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GENERAL GOALS AND CHARACTERISTICS FOR PSEI STANDARDS

Approach Subgroup Of The Project Support
Environment Standards Working Group (PSESWG) Of
The Next Generation Computer Resources (NGCR)
Project

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13. ABSTRACT *(Maximum 200 words)*

This document describes the Department of the Navy's goals and general characteristics for the definition and specification of Project Support Environment (PSE) Interface (PSEI) standards for the Next Generation Computer Resources (NGCR) Program.

These goals and characteristics provide general guidance to the NGCR Project Support Environment Standards Working Group (PSESWG) in the selection of PSEI standards. It is expected that more specific goals and characteristics will be defined within particular PSE service areas to guide the selection of individual PSEI standards.

Each general goal and characteristic is described in a subsection of this document. In addition, each general characteristic description includes evaluation criteria with a scoring scheme. It is intended that these evaluation criteria be used for subjective scoring and analysis of competing standards.

14. SUBJECT TERMS
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standards, project support environments, PSESWG, PSESWG goals

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1. Introduction

1.1. Scope

This document describes the Department of the Navy's goals and general characteristics for the definition and specification of Project Support Environment (PSE) Interface (PSEI) standards for the Next Generation Computer Resources (NGCR) Program.

PSEI standards are essential to the timely and cost effective development of the majority of the next generation Navy mission critical computing systems. PSEI standards will assist the Navy in efficiently providing systems which address a wide range of performance levels, compatible computing service levels, and functionality levels.

These goals and characteristics provide general guidance to the NGCR Project Support Environment Standards Working Group (PSESWG) in the selection of PSEI standards. It is expected that more specific goals and characteristics will be defined within particular PSE service areas to guide the selection of individual PSEI standards.

Each general goal and characteristic is described in a subsection of this document. In addition, each general characteristic description includes evaluation criteria with a scoring scheme. It is intended that these evaluation criteria be used for subjective scoring and analysis of competing standards; quantitative scoring should only be applied to the specific characteristics defined for a particular PSE service area.

1.2. Terminology

The goals and characteristics in this document are presented informally and at a fairly abstract level. It may not be possible or even desirable to make this document precise. However, consistent usage of terms will evolve in subsequent revisions of this document.

2. Goals

2.1. Transportability of Data, Tools and Users

Transportability is measured in the degree to which the change to a different PSE can be accomplished without rework.

Data transportability refers to the ability to move project related data to a different PSE without change to the representation format of that data.

Tool transportability refers to the ability to install a tool on a different PSE without changing its implementation.

User transportability refers to the ability of a PSE user to move to a different PSE without requiring retraining on the PSE user interface and/or on the included PSE tools.

2.2. Quality Interface

The goals associated with the quality of PSEI standards address characteristics of standards which directly or indirectly specify a feature of the interface that contributes to overall support environment desirability. These goals are both technical and psychological in nature. An acceptable interface standard will have high subjective or objective scores in as

many of the stated goals for quality as possible. Quality goals have been grouped into seven broad categories for comparison purposes.

"***Modularity***"
Interface standards will be of high quality if they are self contained, well defined, and exhibit the technical features of high cohesion and low coupling. For example, interfaces which have no coupling are pairwise orthogonal and will not interact or conflict with each other in any way.

"***Simplicity***"
The client-to-interface relationship in a high quality standard will be straight forward and uncomplicated. This is not to be construed as unsophisticated or of minimal functionality.

"***Minimal Definition***"
This goal specifies that there be no excess specification in the standard, or that the standard consists of primitives and control of those primitives only. An ideal standard will have a minimal specification.

"***Testability***"
The interface defined by a quality standard will be testable. Further, test suites or benchmarks will be available against which to measure performance and compliance to a standard. This characteristic is intended to include the concept of ``Built-In-Test" (BIT) provisions.

"***Friendliness for User and Buyer***"
This goal requires that in order for a PSEI to be a quality interface it must be understandable, have a high degree of safety and confidence associated with it, be robust, and be recognized as such by both buyers and users. ``Buyer" is used here to mean the Program Manager putting together an acquisition package to configure a PSE for his project. It is insufficient that only highly technical individuals be able to determine the benefit and power of a particular interface standard.

