testing.

- **Utilize controlled vocabulary**
  This requirement refers to the metadata repository. The metadata repository allows metadata of *any* schema to be entered, and does not require compliance with any particular controlled vocabulary. This generality is necessary given the unavailability of any community consensus on metadata schema or controlled vocabulary in the fields supported by NEESgrid. There is no reason that the NEESgrid user community can not utilize a controlled vocabulary for metadata stored in the NEESgrid metadata repository whenever such a vocabulary becomes available. At this time, however, it would be inappropriate for the repository to implement any specific vocabulary requirements, so this requirement cannot currently be met.

- **Develop a metadata registry which enforces business rules for specification of metadata elements**
  This requirement is essentially the same as the previous one and is not "testable" for the reasons mentioned above.

- **Assure data integrity**
  "Data integrity" is a very broad term, and assurance of data integrity is a goal that organizations typically spend vast quantities of money to attain. NEESgrid system components employ a wide variety of mechanisms to ensure data integrity at various levels, but a study to determine the degree to which the *entire* system assures data integrity is well beyond the scope of the System Integration award.

- **Backup-restore/archive-recovery of data**
  The NEESgrid system does not explicitly define or require any particular data storage system. A wide variety of systems can be used with the NEESgrid system components. The storage systems used by NEESgrid will undoubtedly change during the transition of operations from the System Integration awardee to the NEES Consortium, so any tests conducted on the storage systems currently in use would be irrelevant following the transition. The capabilities of the storage systems used post-transition with respect to backups, archiving, recoverability, etc. will be determined by the choices made by the Consortium and are beyond the System Integrator's ability to control. The NEESgrid system does not use storage systems in any way that would prevent or inhibit backing up, archiving, or recovering data.

- **Privacy/Reciprocity**
  The availability of privacy and reciprocity in the NEESgrid system is highly dependent on the operation and management of the system. NEESgrid system components offer a number of features for controlling access to information stored in the data/metadata repository and these features are covered by acceptance test plans. These features can be used to establish many senses of privacy in an operational system. However, the use of these features to establish privacy is beyond the power of the System Integration team, as this is an operational issue that will be dependent on the policies established by the Consortium and the NEES community and the manner in which the NEES Consortium operates NEESgrid.

- **Data audit protocols**
  The availability of data audit protocols in the NEESgrid system is highly dependent on the operation, management, and use of the system. NEESgrid system components offer a variety of features that may be used to implement a variety of data auditing protocols. However, establishing specific protocols for data auditing is beyond the power of the System Integration team, as this is an operational issue that will be dependent on the policies established by the Consortium and the NEES community, the manner in which the NEES Consortium operates NEESgrid, and the manner in which users make use of NEESgrid.

- **Ease of use**
  "Ease of use" is both highly subjective and multifaceted. The NEESgrid system provides a wide variety of interfaces. Some of these interfaces are intended for direct use by end users, some are intended for use by administrators and system operators, and some are intended for use by software developers and future system integrators. While ease of use has been a consideration throughout the implementation of the NEESgrid system, quantification of the success of this effort is elusive. A study to determine the degree to which the *entire* system assures "ease of use" is well beyond the scope of the System Integration award.

- **Platform independence**
  Platform independence has been a goal in some areas of the NEESgrid system (web browser interfaces, for example), but not in all areas. Many of the NEESgrid components do have strong requirements on the platform on which they run, and that is consistent with the scope of the System Integration award. Where specific platforms are required, the NEESgrid documentation identifies supported platforms. A great deal of the code in which NEESgrid is implemented is written in Java, MATLAB, and other platform-independent languages. In principle, this code will run on any platform that supports the language in question. However, a thorough study of platforms that are and are not supported by NEESgrid is beyond the scope of the System Integration award.

Appendix A: Referenced NEESgrid Documentation

1. **NEESgrid System Acceptance Test Plan,** NEES System Integration and Consortium Development Teams, http://neesgrid.org/documents/NEESgrid-ATPlan-Rev1.pdf
2. **NEESgrid Requirements Traceability Matrix - TR-2003-13,** Thomas A. Finholt, Dan Horn, Suzandeise Thomé, http://neesgrid.org/documents/TR_2003_13_v1.1.pdf
3. **NEESgrid System Overview v2.1,** Tom Prudhomme, http://www.neesgrid.org/documents/NEESSystemOverview2_1.pdf
4. **NSF Program Solicitation,** http://www.nsf.gov/pubsys/ods/getpub.cfm?nsf007
5. **NEESgrid User Requirements Document v2.0,** http://www.neesgrid.org/documents/NEESgrid_UR_Feb15.2002.pdf
6. **NEESgrid User Requirements Document v3.0,** http://neesgrid.org/documents/NEESgrid_User_Requirements_v3_0.pdf