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ABSTRACT

This memorandum describes a user documentation plan for the UNIX time-sharing software system. Included are discussions of the study effort completed by Dept. 9131 which led to the establishment of the plan. Information concerning user types and documentation needs was obtained from various existing users at BTL. Additional information was obtained from a review of existing UNIX documents and Dept. 9131's own experience as a user of the system.

UNIX users were identified and classified according to the function(s) they perform. Specific user documents, appropriate to user functions, were determined. Recommendations and guidelines for implementing the plan were provided along with the identification of content sources from existing documents.

Although this plan is primarily intended for UNIX documentation, its content and development process are largely applicable to the user documentation required to support other software systems.

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Bell Laboratories

Subject: UNIX User Documentation Plan
Case- 39382 -- File- 39382-38

date: April 29, 1976

from: Jerome T. Walker
Robert A. Zinke

TM: 76-9131-4

MEMORANDUM FOR FILE

INTRODUCTION

This memorandum describes a user documentation plan for the UNIX time-sharing software system. UNIX is a general purpose, multiple user,interactive operating system for the Digital Equipment Corporation PDP-11/40,11/45, and 11/70 minicomputers. UNIX features include the following:

1. A hierarchical file system incorporating demountable volumes,
2. Compatible file, device, and inter-process I/O,
3. The ability to initiate asynchronous processes,
4. System command language selectable on a per-user basis,
5. Over 100 subsystems including a dozen languages.

The system is particularly popular among users in preparing and editing textual material.

Since the initial request for redocumentation assistance from the UNIX Support Group (USG) (8234) was received, the objective of the Personnel Subsystems Department (9131) has been to establish a documentation scheme which would:

1) consider the user groups and their particular needs
2) identify the type and number of documents required
3) recommend the appropriate formats of user documentation
4) establish content outlines for each kind of document

This objective has been addressed and the results are presented herein.

Additionally, one document, "Setting Up UNIX", was rewritten and tested to serve as an example of how operating procedures might be presented. A complete report of that effort has been issued (Walker and Zinke, 1976).

STRATEGY

Several activities were performed leading to the establishment of a general documentation plan.

1. Identification of existing documentation problems from questionnaires administered to the USG and various UNIX system users at BTL.

2. Identification of documentation problems from review of existing documents and from first-hand use by members of the Personnel Subsystems Department.

3. Identification of primary users and their functions.

4. Determination of required information elements appropriate to each function and user type.

5. Establishment of seven documents intended to satisfy the needs of the user population.

6. Identification of existing content sources for obtaining information to be presented in the prescribed user documents.

Problem Definition Sources

Information on documentation problems, user types, and their needs was obtained in several ways. A questionnaire was designed and delivered to members of the UNIX Support Group to obtain first-hand information on the areas and types of documentation problems reported by UNIX system users. All members of that group are involved in developing and maintaining the UNIX system on the PDP-11 and supporting its users. Some members are directly involved in assisting users with new system installations. The USG members have been working on UNIX for an average of twenty months.

Additionally, fourteen UNIX users at various BTL locations were identified and queried as to the nature and extent of documentation problems they had experienced in installing and using UNIX. Bell Laboratories users are applications programmers, system programmers and system operations personnel employing UNIX on a daily basis as a supportive operating system or in the development of another system.

The majority of these users had worked with UNIX on the PDP 11/40 and 11/45 models.

A critical review of the UNIX Programmer's Manual (Fifth Edition) and the UNIX Handbook (a Collection of Manuals, tutorials and memoranda on UNIX Facilities) was conducted. These documents were examined with the documentation plan objectives in mind. Informal conversations with UNIX users and support personnel and personal experiences with the operating system (e.g. rewriting the document "Setting Up UNIX") as "naive" or beginning users provided additional insight into the problems with existing documentation.