"***Producibility***"
This goal is the combined effect of those elements of a design and the planning for a design that enables an item to be produced in the least amount of time with the least cost, while still meeting the necessary quality and performance requirements. Producibility applies equally to issues concerning software, firmware, hardware, and system and interface specification and production. By definition, producibility must be integral with all aspects of a PSE from development of the initial concept through acceptance testing of the delivered system. Continuous evaluation and consideration of producibility is particularly important when meeting the stringent requirements of mission critical computing systems which may require the efficient interaction of complex, heterogeneous, modularized backplane bus architectures or the utilization of a single, dedicated processor. Attention to producibility in the development phase of a system, whether it is complex or simple, will enhance operability throughout the system's life cycle, from initial fielding through retirement.

"***PSE Extensibility***"
Like many other goals, quality goals shall be compatible with and expandable under other PSE specifications. This is intended to include the concepts of open-ended specifications and upgradable growth potential.

2.3. User Confidence

In large measure, the success of any standard depends on user confidence. When the standard is reflected in the specification of an interface, user confidence is all the more important. Developers of products on either side of the interface are likely to be impacted in ways requiring modifications of existing products or products under development in order to meet the interface specification. In addition, there is the potential for concerns to be raised regarding robustness (will I be able to do all that I want across the interface), ambiguity (will the specification be liable to variable interpretation by implementors), efficiency (will the specification admit to efficient implementations), and orthogonality (will adoption of this interface specification preclude or interfere with choices for other interfaces or products). Adoption of standard interfaces results in new constraints on users while holding out the promise of future benefits in product portability, interoperability, and maintainability. User confidence in the interface specification is essential if he is to be asked to invest in it today on the basis of a promise of future benefit. Consequently, user confidence is a significant goal for all NGCR products, and for the planned PSEI specifications in particular.

2.4. Long Life-time Project Support

All PSEs must be developed with a view toward a long, useful life-time. Consideration must be given to insuring that the most current technology is employed within the system under development or modification. Use of technology, even though advanced and state-of-the-art or state-of-the-practice, must be proven in real, current systems to engender user support and confidence. The risks for implementation of the system or interface technology should be analyzed and judged acceptable prior to production decisions.

To insure long-life usefulness of a system, it is imperative that the issues of growth and modernization of a system be considered early. New technologies, even those just now on the horizon, must be examined for potential future inclusion in the current developmental or operational system. The system design, insofar as possible, must be logically modeled in such a way as to ensure extensibility in the future. Technology insertion must be a primary driver in developing specifications and standards to insure system operability with future technology. Strategies to identify and capture future technology must be examined. Strong consideration must be given to using commercial off-the-shelf (COTS) software in an effort to drive down costs and add vendor support. This characteristic maps directly to OSI/ISO standards and specifications under review within the NGCR Program.

The projected life cycle of the system should be evaluated from initial concept, given current mature technology and developmental items which may also effect long term operation. Factors effecting the operating environment must also be considered in light of current and viewable future technology. Similarly, plans for lay-away and potential mobilization must be considered. The system and all its parts and the defined and developed interfaces may be required to operate on a ramp-up schedule basis after some extended period of dormancy. Consequently, the logicalization of a system must be such that long life can be achieved.

2.5. Reduced Navy Cost

Currently, a PSE is developed specifically for the MCCR of each weapons system, and is usually rebuilt several times during the life of the system, just as is the weapons system itself. By providing a clear path for PSE development and upgrade for the MCCR of a weapons system, the cost of first time development of PSEs for MCCR will be reduced as well as upgrade and maintenance phases of the PSEs. Cost can be reduced by minimizing

the cost to migrate software products between PSEs; for example from subcontractor to prime contractor to governmental PSE.

2.6. NGCR Program Support

Many of the other goals in this section are also goals for the whole NGCR Program. This section describes those goals or constraints imposed on interface specifications which are due to limits and constraints imposed by the NGCR Program itself. These goals are not primarily technical in nature. The NGCR Program has several goals, such as the goal that the interface specifications should be non-proprietary, or that the specifications should have wide industry use and support. However, these goals are technical goals based on the higher level goals of getting more current technology at lower prices into Navy computer systems.

