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A Guide to ITS Operations
Useful Spells And Incantations

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Abstract

It is said that it is not wise to dabble in the Arts without care and caution, for the spell is at once subtle and dangerous: Look herein! For if you read carefully and closely, you can incant a Word of Magic, and the system might be revived.

This Working Paper describes crash recovery procedures for a DEC KA-10 computer running ITS, the Incompatible Timesharing System. It is intended for people not intimately familiar with the system internals who need to handle emergency operation problems when a system maintaner is not available.

1. Introduction

This document describes procedures for handling ITS system crashes.

ITS runs on four machines: AI, ML, MC, and DM. Currently, AI, ML, and DM are all KA processors. MC is a model KL processor with some different software and is discussed in a section by itself. This document deals primarily with the KA.

It must be strongly emphasized that these procedures are NOT comprehensive, and that you should always make a concerted effort to locate one of the people mentioned at the end of this paper before trying to do *anything*. Note that, "I followed the written instructions", is not a valid excuse for blowing it. A system wizard should generally see the system crash. If no one is around and you are not sure of what you are doing, you may want to simply reload the system. See *Reloading*.

Be sure you read and understand everything in this *Introduction* before you read the remainder of this document.

1.1. System Log

Near the system console of each machine is the system log book. The most important thing to do when handling any crash is to record in the log the state of the machine. Record your name (or uname), the date, and time.[1] Write down any unusual circumstances such as "momentary power failure" or "smoke coming out of machine". The specific information you need to record for a crash will be discussed in detail.

1.2. Front Switch Panel

KA-10 processors have a front panel of swicthes and lights which can be used to determine the state of the machine. Many of the indicator lights can be read from either the front panel or the top of the two processor bays on the left (the CPA register). Indicator lights should be recorded in the log as octal numbers.

The most important lights on the panel are the Memory Address (MA) lights, and Program Counter (PC), the RUN, USER MODE, PROGRAM STOP (PSTP), MEMORY STOP (MSTP),

The most important switches are the Memory Address switches, STOP, START, RESET, CONT, and PARity STOP and NXM STOP.

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[1] If you are not willing to take responsability for what you do to the system, do not touch the machine!

The RESET key is used to initialize the state of the machine; if you press RESET you cannot continue ITS and will need to reload.

1.3. Exec DDT

Exec DDT is a program for examining and modifying the contents of memory, and running and debugging programs. DDT can be used to obtain useful crash information and possibly debug the system. You can get to DDT (assuming it is not clobbered) by setting the address switches to 774000, and pressing START. If DDT is alive it will kerchink the console TTY.

The most useful DDT commands include:

- <addr>]
  Close-bracket types out the symbolic name of an address.

- <addr>/
  Slash opens a memory location for inspection and alteration.

- [CRLF]
  Carriage-return means: deposit in the currently open location.

- [LF]
  Linefeed means: deposit in this location and open the next one.

- $U
  Gets you into DSKPMP. (The $ character in this document is an [ALTMODE].)

1.4. DSKDMP

DSKDMP is a utility program which can be used to bootload an ITS.

If you are in exec DDT, you can get to DSKDMP by typing *$U*.

Otherwise: Set the address switches to 777700, and press RESET and START. Hopefully, DSKDMP will announce itself on the console. If it does not, it has probably been clobberred and you will need to reload from paper or mag tape.

· To load a file (such as ITS) into the machine, simply type its name at DSKDMP, and DSKDMP will try to load the program from disk. After DSKDMP loads a file, it drops you into exec DDT.

1.5. Paper Tape DSKDMP

If DSKDMP is clobbered, you can sometimes boot DSKDMP from paper tape off the disk. Find the

paper tape labeled *DSKDMP BOOT*. Thread the tape through the reader; the holes should fit in the
feed sprockets. Look inside the cabinet above the switches and make sure the READIN DEVICE
switches are set so that 3,4,6,7, and 8 are up. Put the tape into the reader, and press RESET and
READIN. DSKDMP should announce itself on the console as usual.