PROBLEM DEFINITION

Results reported by the UNIX Support Group

The members of the UNIX Support Group reported such recurrent user problems as the following:

- inability to boot the system
- inability to reconfigure the disks
- inability to effectively use nroff
- inability to properly execute commands
- inability to find needed information
- System Administration

System administration and management was a frequently reported problem with high criticality. Problems with reconfiguring disks and properly executing commands were reported to be very frequent and of medium criticality on a 3 point scale with anchors at "High" "Medium" and "Low". Failure to boot the system was reported to be a low frequency occurrence; however, its criticality was judged to be "High". Problems with nroff were seen as least critical (low) even though they occurred with medium frequency.

Since reconfiguration and command execution problems were usually resolved through consulation with the UNIX Support Group and were of high frequency and medium criticality, it is suggested that the redocumentation of these procedures be given initial attention.

Further review and testing of existing documentation in these areas will be useful in revealing the specific procedures and sections which are problematic and which were reported to be unclear.

Further comments on UNIX documentation made by the UNIX Support Group indicated: 1) the need for more examples in the UNIX Programmer's Manual (UPM); and 2) the need for greater familiarity with the UNIX system in using the UPM. Response to the second comment should be directed at making the UPM usable by inexperienced UNIX users rather than requiring that users be more familiar with UNIX.

Results from BTL users

The responses of the BTL questionnaire were reviewed for information which would contribute to the problem definition and documentation plan. Those responses revealed the following information concerning the users' acquisition of knowledge about UNIX:

- 86% acquired their familiarity with UNIX from the documentation that was provided with the software. (The amount of documentation provided was reported to vary from user to user).
- 57% reported receiving hands-on training from their co-workers.
- Only 29% received formal classroom training.
- 64% reported that they had acquired familiarity with UNIX by examining the souce code, trial and error learning, asking others, etc.

The large percentage of users who claim dependency on the documentation for acquiring their familiarity with UNIX gives a great deal of evidence for the need for complete and accurate documentation on the system. The data also indicate that a small number of users receive formal UNIX training. Most importantly, a large (64%) percentage of BTL users resort to reading the source code, consulting, and trial and error learning in becoming experienced UNIX users. It is suggested that optimal documentation will greatly reduce the amount of trial and error learning and consultation with others as well as the reliance on source code reading for gaining familiarity with UNIX.

The problems and resolutions, specifically related to documentation, as reported by BTL users, are contained in Table 1. From the responses in Table 1, at least two things again are evident. First, there is insufficient content and incorrect information in some parts of the documentation on UNIX. Certain necessary information is completely absent in the documentation. Secondly, the resolution of the majority of documentation problems came through either reading the source code or consulting with the UNIX Support Group or other knowledgeable users. In this respect,

Table 1

A Summary of BTL User Reported Documentation Problems and Users' Resolutions

	PROBLEM	RESOLUTION
1.	Need for a more current UPM	Wait
2.	Assumes prior unstated knowledge	Consult
3.	Updates not consistently released with mods in troff format	UCAT from USG system
4.	Updates don't show revised dates	Compare updates with existing manual
5.	Listings are not commented	Self-commented
6.	Open to incorrect interpretation and information	Consult, trial and error learning
7.	Inadequate documentation of how UNIX actually works	Read source code, consult
8.	Inadequate documentation of programm code	Read source code, consult
9.	Inadequate documentation for procedures following bad file check	Consult
10.	How tty drivers work	Read source code
11.	How to add a system call	Read source code
12.	New STTY use (n/1 and n/2 options)	Trial and error learning

it is suggested that the documentation is inadequate - especially in light of the fact that there are no explicit statements in any of the reviewed documentation instructing the user to examine the source code. Even with the inclusion of such referents, the documentation appears insufficient for the needs of the user and needs to be expanded, revised, tested, and corrected.

The overall evaluation of UNIX documentation by BTL users was that the documentation they initially received was adequate except for C language documents which were described as "Somewhat weak" and "not suitable for some backgrounds". Evaluations of specific documents used by BTL UNIX users are summarized in Table 2.