The major programmatic goals are based upon the program deadlines. The program plan calls for the NGCR PSEI standard to be in place by 1998. The interface specifications chosen for inclusion in the standard must be mature enough by 1996 to be included in the draft standard. Those interface areas that have no mature, industry accepted interface specifications by the 1996 time-frame can not be included in the standard.

Another programmatic goal is that the standards of the NGCR Working Groups should be usable together when building systems. This goal applies less to the PSEI standard than to the others because PSEs do not need to be built to real-time mission-critical requirements, but only need to be able to produce systems that are. In addition, it is a fundamental premise of the NGCR Program that standards selected by the Navy reflect an ``open systems'' approach. Thus, standardization on proprietary designs is to be avoided.

2.7. Tool Integration

The use of tools for project management, engineering, debugging, testing, and data management provides some relief from the complexities of development that modern systems generate. However, the present lack of integration of these tools does not allow manual steps to be eliminated in moving data between the various tool groups. Often, project management must generate paper charts for the design phase; test results must be transferred by disk or paper to data repositories. Additional manpower is required when training and experience does not reach across all of the tools.

Integration of these tools in a common framework with a common user interface and databases would truly release their power. Project managers would have access to design data for insights on project schedules. Designers would be able to examine test results for performance information.

3. General Characteristics

3.1. Consistent with Other NGCR and PSESWG Interfaces

3.1.1. Definition

The interfaces chosen to be part of the NGCR PSEI standard should be consistent with each other and to a lesser degree should also be consistent with the other NGCR standards and general industry usage.

3.1.2. Relationships to Goals

This characteristic helps build user confidence: when the interfaces are consistent and usable together there is less risk in using them. It also reduces Navy system engineering costs when the interfaces chosen for a project are known to be consistent. This characteristic also supports the NGCR Program Support goal.

3.1.3. Evaluation Criteria

10.....No inconsistencies found for candidate interface specification.

5.....Several minor inconsistencies found.

0.....Major inconsistencies found with two or more interfaces already chosen.

3.1.4. Rationale for Criteria

It is most important to look for inconsistencies with interface specifications already chosen for the PSEI standard, so it should be given the most weight when found. Inconsistencies with other candidates are of importance even if the other candidates are not chosen because they represent approaches chosen by industry. Being inconsistent with other industry approaches limits the participation of industry. The other NGCR standards are only weakly related to the PSEI standard, so those inconsistencies are given the least weight.

When an inconsistency is found it can be classified as either a major inconsistency or a minor inconsistency. Major inconsistencies should count much more against a candidate than minor inconsistencies. A major inconsistency implies that the two interface specifications could not be used together in the same system without a significant loss of functionality, while a minor inconsistency implies that a non-trivial work-around exists for the inconsistency allowing the two interfaces to be used together with only a minor loss of functionality. Two interfaces should not be considered inconsistent if a simple, trivial work-around allows both interfaces to be used together without loss of functionality.

3.2. Interface Sufficiency

3.2.1. Definition

A sufficient interface provides all necessary functionality to using applications. The degree to which this characteristic is satisfied may vary depending on the needs of a particular application or application domain.

3.2.2. Relationships to Goals

This characteristic supports the goals of User Confidence, Reduced Navy Cost, and Tool Integration.

3.2.3. Evaluation Criteria

10.....All necessary functionality is directly available via the interface.

8.....All necessary functionality is either directly available, or else is available by composition of directly available functionality provided at the interface.

5.....Only commonly used functionality is directly available or available by composition of directly available functionality from the interface.

1.....All necessary functionality can be obtained, but may require adding significant modules that use the interface as a starting point.

0.....Significant necessary functionality is unavailable via the standard interface; it may either be completely unavailable, or else may only be available via proprietary extensions to the interface standard.

3.2.4. Rationale of Criteria

A standard interface is most useful if it provides all necessary functionality in its domain of applicability, rather than requiring applications to develop additional layers of code to provide the missing functionality. The necessity to develop additional functionality increases costs, and encourages the development of redundant and incompatible solutions to the missing functionality.

