IEEE P1003.2a Draft 8 – December 1991

STANDARDS PROJECT

Draft Standard for Information Technology — Portable Operating System Interface (POSIX) Part 2: Shell and Utilities — Amendment 1: User Portability Extension (UPE)

Sponsor

Technical Committee on Operating Systems and Application Environments
of the
IEEE Computer Society

Work Item Number: JTC 1.22.21.2

Abstract: ISO/IEC 9945-2: 199x (corresponding to the merger of IEEE Std 1003.2-199x and IEEE Std 1003.2a-199x) is part of the POSIX series of standards for applications and user interfaces to open systems. It defines the applications interface to a shell command language and a set of utility programs for complex data manipulation. When the User Portability Utilities Option is included, the standard also defines a common environment for general purpose time-sharing users on character-oriented display terminals.

Keywords: API, application portability, data processing, open systems, operating system, portable application, POSIX, shell and utilities, user portability

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December 1991

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December 1991 *SH XXXXX*

Editor's Notes

This section will not appear in the final document. It is used for editorial comments concerning this draft.

The IEEE ballot for Draft 8 is due at the IEEE Standards Office on 8
***24 January 1992*. Please read the balloting instructions in Annex F. 8**

This is the third IEEE recirculation draft of the UPE. 8

This document is also registered as ISO/IEC CD Amendment 1 to CD 9945-2. The 8
international balloting period is unrelated to the IEEE balloting. Member bodies, 8
please consult any accompanying materials from SC22. Also, please read the 8
remainder of these Editor Notes to see explanations of stylistic differences 8
between a draft and the final standard (copyright notices, inline rationale, etc.). 8

The IEEE balloting will be on hiatus during the international balloting period, 8
which is probably scheduled to complete at the May 1992 WG15 meeting. This is 8
in accordance with the WG15 Synchronization Plan, which calls for coordinated 8
balloting to result in the approval of an IEEE/ANSI standard that is identical to 8
the ISO/IEC Draft International Standard (DIS) or Draft Amendment (DAM). 8
There will be a final recirculation of a full draft (9) to the IEEE balloting group 8
before it is sent to the Standards Board. 8

Draft 8 contains diff marks ('8'')in the right margin denoting changes from Draft 8
7 to Draft 8; 7 marks denote changes from Draft 6 to Draft 7. All diff marks from 8
previous drafts have been removed to focus balloting group attention on the 8
remaining issues to be considered in the recirculation. Editorial changes such as 7
typos, grammatical errors or changes, changes in cross references, and removal of editorial notes are not diff-marked. Please note that it is not always feasible to get the diff marks exactly right; they will sometimes start or end a line too soon.

We have been directed that all sentences that are currently declarative must be changed to use the ''shall'' form if they pose a requirement: ''The status is zero'' → ''The status shall be zero.'' It is a tedious process to do all these translations and they are not complete. They will completed on a draft-by-draft basis. In the meantime, please assume that all declarative sentences mean to use ''shall'' and treat them as either implementation or application requirements unless they specifically say ''may,'' ''should,'' or ''can.''

This draft makes assumptions about the organization and content of POSIX.2 8
Draft 11.2 (also known as ISO/IEC CD 9945-2.2, JTC 1 SC22 N1063), which is being 8
balloted by a slightly different group of people. If you are not in the POSIX.2 bal- 8
loting group (i.e., if you did not receive Draft 11.2), you can purchase the draft by 8
contacting:

IEEE Publications 8
P.O. Box 1331
445 Hoes Lane
Piscataway, NJ 08855-1331

1 (800) 678-IEEE 8
+1 (908) 562-3800 (outside US) 8

(Or see the online access instructions below.) 8

Since portions of this standard are meant to be modifications of the base POSIX.2 standard, the draft headings in Sections 1 through 4 have been set up to match the affected clauses and still go into the table of contents. There are therefore gaps in the clause numbers.

Please report typographical errors to:

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This draft and the current P1003.2 draft are available in various electronic forms to assist the review process. Our thanks to Andrew Hume of AT&T Bell Laboratories for providing online access facilities. Note that this is a limited experiment in providing online access; future ballots may provide other forms, such as diskettes or a bulletin board arrangement, but the instructions shown here are the only methods currently available. Please also observe the additional copyright restrictions that are described in the online files.