Here is a list of DSKDMP commands:

```
L$file     load file into core
T$file     load file into core and give symbols to DDT and start DDT
M$file     load file into core without clearing core first
K$file     delete file
D$file     dump core into file
I$file     verify file against core
G$         start at starting address
U$dir;     list directory
F$         list current directory
S$         list pack ids then mfd
nnn$       set starting address to nnn
L$n$       put disk n online
K$n$       take disk n offline
```

```
DSKDMP Error Messages include:
```

```
CMPERR     verify failed to match
DIRFUL     directory full
EOF        unexpected end of file
DIRNF      directory does not exist
FNF        file not found
PKNMTD     file is on pack that is not mounted
CKSERR     checksum error
DSKFUL     disk full
NODDT      can't address DDT symbol table (bug)
?BUG?      BUG
SEEKFL     disk failed to seek
CLOBRD     disk read error
CLOBWR     disk write error
DIRCLB     dir name differs, TUT disagrees with UFD
MFDCLB     M.F.D. clobbered
```

1.6. MAGDMP

In some cases it may be necesary to use the MAGDMP program. MAGDMP is somewhat like
DSKDMP, but it loads programs from magnetic tape. The usual thing to do with MAGDMP is load up
DSKDMP, so that you can then load up an ITS.

Locate a reel of mag tape containing MAGDMP. Look inside the cabinet above the switches and
make sure the READIN DEVICE switches are set so that the magnetic tape is selected as the bootload
device (usually, swithces 3,7 and 8 are up). Mount the MAGDMP reel on the drive and press RESET

and READIN. When the MAGDMP announces itself on the system console, type **DSKDMP BIN** and press carriage return. When DSKDMP comes up, you will need to use the **$L*n*$** command to specify which of the five disks are online.

1.7. SALVAGER

A program called the SALVAGER is run whenever ITS is started. It garbage collects directories and makes free space on the disks. It also reports about locked blocks which are possibly bad. If there are locked blocks on the disk, find a system hacker to see about UNLOCKing them.

UCOP is a subroutine which allows you to copy directories from pack to pack. You should *not* use this unless you know what you are doing, or you might easily destroy the file system.

1.8. Time

If a system has been powered off, it will probably not know what time it is. Use the PDSET program under ITS to set the time of day. The TIMES program can be used to figure out what various other machines on the ARPAnet think the time is.

2. Memory Errors

Frequently, a hardware memory error is responsible for halting the system. If the machine is in this state it is sometimes possible to continue the operation of ITS without losing anything.

If the RUN light and the MEMORY-STOP light are both on, the system has encountered a memory error.

In this case, look at the CPA register on Bay 2. Either NXM or PARERR should be lit, indicating a Nonexistant-memory or a Parity error, respectively. Be sure to record which one. If neither light is lit, one of them is burned out.

Record the PC, the MA, and if the machine is AI, record the right 20 bits indicated on the Paging Box, which is located at the top of the kludgey-looking bay on the right of the front panel.

If you are on ML, determine which memory module failed as follows: The four memory cabinets are named A,B,C, and D, from left to right. The leftmost bit of the ADDRESS is 0 for "A" and "B", 1 for "C" and "D". Each cabinet contains four memory drawers, called 0,1,2, and 3 from bottom to top. Open the doors on the two memories in question and check the address switches at the lower left. Find the drawer whose MA18,MA19, and MA20 switches match bits 18,19, and 20 of the ADDRESS lights. This is the losing memory. Record the memory letter and drawer number in the log.

On ML or DM, If NXM FLAG is on, a memory may be hung. You may need to push the RESTART button on the hung memory before it will proceed.

2.1. Parity Errors

In the parity error case, also record the PARITY BUFFER and PAR BIT indicators in the bottom row of lights one cabinet to the left of the console. This can be used to determine why the parity error occured, if the correct contents of the memory location can be determined.

If a parity error occurred in USER MODE, the system can probably be continued. Do not do this if there are any PI IN PROGRESS lights on at the console or if the machine is not in USER MODE.

Try to recover from parity errors by turning the PAR STOP switch on the console OFF, and then pressing STOP and CONT.

If PSTP comes on, hit CONT.[2] If it keeps coming on, then the system has been clobbered by a

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[2]If nothing at all happens when you press CONT, the switch is flakey and needs to be pressed again.

memory error, and you will need to reload the system. Otherwise the system should ring bells on theconsole and print *ITS REVIVED*. DO NOT FORGET to turn PAR STOP Back On. If another memory stop happens right away, something is seriously wrong with the memories. In that case, Get a system wizard.