3.3. Extensible Interface

3.3.1. Definition

An extensible interface is an interface standard which allows upward mobility for new products by an extension path.

3.3.2. Relationships to Goals

This characteristic directly supports the goal of Quality Interface (PSE Extensibility). An extensible interface is vital to Transportability of Tools and Data, and indirectly supports the goal of Reduced Navy Cost. As new tools are developed, they will begin to obsolete the interface as it is originally designed.

3.3.3. Evaluation Criteria

10.....Extensibility has been demonstrated.

5.....Extensibility features exist but have not been demonstrated.

0.....No extensibility features exist or extensibility attempt was unsuccessful.

3.3.4. Rationale for Criteria

Demonstrated extensibility provides evidence that the interface will support future enhancements without major changes to applications using the current interface.

3.4. Lasting Interface Technology

3.4.1. Definition

The interface is in use at the time of its selection for incorporation into the PSEI standard, and will be in wide use for a useful period of time following the adoption of the PSEI standard.

3.4.2. Relationships to Goals

This characteristic supports the primary goal of Long Life-time Project Support and the secondary goals of Tool Integration, NGCR Program Support, Reduced Navy Cost, and User Confidence.

3.4.3. Evaluation Criteria

10.....The candidate interface is widely used commercially, and is the clear choice by users, where applicable, over any competition.

5.....The candidate interface is available commercially on a number of platforms, and is the clear choice by users where available. However, the candidate interface has competition which is equally available and utilized by users on other platforms.

0.....The candidate interface is not widely available, and has multiple competitors available at least as widely on the same or different platforms.

3.4.4. Rationale for Criteria

This is a subjective prediction based upon the assumption that a PSE service area that is experiencing intense competition is not likely to have settled on a stable choice.

3.5. Technology Utilization

3.5.1. Definition

The specification of a PSEI standard should embody state-of-the-practice technology, and should be implementation independent.

3.5.2. Relationships to Goals

This characteristic supports the goals of Long Life-time Project Support and Tool Integration.

3.5.3. Evaluation Criteria

10.....The specification reflects state-of-the-practice and does not depend on a particular implementation technology.

5.....The use of the specification is expected to decline over the life-time of the PSEIs, or is bound to a particular implementation technology.

0.....The specification reflects obsolete technology and is unlikely to be used in the near future.

3.5.4. Rationale for Criteria

We want to select specifications that will be usable during the life-time of the PSEIs and which will incorporate newer technology.

3.6. Stability of Interface Specification

3.6.1. Definition

An interface specification needs to be relatively stabile over the life-time of the PSEI standard, with incompatible changes unlikely, if it is to provide a useful level of PSE compatibility.

3.6.2. Relationships to Goals

This characteristic supports the goals of User Confidence, Reduced Navy Cost, and Tool Integration.

3.6.3. Evaluation Criteria

10.....The candidate interface is not expected to undergo major or frequent incompatible changes.

5.....The candidate interface is expected to undergo minor or infrequent incompatible changes.

0.....The candidate interface is likely to undergo major or frequent incompatible changes.

3.6.4. Rationale for Criteria

An interface that is subject to major or frequent incompatible changes will require excessive rework.

3.7. Compatibility With Older Versions

3.7.1. Definition

The specifications chosen to be part of the NGCR PSEI standard should be compatible with respect to data and function of older versions.

3.7.2. Relationships to Goals

The characteristic of upward compatibility will build user confidence and provide consistency. It will reduce Navy project costs by reducing user retraining and data conversion time. This characteristic directly supports the goal of Long Life-time Project Support.

3.7.3. Evaluation Criteria

10.....Completely compatible with older versions.

5.....Several minor inconsistencies with older versions.

0.....Major inconsistencies with older versions.

3.7.4. Rationale for Criteria

Complete upward compatibility is the goal for a NGCR PSEI standard interface.

It is possible to move upward with a few minor inconsistencies, however retraining and conversion costs will be incurred.

An interface which requires major retraining and conversion efforts should not be considered upwardly compatible.

3.8. Support Exists For Interface Specification

3.8.1. Definition

Support for the interface specification exists in the form of actively meeting users' groups or technical conferences, publically available tutorials or training courses, and publications (textbooks, etc.).