Assuming you have access to the Internet, the scenario is approximately

```
ftp research.att.com # research's IP address is 192.20.225.2
<login as netlib; password is your email address>
cd posix/p1003.2a/d8
get toc index
binary
get p11-20.Z
```

The draft is available in several forms. The table of contents can be found in `toc`, pages containing a particular section are stored under the section number, sets of pages are stored in files with names of the form `p`*n*–*m*, and the entire draft is stored in `all`. By default, files are ASCII. A `.ps` suffix indicates PostScript. A `.Z` suffix indicates a `compress`'ed file. The file `index` contains a general description of the files available.

These files are also available via electronic mail by sending a message like

```
send 4.55 5.6 from posix/p1003.2a/d8
```

to `netlib@research.att.com`. If you use email, you should *not* ask for the compressed version. For a more complete introduction to this form of *netlib*, send the message

```
send help
```

POSIX.2a Change History

This section is provided to track major changes between drafts. Since it was first added in Draft 6, earlier entries omit some degree of detail.

Draft 8 [November 1991] Fourth IEEE ballot (third recirculation). First 8
circulation as an ISO/IEC Proposed Draft Amendment: CD 8
Amendment 1 to CD 9945-2. 8

— `sh` (4.55): `emacs` command-line editing mode removed. 8

— `at` (5.2): Numerous clarifications to the *timespec* operands. 8

— `ex` (5.10): Addition of tilde resubstitute command; 8
clarification of startup sequence and `-s` option; explanation of 8
`control-Q` effects (changes also affect `vi`). 8

— `fc` (5.12): Clarification of command history numbering and 8
editing multiple commands. 8

— `mesg` (5.17): Modified algorithm for terminal selection. 8

— `more` (5.18): Changed `-p` *pattern* to `-p` *command*; disal- 8
lowed data modification when used as a filter; moved standard 8
output description to standard error. 8

— `patch` (5.22): Removed `-p`, `Prereq:` feature. 8

— `time` (5.29): Modified to allow the KornShell practice that 8
times a pipeline. 8

— Miscellaneous clarifications and corrections to various utili- 8
ties. 8

Draft 7 [July 1991] Third IEEE ballot (second recirculation). 7

— Changes to text in Sections 2 through 5 that clarify which 7
features are being added to support the UPUO (and are thus 7
optional for POSIX.2-only systems). 7

— General cleanup of the defaults values and usage of **TERM**, 7
COLUMNS, and **LINES**. 7

— Clarifications to Section 2 and the `nice` and `renice` utilities 7
on the nature of ‘‘system scheduling priority’’ (versus other 7
scheduling policies on the system) and how privileges are 7
involved. 7

— Clarifications to various uses of the term ‘‘nonprintable’’; the 7
POSIX.2 term ‘‘printable’’ does not include any white-space 7
characters other than `<space>`, causing some synchronization 7
problems. 7

— Modifications to the `uuencode` algorithm to address differ- 7
ences between ISO/IEC 646 {1} and other, incompatible, code 7
sets. 7

— Modifications to the descriptions of the `mailx` mailbox for- 7
mats. 7

— Numerous clarifications and minor modifications to `ex`, `more`, 7
and `vi`, mostly concerning screen movements. 7

— Miscellaneous clarifications and minor modifications to other 7
utilities. 7

Draft 6 [March 1991] Second IEEE ballot (first recirculation).

— The `compress`, `lint89`, `passwd`, `uncompress`, and `zcat` utilities were removed due to balloting opposition. See the rationale in clause E.4.

— The {POSIX2_CHAR_TERM} option was added.

— An asynchronous job notification option has been added to the `set` built-in. This is done through both `set -o notify` and `set -b`.

— Global shell variables **RANDOM**, **SECONDS**, and _ have been removed.