In accord with our review, the UNIX Programmer's Manual was favorably evaluated as "easy to use", "very helpful", "material well organized" and "easy to find what was needed". However, there was disagreement over whether the information in the UPM was complete. Editor and C tutorials were reportedly "easy to use" and "very helpful" while the C reference manual received mixed evaluations. Other documents received minimal review.

Recommendations for improving UNIX documentation were made by 36% of the BTL respondents and included the following:

- A revised C reference manual to bridge the technically complete but difficult to interpret manual with the readable but incomplete tutorial
- The testing of all documents - especially procedural ones - by naive users to uncover problems
- Fortran and assembler manuals with error messages
- A better description of user ID's and group ID's
- An explanation of each part of the operating system
- An explanation of solutions to commonly encountered problems
- Procedures for regenerating the system
- Indications of necessary precautions to be taken
- Setting Up UNIX procedures in a checklist format
- A short general description of functions, implementation procedures and interrelationships for program modules

Table 2

A Summary of BTL Users' Evaluations of UNIX Documents

Document Name	Evaluations (Number of responses)																
	a	b	c	d	e	f	g	h	i	j	k	l	m	n	o	p	q	r
Setting Up UNIX	2	1	1		1	1		1				2	1		1			1
UNIX Programmer's Manual (5th Ed.)	6		2	3	3		1	7	2		7		5	1				
Regenerating System Software	1		1		2	1			2		1		1					
Installing Mods.					1	1												
C Reference Manual	1	2	2	3			1	2			3		1	1	1			
NROFF User's Manual		1									1			1				
A Tutorial Introduction to the UNIX Text Editor	2			1				2			1		1					
Programming in C-A Tutorial	3			1	1			3			1		1					
The UNIX System I/O	1			1				1	1									
UNIX Handbook		2		2					1			1		1				
UNIX Programm	1								1				1					
UNIX for Beginners	1							1			1		1					
DH.C & TTY.C		1		1										1				
Course Handouts								1										
Others								1										

a. Easy to use
b. Difficult to follow
c. Had to request interpretation
d. Contained everything needed
e. Does not supply enough information
f. Misleading-caused problems
g. Assumed too much knowledge
h. Very helpful
i. Somewhat helpful
j. Not helpful
k. Material well organized
l. Material not well organized
m. Easy to find what was needed
n. Difficult to find what was needed
o. Too wordy
p. Used much unfamiliar terminology
q. Contained more information than needed
r. Contained irrelevant information

Results of the Documentation Review

The following general comments and recommendations are based on our review of existing UNIX documents.

1. Generally, the documentation technically describes the process or language but is not written with the user in mind, i.e., there are few or no procedural documents available.

2. A common problem with existing documents is the necessity for users to refer to several separate documents to find what is needed. This problem can be reduced by combining elements of the same subject matter into one document. The revised documents should be organized by user function.

3. Many documents contain technical discussions on the design and development of particular software features, but this kind of information is not appropriate to user needs, and therefore should be eliminated.

4. Several documents do not contain clearly defined purposes, uses, and intended users. These are important elements and should be included in an introductory section of each document, effectively stating that this document will support this need.

5. Most documents assume that the reader already knows the subject and/or has an extensive background in software design and programing. User documents should be written to specific user types, and the assumed capabilities of the reader should be realistic. In general, a document will effectively serve a greater population of users if little expertise is assumed.

6. Many documents lack sufficient direction for implementation. More emphasis is needed on "how to", "when", and "where" to start. The document should include procedural sequences where appropriate. In addition, rules, coding, instruction sequences, etc., should be clearly defined and amply supported with examples.

7. Several documents are difficult to read and understand because of the excessive use of undefined technical terms combined with a highly technical and sophisticated prose style. The language should be geared to the least knowledgeable readers among the intended user population. When new, uncommon or specialized terms are used, they should be adequately defined in the text. In ad-

dition, a glossary should be appended to each document.

8. In many of the reference documents it is difficult to find a particular piece of information. The contents should be carefully organized into smaller sections by topic, and a table of contents provided for easier reference.

9. Several documents seriously lack organization. The reader is confronted with a rambling core dump of everything on the subject. Such documents are difficult to follow, and cause the reader frustration.