3. Program Halts

If RUN is on and PSTP is on, then the system has hit some sort of error halt. This can be either a software error or something wrong with the hardware such as a disk failure.

Record at least: the PC , the MA, the PI ACTIVE lights, PI IN PROGRESS lights, the IO3 REQUEST lights, the USER MODE and RUN lights.

You should either leave the system down for examination, or reload it. See *Reloading*.

If RUN is on, neither PSTP and MSTP are lit, and the machine is not doing anything, it may have dropped a pulse, or perhaps a light is burned out. If the system is really not running, try pressing STOP and then CONT a few times. If this doesnt work, get a system hacker.

Sometimes the system will halt with an informative error message called a Bughalt. These messages are self-explanatory and look something like this:

```
BUGHALT. FIND A WIZARD OR CONSIDER TAKING A CRASH DUMP.
THE SYSTEM HAS CRASHED AND CANNOT BE REVIVED WITHOUT EXPERT ATTENTION.
IF YOU CAN'T FIND HELP, RELOAD THE SYSTEM.
YOU ARE NOW IN DDT.
```

3.1. Taking a Crash Dump

To take a crash dump of the system core image to disk, get to DSKDMP and use the *D$* command. See *DSKDMP*.

4. Disk Problems

Bear in mind that if you deal with the disk system and blow it, you will probably permanently destroy all the data on the disks. If you are not sure of what you are doing or dont want to take the risk, leave the system alone and call one of the people listed in the back of this document.

If the system has trouble accessing a disk drive, and perhaps prints a message like

DSK:HUNG ON UNIT 1, QCHPRG = 521024,,150601 08:08:11

there is something wrong with the indicated disk drive. If the system seems to be stopped, there is sometimes something you can do. Begin by pressing the STOP key on the console.

On AI, there are eight Calcomp disk drives labeled "Moon's Laundromat", next to the PDP-6. You can locate a particular drive by reading the posted map of unit numbers. The offending drive will have a red light lit. Power the drive down with the toggle switch, and then spin it back up again. If this does not clear the red indicator, the disk drive is really broken. Get a system hacker.

If the red light goes out but the system does not continue to run, go to the disk controller (located inside the on the rightmost rack of AI). Open the door, and try pressing the big black button to reset the disk controller.

ML has four Calcomp disks which are handled the same as AI's, and several DEC disks. Don't bother trying to reset the controller.

The leftmost rack behind the DM processor cabinet houses the DM disk controller. If a light comes on indicating NRDY, note if the FILE UNSAFE light on the disk is lit and also write down the Unit Number shown (on the left of the controller panel). Power cycle the drive.

5. Reloading

To reload ITS, get into DSKDMP. There is a punched card near the console which tells you the name of the system to load. There may also be additional patches which you should type at DDT after the system is loaded.

To start ITS running, turn off NXM STIO and type *$G* at exec DDT. The Salvager should start running; it may take a few minutes to work on the disks. You may be asked a few yes or no questions concerning memories being turned off, the status of the lineprinter, etc. **Be sure that NXM STOP and PAR STOP are turned ON before the system comes up.** When the Salvager is done, the console TTY will kerchink, ring bells, and in a few seconds ITS should start up and print

AI ITS 1223 IN OPERATION AT 16:27:50

AI ITS 1123 SYSTEM JOB USING THIS CONSOLE.

IT IS NOW 4:27:54 PM EDT, SATURDAY, OCT 24, 1981

TV 11 IS UP - 16:27:54

If the system prints any other mssages, save them in the log. If it says: * * * *ERROR SYSTEM*

*CANNOT BE BROUGHT BACK UP * * ** you should believe it and get a system hacker.

To reload ML or DM, the same basic procedure is used.

Are NXM STOP and PAR STOP turned ON !!!??!!! Good.

6. KL Machines - MC

MC is a KL-10 processor, a newer generation of machine than the KA. It has a PDP-11 instead of a front panel, and runs a different set of console software.

To stop a program (such as ITS) which is running on the KL, press BREAK, followed by [CONTROL-C] on the system console TTY. Now type *SP* (stop).

To get to Exec DDT from KLDCP, type *J NTSDDT [Return]*.

