To: MTB Distribution

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Subject: Rewriting the Multics Operators' Handbook

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MTB-544
Revision 1

This MTB is a revision of MTB-544. It incorporates changes which were agreed on at a CISL design review, held January 27, 1982. It isn't necessary to have read MTB-544 to understand this revision.

INTRODUCTION

This MTB discusses the shortcomings of the Multics Operators' Handbook (Order No. AM81) and the possibility of addressing these shortcomings with a cover to cover rewrite.

PROBLEM DEFINITION

The Multics Operators' Handbook, commonly referred to as the MOH, has many serious problems. These problems can be divided into three categories: audience problems, organization problems, and language problems.

Audience Problems

The MOH is not just a handbook for Operators. It actually contains information for three different audiences: Operators, System Maintainers, and System Administrators. Operators are machine room personnel who control the functioning of the computer hardware by following operational procedures provided by System Maintainers and System Administrators. Operators must see that the hardware is serviced in a timely manner so users experience a minimum number of service interruptions. More specifically, operators are responsible for such tasks as managing peripherals, operating daemons, and responding to special requests from users.

System Maintainers are system programmers who maintain and modify the operating system to comply with the special requirements of each customer site. They are responsible for analyzing dumps, solving user problems, preserving the integrity of the storage system, dealing with storage system crashes, and doing system recovery when the standard procedures don't work.

System Administrators are people who provide users with a Multics operating environment, control usage within that

environment, and account for the use of system resources. More importantly, they are responsible for scheduling system activities, such as printer processing and dumping, and making final decisions when there are problems, such as system crashes and damaged files. System Administrators are often designated by upper management as the people responsible for the overall operation of the entire computer system, and as such, set policies from which System Maintainers and Operators take their direction.

Clearly, these three groups of people interact with Multics in different ways, with different levels of interest in and knowledge about the system. The MOH attempts to speak to all of these audiences, and ends up satisfying none of them.

Organization Problems

The MOH lacks a basic underlying structure, a clearly defined set of tasks which serve as a foundation and determine the order in which information is presented and the way information is split into sections. Currently, the information is split into sections by function only to a certain extent, and the differences between the functions, and their relationships to each other, are never explained.

The MOH does not sufficiently answer the following questions: What tasks is an operator responsible for? How often must a given task be accomplished? Every day? Every week? Every year? What are all of the steps involved in the task? What is the exact order of the steps? What relationship does the task have to other tasks? And why should this task be done in the first place?

Language Problems

Language problems are the most challenging and time-consuming ones to fix. The language problems of the MOH are best shown by an example. The first sentence of the MOH reads as follows: "The functions performed by the operators of Multics play a significant role in providing service to the user community." The language of this sentence is indirect, passive, and somewhat formal. The sentence can be changed to read as follows: "As a Multics operator, your functions play a

significant role in providing service to users." The language of the sentence is now direct, active, and more friendly.

The lack of a single audience contributes to language problems. Assumptions about which terms and concepts a reader is familiar with affect the use of jargon and the extent to which ideas are explained before being built on. The same explanation may be too detailed and frustratingly obscure for one audience, while it is too general and frustratingly obvious for another audience.

The lack of good organization also contributes to language problems. An explanation may be confusing largely because it has no clear relationship to other explanations.

PROPOSED SOLUTION

The best solution to the problems of the MOH is a complete reworking of the entire manual. As it stands now, the MOH tries to be both a reference manual and a users' guide (of sorts). The reworking should involve converting the MOH to a straight reference manual, and creating two new manuals -- a Multics Operators' Guide and a System Maintainers' Guide. Information intended for System Administrators should be moved to the MAM set.

Multics Operators' Guide

The Operators' Guide should begin with a much clearer overview of the operators' responsibilities, and these responsibilities should be discussed throughout the manual in terms of the specific tasks they involve. Each task should be clearly defined in terms of when it has to be done, why it has to be done, and how it has to be done. The emphasis should be on step-by-step explanations (the "cookbook" approach), including realistic examples, hints as to which techniques work best, and pictures wherever possible.

The Operators' Guide should assume less than the MOH does about its intended audience's level of knowledge. The glossary should be extended, including comparisons of Multics jargon with that of other large systems (i.e., IBM's). Each new term or concept should be defined as it's introduced and clearly

explained before it's used. Overall, the material should be less technically detailed and more streamlined, emphasizing recommended procedures that can be modified at individual sites.

A distinction should be made between recipes for everyday tasks and recipes for unusual tasks. Recipes for everyday tasks should include possible problems and how to detect them, plus pointers to recipes for unusual tasks which explain how to deal with them.

Information not currently included in the MOH should be added to the Operators' Guide. Examples of this information include how to authenticate a tape, how to cancel an absentee job, and how to reprint a segment.

