The Seven Wonders of TERMDSM

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Abstract

TERMDSM (*Terminal On-line Diagnostic/Support Monitor*) is an HP-written utility program, distributed as part of the Fundamental Operating System (FOS) and commonly used to fix "broken" ports on the HP3000. Most system managers never fully realize the potential of this wondrous program which understands the internal system tables (PPDIT, HWDIT, etc). This paper documents more fully the workings of TERMDSM, and how the system manager (or data communications manager) may use it more effectively.

The paper emphasizes the DISPLAY and DUMP commands and explains the various system tables which may be viewed through their use. (These tables are not explained in either the TERMDSM manual or the System Tables manual.) This paper is applicable only to MPE V.

Introduction

TERMDSM is available in the PUB group of the SYS account. TERMDSM was written to provide SEs (and later the system manager) a means of correcting port lock ups without needing a shutdown and restart. This program provides simple commands which allows the user to determine the hardware status of a port, the internal MPE software status of the port, and how the port is really configured (default port or a customized port).

Why study TERMDSM? The best reason is that it is in your own self interest! The official view from HP is expressed on two consecutive pages in the TERMDSM manual. First: *Generally, the system manager has many troubleshooting responsibilities and is required to collect and analyze a great deal of information. It is often helpful to keep a journal that documents information about past and present problems. But most importantly, the system manager must know when to call an HP service representative. When an HP service representative is called, he or she should be provided with all the pertinent information that could aid in the problem resolution process.*[1] This does not necessarily mean that HP would like all of the system managers to be handy with a wire cutters, hammer and screw driver. In fact HP is very quick to point out that: *It is Hewlett-Packard's responsibility to resolve problems that arise from the use of products under the warranty of a customer service contract. When support personnel are presented with complete information, the problem resolution process is made easier for all concerned.* [2]

The intent of this paper is to provide only a general overview of the tables used by MPE as information moves to and from users' terminals. **The contents of this paper should not be used to design privileged mode programs which access or modify the tables!**

MPE Data Communication Principles

The connection between the real world of the user and the HP3000 Central Processing Unit (CPU) is typically through either an Asynchronous Data Communications Controller (ADCC), an Advanced Terminal Processor (ATP), or a Terminal Interrupt Controller (TIC - the Micro HP3000 equivalent of an ATP). These devices are the port controllers (with many ports to each card). The ATP-type port controller is capable of "running" independently of the main CPU, transferring the contents of its buffers to and from the user's terminal. A special control program sent from the CPU to each port controller contains a complete description of the next task the controller is to perform. This task could be as simple as "remain idle - waiting for a key to be depressed" or as complicated as detecting a BREAK or modem disconnect. Unlike the ATP, ADCCs are not "intelligent" and require the intervention of the main CPU for EVERY character transferred to and from the terminals! ADCCs do not use a control program but instead a "channel" program. Because of the performance limitations of the ADCCs, HP has been gently nudging the user community to migrate away from ADCCs to the newer ATPs.

The control program which is sent to the port controller is "compiled" by the CPU after referencing a number of special "DEVICE INFORMATION TABLES" or DITs. These low level DITs are called the Hardware DIT (HWDIT), Protocol and Data Manager DIT (PDDIT), and Port Protocol DIT (PPDIT). In addition to these special tables MPE also maintains Terminal Buffers (TBUFs), VFC buffers, Interrupt Linkage Tables, and Logical Device Tables. Confused? Lost? Rightfully so! Deciphering what does what and who talks to whom while doing terminal I/O is much like the problem that a blind-folded tourist encounters when he is "dumped" into a foreign country and cannot speak the local language!

