Identification

Multics Bootloading Procedures
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Purpose

As testing of Multics continues, bootloads will be run
more and more by persons who are not intimately familiar
with either the 645 hardware or the Multics software.
This document will explain the steps taken in a bootload
and suggest dumping techniques to provide information
for further analysis. See MSPM section BL for a complete
description of the bootload sequence.

I   Hardware Configuration

At present two processors, two GIOC's, five 64-k memories,
eight tape drives, one Fire Hose drum, two clocks, and
two card readers are available. Not all of these will
be required for any given run. The 645 operators will
know which modules are available.

a)   Processor - Two processors, labeled A and B, exist, and
                 at least one will be on-line (available for
                 use).

b)   GIOC   - Two GIOC's, labeled A and B, exist. At
                 the present stage of development only one
                 will be on-line.

c)   Memory   - Multics can support up to 8 memories and
                 4 memory controllers. At present the
                 installation has five memories, and 4
                 controllers labeled E, F, G and H. The
                 operators will know which memories and
                 controllers are available.

d)   Tape Drives - Eight tape drives are attached to the 645.
                 The collection tapes can be counted on any
                 units which may be available.

e)   Fire Hose Drum - Only one Fire Hose Drum is at this
                 installation, and it will always be
                 required.

f)   Clocks   - Two clocks are at this installation. The
                    switch inside the door on each clock should be
                    set to connect it to the on-line processor.

g)   Card Readers - The installation has two card readers. The
                     operators will know which one is in use at
                     any time.

II.   Running a Bootload

a)   Determine which processor and GIOC are currently on-line.
      This information should be posted on the 645 configuration
      panel on the wall behind the printers. It can also be
      inferred from the placement of signs on the units themselves
      and on the Central Configuration Panel. Determine the
      memory configuration from the Central Configuration Panel.
      Ask the operators which card reader is in use. If it is not
      running, press the POWER ON switch. Mount the collection
      tapes on any available drives. The tapes will be read from
      units 3, 4, 5, 6, 3, 4, ... in that order.

b)   Set the Bootload base on the switches behind the on-line
      GIOC to 61 (base 8).

c)   Set the base switches on the Central Configuration Panel
      (located to the left of console B) to

            60 (base 8)   on-line Processor

            100 (base 8)   on-line GIOC

            140 (base 8)   Drum

      See Appendix A for the layout of the Central Configuration
      Panel.

d)   Press INIT and RESET CONSOLE on the console associated with
      the on-line GIOC. The buttons are located under the flip-up
      cover.

e)   Place the Multics Bootload deck, preceded by a clear card,
      and followed by a blank card, into the on-line card reader
      and press OPERATE on the reader.

f)   Press BOOTLOAD on the operators console (located under the
      flip-up cover). One card will be read and all core cleared.
      Wait a few seconds and press BOOTLOAD again. The Multics
      Bootload deck will be read in.

g) Collection 1 will be read from tape 0. Immediately after
    reading finishes the processor will display 000000000007
    in the Q register. Enter the hardware configuration
    into bits 18-35 of the Data switches (see appendix B
    for the meaning of each switch). The switch settings
    will be indicated in the A register. Check to make sure
    the switches are correct, and flip switch 0 up and down.
    The switches can be set at any time, as they are not
    examined until switch 0 is flipped.

h) Collection 2 will now be read from tape 1. After reading
    is completed the processor will display 000000000070 in
    the Q register. Enter the procedures to be invoked during
    initialization into bits 1 - 17 of the Data switches
    (see appendix), check the settings in A, and flip switch 0
    up and down. These switches may be set when the hardware
    switches are set, although they are not examined until
    after this second pause.

i) The teletype terminal must be dialed in. Determine to
    which data set the on-line GIOC is connected, and dial
    the appropriate number on the Teletype. The data sets are
    located in the gray cabinet behind and between the GIOC's.

j) Wait for a message on the teletype indicating that Multics
    is in operation.

III. Trouble

Not every Bootload will be successful. This section covers
the most likely problems and their probably causes, and
suggests procedures for either recovery or termination.

	Symptom	Cause	Action
1.	Bootload cards not read	1. Pressed button on wrong console	Check which GIOC is in use
		2. Wrong card reader used	Try other card reader
		3. Power off on card reader	Press POWER ON and re-Boot
		4. Card reader not ready	Press OPERATE and re-Boot
		5. Wrong Base Switch settings on GIOC or processor	Reset Base Switches

2.   Halt on DIS
      instruction
      (op code 616)

1. Error in
   BOOTSTRAP1
   (PBR=4003)

Record address field
of instruction, A, and
Q. If A =11, record
contents of X0, X1, X2,
and X3. See BL.12 for
description of errors.