Some thought should be given to the physical design of the Operators' Guide. Since an emphasis will be placed on outlining general procedures that can (and probably will) be modified at individual sites, each recipe should start on a new page so it can be conveniently replaced if necessary. Wide margins or blank pages or both should be included for notes. In addition, blanks should be left in command line descriptions so site parameters can be filled in if desired.

Finally, the kind of direct, active, friendly language discussed previously should be used throughout. For an outline of the Operators' Guide, see Appendix A.

System Maintainers' Guide

The System Maintainers' Guide should be similar to the Operators' Guide in that it should also be a cookbook, with the emphasis on step-by-step procedures for accomplishing various tasks. It should differ, of course, in the level of understanding and ability it assumes, and the amount of technical detail it offers.

Clear organization and precise, appropriate language should of course be applied to this manual as well. An outline of the System Maintainers' Guide will be presented in a future MTB.

Operators' and System Maintainers' Reference Manual

When the MOH becomes the Reference Manual, it should contain complete reference material on all operations-related functions. The bulk of this material should be command descriptions, including all of the BOS, initializer, backup, and x commands. Standard formats should be adopted for all of these descriptions. In addition, each one should include an example, possible output and error messages, limitations on the use of control arguments, and cross references to related commands. Descriptions should also explain why an Operator/System Maintainer may want to use a command in the first place, and what damage can be done if a command is used incorrectly.

The Reference Manual should also include a detailed description of the system hardware and how to configure it, plus complete descriptions of the configuration cards. A Pocket Guide to this reference material should also be created.

Procedure

The job of rewriting the MOH is a large and difficult one, made more difficult by the fact that writers don't usually have much contact with the environment to be described. The rewrite will be accomplished in two phases. The first phase will involve writing the Operators' Guide, pretty much from scratch, and changing the title of the MOH to the Operators' and System Maintainers' Reference Manual.

The second phase will involve writing the System Maintainers' Guide, partly from scratch, partly by moving and rewriting material from the MOH (now the Reference Manual). This phase will also involve cleaning up the documentation remaining in the MOH so it is in the form of straight reference material.

The first phase will require a long-term commitment of approximately nine man-months spread over a period of at least twelve calendar months from the writer involved. It will also require a clear commitment of fifteen to twenty hours per month from the development staff.

Time estimates for the second phase have not been made yet, but clearly similar amounts of time and commitment will be required from both the writer and the development staff.

SUMMARY

The people who use the MOH and the writers who maintain it have been struggling with it in its current form for years, to the point of extreme frustration on both sides. Although a large commitment is required to rewrite the MOH, it is well worth our while to do so.

APPENDIX A

This appendix offers an outline of the Multics Operators' Guide. Suggestions on the outline are welcome, especially those related to recipes that are missing.

MULTICS OPERATORS' GUIDE:

INTRODUCTION

How To Use This Manual (where everyday info is, where special info is)

Operator Responsibilities (overview of major tasks, including an explanation of their relationships to each other, and how the book's organization reflects these relationships)

This section will also include a discussion of the fact that this manual offers recommended procedures which will probably differ somewhat from site to site, and that it's OK to do things not exactly by the book if the operator's site specifies otherwise.

SYSTEM DESCRIPTION

Hardware

This section will offer a sentence or two about each piece of hardware, including an explanation of how all of the pieces fit together, and a diagram of a typical system layout.

Software

BOS

BOS Tape
BOS Runcoms

Multics

- Multics System Tape
- Ring 1 (Admin Ring)
  - Physical Volumes vs Logical Volumes
- Ring 4 (User Ring)
- Answering Service
- Admin Mode

Storage System Hierarchy

- Online Libraries

Processes

- Absentee
  - Foreground
  - Background
- Daemon
- Initializer/Answering Service
- User

Daemons

- Operating Daemon Processes
- Message Coordinator
  - Sending Commands to Daemons
  - Replying to Messages from Daemons
- I/O Daemons
- Backup Daemons
  - Hierarchy
  - Volume

Resource Control Package

- RCP Messages

Other Things to Know About

System Log Book
Test and Diagnostics (T & D)
Field Engineering Division (FED)

COMMUNICATING WITH THE SYSTEM

Using the BOS Console

Low Cost Consoles
Entry Model Consoles
Typing Conventions
erase/kill/eom
30-Second Timer
Talking to BOS

Editing
Prompting

Using the Initializer Terminal(s)

Typing Conventions
erase/kill
Carriage Return Convention
Talking to Multics

RECIPES FOR BRINGING UP THE SYSTEM

Introduction (which step in which recipe to start with, depending on what condition the system is in)

Powering on Machines
Checking Switch Settings (pointer to Reference Manual)
Bootloading BOS