3.8.2. Relationships to Goals

This characteristic supports the goals of User Confidence, Long Life-time Product Support, and NGCR Program Support.

3.8.3. Evaluation Criteria

10.....Regularly meeting users' groups, technical conferences, publically available tutorials or training courses, and currently published technical books or documentation exist that provide technical support for the interface specification.

5.....Technical books or documentation exist, but there are no regular meetings of technical organizations related to the interface specification; consequently, technical support is limited.

0.....No publically available support exists.

3.8.4. Rationale for Criteria

Users will perceive more risk without the availability of active users or experts in the use of the interface. They will incur higher costs, especially during first time use, without technical help providing answers to questions and lessons learned.

3.9. Stature of Sponsoring Organization

3.9.1. Definition

The specification should be an international (*e.g.*, ISO) standard as opposed to a Navy-only or DoD-only standard.

3.9.2. Relationships to Goals

This characteristic supports the goals of User Confidence, Long Life-time Project Support, and NGCR Program Support.

3.9.3. Evaluation Criteria

10.....Approved standards developed by accredited international bodies.

10.....Approved standards developed by accredited regional bodies.

10.....Approved standards developed by accredited national bodies.

8.....Draft standards developed by accredited international bodies.

8.....Draft standards developed by accredited regional bodies.

8.....Draft standards developed by accredited national bodies.

6.....Recognized *de facto* standards and specifications developed by non-accredited bodies using an open forum.

4.....Approved standards and specifications developed by non-accredited international standards bodies using a closed forum.

4.....Approved standards and specifications developed by non-accredited national standards bodies using a closed forum.

2.....Product.

0.....None of the above.

3.9.4. Rationale for Criteria

A goal stated in the POM is to adopt commercial standards. Vendors and users alike will use a standard that has wide acceptance. A larger audience will exist for building experience and evolving the standard.

3.10. Availability of Suitable Documentation

3.10.1. Definition

In addition to the specification itself, documentation for at least the implementor and user should exist.

3.10.2. Relationships to Goals

This characteristic supports the goals of Quality Interface, User Confidence, Reduced Navy Cost, and NGCR Program Support.

3.10.3. Evaluation Criteria

10.....Multiple sources for detailed documentation of various types are available.

5.....Only minimal set of documentation exists.

0.....Nothing is addition to the specification is available.

3.10.4. Rationale for Criteria

Detailed documentation with illustrative examples is essential to insure broad use of the interface specification and to maximize interoperability.

3.11. Navy Influence in Community Maintaining Interface

3.11.1. Definition

The Navy must have the ability to propose changes to the interface standard with the expectation of a fair hearing on the proposal's merits. This requires a formal, documented mechanism for change proposal and change evaluation. The Navy must not be at a disadvantage with respect to other users of the interface when seeking to modify the interface definition or to guide the direction of its evolution. It is not required that the Navy control the interface maintenance activity, but merely that the Navy have some real ability to influence the decision process with regard to changes in the interface.

It is further required that a formal process be documented for reporting problems discovered with the interface standard. The process must include a mechanism for establishing the priority of problem reports for consideration by the community maintaining the interface.

3.11.2. Relationships to Goals

The ability of the Navy to influence the community maintaining the interface is important to several of the Navy's top level goals, including development of sufficient user confidence in the interface standards and reduction of Navy costs. In addition, it is tightly coupled with NGCR Program objectives.

3.11.3. Evaluation Criteria

10.....Expect most Navy interests to be in common with most other constituents.

5.....Expect some Navy interests to be in common with many other constituents.

0.....Expect Navy's views to be in minority on most issues.

3.11.4. Rationale for Criteria

The NGCR Program seeks to reduce costs through adoption of commercially-supported interface standards. The adoption of such standards, however, means a loss of full control over the interfaces. Consequently, the assurance of user confidence in the interface standards, which is itself necessary for success in achieving a practical standard, demands appropriate Navy influence within or upon the community responsible for maintaining the interface. The Navy is likely to have the best chance of exerting this influence where its interests are most in common with other users of the standard.