Let me clarify how terminal I/O is performed by personifying the tables and processes used. Let's set the scene by saying we have been called to solve a hideous crime. The inspector general (also known as the system manager) has observed that agent 99 (also known as LDEV 99) has been HUNG! The inspector is fit to be tied. The last several weeks some mysterious criminal element has been wreaking havoc. The whole country's (system's) network of agents (LDEVs) is concerned that they will be next. You are presented with a thick dossier of the agents and suspects (the tables). With the assistance of a new crime-stoppers' tool (TERMDSM) you must identify the most likely suspects so they can be then tracked down by INTERPOL (your local HP CE & SE). *(In order to make the paper more readable and entertaining I deliberately blur the distinction between processes and tables!)*

The first entry on the inspector's list is a suspect called the Terminal Data Segment alias TDS. TDS is quite nosy; he has maintained a record of the other suspects' (DITs') locations and movements. It also appears that TDS may have a split

personality!

The second suspect is called the Logical Monitor DIT alias MONDIT. Observation of the MONDIT indicates that he gets a lot of action. MONDIT appears to represent the "go-between". He has been edgy lately (perhaps due to the lack of sleep). MONDIT has been seen associating with IOQ, HWDIT, PPDIT, etc. The inspector does not believe that MONDIT is the culprit although we might be able to squeeze him for some information.

The third suspect is Protocol and Data Manager DIT alias PDDIT. PDDIT is an ambassador, he likes strict adherence to protocol. PDDIT will often take documents passed to him and add additional information to them. PDDIT is very demanding and complains that the others never worry about time.

Our fourth suspect is called Physical Driver-Hardware Device Information Table alias HWDIT. HWDIT is our mechanical expert, he spends most of his time working with something called "hardware". The other DITs view him as a social introvert! His only close friends are CNTRLPROG and CHANPROG (suspects five and six). CNTRLPROG - Control Program - is a quick and adaptable talker. CHANPROG - Channel Program - has a much more limited vocabulary and requires constant supervision.

Suspect number seven's name is Terminal Buffer alias TBUF. TBUF has what appears to be a photographic memory, unless she is overloaded with work. TBUF likes to be asked to remember bits and pieces of data. TBUF maintains a running total of all the requests for work, the fact TBUF has always been handy, and that she has a number of relatives waiting to help.

Our eighth suspect is quite crafty. Most of the other DITs are convinced that he has never done anything useful in his life. He appears to take orders from something called "ATTACHIO" and after asking for advice from the other DITs he passes the work on to some other worker. (Sounds like a manager to me!) This suspect uses the name of Input/Output Queue; IOQ is the nickname he prefers. The inspector has observed that shortly after IOQ gets into the act, the process which MONDIT belongs to is often awakened!

Next up we have fraternal quadruplets. Although related, these suspects have unique personalities. They are the Interrupt Linkage Tables (ILT & ILTX), Driver Linkage Table (DLT), and Device Reference Table (DRT). The inspector is sure that these tables are loyal and not the cause. The inspector's analysis is based on the knowledge that if any one of these suspects were compromised, the country would have already fallen (system failure)!

The next two suspects are the Logical-to-Physical Device Table (LPDT) and the Logical Device Table (LDT). The LPDT is the psychoanalyst in the gang. LPDT always knows whether the agents (LDEVs) are duplicative, or can accept jobs or data. The LPDT can immediately tell whether a port is feeling good (UP) or blue (DOWN). The LDT is a certified public accountant. LDT feels that items such as record length,

printer header & trailers, and access count are not given enough mention.

The two suspects who appear to have most at stake are the Process Control Block twins, aliases PCB and LDTPCB (process control block associated with LDT). These two tables appear to be the origin of all input/output on the system. When an agent working for them hangs, they hang! Conversely if something happens to the PCB then the agent is left waiting and wondering when more data will come.

The second-to-last suspect's name is Vertical Format Control alias the VFC table. This suspect only visits the scene of port hangs when the port was configured as a spooled device. It is unlikely that a bad VFC table will cause a hung agent (LDEV); however, bad VFCs are known to cause erratic and strange evidence (e.g., top-of-form when it was not called for.)

The last suspect, Port Protocol DIT alias PPDIT, often looks and acts very suspicious before and after agent hangings (LDEV problems). The inspector has noted that the PPDIT appears to be wishy-washy, constantly changing his story when a different user is working with our agents. Rumor has it that PPDIT has undergone a "face lift" from something called a "Workstation Configurator".