— The `nice` and `renice` utilities have changed from the use of ‘‘nice value’’ to ‘‘system scheduling priority.’’ They have also removed the {MAX_NICE}, and {MIN_NICE} and related limits. The `renice` utility has major interface changes to conform to the utility syntax guidelines

— The `mailx` and `patch` utilities have had major clarifications applied.

— The tags features of `ex`, `more`, and `vi` have been marked as belonging to the Software Development Option.

— The `df` and `du` were changed to use consistent, historical 512-byte reporting units and given a `−k` option to report in kilobytes.

— The `file` utility has extra defined strings and an explanation of `/etc/magic` in the rationale.

— The `man` utility added keyword searching and paging abilities.

— The `nm` and `ps` utilities have had major interface changes and clarifications.

— The `uuencode` and `uudecode` utilities have had clarifications added in the processing of octets versus bytes.

— The `unalias` utility now has the `a` option added for removing all aliases.

— Miscellaneous clarifications and minor technical changes have been made to various utilities.

— Instances of the verb ''print'' were changed to ''write'' as part of a general cleanup.

Draft 5 [June 1990] First IEEE ballot.

— Mostly clarifications and cleanups from the mock ballot.

— The `pshar` utility was removed.

— The `ps` utility was given a standardized method of producing custom output.

Draft 4 [February 1990] ''Mock ballot'' conducted by working group members only. During this ballot, numerous changes were made to ensure that the interfaces closely adhered to the existing practice of the Base Documents, with the exceptions noted in the POSIX. 2a PAR (and in the Scope).

POSIX.2a Technical Reviewers

The individuals denoted in Table i are the Technical Reviewers for this draft. During balloting they are the subject matter experts who coordinate the resolution process for specific sections, as shown.

Table i — POSIX.2a Technical Reviewers

Section	Topic	Reviewer	
1	*Revisions to General*	Jespersen	
2	*Revisions to Terminology and General Requirements*	Jespersen	
3	*Revisions to Shell Command Language*	Jespersen	7
4	*Revisions to Execution Environment Utilities*	Jespersen	7
5	*User Portability Utilities Option:* `patch`	Bostic	8
5	*User Portability Utilities Option: the rest*	Jespersen	7
	Front matter and Annexes	Jespersen	

P1003.2a Proposed Schedule

This section will not appear in the final document. It is used to provide editorial notes regarding the proposed P1003.2a schedule.

Date	Milestone (End of Meeting)	Draft	
Oct 24-28, 1988 *Honolulu, HI*	UPE planning begins.	–	
Jan 9-11, 1989 *Ft. Lauderdale, FL*	Begin UPE command selections and initial definitions.	–	
Apr 24-28, 1989 *Minneapolis, MN*	Select and define UPE utilities; PAR approved by Sponsor Executive Committee	**0**	
Jul 10-14, 1989 *San Jose, CA*	Refine utility descriptions; resolve version control contents.	**1**	
Oct 16-20, 1989 *Brussels, Belgium*	Refine utility descriptions; freeze utility selections; address internationalization issues.	**2**	
Jan 8-12, 1990 *New Orleans, LA*	Prepare Working Group Mock Ballot.	**3**	
[Feb 1990 - Apr 1990]	Working Group Mock Ballot.	**4**	
Apr 23 - 27, 1990 *Salt Lake City, UT*	Resolve Working Group Mock Ballot.	**4**	
[Jul 1990 - Feb 1991]	[Ballot Draft 5]	**5**	
[Mar 1991 - Jun 1991]	[Ballot Draft 6]	**6**	
[Jul 1991 - Oct 1991]	[Ballot Draft 7]	**7**	
[Jan 1992]	[Ballot Draft 8]	**8**	8
[Jan 1992 - May 1992]	[WG15 Balloting of PDAM 9945-2.1]	**8**	8

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Comments on standards and requests for interpretations should be addressed to:

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Introduction

(This Introduction is not a normative part of P1003.2a Information technology — Portable Operating System Interface (POSIX) — Part 2: Shell and Utilities — Amendment 1: User Portability Extension (UPE), but is included for information only.)