Mounting BOS Tape
Booting BOS Tape
Loading Firmware

Resynchronizing Paper in Printer

COLD BOOTs vs WARM BOOTs
Loading the Config Deck (CONFIG Command)

Making Emergency Changes to the Deck (pointer to SM Guide)

Setting Calendar Clock in 4MW SCU (TIME Command)

Setting Clock in 6000 SC (pointer to Reference Manual)

BOS Messages if Things are Going Right
BOS Messages if Things are Going Wrong (pointer to Special Recipes section)

Bootloading Multics (AUTO RUNCOM)

Mounting Multics System Tape
Multics Messages if Things are Going Right
Multics Messages if Things are Going Wrong (pointer to Special Recipes section)

Talking to Daemons (if necessary)

Logging in the I/O Daemon
Starting the Dumper (Backup Daemon)

Starting the Hierarchy Dumper
Starting the Volume Dumper

RECIPES FOR EVERYDAY OPERATIONS

Normal Messages

What To Watch For
How To Respond
Repeated Messages

Peripherals and I/O Devices

Managing Tapes

Mounting Tapes

User Requests

Cancelling an Absentee Job
Warning Users
Bumping Users

Bumping on a Channel

Unattended Service

Attended/Unattended Mode

Setting Unattended Mode
Returning to Attended Mode

Manual/Automatic Mode

Setting Automatic Mode
Returning to Manual Mode

I/O Daemons

This section will begin by saying that there may be other daemons to deal with, and if so, the System Maintainer will tell the operator about them.

Operating I/O Daemons

Starting at a Page
Reprinting a Segment
What To Do With the Daemon When the Printer Runs Out of Paper
Cancelling a Printer Request
Reinitializing the Daemon

Managing Printers

What to Watch For
Using a High Quality Print Terminal

Managing Card Punches
Managing Card Readers
Managing Combined Card Units (CCU's)
Running a RJE Station

Backup Daemons

This section will begin with a discussion of wakeup/backup/incremental tapes, catchup/consolidated tapes, and complete dump tapes.

Doing Retrievals

Doing Hierarchy Retrievals
Doing Volume Retrievals
Deciding Which Kind of Retrieval to Do If Your Site Runs Both Dumpers

Doing Catchup/Consolidated Dumps
Doing Complete Dumps

Reconfiguration

Adding a Processor
Deleting a Processor
Adding Memory
Deleting Memory
Adding Peripherals
Deleting Peripherals
Recon. Messages if Things are Going Right
Recon. Messages if Things are Going Wrong (pointer to Special Recipes section)

Storage System Maintainance

Moving a Pack While Multics is Running
Moving a Pack While Multics is Not Running
Doing BOS Saves

Answering Service

Triggering Automatic Shutdown
Changing the Message of the Day
Leaving a Note in the Log
Detecting Answering Service Problems

Resetting the Answering Service When It's Stuck

Multiplexers

Loading Multiplexers
Stopping Multiplexers
Dumping Multiplexers

Communications Channels

Attaching a Channel
Removing a Channel

I/O Errors

Detecting Problems With Tape Reels or Devices
Handling Disk Errors

Disk Error Messages
Disk Recovery Actions

System Shutdown

Scheduled
Non-Scheduled
Shutdown Messages if Things are Going Right
Shutdown Messages if Things are Going Wrong (pointer to Special Recipes section)
Powering Off Machines

RECIPES FOR SPECIAL OPERATIONS

System Failures

What to Watch For and How to Respond

System Crashes (Stops and Returns to BOS)

Emergency Shutdown
ESD Messages if Things are Going Right
ESD Messages if Things are Going Wrong (pointer to Later Section)

System Hangs (Stops and Doesn't Return to BOS)
System Loops (Doesn't Stop, But Isn't Working)
No Users Can Log In

Processor Stops

Bootload
Non-Bootload

Audible Alarms
Error Messages

Other Failures

Automatic Dump and Reboot Failure
Crash Recovery Failure

Saving the DUMP Partition

BOS Bootload Failure
Multics Bootload Failure

Starting the System Up Manually

Using Startup Commands
Starting Up the Answering Service
Logging in the Daemons
Sample Startup Sequence
Startup Messages if Things are Going Right
Startup Messages if Things are Going Wrong
Startup Failure

Mounting the Root Physical Volume
Mounting the Root Logical Volume

Shutdown Failure
Emergency Shutdown Failure

Forced Hierarchy Salvage
Forced Volume Salvage

Reconfiguration Failure
FNP Failure
Storage System Failure
Disk Unit Failure

Error Documentation (pointer to err. doc. that comes with each release)

Unusual Operations

Printing Spooler Tapes
Printing an FDUMP

GLOSSARY OF TERMS