Before we begin our actual investigation of the crime scene, some additional background information is necessary. Virtually all of the forenamed suspects are involved with I/O between the CPU and the agent (LDEV). The suspects have been greatly influenced by something called the "SYSTEM CONFIGURATION". Each suspect has been read its rights by another computer program called the "Initiator". Perhaps you've seen the Initiator repeat the rights to all the tables, it looks something like:

```
DIRECTORY MAINTENANCE COMPLETED
PART 1 OF 6 COMPLETED - MEMORY RESIDENT TABLES SET UP
PART 2 OF 6 COMPLETED - SL BINDING
PART 3 OF 6 COMPLETED - SYSTEM I/O PROCESS CREATION
PART 4 OF 6 COMPLETED - DRIVER LOADING
PART 5 OF 6 COMPLETED - DISC RESIDENT TABLES SET UP
PART 6 OF 6 COMPLETED - SYSTEM PROCESS CREATION
```

After the Initiator has completed, each table will retain the basic characteristics specified in the system configuration until one of two events happens: the port is allocated, or an FCONTROL is issued requesting changes in the port characteristics. Allocation means that either a user has entered a [RETURN] to logon or the port has been FOPENed. **Once a port's characteristics have changed they will remain in this new state until either the port is de-allocated or another FCONTROL is issued.** So what? Well, it is possible to write a very simple "user mode" program that alters the port's characteristics so that it will work incorrectly for the next program or make the port appear to be hung. (I know. I have accidentally done so.) TERMDSM allows you to determine very quickly the characteristics of any port.

Troubleshooting Tips

There are three basic items that are required for fast and effective troubleshooting. The first is knowledge. Fortunately for the new system manager, there have been experimenters who have preceded you. The work of Ross Scroggs is still a classic and should be required reading. In order to troubleshoot, you must be able to distinguish what appears to be normal (or correct) from what is wrong. Take the time to read the reference material I have listed. Make sure that you keep good notes when you encounter problems, including what the causes, effects and cures were. The second basic "thing" that you need are tools. This does not mean that you must spend several thousand dollars for data communication analyzers. First learn to use effectively the free tools that exist on your system. These tools range from the very basic :SHOWJOB, :SHOWOUT, and :SHOWDEV commands to the more sophisticated TERMDSM program. The third basic item is a troubleshooting methodology. By this I mean knowing where to start looking and the sequence of problem areas to check.

HP's *Fundamental Data Communications Handbook* contains an entire chapter devoted to troubleshooting. You should become familar with it. But even before starting the steps HP lists, I do the following:

1 - If the port is a terminal then :SHOWJOB. Look for an asterisk ("*") in the state column; it means that MPE has not yet completed the logon sequence for the session. The JOBNUM and LDEV (JIN/JLIST) will be required for later tracking.

```
:SHOWJOB

JOBNUM  STATE IPRI JIN  JLIST    INTRODUCED  JOB NAME

#S154   EXEC        20  20       MON  4:11P  OPERATOR.SYS
#J971   EXEC QUIET  10S LP       WED  5:51P  REV03I,IDLE.SYS
#S646   EXEC        46  46       SAT 11:52A  DENNIS,TEM.TEIMS

3 JOBS:
    0 INTRO
    0 WAIT; INCL 0 DEFERRED
    3 EXEC; INCL 2 SESSIONS
    0 SUSP
JOBFENCE= 0; JLIMIT= 5; SLIMIT= 30
```