3.12. Acceptance by Commercial Providers

3.12.1. Definition

The interface standard must not only be embraced by weapon systems developers who also build support environments, but also by commercial entities who must build products to meet the specification.

3.12.2. Relationships to Goals

This characteristic is related to the goals of User Confidence, Long Life-time Support, Reduced Navy Cost, and NGCR Program Support.

3.12.3. Evaluation Criteria

10.....Commercial providers actively support specification development and have available products.

5.....Commercial providers are supporting specification development, but are building prototype products.

0.....Commercial providers are ignoring the NGCR PSEIs and are building products to other or no standards.

3.12.4. Rationale for Criteria

A stated goal of the NGCR Program is to work with commercial interests to develop specifications. These commercial interests must be actively supporting the specification development and show their understanding and perception of low risk by using the standards developed for their product lines.

3.13. Nonproprietary Interface Specification

3.13.1. Definition

An interface specification is nonproprietary if either it is not based on the interfaces exported by a particular proprietary product, or else the vendor of the proprietary product has released the exported interface specification into the public domain so that competing vendors can build to the interface without paying for the privilege.

3.13.2. Relationships to Goals

This characteristic supports the goals of Transportability, Long Life-time Project Support, Reduced Navy Cost, and NGCR Program Support.

3.13.3. Evaluation Criteria

10.....The interface specification is a formal standard (*e.g.*, ISO, ANSI, IEEE, *etc.*).

8.....The interface specification is an industry standard implemented by multiple vendors without royalties to an ``owner".

5.....The interface specification is an industry standard implemented by multiple vendors, but licensed by an ``owner" to those vendors.

1.....The interface specification is an industry standard implemented by multiple vendors, but the implementation must be acquired from the ``owner".

0.....The interface specification is implementable by only one vendor.

3.13.4. Rationale for Criteria

Proprietary interface specifications conflict with the goal of expanding competition and increasing product availability.

3.14. Low User Risk

3.14.1. Definition

In order to be successfully used in weapon system development programs, especially during the Engineering and Manufacturing phase, the specification must appear to be low risk to the user. Otherwise, the user will pursue waivers or ``work-around" strategies.

3.14.2. Relationships to Goals

This characteristic supports the goals of Quality Interface (Simplicity, Testability and Friendliness), User Confidence, Long Life-time Project Support, and Reduced Navy Cost.

3.14.3. Evaluation Criteria

10.....Standard has been successfully used on a prior program, and is adequately supported.

5.....Standard has been used in a prototype with a substantial body of information indicating it can be used successfully on a real program.

0.....Standard has not been used on a real program.

3.14.4. Rationale for Criteria

All weapons system development decisions are based in large part on perceived as well as measured risk. In the later phases of development, less risk is allowable. The user must feel that the level of risk is acceptable, or he/she will not use the standard.

3.15. Language Bindings Exist

3.15.1. Definition

Many of the interface specifications will require an application programming interface (API) so that tool builders and integrators can write programs that access the services. Some interfaces are specified in a language-independent manner rather than in a particular programming language. This is especially true of international specifications. To meet goals for portability, the interface specification must include language bindings for the major programming languages used for developing PSEs: Ada and C.

3.15.2. Relationships to Goals

This characteristic is needed to achieve the goal of tool and user portability. Standard language bindings allow tools to be transported by recompiling on the new system. This characteristic also makes tool integration easier and will reduce the PSESWG effort needed to produce a standard that includes a language binding for the interface.

3.15.3. Evaluation Criteria

10.....has both Ada and C binding standards.

6.....has binding standard in Ada only.

4.....has binding standard in C only.

0.....has no Ada or C binding standard available.

3.15.4. Rationale for Criteria

(Note: this characteristic is not applicable to specifications that do not need an API.) The two major languages for current PSE development are Ada and C. Other languages were not considered because bindings in those languages would not significantly aid in achieving

binding standards in these two important languages and it is expected that few environments would require other language bindings. Ada is given priority over C because of the emphasis within DoD on the use of Ada.