2. PANIC was
   called
   (PBR = 14)

AQ will contain ITS
pair to caller. Left
half of A is segment
number of caller. Using
SUPERDUMP, dump this
segment and any others
of interest

3. Unexpected
   interrupt
   (address of DIS
   instruction is
   777776) (PBR=14)

Dump Panic, etc.

4. Unexpected
   fault (address
   of DIS instruc-
   tion is 777774)
   (PBR=14)

Fault code will be in A,
bits 31-35. Subcondition
will be in bits 26-30 (See
chart on pillar next to
CPU A). To recover from an
op-not-complete fault
(code35(base 8)), put
EXECUTE SWITCHES switch
down and press the EXECUTE
button. Otherwise, get
number of segment generat-
ing the fault from X2.
Dump it, PANIC, and any
other segments of interest

5. Master Mode
   procedure called
   MXERR (address
   of DIS instruc-
   tion is
   777770, PBR=14)

Dump PANIC, stacks, regis-
ters, and the offending
procedure. Its segment
number will be in the left
half of A.

6. Tape read error
   (address of DIS
   instruction is
   525252)

Remake collection tape

3. Program loop-   Program Error   Put EXECUTE SWITCHES
    ing or running   switch off (down) and
    too long   push EXECUTE. PANIC
                                           will be entered as in
                                           2.4

IV. Dumping Procedure

After a Bootload has terminated, either normally or abnormally,
selective dumps can be taken with a program called SUPERDUMPER.
See MSPM section BV.1 for a full description of the 645
segment dump program. Basically the procedure is as follows:

a) Set Bootload base at back of GIOC to 1

b) Set Control Configuration Panel switches to

        0 for Processor
        2 for GIOC
        4 for Drum (if needed)

c) Press INIT on console

d) Load SUPERDUMPER deck into card reader and press OPERATE

e) Press BOOTLOAD on console

    Note: Do not Power On or press OPERATE on card reader
           between bootload termination and step C. The
           interrupt which is generated would alter the
           machine state.

The dumper will be read from the card reader and will
accept requests from cards or the operators console.
To enter requests from the console, hit REQUEST. The
keyboard should carriage return and unlock. Type the
request, and press END OF MESSAGE. If the line is in
error, hit OPERATOR ERROR and enter the line again. To
dump from cards place the deck in the reader and press
OPERATE. At present, all requests must be in octal;
alphabetics are not allowed. A summary of requests is
as follows. N refers to bits 0-17, or octal digits 0 - 5.
Every request must consist of 12 octal digits.

        N000063   Direct output to tape N

        000000000047   Direct output to printer

        nnnnnnnnnn24   Set dbr to value indicated

N000062	Dump segment N
N000023	Dump all data segments from N on
N000723	Dump all segments from N on
000000000000	Dump registers, segments and stack Do not dump procedure segments
000000000700	Dump registers, segments, and stack including procedure segments
N000042	Dump segment N as a stack
000000000025	If output is to tape, write EOF and unload, and switch to printer. If output is to printer, eject page
000000000061	Dump registers and descriptor segment
000000000077	Stop reading cards

Dumper Problems

On rare occasions the dumper will fail to "take", that
is, after the dumper deck has been read in requests cannot
be made via the operator's console or the card reader.
Recovery is made as follows:

Procedure I

a)   Put EXECUTE SWITCHES switch on processor panel in down
     position.

b)   Enter 000000000077 into data switches.

c)   Press EXECUTE button on processor panel.

In most cases this will reset the dumper and requests can be
entered.

Procedure II

If this fails one more avenue is open. Remove any dump
request cards from behind the dumper deck. Re-Boot the
dumper (Page 5, steps c, d, e) until at last the dumper
is ready and requests can be entered. The first request
must set the dbr (descriptor base register), as it has
been destroyed by the second Bootload. The request is

     000301077424

The request cards can now be placed in the card reader,
and when OPERATE is pressed the dumper will read them.