If the port is a spooled device (plotter or printer), use the :SHOWOUT command to check the status of the spooler. If the spooler shows it is active but there is nothing being printed, check for messages on the operator's console. Make a mental note of the STATE. (Remember, only READY files print). Also make sure that the priority of your output exceeds the OUTFENCE.

```
:SHOWOUT

DEV/CL   DFID    JOBNUM  FNAME     STATE FRM SPACE RANK PRI #C
LP       #02671  #J959   LP        READY       248    D 3   1
LP       #02989  #J1064  $STDLIST READY       104    D 2   1
20       #0648   #S154   $STDLIST OPENED
..        ...     ...      ...     ...
46       #03017  #S646   $STDLIST OPENED

29 FILES:
    0 ACTIVE
    26 READY; INCLUDING 26 SPOOFLES, 26 DEFERRED
    3 OPENED; INCLUDING 1 SPOOFLES
    0 LOCKED; INCLUDING 0 SPOOFLES
    27 SPOOFLES:  3888 SECTORS
OUTFENCE = 3
```

2 - If you have passed step 1, then have the operator use the :SHOWDEV command. Check to see if the port is available ("AVAIL") and job accepting ("A"). If they are not, find out why and take corrective action. A printer can become "owned" by a user's program if the system spooler process for the device was stopped. Once a printer is privately owned, other users' requests for it will be denied with a file system error 55 - "device unavailable". If the port is privately owned, the pin number of the owner will be displayed in the "OWNERSHIP" column. Jot down the offending pin and look it up with the :SHOWQ command. A port may also be "DOWNed" by the operator or by the security monitor. One other interesting item to look for is the number of files open at each LDEV. An interactive session waiting at the ":" prompt will only have two files open. If you see more, it means that the user is running a program.

```
:SHOWDEV
LDEV  AVAIL          OWNERSHIP          VOLID          DEN   ASSOCIATION

  1   DISC           6 FILES
  2   DISC  (RPS)    22 FILES
  6   SPOOLED        SPOOLER OUT
  7   UNAVAIL        SYS #1             LOGTAP(ANSI)
  8   AVAIL
  9   AVAIL
 10 A AVAIL
 20 A UNAVAIL        #S154: 2 FILES
 21 A AVAIL
 22   SPOOLED        SPOOLER OUT
 23 A AVAIL
  .....
 39 A AVAIL
 40   SPOOLED        SPOOLER OUT
 41 A AVAIL
 42 A AVAIL
 43 A AVAIL
 44 A AVAIL
 45   SPOOLED        SPOOLER OUT
 46 A UNAVAIL        #S646: 2 FILES
```

3 - Use the :SHOWQ command to check if the process is able to run or to obtain the Job/Session number of a pin that is holding a printer. Pin numbers which are preceded with "M" are typically waiting at the ":" prompt. Pin numbers which are preceded with a "U" are application programs. System processes (like spoolers) will not have any letter in front of them.

```
:SHOWQ

 DORMANT              WAITING              RUNNING

Q  PIN   JOBNUM      Q  PIN   JOBNUM      Q  PIN   JOBNUM


L   1                                     C  M129  #S646
L   2
L   3
L   4
 ....
L   16
C  M18   #S154
C  U30   #J971
L   42
L  U51   #J971
D  M99   #J971
C  U112  #J971
C  U120  #J971
```

After you have performed the easy and simple checks it may finally be time to use TERMDSM. This program has seven wonderful commands that we will cover in this paper. They are ABORTIO, ABORTJOB, BROKEN, DISPLAY, DUMP, RESET, and EXIT. (Not covered, but available, are diagnostics for ATP, ASNP, and DMI ports).

Running TERMDSM

TERMDSM may only be run by a user with SM or OP capability. Although the program is safe (and should not cause system failures), it does give the user the ability to abort I/O or jobs, and view terminal buffers. The latter should be of special interest to the security-conscious, since it allows all passwords to be viewed as they are typed in (even with the new security product installed).