10. The second part of the two-part document "Regenerating System Sotware" is an operations document written in narrative form. This document should be rewritten employing the same conventions and principles for procedural documentation as used in the revision of the first part, "Setting Up UNIX".

11. The index scheme in the UPM may be practical for updating purposes, but it is not very convenient for the user. Almost all the pages in the manual are number "1". The more conventional alphabetical index with page numbers would be more appropriate. In addition, the sections would be easier to find if separators with index tabs were used.

12. Documentation exists at many levels even for the same user because of multiple documents with differing authors - sometimes on the same subject. Subject matter should be gleaned from associated documents, combined, and rewritten for specific user types, maintaining the same level.

13. There is a general lack of correspondence between similar type documents in terms of format, terminology, conventions, readability, etc. Emphasize consistency throughout all documents by employing:

    - a standard format
    - a coding structure
    - more examples

14. Generally, existing documents are not user documents. The present documents should be cataloged and filed.

15. Better indexing is needed for all documentation, especially documentation on programming languages.

DOCUMENTATION PLAN

Definition of Users, Functions, and Documentation Needs

An overall documentation plan for UNIX was developed based on the information gathered during the previously described data collection activities. The identification of the functions that must be performed in installing, using, and operating UNIX and the various types of users who perform those functions provided the structure for identifying the documentation required to support those activities. The following sections describe each user group, their identified functions, and the recommended associated documentation. A summary of this information is presented in the Documentation Plan Overview, Table 3.

Table 3

DOCUMENTATION PLAN OVERVIEW

UNIX USERS	USER FUNCTIONS	PROPOSED USER DOCUMENT	CONTENT SOURCES*
• Prospective Purchaser	Plan for installation	System Planning Guide (DL) • brochure • order form	Helicopter book (summary of hardware for outside user) 1 - 34, (35), 36
• System Manager	Management of the system	System Management Guide (PA-1C30X)	1 - 27, 36
• System Operator	Install operate and maintain the system	System Operations Manual (PO-1C300)	1 - 5, 30 + 31, 36
• System Programmer	Maintain and modify	System Programmer's Manual (PA-1C30X) (TLM)	1 - 14, 28 - 31, 36
• Application Programmer	Write programs for particular applications	Programming Languages (PA-1C30X)	15 - 22, 26, 27
• Document Composer	Prepare documents	Document Preparation Guide (PA-1C30X)	2, 3, 5 - 14, 36
• All	Interpret error messages and correct errors	System Error Messages and Corrective Procedures (OM-1C30X)	(to be written) 30, 36 (III)
• All	All	UNIX Programmer's Manual PG-1C300 (expanded) (PA-1C300)	1 - 14, 36

* These numbers pertain to the documents listed in Appendix I and are not an exhaustive list. Additional information appropriate to a user may be required.

Prospective UNIX Purchaser

One type of user of UNIX has been identified as the client who has expressed an interest in purchasing the system. The function of this person is to decide if UNIX would be an asset to their organization, and if so, properly plan for its purchase and installation. The documentation needs of this user are suggested by the function. A complete description of the UNIX system is needed in the form of a System Planning Guide with information about development, capabilities, advantages, special features, hardware specifications, supported program language(s), options, installation, operating costs, and purchase information.

A brochure, similar to those published by other commercial vendors and containing the above information complete with illustrations, diagrams, etc., would be very appropriate.

In addition to the brochure, an order form would be needed. The form should be designed for ease of use by both the purchaser and the vendor, and with care being taken to avoid complexity, ambiguity or misinterpretation. All specific options should be laid out for easy selection and check-off.

Existing sources of documentation for compilation into a planning document include elements from documents 1 through 27 and 36 in Appendix I.

System Manager

The system manager is the person responsible for directing all efforts associated with installing the UNIX system and operating and maintaining the system from day to day for his organization. Depending upon the characteristics and size of the organization, the system manager could be the purchaser and/or the system programmer. Nevertheless, this person has been defined as a unique user with specific managerial functions.