Editor's Note: This Introduction consists of material that will eventually be integrated into the base POSIX.2 standard's Introduction (and the portion of Annex B that contains general rationale about the standard). The Introduction contains text that was previously held in either the Foreword or Scope. As this portion of the standard is for information only (nonnormative), specific details of the integration with POSIX.2 are left as an editorial exercise.

The purpose of this document is to supplement the work begun in P1003.2, Shell and Utility Application Interface for Computer Operating System Environment, to promote the ''portability'' of users and programmers between conforming systems. The original POSIX.2 sought to define a standard interface and environment for application programs that require the services of a ''shell'' command language interpreter and a set of common utility programs. This supplement extends the list of utilities, and features of previously-defined utilities, to provide a common interactive environment. It is intended for end users, program developers, systems implementors, and application software developers and is complementary to ISO/IEC 9945-1: 1990 (first in a family of 'POSIX'' standards), which specifies operating system interfaces and source code level functions, based on the UNIX [1] system documentation; POSIX.2 and POSIX.2a are based upon documentation and the knowledge of existing programs that assume an interface and architecture similar to that described by POSIX.1 {8}.[2]

This document consists of a series of additions to the POSIX.2 base standard. Some are completely new utilities, others are added features or behaviors that are appropriate for the interactive nature of the scope of work. For the immediate future, this document must be considered as a standalone work; it is not intended to be a series of changes that immediately overthrow the base POSIX.2 standard. The intent of the working group is that POSIX.2 and POSIX.2a exist as separate IEEE documents, separately specifiable by the marketplace (although a system cannot claim conformance only to POSIX.2a). However, these two documents may eventually be accepted by ISO/IEC JTC 1 as international standards and it is intended that, in that timeframe (1992 or 1993), POSIX.2 and POSIX.2a be combined into a single integrated IS 9945-2 (although every portion marked as an optional facility, such as the UPE itself, would remain optional).

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1) UNIX is a registered trademark of UNIX System Laboratories in the USA and other countries.

2) The number in braces corresponds to those of the references in 1.2 (or the bibliographic entry in Annex A if the number is preceded by the letter B). The normative references clause and bibliography annex appear in POSIX.2, Draft 11.1.

The developers of this standard established the following goals for their work:

Extend/supplement the shell services and common utilities of POSIX.2 for the Portable Operating System Interface for Computer Environments (ISO/IEC 9945-1: 1990) and similar systems. Provide extensions to those services and additional utilities to support terminal users in a consistent manner across all conforming systems. The extension, to be packaged as a supplement to the POSIX.2 standard, is limited by three constraints:

(1) The *users* in this context are limited to the group of individuals who are familiar with the style of interaction characteristic of historically derived systems based on one of the UNIX operating systems. Typical users would include program developers, engineers, or general purpose time-sharing users.

(2) The *environment* to be supported is a multi-user time-sharing system supporting character-oriented display terminals. Alternatively, it is a collection of single-user systems interconnected via local area networks or telephone lines, but with similar user interfaces. The standard does not include support tailored for bit-mapped or graphics display terminals, although it is expected that such terminals could emulate the character orientation required by this environment. When facilities require cursor addressability from the terminal hardware, these shall be specifically identified in the standard.

(3) The facilities to be provided are based on the historical models of the following documents: the *System V Interface Definition* {B24}; the BSD User Manual {B28}; the *X/Open Portability Guide* {B31}; and, documentation for the KornShell {B25}. Emphasis will be placed on standardizing existing practice for existing users, with changes or additions limited to correcting deficiencies in the following areas:

   (a) Support for international character sets and other localization requirements, such as date formats, collation sequences, etc.

   (b) Reconciliation of differences between the historical implementations

   (c) Elimination of system or device dependencies

   (d) Corrections of features that could reduce system or user security/integrity

The extended facilities shall be designed to be cognizant of international character sets and other localization requirements, such as date formats, collation sequences, etc.