APPENDIX A

Central Configuration Panel
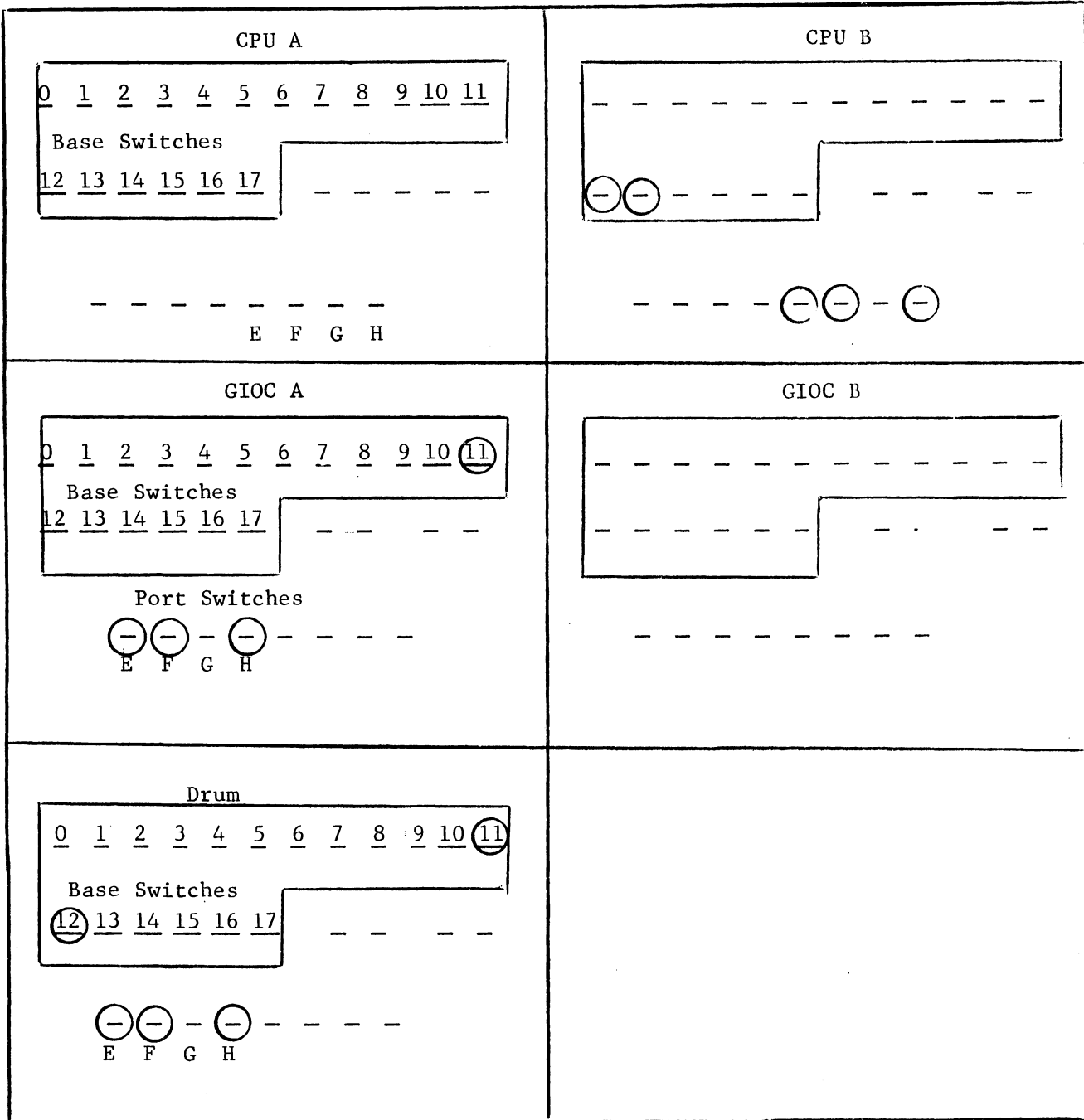
If the configuration were CPU B, GIOC A, the drum, and memories E, F, and H, the circled switches should be up.

APPENDIX B

Setting of Processor Data Switches

Switches 18-35 are used to communicate the hardware
configuration to the initialization procedures. The meaning
of each switch is as follows: (up means the device is
to be used, down means it is not).

Switch No.	Hardware Device
18	Not Used
19	Not Used
20	Not Used
21	CPU A
22	CPU B
23	GIOC A
24	GIOC B
25	DRUM
26	CLOCK A
27	CLOCK B
28	Memory E
29	E External
30	Memory F
31	F External
32	Memory G
33	G External
34	Memory H
35	H External

Note: If an External memory is used, the corresponding internal
memory must be used also. For example, if switch 31 is up,
switch 30 must be up also.

Switches 1 - 17 are used to indicate which of certain
initialization procedures are to be called. Again up
means the procedure is to be invoked, and down means the
procedure will not be invoked.

Switch No.	Label (under switch)	Procedure Name
1	FS-1	fs_init_1
2	SEGF-2	seg_fault$use_mode_2
3	SL-3	segment_loader
4	FS-3	fs_init_3
5	SEGF-3	segfault$use_mode_3
6	FS-4	fs_init_4
7	II	interrupt_init
8	IO-1	io_init$one
9	IO-2	io_init$two
10	SMM	turn_on_smm
11	FI-2	fault_init$two
12	TC	tc_init
13	FS-W	fs_windup
14	Not Used	
15	Not Used	
16	Not Used	
17	Not Used	