Also, there are 4 levels of binding status, with priority or value decreasing from top to bottom:

a.....Binding standard exits.

b.....Draft standard or industry *de facto* standard exists

c.....A base-line specification that can be used to start a standardization effort exists.

d.....No binding exists

3.16. Conformance Tests are Available

3.16.1. Definition

Conformance tests are used to evaluate a candidate product's conformance to a particular standard by running tests on that product.

3.16.2. Relationships to Goals

This characteristic supports the goal of User Confidence, Data Transportability and Quality Interface (Testability).

3.16.3. Evaluation Criteria

10.....Formal/rigorous/complete conformance tests are available.

5.....Some conformance tests are available.

0.....Conformance tests are not available.

3.16.4. Rationale for Criteria

Any level of conformance testing is better than nothing, but partial conformance testing may give a false impression of the quality or level of conformance.

3.17. Transportable Data

3.17.1. Definition

The data produced by a PSEI specification should be transportable between tools and environments without major conversion.

3.17.2. Relationships to Goals

When data is transportable between tools and environments without major conversion, the cost of Navy systems is reduced and user confidence in the data is increased. Transportability of data allows the user to consider a wider variety of interfaces and removes the need for specialized products.

3.17.3. Evaluation Criteria

10.....Data is transportable between tools and environments.

5.....Minor conversion is necessary in order for the data to be transported.

0.....Major conversion is necessary to transport data.

3.17.4. Rationale for Criteria

Having the capability to transport data between interfaces reduces the cost of Navy systems and increases the user's confidence in the data. The more transportable the data is with other PSEIs, the more open the selection will be when choosing a project environment.

Transportability can be achieved with several minor inconsistencies in the data. Navy project costs are increased by data conversion efforts and user confidence in the data is decreased.

A major conversion effort implies that two interfaces cannot exchange data. The project environment selection would be limited.

3.18. Heterogeneous Distribution

3.18.1. Definition

A heterogeneous distributed system is a collection of multiple, independent but logically related heterogeneous processors connected by a computer network. It permits the development and manipulation of distributed data and functions on disparate systems while making the distribution transparent to the user and provides user control, as necessary. Heterogeneous distributed systems allow data to be entered, processed, and stored where it is generated, shared with different sites, and replicated to give users the option of accessing copies of data in the event of a site or network failure.

3.18.2. Relationships to Goals

This characteristic supports the goals of Quality Interface (PSE Extensibility), Transportable Data, Reduced Navy Cost, and Long Life-time Project Support.

3.18.3. Evaluation Criteria

10.....Specification has demonstrated support for heterogeneous distributed systems.

5.....Specific support for heterogeneous distributed systems is minimal, but nothing precludes support.

0.....Not useful in a heterogeneous distributed system.

3.18.4. Rationale for Criteria

Evaluation criteria for heterogeneous systems must examine heterogeneity issues in areas such as the following:

a.....existing/planned hardware/firmware/software

b.....current and future operating systems

c.....communications protocols

d.....communications links

e.....data management systems

f.....data models

g.....data manipulation languages and transaction management protocols

Site autonomy, with each site in the heterogeneous distributed system maintaining control and privacy of data, must be preserved while allowing users to commonly share data at varied sites. Continuous operation of the system must be preserved with no system-wide down time for random or planned events. Data location, fragmentation, and replication must be transparent to the user and to any shared applications. Systems operations must be, during performance and conformance testing, as well as long-term operation, hardware, operating system, and network independent from the user's viewpoint.

To obtain a high degree of reliability, availability, maintainability, and stability from heterogeneous distributed systems, the transparent communication of data must be available across multiple sites. Dynamic processing of common data and communications must deal with the analysis, optimization and execution of distributed processing while each site carries on its own local execution load. This must occur transparently while aspects of the network are subjected to varying traffic patterns and bottlenecks. The development of new, heterogeneous distributed processing technology is stimulating the development of applications that require support for distributed communications and data processing. In turn, the ability to share data from environment to environment must be based on proper system integration and system cooperation in order to reduce long term system development and operation costs and improve user productivity.

3.19. Hardware Independent

3.19.1. Definition

Hardware independence indicates the degree a configuration item (software, hardware, interface, standard) depends on the hardware and operating system of a particular host.