The prompt for TERMDSM is "->". TERMDSM is accessed by entering

```
:RUN TERMDSM.PUB.SYS

HP32196G.05.04 - TERMDSM - Terminal Diagnostics (C) Hewlett-Packard
Co.

ADCC software version - G.51.24

Type HELP for aid
```

HELP

TERMDSM has built into it a help function. In addition to the "high level" help, each command also will provide additional help.

```
-> HELP
Valid input at this point is any one of the following:
  DIAGnostics - to enter dialog for running diagnostics on
                one or more ATP/ASNP ports
  DMIdiag     - to enter dialog for running diagnostics on
                one or more DMI ports
  ABORTJOB    - to enter dialog for aborting one or more
                jobs
  ABORTIO     - to enter dialog for aborting I/O pending on
                an ATP/ADCC/ASNP/DMI port
  RESET       - to enter dialog for resetting one or more
                ATP/ADCC/ASNP/DMI ports and associated tables
  DISplay     - to enter dialog for displaying ATP/ADCC/ASNP/DMI
                tables and terminal buffers
  DUmp        - to enter dialog for dumping ATP/ADCC/ASNP/DMI
                tables and terminal buffers
  Broken      - to obtain a list of ATP/ADCC/ASNP/DMI
                considered broken and/or unfixable
                by the driver software
  Exit        - to exit TERMDSM
The capital letters indicate abbreviated valid input.  The
message output when you enter HELP will change depending on
where you are in what dialog.

Anytime // is entered, TERMDSM will terminate.
```

BROKEN

The command BROKEN is used as a quick check for ports which have encountered some unusual condition which caused them to "break". Once you have identified a broken port you may use the TERMDSM RESET command to fix the port. However not all broken ports can be fixed. If the port is unfixable TERMDSM will indicate so. Unfixable ports can only be reset by shutting the system down and restarting with either a WARMSTART, COOLSTART or a COLDSTART. An example of the BROKEN command is:

```
-> BROKEN
BROKEN PORTS

        LDEV#    BROKEN    UNFIXABLE
        27         *
        33         *           *
```

DISPLAY

TERMDSM allows the user to display active information for virtually all of the tables used by the system for terminal I/O. In fact TERMDSM is the only HP-supported program which will allow the system manager to find out the terminal type and termtype file defined for a specific port. With this command you get only what you

ask for. A sample dialogue with the DISPLAY command is:

```
-> DISPLAY
DISPLAY

Enter table name or ldev number:  HELP
Enter one of LPDT, LDT, TDS, MONDIT, HWDIT, IOQ,
DLT, ILT, DRT, PCB, LDTPCB, PDDIT (ATP/ADCC/DMI),
PPDIT (ATP/ADCC/DMI), VFC (ATP/ADCC/DMI), TBUF (ATP/ADCC/DMI),
CNTLPROG (ATP/ASNP/DMI), CHANPROG (ADCC only), an
ATP/ADCC/ASNP/DMI device LDEV number or just a carriage
return.

There are two sets of tables associated with each
device:  queues of tables and single tables.  IOQs and TBUFs
are queues of tables while the rest of the tables are individuals.
If IOQ or TBUF is entered, the first table in the queue will
be displayed and you will be prompted whether to continue
with the next.  If any other table name is entered, it will
be displayed.

If an ATP/ADCC/ASNP/DMI LDEV number is entered, it is now the
device whose tables are to be displayed, not the device
whose LDEV number was input previously.

If just a carriage return is input, TERMDSM returns to the
outer block.

Enter table name or ldev number: 46
Enter table name or ldev number: VFC

***** VFC Table SIR's *****

 OWNER'PCB      = 0       HEAD'PCB       = 0       TAIL'PCB       = 0
 QUEUE'LENGTH   = 0

***** VFC Table SIR's *****

WORD
0    000000 000000 000000 000000

No VFC entry associated with LDEV #46
```

A more complete explanation of the tables will be given later in the paper.

DUMP

The DUMP command will format "snapshots" of active systems taken by MPE immediately after a port breaks. Unlike the DISPLAY command DUMP can be used to RESET ports or format broken ports. Because it will reset both good and broken ports, *the DUMP command should be used with CAUTION!* For ATP-type controllers the user may request that the PCC memory also be dumped. The catch is that in the

