

Lukey

MOSN-246

TO: Distribution
FROM: N. I. Morris
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SUBJECT: Operation of the Multics Salvager

This document obsoletes MOSN-226.

Discussion

The Multics Salvager is designed to be run after a normal Multics System shutdown or after a system crash and attempted emergency shutdown. It is run by bootloading a special Multics Standard Tape containing the Salvager System. The Multics Salvager will scan through the Multics directory hierarchy, noting and correcting all error conditions. The salvager has four modes of operation; FAST, ACTIVE, REGULAR and LONG. The mode of operation is a function of the successfulness of the previous shutdown (emergency or normal) sequence. The modes are described below.

- A. FAST - If the shutdown or emergency shutdown was successful the fast mode of operation is used. No directories are touched. Certain system variables are modified.
- B. ACTIVE - If emergency shutdown part 1 was successful then the active mode of operation is used. Only these directories that were active at the time of the crash will be scanned and their errors corrected.

- C. REGULAR - If the shutdown sequence failed (e.g., locking errors in wired-shutdown) or was not run, then this mode of operation is used. In the regular mode of operation, all directories are scanned and errors are corrected, but directories are not reformatted unless a serious error condition exists.
- D. LONG - If it is desired to reformat all the directories in the Multics hierarchy this mode of operation is used.

Most error messages from the Salvager are printed on the on-line printer. Serious errors which are detrimental to the Multics directory hierarchy are printed on the operator's typewriter. Should one of these occur, a programming staff member should be contacted. When the Salvager has completed its operation, the Multics directory hierarchy should be "clean", and, if no serious errors have occurred, the Multics System may be re-booted.

Processor Switches

The processor switches control the mode of operation of the Salvager. They must be set before bootloading the Salvager. Switch 0 controls the printing of segment names in the Multics directory hierarchy. When Switch 0 is up, the names of all directories scanned will be printed. When it is down, only those segments in which the Salvager finds error conditions will be identified. Normally, the Salvager is to be run with Switch 0 in the down position except when operating in the long mode. Switch 1 controls the regular and long modes of operation. It also overrides the software indicators which control the ACTIVE and FAST modes of operation. When

switch 1 is on at the start of a salvage the long mode of operation will be started. Should it then be turned off, the regular mode of operation will be entered. Normally, the Salvager is to be run with Switch 1 in the down position. Switch 2 controls whether a complete write down of the paging device will be done. [Note: This is only applicable to system 16.0 and above.] Normally the Salvager is to be run with switch 2 in the down position.

Operation

1. Mount the current Salvager MST (as found in the current system log) on drive 2.
2. With the system in BOS waiting for a command, type "SALV". The Salvager MST should start to read in. Enter the time in the Multics log as "SALV".
3. After about one minute, the operator's typewriter should type "BEGIN" (mode name) SALVAGING". The Salvager is now in operation.
4. When the Salvager finishes operation it will type "END (mode name) SALVAGING" on the operator's typewriter. If the Salvager loops or returns to BOS with or without an error message on the operator's typewriter take a dump, (DUMP W) and contact a member of the programming staff immediately.
5. Examine the operator's console output for any error listed under "serious errors" below. If one or more such errors were noted during the ACTIVE mode of operation, rerun the salvager.
6. File the Salvager output in the output bin marked "SALV".

7. Bring up the Multics System.

Note: Any and all errors reported for the segment ">pdd" or ">process_dir_dir" and for segments contained in this directory are to be considered non-serious errors and are not to be reported to programming staff.

Serious Salvager Errors

Programming staff must be contacted if any of the following errors appear in the Salvager's output:

1. Fatal directory error

An unsalvageable directory was deleted. All segments found in the directory will also be deleted. The reason for this action will be found immediately above this error comment.

2. Fatal error, ep = x

An entry in a directory had to be deleted for the reason printed immediately above this error comment.

3. Entries may be lost

For the reason printed above this error comment, several directory entries were inaccessible and had to be deleted.

4. Illegal device I.D.

The secondary storage device identification found in the directory entry for this segment was improper. All pages of this segment will be deleted.

5. Reused address

A page of a segment is indicated as residing on a device address which

has already been found to be used by a page of another segment. The page will be deleted for this segment.

Non-Serious Salvager Errors

The following errors may be encountered while salvaging after a Multics System crash. They need not be reported to programming staff:

1. Address out-of-bounds

A device address was incorrect for a page of a segment. That page will be deleted.

2. Branch count changed from x to y

The Salvager disagreed with the branch count in the directory and updated the correct count as indicated in the message.

3. Current length changed from x to y

The current length of the segment found in a directory entry was incorrect. The Salvager will update the current length as indicated in the message.

4. Illegal address in x pointer

An address pointing to an unused page was found in a pointer of type x. The action to be taken by the Salvager will appear on the next line of the error message.

5. Illegal move device I.D.

The move device I.D. found in this directory entry was incorrect. Any pages of this segment which are being moved will be deleted.

6. Improper move address

A page of this segment was being moved, but no move device identifier was specified. That page will be deleted.

7. Link count changed from x to y

The link count found in a directory was incorrect. The correct count will be updated.

8. Non-zero [out-of-serice-switch, master-limit-switch, lock, modify-switch, account-switch, ppml].

An item in a directory was found to be set. The Salvager will reset it.

9. Out-of-bounds x pointer

The Salvager has found a pointer of type x which is out-of-bounds.

The action to be taken by the Salvager will be found on the next line of the error message.

10. Segment was active

The segment currently being salvaged was found to have been in use at the time Multics was running. The Salvager will make this segment inactive.

11. Unprotected address

A page of a segment was indicated as being used and residing on a device, but that device address was not indicated as being used in the FSDCT bit table. The Salvager will turn on the appropriate bit in the FSDCT to indicate that that address is in use.

12. Zero relative x pointer

A relative pointer of type x in a directory was found to be zero. The

action to be taken by the Salvager will appear on the next page.

13. Improper move in root address

The move indicator was on in the root directory file map. It will be reset.

14. A portion of the CACL may be lost

Some or all of the entries in the common access control list (CACL) have been deleted.

15. A portion of the ACL of entry x may be lost

Some or all of the entries in the access control list (ACL) of entry x have been deleted.

16. Unable to allocate a new x entry

The Salvager was unable to completely rebuild a directory. Some branches, links, ACL's or the CACL may have been lost.

17. Several names may be lost

The Salvager was unable to determine the name of a directory entry.

18. Some names may be lost from entry x

Some names of entry x other than x may have been lost.

19. Records used changed from x to y

The records used changed to the directory's quota as found in the directory was incorrect. It will be updated as indicated.

20. Inferior account count from x to y

The count of terminal quota directories inferior to this directory was incorrect. It will be updated as indicated.

21. Error detected on record x devadd y.

The indicated paging device map entry was incorrect and has been corrected.

22. Reused pd entry x

A page of a segment is indicated as using the same paging device record as some previous page of another segment. It will be corrected.

23. Record count changed from x to y

The record count as found in a directory entry was incorrect. It will be updated as indicated.

Errors Fatal to the Salvager

Should the salvager loop or return BOS without completing its BEGIN-END cycle the following should be done:

1. A complete dump should be taken.
2. The ESD command should be issued to BOS to shut the salvager down.
3. The salvager should be restarted.

Should the failure occur again the above procedures should be repeated and a programming staff member should be contacted.