The extended facilities to be provided may include:

(1) Enhancements to utilities already defined in POSIX.2 to facilitate interactive use

(2) Utilities for editing and displaying files on full-screen character-oriented display terminals

(3) Utilities for querying and managing the user's environment

(4) Utilities for interacting with other users on the system or local network

(5) Utilities for scheduling and controlling the user's background, or periodically running, work

(6) Utilities to enhance the interactive program development activities, complementary to those tools used for software installation in the original project

(7) Other user portability utilities and features within the general limitations described by this Introduction

The following areas were considered to be outside the scope of this standard:

(1) Operating system administrative utilities (privileged processes, system processes, daemons, etc.)

(2) Commands required for the installation, configuration, or maintenance of operating systems or file systems

(3) Networking commands

(4) Graphics programs or interfaces

(5) Text formatting programs or languages

(6) Database programs or interfaces (e.g., SQL, etc.)

General Rationale. *(This subclause is not a part of P1003.2a)*

This section summarizes the deliberations of the IEEE P1003.2 working group, the committee charged by the IEEE Computer Society's Technical Committee on Operating Systems and Operational Environments with devising an interface standard for supplementing the original POSIX.2 standard for user portability.

The rationale annex is being published along with the standard to assist in the process of review. It contains historical information concerning the contents of the standard and why features were included or discarded by the working group. It also contains notes of interest to application programmers on recommended programming practices, emphasizing the consequences of some aspects of the standard that may not be immediately apparent.

The purpose of the original project was to extend the services of the POSIX.1 {8} standard that were available to the portable applications program. The extended services consisted of a shell command language and a collection of utility programs (tools) that could be called from applications for complex data and file manipulation; both were to be based on the same historical models as the POSIX.1 {8} standard.

Draft 2 concluded the scope statement with: ''This supplement requires a fully conforming POSIX.2 base.'' The sentence was removed because when the revised material is integrated into the base standard, it should be perfectly obvious that it is not meant to be a stand alone system, but merely a series of extensions to the base.

The list of areas outside the scope of this standard is identical to that in the Introduction to POSIX.2, with the exception of the item:

(4) Terminal control or user-interface programs (e.g., visual shells, visual editors, window managers, command history mechanisms, etc.).

This is, of course, the entire purpose of this supplement.

Just as this standard relies on the knowledge of architecture, history, and definitions from the POSIX.1 {8}, this supplement relies on the entirety of POSIX.2. The reader is referred to the Rationale and Notes and Bibliography annexes of POSIX.1 {8} and POSIX.2 for background material about UNIX systems in general and POSIX specifically, which will not be duplicated here.

There was periodic debate in the working group about how various of the standard utilities could be implemented, given the set of features provided by POSIX.1 {8}, the presumed base operating system. For example, the `nice` utility is not necessarily supported by a *nice*() system call or function because one does not exist in POSIX.1 {8}. Thus, `nice` cannot be a Strictly Conforming POSIX Shell Application; at most it could be a Conforming POSIX Shell Application with Extensions. However, there is no requirement stated in this standard that the standard utilities have to be strictly conforming programs themselves. The base standard expressed a goal that: ''This interface should be implementable on conforming POSIX.1 {8} systems.'' Most, if not all, of the standard utilities in the base standard met that goal, but the expanded scope for this supplement made that more difficult to achieve. A few of the utilities have some requirements for administrative support that were outside the scope of POSIX.1 {8}: `crontab`, `df`, `nice`, `ps`, `renice`, and `who` are examples. It is anticipated that the emerging POSIX System Administration work will provide standard underpinnings for such services, but until they are approved, common historical implementation extensions will have to be relied upon.

There was a number of differences in philosophy used in preparing the utilities in this supplement from those in the base standard:

— It was assumed that a human was the audience for the output of utilities. Unlike a shell script, the primary audience of the base standard, the human is not so concerned about exactness of format. Therefore, in many cases, the UPE merely suggests the form of the output, rather than using the *printf*()-like form of the base standard. This has the benefit of allowing multiple historical implementations to conform without change. There are exceptions to this general philosophy, however. In some cases, such as `df`, it was felt that users were confused by the historical differences in output. A compromise ''portable'' output format that could be provided by all systems in an upward-compatible manner was provided. That this output could then be parsed by a shell script is a serendipitous side effect. (As explained in the original base standard, `df` is a utility that produces output requiring human judgment for its interpretation; shell scripts should probably avoid using `df` to make decisions about allocating new files.)