In order to manage the UNIX system, this person would require descriptive and functional information on the features, capabilities, maintenance, resources, etc. A UNIX System Management Guide which would facilitate the responsibilities of this user is required. Information for recompilation into such a guide exists is documents 1 - 27 and 36 (Appendix I). Such information would be best presented in terms of the detailed functions ascribed to the system manager. It is felt that further attention needs to be given to the detailed functions of this user before composing the guide.

System or Computer Operator

Another UNIX user is the system or computer operator. This person is concerned with the daily operation and maintenance of the system and with the installation of the hardware necessary to operate the UNIX software. In addition, he may be required to install the UNIX software on the minicomputer after performing the appropriate DEC diagnostics. The system operator will require procedural and descriptive information on

- logging on and off
- editing
- system installation and shut-down
- file system checks
- file system backup and restoration
- recovery from a crash
- file system regeneration
- trouble reporting
- software and hardware maintenance
- error messages
- etc.

A description of the needs of this user has been documented by Vogel (1975). However, this report differs from Vogel in that it reasonably assumes that the operator will be knowledgeable regarding computer console and peripheral device operations. In the event that such basic knowledge is determined to be lacking, documentation and training necessary for the computer operator to acquire this information has presently been deemed to be outside the purview of the UNIX redocumentation effort. It is also likely that this job may be subsumed by some other user (e.g. system programmer, system manager, etc.).

A unique document entitled the UNIX System Operations Manual would be appropriate. The document should contain a table of contents, and the above information with step-by-step procedures presented in functionally separate sections. Descriptions of UNIX software features, capabilities and limitations should be included as well as a glossary and index. This manual can be composed from the contents of documents 1 - 5, 30, 31 and 36 (Appendix I).

System Programmer

The system programmer is another UNIX user. The needs of this user include procedural information on

- logging on and off
- editing
- system generation
- file systems allocation and structuring
- system accounting
- OS enhancements
- software updating
- trouble reporting
- error messages and recovery
- regression testing
- system maintenance
- etc.

Additionally, descriptive information is required for I/O drivers, commands, system calls, etc. Program descriptions and source code should also be made available. It is conceivable that this user may functionally perform many of the same functions as the application programmer, the computer operator, or the system manager. However, the functions of maintenance and modification of the system software have been ascribed to this user.

The proposed user document deemed unique for the system programmer is a UNIX System Programmer's Manual. It is recommended that a suitable document for this programmer be composed from the contents of documents 1 - 14, 28 - 31, and 36 listed in Appendix I. These documents contain information that is necessary for the efficient performance of the system programmer. The proposed user document should be geared toward the minimally experienced programmer and contain a table of contents and a glossary of UNIX terms. Each topic should be introduced in a separate section with a full description of its user, its use, its features, error and system recovery procedures, etc.

Application Programmer

The user defined as an application programmer is the second programming user. This programmer needs information concerning the functional capabilities of the UNIX operational system. The application programmer will also require information on UNIX programming languages. Vogel (1975) pointed out that much of the information required by this user is presently available in the UNIX Programmer's Manual but not in a form which would benefit new UNIX application programmers. Documentation required by the application programmer includes information on

- Logging on and off
- Editing
- Commands
- System calls
- Subroutines
- Special files
- File formats and conventions
- Error messages and recovery procedures
- Programming languages
- etc.

It is supposed that both descriptive and procedural information in the above areas is required by this user in order for them to function in the capacity of writing programs for their particular application, development, and/or support oganization.

Existing content sources suitable for recompilation include documents 15 - 22, 26 and 27 in Appendix I. Documents 15 - 22, 26 and 27 deal specifically with programming languages and would be suitable content for compiling a UNIX Programming Languages manual. Each language should be presented in a separate section. Each section should begin with an introduction which describes the language, intended user(s), capabilities, advantages, etc. The coding conventions, rules, syntax and so forth should be fully documented using a "how to" or tutorial approach with plenty of examples. The Programming Languages document should be written for the relatively inexperienced programmer and should contain a table of contents and a glossary.