3.19.2. Relationships to Goals

By definition, hardware independence is crucial to the transportability of data and tools without standardizing on a particular hardware product. This characteristic also supports the goals of User Confidence, Long Life-time Project Support, and Reduced Navy Cost.

3.19.3. Evaluation Criteria

10.....is completely independent of the host hardware and operating system.

6.....depends on host operating system.

4.....depends on host hardware.

0.....depends on both hardware and software.

3.19.4. Rationale for Criteria

Since popular operating systems are usually developed to be hardware-independent themselves (*e.g.*, Unix), standardization of an interface on a particular operating system product does not impact transportability as much as hardware standardization.

3.20. Security

3.20.1. Definition

The PSE interfaces must be compatible with commercial and government definitions of security requirements. There are differences in requirements between military users of secure services and commercial users seeking protection from unauthorized disclosure of and access to data and processes. Security provisions for PSE interfaces must support both concepts of security mentioned previously. Many of the security services which must be specified in PSE interfaces will be transparent to users when the system is running.

Security provisions are most commonly defined in the U.S. using the terms, concepts, and requirements of the Department of Defense Trusted Computer System Evaluation Criteria (TCSEC) [DOD 5200.28-STD]. These are appropriate for NGCR PSE interfaces as well. The Computer System Laboratory (CSL) of NIST, as part of its program to promulgate technical computer security guidelines, has published the Computer Security Subsystem Interpretation of the TCSEC which provides further rationale and definitions pertinent to security implementations on computer-based systems.

3.20.2. Relationships to Goals

Classified data will be processed, at a minimum, by operating systems, networks, and database products, and will be passed from one phase of program development to another. This may include transferring from one PSE to another. Interface specifications which provide proper support to security considerations support the Transportability, Quality Interface, Long Life-time Project Support, Reduced Navy Cost, and Tool Integration goals.

3.20.3. Evaluation Criteria

10.....Specification has been implemented with multilevel secure provisions.

5.....Specification does not prohibit security provisions.

0.....Specification is not adequate to support security provisions.

3.20.4. Rationale for Criteria

The security characteristic must be assurable for any PSE which could host secure data in any phase of project life. However, if a particular PSE will never host secure data, the security requirements need not apply. Security standards exist in two broad categories: 1)

specifications for DoD Trusted Computer Systems provided in a series of DoD documents, and 2) encryption and authorization standards for privacy and proprietary control in commercial systems.

Navy PSEs will be required to store, process, and transfer classified data with secure methods satisfying DOD security standard requirements. A PSEI which does not provide adequate provisions for secure interfaces will not support Navy projects with classified data and processing requirements.

PSEIs such as those for operating systems, networks (local and wide area), and database systems which process secure data must be supportable in a PSE with multilevel security provisions.

Appendix A. Mapping of Goals to Characteristics

	2.1 Transportability of Data, Tools and Users	2.2 Quality Interface	2.3 User Confidence	2.4 Long Life-time Project Support	2.5 Reduced Navy Cost	2.6 NGCR Program Support	2.7 Tool Integration
3.1 Consistent\ with other\ NGCR and\ PSESWG Interfaces		X	X			X	
3.2 Interface Sufficiency			X		X		
3.3 Extensible Interface		X			X		
3.4 Lasting Interface Technology				X			
3.5 Technology Utilization		X		X			X
3.6 Stability of Interface Specification			X		X		X
3.7 Compatibility with Older Versions			X	X	X		
3.8 Support Exists for Interface Specification			X	X		X	
3.9 Stature\ of Sponsoring Organization			X				
3.10 Availability of\ Suitable Documentation		X	X		X		X

General Goals and Characteristics for PSEI Standards

3.11 Navy Influence\ in Community Maintaining Interface					X	X	
3.12 Acceptance\ by Commercial Providers			X				
3.13 Nonproprietary Interface Specification	X				X	X	
3.14 Low User Risk		X	X	X	X		
3.15 Language Bindings Exist	X		X	X			X
3.16 Conformance Tests\ are Available		X	X		X	X	
3.17 Transportable Data	X						
3.18 Heterogeneous Distribution	X	X		X			X
3.19 Hardware Independent	X		X	X	X		X
3.20 Security	X	X		X	X		

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