— Since the idea of the UPE was to form a common environment for system users of existing technology terminals, and not blaze new trails in user interfaces, the working group chose to limit changes to command names and syntax. While the application orientation of the base standard caused various name and option changes for consistency and historical harmonization, this standard chose to leave many of the unusual quirks intact so that users would continue to feel comfortable at their terminals. It is for this reason that the UPE has comparatively fewer obsolescent features than the base standard does.

Related Standards Activities

Activities to extend this standard to address additional requirements are in progress, and similar efforts can be anticipated in the future.

The following areas are under active consideration at this time, or are expected to become active in the near future: [3)]

(1) Language-independent service descriptions of POSIX.1 {8}

(2) C, Ada, and FORTRAN Language bindings to (1)

(3) Verification testing methods

(4) Realtime facilities

(5) Secure/Trusted System considerations

(6) Network interface facilities

(7) System Administration

(8) Graphical User Interfaces

(9) Profiles describing application- or user-specific combinations of Open Systems standards for: supercomputing, multiprocessor, and batch extensions; transaction processing; realtime systems; and multiuser systems based on historical models

(10) An overall guide to POSIX-based or related Open Systems standards and profiles

Extensions are approved as ‘‘amendments’’ or ‘‘revisions’’ to this document, following the IEEE and ISO/IEC Procedures.

Approved amendments are published separately until the full document is reprinted and such amendments are incorporated in their proper positions.

If you have interest in participating in the TCOS working groups addressing these issues, please send your name, address, and phone number to the Secretary, IEEE Standards Board, Institute of Electrical and Electronics Engineers, Inc., P.O. Box

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3) A *Standards Status Report* that lists all current IEEE Computer Society standards projects is available from the IEEE Computer Society, 1730 Massachusetts Avenue NW, Washington, DC 20036-1903; Telephone: +1 202 371-0101; FAX: +1 202 728-9614. Working drafts of POSIX standards under development are also available from this office.

1331, 445 Hoes Lane, Piscataway, NJ 08855-1331, and ask to have this forwarded to the chairperson of the appropriate TCOS working group. If you have interest in participating in this work at the international level, contact your ISO/IEC national body.

P1003.2a was prepared by the 1003.2a working group, sponsored by the Technical Committee on Operating Systems and Application Environments of the IEEE Computer Society. At the time this standard was approved, the membership of the 1003.2a working group was as follows:

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TCOS Standards Subcommittee

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	Robert Bismuth
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Vice Chair:	Donald W. Cragun
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Keith Bostic	Hal Jespersen	Scott Sutter
Donald W. Cragun		

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David Williams
Neil Winton
Morten With
John Wu
Jim Young

The following persons were members of the 1003.2a Balloting Group that approved the standard for submission to the IEEE Standards Board:

Richard Alexander	*SHARE Institutional Representative*
Ralph Barker	*UniForum Institutional Representative*
Michael Lambert	*X/Open Institutional Representative*
John Quarterman	*Usenix Institutional Representative*

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When the IEEE Standards Board approved this standard on <*date to be provided*> it had the following membership:

(to be pasted in by IEEE)

Information technology — Portable Operating System Interface (POSIX) — Part 2: Shell and Utilities — Amendment 1: User Portability Extension (UPE)

Section 1: Revisions to General

⇒ **1.1 Scope.** *Modify the contents of clause 1.1, Scope, as shown below.*

1.1 Scope

This standard defines a standard source code level interface to command interpretation, or ''shell,'' services and common utility programs for application programs. These services and programs are complementary to those specified by ISO/IEC 9945-1: 1990 {8}, hereinafter referred to as 'POSIX.1 {8}.'' When the User Portability Utilities Option is included, this standard has additional scope. The list of utilities and features is extended to provide a common interactive environment for system users and program developers.

The standard has been designed to be used by both application programmers and system implementors. When the User Portability Utilities Option is included, it is also to be used by system users and program developers. However, it is intended to be a reference document and not a tutorial on the use of the services, the utilities, or the interrelationships between the utilities.