6.1. Cold Booting

A cold boot completely reloads ITS after a power failure or when a Warm Boot fails.

o Ensure that the correct disks are mounted.

o Make sure the ENABLE switch is pushed in, allowing you to bootload.

o Push the DISK button. The system should respond by typing

DECSYSTEM10 DIAGNOSTIC CONSOLE

o Type *RPO [Return]*.

o Type *J KLINIT [Return]*.

o Wait for a >. prompt. If the "two-way interleave: note is on the console, type KLINI2 instead of KLINIT.

The system should respond

```
;INITIALIZE KL10 FOR ITS
MR
P U1.RAM
ITS OFF
MR
SM
EX 700600 0
I X2
0000007/004000 000000
```

```
SP
P CHSREF$
SM
CMD:
>.
```

o Type *J NTSDDT [Return]*. The system should repond with the message

```
MR
P IOELEV.A11
ITS
I NTSDDT
```

If it doesn's respond properly, find a system wizard. Exec DDT is now running.

o Reload the IO-11 by typing *$L .;BOOT11 [Return]*. Type *$G*.

o Continue with the warm boot procedure.

6.2. Warm Boting

1. Type *$L.;<sys> [Return]*, where <sys> is the name of the current version of ITS (such as ITS, NITS, NITS1, etc.).

2. Type *$G* to start the system running.

The Salvager should start running; it may take a few minutes to work on the disks. You may be asked a few yes or no questions concerning memories being tuned off, the status of the lineprinter, etc. When the Salvager is done, the console TTY will kerchink, ring bells, and in a few seconds ITS should start up and print

MC ITS 1223 IN OPERATION AT 16:27:50

MC ITS 1123 SYSTEM JOB USING THIS CONSOLE.

IT IS NOW 4:27:54 PM EDT, SATURDAY, OCT 24, 1981

If the system prints any other mssages, save them in the log. If it says: *** *ERROR SYSTEM CANNOT BE BROUGHT BACK UP* *** you should believe it and get a system hacker.

If it prints out *ITS IN OPERATION* but does nothing else, the IO-11 may need reloading. Use the Cold Boot procedure descibed above.

6.3. KL Crash Procedures

The best thing to do when the KL crashes is to call a system wizard. The next best thing is to get to exec DDT and take a system core dump (and then cold boot). The command is *$Y CRASH; ⟨reason⟩ [Return]*, where ⟨reason⟩ is a six letter file name indicative of the cause of the crash.

Be sure to make an entry in the log book which says what error message the system crashed with.

In some cases, the system can be continued with the *$P* command. The error message on the console TTY will tell you if this is a reasonable option.

7. TV system

The Knight TVs are controlled by the PDP-11 against the wall near the AI PDP-10. You can't miss it; it is the large rack with all the wires hanging out. It is extremely fragile.

If the TV-11 should crash, locate one of the people listed in the back of this document.

Before the TV system can be reloaded, it must be running. To start the TV-11 running, Halt it, Load Address 0 with 777, and Start the machine at 0. Run the STUFF program under ITS. If necessary, patch the value 1 into TT11P.

8. Network problems

Sometimes ITS will decide that the connection to the ARPANET is losing, and will logically disconnect. The NET command in the LOCK will reset ITS's Network Control Program (NCP) and abort all connections; it will then attempt to reconnect to the network. If there seem to be consistant problems with the ARPANET connection, some cables may have to be diddled. Get a system hacker.

The Chaosnet interface to AI is the AI-CHAOS-11 next to the ARM-10 memory. It should not normally need to be touched.

9. Shutting down the 9th floor

Sometimes, it may be necessary to shut down the ninth floor, typically because the air-conditioning has failed and alarms are going off.

The file SYS;SHUT DOWN contains detailed instructions for bringing down all the machines on the ninth floor. Unless you know exactly what you are doing (and you have been through the procedure before) you should not attempt this without help or you will probably severely screw things up.

10. Wizards

Around the 9th or 8th floor, you are likely to find one of the following people around:

RG (Richard Greenblatt) at Lisp Machines Incorporated, 876-2890/6819.

CSTACY (Chris Stacy) at home, 646-4162.

For the AI machine: RMS (Richard Stallman).

TK (Tom Knight).

RWK (Bob Kerns) at home, 266-8853; at Symbolics, 864-4660.

For the ML machine: GSB (Glen Burke).

At the Symbolics Cambridge Research Center (864-4660), you may try to contact MOON (Dave Moon) or HIC (Howard Cannon).

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