Document Composer

UNIX users who employ the editing and documentation preparation capabilities of the UNIX system may be referred to as document composers. It is assumed that there would be little need for documentation outside of the areas named below. Procedural documentation for this group of users would require written communication at the lowest or beginning level. In many cases, this user would probably be a clerical person.

In composing documents using UNIX, this user would require procedural information on

- logging on and off
- entering text
- editing text
- formatting text
- error correction
- special character usage

and descriptive information on

- special character functions
- edit commands
- UNIX terminology
- format commands
- etc.

A manual entitled UNIX Document Preparation Guide is necessary for such a user and should be designed for ready reference, quick indexing, and easy use. Care should be taken to provide complete and accurate step-by-step procedures along with cautions and corrective procedures wherever necessary.

Content sources of documentation for a Document Preparation Guide are available in references 2, 3, 5 - 14, and 36 in Appendix I.

This proposed user document should include sections involving logging on and off procedures, a tutorial on editing with special character information appearing

early in the tutorial, formatting procedures in the form of a tutorial, a brief overview of the system, error messages and corrective procedures, a UNIX glossary, etc. Each section should contain simple explanations and plenty of examples.

All Users

All UNIX users require information to assist them in interpreting error messages and in applying the appropriate corrective procedures as they interact with the UNIX operting system. In order to facilitate this function for all users, a System Error Messages and Corrective Procedures Manual is recommended. This document should be arranged numerically or alphabetically with each error message occupying a separate page. The error messages may also be arranged by user needs and functions delineated in this section of the report. Each error message should contain descriptions, interpretations, conditions and corrective procedures. An introduction and table of contents will be required for describing use of the manual.

Once all the error messages have been compiled, a decision must be made as to whether error messages and corrective procedures warrant being placed in a unique document or whether the appropriate ones might be best placed in a separate section of each proposed user document. The volume of error messages should be a prime consideration in this decision such that a large volume of error messages dictates the need for a separate manual.

Based on our review of the documents in Appendix I, documents 30 and 36 are the only available content sources. It is felt that much of the information to be contained in UNIX System Error Messages will have to be generated from other sources.

Additionally, it is felt that an expanded version of the UNIX Programmer's Manual PG-1C300 is required by all users to assist them in all UNIX functions. Content sources identified for this proposed user document include 1 - 14 and 36. This document should be highly descriptive and should be written for beginning UNIX users at the lowest level.

Discussion

Information on the qualifications, experience levels, minicomputer background, application of UNIX for each user, and their related function(s) is necessary in order to determine the lowest level at which each user-related guide must be written. All users cannot

be categorized specifically since it is believed that user designations may vary from organization to organization. However, we have attempted to identify users that are best described in terms of the allocated human functions. It is recognized that some functions and, therefore, users may be combined or overlap within a specific UNIX environment based on human resources and other considerations. For example, it is conceivable that the functions of System Manager (Administrator) and Computer (System) Operator will be performed by a single person in some instances. Furthermore, both of the above user types may be subsumed on a rotational basis by system programmers at some organizations. In such cases the appropriate user would employ the document(s) which is (are) related to his (their) appointed function(s).

GUIDELINES FOR PREPARING NEW DOCUMENTS

Based on our studies, the establishment of effective UNIX user documentation will require the writing of totally new documents according to the specific user types which have been identified. Rewriting or "beefing-up" existing documents will not adequately satisfy all user needs. The identification of content sources from existing documents is intended to assist the writers in locating information relative to the needs of a particular user. But it is not suggested that these sources will constitute all of the information requirements for any new document.

When writing the new documentation certain considerations must be kept in mind. Overall, the most important considerations are the qualifications, functions and needs of each and every user. These must be given continuous attention as each new document is being generated. Furthermore, the document writers are urged to use the following guidelines:

- Standardize all terms and concepts using the UNIX Programmer's Manual (PG-1C300 Issue 2 (expanded)) as the basic source. Standardization will introduce consistent terminology throughout the documentation and reduce the uncertainty over what information is being conveyed. Employ the synopsis conventions of the UPM when presenting variable entry commands.