process of dumping the PCC memory, the port will also be reset! TERMDSM will ask whether or not you want the PCC memory included in the dump. If the port is already broken then you should say yes; if not and the port is in use, think twice! The sample tables that are explained later in the paper were dumped from an ADCC device that was active (ADCCs do not contain PCC memory). TERMDSM will dump and format the table information for the specified port to a file called TERMnnn, where nnn is the port logical device number. The file will contain carriage control characters for "top-of-form". It is best printed by using FCOPY. The dump command used to format the tables for the paper follows:

```
-> DUMP
DUMP
 Enter ldev number: HELP
Valid input is an ATP/ADCC/ASNP/DMI device LDEV number or just a
carriage return to terminate input.  As long as just the carriage
return is not entered, the prompt is repeated until all the
devices that are to be dumped have been input.

 Enter ldev number: 46
 Do you want to include a message? Y
   message-> MODEM CARRIER LOSS, BUT SESSION STILL ACTIVE
   message->
 Data dumped into file TERM46.
 Enter ldev number:
```

RESET

The RESET command will cause TERMDSM to abort sessions that were using the device, reset the hardware, and rebuild the internal tables related to the device. (Please note: If the device was unfixable, (see BROKEN) even RESET cannot fix it!) I have included a sample dialogue for fixing a typical port. Users who have the DMI interface should refer to HP's *Terminal Online Diagnostic/Support Monitor (TERMDSM)* reference manual.

```
-> RESET
RESET

Enter ldev number: HELP
Valid input is an ATP/ADCC/ASNP/DMI device LDEV number or just a
carriage return to terminate input.  As long as a valid
ATP/ADCC/ASNP/DMI device LDEV number is entered, the prompt will
be repeated until all the devices you want to reset are reset.

Enter ldev number: 46
The device entered is currently owned.  Resetting this device will
abort the session associated with it.  Be sure that you have the
correct logical device number!  If you wish to continue with the
reset process, respond with "Y", "N" or [RETURN]. y
```

```
The DEVICE DRIVER does not consider this device broken.  However
this does not exclude the possibility of a hung port.  If you wish
to continue with the reset process respond with "Y", "N" or
[RETURN] y
```

EXIT

When you are done and want to leave TERMDSM enter "EXIT" or "//".

```
-> EXIT
```

SAMPLE TABLE DUMP

Perhaps one of the largest drawback to using TERMDSM for our criminal investigation is simply information overload! If we format the tables for a specific port, somewhere between 15 and 25 related tables will be printed! For neophytes this is generally enough to cause immediate panic. Fortunately the information that we are really after is only a small subset. (This paper is not intended to teach you how to write device drivers, only how to troubleshoot common problems.) I have annotated the tables that you should be able to skip with the phrase "beyond the scope of this paper". For the rest of the dumps (or displays) we must play the part of the master detective Sherlock Holmes.

The Banner

The DUMP command will automatically include a banner at the beginning of the formatted file.

```
HP32196G.05.05 - TERMDSM - Terminal Diagnostics (C) Hewlett-Packard Co. 1983

MODEM CARRIER LOSS, BUT SESSION IS STILL ACTIVE!

DUMP OF LDEV#46 ON SAT, APR  9, 1988,  9:59 AM
```

Terminal Data Segment (TDS)

Terminal Data Segments contain the Hardware, Protocol, Data Manager DITs, the control (or channel) program and Vertical Format Control tables. MPE will automatically create the correct number of TDSs required. For systems which contain ATPs there will be one or two TDSs for each Device Reference Table (DRT) channel. Because ADCCs are much smaller, only one TDS is required for each DRT channel.

```
***** ADCC Terminal Data Segment Header *****

 HDDIT'P        =%000043  PORTAREA'P     =%000647  VFCAREA'P      =%000247
 HIGHLDEV'WRD   = 58      PORTDUMP'P     =%017752  WAITHEAD'P     =%000000
 LOWLDEV'WRD    = 20      TBUFTBL'P      =%022376  WAITTAIL'P     =%177777
 MSGTBL'P       =%017677  TDS'VER        = 2

***** Software Versions *****

SOFTWARE LEVEL  G.51.32
ADCCDRIVER      G.04.44
ADCCINIT        G.04.18
IHANDLER        G.04.36
IMANAGER        G.04.71
LPMON           G.04.19
TDS'VER         2
TERMDSM         G.05.05.0
TERMMON         G.04.28
TERMUTIL        G.04.27
```

Now back to our detective role. The TDS maintains pointers to the other DITs required for the port. If the pointers were bad the port would indeed hang, but more likely is a system failure! The version numbers are primarily for reference. Unfortunately our suspect's nosy habits are of little use to us in this case. After viewing the TDS, we can't hold this suspect; the verdict would be innocent.