- Before writing a particular document, define the users in terms of their qualifications and needs. This will require a more detailed user analysis than is reflected in our study. Furthermore, when writing the introductory

section for each document the assumed qualifications and needs of the intended users should be specified.

- Write the document at the lowest level among its intended user population.
- Provide separate and different documents if the user groups differ widely.
- Examine in detail the content of existing sources of documentation for technical accuracy and logical presentation.
- Present the material in the way that it is normally used and in a way that is most appropriate to the level and needs of the defined user.
- Considerations should be given to the development of performance aids where frequently used reference material would be made handy and easy to use.
- Provide more introductory and procedural information in software documentation to assist the user in implementing the procedures.
- Present procedures for logging on and off UNIX and appropriate information from "Getting Started" at the beginning of each manual after the cover sheet, table of contents and introduction.
- A separate section of the manuals or guides produced for all users should contain information on the inter-user communication feature of UNIX. This feature should be fully described and the procedures for employing WRITE and MAIL should be fully presented in this separate section.
- All users require a standard glossary of UNIX-specific terminology which would best be presented at the end of every manual.
- Provide plenty of examples throughout the text to augment descriptive and procedural information.
- Refer users of user-specific documents to the appropriate sections and pages of the UNIX Programmer's Manual (expanded) for additional but not necessary information on commands,

driver, file formats, subroutines, system calls, system programs, etc., tables, and user programs.

- It is reported that many user problems are based on differing hardware configurations and not on the software configuration. The new documentation should specify procedural differences based on hardware configuration. "Procedures for Installing UNIX on the PDP 11" considered these differences and can serve as an example for other documentation.

- In general the following format is suggested in the preparation of the proposed user documents with the exception of the UNIX Planning Guide:

    - Title page
    - Table of contents
    - Introduction
    - Text
    - Index/Glossary

- The title page should contain a document title such as those that were introduced in Table 3. The title should clearly indicate the subject matter of the particular document. Appropriate proprietary information, document numbers and other information should appear on this page.

- The table of contents should provide a means of easily locating pertinent information within the document. The topics listed should be the same headings and subheadings used within the document and should be accompanied by page numbers.

- The introduction to each document may vary depending on the user and their functions. It should contain information on the intended users, the purpose of the document (functions to be described or procedures to be implemented), assumptions that are made about the user, cautions, advantages, special features, and how the document is to be used.

- The text of the document will also depend on the intended users and their functions. It may contain descriptive, procedural or a combination of descriptive and procedural information. It may be in the form of a tutorial

or in a step by step presentation.

- Each document should begin with procedures for logging on and off of UNIX as well as a tutorial on text editing. Rules, conditions and procedures should be made explicit in each section of each document. Appropriate examples and illustrations should be included. A final section of each document may be composed of error messages appropriate to the user and the activities they perform in using the document.

- The glossary should contain all the UNIX generic terms used in the document. These should be arranged alphabetically, and defined or described in terms that can be easily understood by the designated user. If the text contains other computer terms which are considered beyond the understanding of the intended user, then these terms should also be included in the glossary. The glossary and index may be combined as shown in Figure 1.

- The document composer and system manager need to be more clearly defined in terms of the activities they perform, their needs and the problems they are experiencing with the existing available documentation.

- In addition to the recommendations contained in this report, new documentation should be written using principles provided in the test report (Walker and Zinke, 1976).

While the guidelines presented here primarily reflect human considerations it is assumed that the new user documentation will conform to BTL Documentation Guidelines for Minicomputer Applications in Standard Systems.

Figure 1. An example of an index/glossary. (From Introduction to Programming. 4th ed. Maynard, Mass.: Digital Equipment Corporation, 1973.)

OTHER CONSIDERATIONS

Training

A review of the documentation, questionnaires and informal conversations as well as our own experiences with using the existing operational documents revealed the need for training. As a part of the documentation scheme it is recommended that a decision be made on the inclusion or exclusion of training prior to revising the documentation. Generally, documentation is produced such that beginning users can perform their functions without formal training - i.e. stand-alone documentation - and training is employed to enhance that performance and familiarize persons with the use of the documentation. If training is to be excluded from the UNIX PSS package, it becomes more imperative that documentation contain all the necessary information, procedures, descriptions, explanations, examples, etc.

Testing

To ensure that the content and format of the revised documents are optimal (i.e. meets user needs through being accurate, complete, readily usable, readable, understandable, etc.) test the documents with a typical user. Such an effort will identify sub-optimal sections/procedures in the documents which are in need of further revision. Given the wide possible distribution of the UNIX operating system and its accompanying documentation package, it is imperative that such testing be conducted prior to printing and reproduction of each document.

In order to test operational documents, a test situation which recreates or simulates real-world usage is needed. Participants (i.e. users) can be instructed to perform the functions using the operational document(s). Discrepancies between the desired and actual performance are noted. Subsequent analysis of these discrepancies will determine the revisions which are necessary to ensure the correct and timely (i.e. desired) performance of the task(s). Major task discrepancies must be retested after the final revisions are made (See Walker and Zinke, 1976).

Cost

The cost of documenting a system such as UNIX has been inferred to be a very expensive and time- and personnel-consuming effort for which no funds have been made available. This statement should be addressed in terms of the ultimate long range costs if redocumentation does not occur. A decision to forego redocument-

ing a system that has clearly exhibited the need for new user-oriented operational documentation is likewise costly.

The existing documentation cost is the sum total of all direct and indirect costs associated with installing UNIX, consulting with USG and other BTL users, additional computer time, trial and error learning, psychological frustration, etc. These costs are given some attention in this section of the report.

It has been reported that the UNIX Support Group may spend as much as two weeks (normally 3 - 4 days) installing the new system and providing extensive consultation. Additionally, a full day is normally spent reconfiguring the system - a procedure for which no document exists to date. Installation and consultation costs include travel and lodging expenses for on-site visits, time away from development work, telephone calls, and computer time. These costs are incurred by the USG and the new user.

The new user also incurs expenses in the use of non-user-oriented documentation. Costs are incurred on tasks in terms of trial and error learning, personal time, consultation time, additional computer time, etc. It has been brought to our attention that consultation may involve other UNIX users as well as the USG. Additionally, performance and service may be degraded as a result of increased frustration associated with using a document which is at times ambiguous, incomplete, incorrect or altogether lacking. It is inferred that unnecessary computer maintenance may be performed due to errors in the documentation when consultation support is not available.

On the other hand, redocumentation can be a costly endeavor. The extent to which large costs will be incurred depends on the extent to which documents have to be rewritten, revised and generated.

Our contention is that in the long run with a large number of users, the costs of redocumentation will be minimal compared with the costs of supporting UNIX in the areas specified above. Attention to the considerations presented in this documentation plan will ensure that future documentation will best serve the users and minimize the need for personnel support, additional computer time, travel costs, trial and error learning, user frustration, service delays, etc. With a promising operating system such as UNIX, the number of users will soon number in the thousands. Whoever assumes the responsibility for support of the system will not be able to handle the volume of requests for assistance

that can be directly attributed to suboptimal documentation. If the new documentation is accomplished in a systematic and corrective fashion, the major task will need to be done only once. Subsequently, if the documents conform to a set of content, format and user standards, only minimal attention will have to be given to maintenance and updating of the documentation.

Document Writers

The writing of new user documentation will require the involvement of both subject matter experts as well as skilled writers. Normally, it will require less time for the designer or technical expert to acquire and apply user considerations than for the technical writer to acquire and apply the technical expertise necessary for rewriting and expanding existing documentation. However, if it is desired that the technical expert will not do the writing, the prose expert will still need a great deal of time from the technical person for correct interpretation and technical accuracy during the documentation effort.

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Attachments

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Appendix I

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APPENDIX I

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