Terminal Monitor DIT (MONDIT)

The MONDIT contains flags which indicate whether or not a device has been "DOWNed" or placed in diagnostics (:SHOWDEV will also display this information). MONDIT also contains the flags for pre-spacing and post-spacing (FCONTROL 1 with parm equal %100 or %101). The MONDIT is also the place to look to see if the user is "in BREAK", running an interactive session or job.

```
***** Terminal Monitor DIT *****

 DL'ACK'TO      = 0       DL'LDEV        =%000056  DL'READ'TIME   = 0
 DL'ACTIVE      = 0       DL'LOG         =%000000  DL'READ'TO     = 0
 DL'BINARY      = 0       DL'LOG1        =%000000  DL'READ'TVAL   = 0
 DL'BRK'MOD     = 0       DL'LOGN'TRLX   =%000000  DL'REQUEST     = 0
 DL'BROKEN      = 0       DL'LOGON'TO    = 0       DL'RESET       = 0
 DL'CFAIL'TO    = 0       DL'LOGON'TYP   = 1       DL'SAVE'PF     = 0
 DL'CONSOLE     = 0       DL'MCC'STAT    =%000000  DL'SPD'SNS     = 0
 DL'CONTROLLER  = 2       DL'MCC'VER     = 0       DL'SSTO        = 0
 DL'DATE'CODE   =%000000  DL'MISC        =%000103  DL'START'SS    =!0000
 DL'DEVTYPE     = 16      DL'MISC3       =%040020  DL'TBUFAVAIL   = 0
 DL'DLTP        =%072300  DL'MSC'STAT    =%000000  DL'TEMP        =%000000
 DL'DMI'STATE   =!0000    DL'MSC'VER     = 0       DL'TERM        = 1
 DL'DONT'CAT    = 0       DL'NEXT        =%000000  DL'TICK        =%000000
 DL'ERROR'CODE  = 0       DL'PCC'STAT    =%000000  DL'TIME        =%000000
 DL'FLAGS       =%140000  DL'PCC'VER     = 0       DL'TIME'FLAG   = 0
 DL'FLUSH       = 0       DL'PD'DITP     =%012503  DL'TRUEUNIT    = 0
 DL'HANGUP'TO   = 0       DL'PF'REC      = 0       DL'UNFIXABLE   = 0
 DL'ILTP        =%062704  DL'PREEMPT     = 0       DL'UNIT        =%000000
 DL'INT'MAN     =!0000    DL'PRESPACE    = 0       DL'UP          = 1
 DL'INT1        = 0       DL'PRP'LEVEL   = 3       DL'VERSION     = 0
 DL'IOQP        =%005464  DL'QPARM       = 3       DL'WAIT'RSN    = 0
```

And now a few words of explanation of MONDIT's street slang, so you can follow the progress of the questioning of our informer:

```
DL'TERM                 1 - device is a terminal
```

```
DL'UP              0 - device not in use
                   1 - device has been speed-sensed or
                       FOPENed

DL'BROKEN          1 - Port is broken

DL'LDEV            nnn - Logical device number for port

DL'PRESPACE        0 - Pre-spacing not enabled
                   1 - Pre-spacing is enabled

DL'BINARY          0 - Not Binary Mode
                   1 - Binary Mode

DL'SPD'SNS         1 - Device was speed-sensed


DL'FLUSH           1 - BREAK was seen, and has been processed

DL'LOGON'TYP       0 - :DATA
                   1 - :HELLO
                   3 - :JOB

DL'DATE'CODE       Contains the ATP hardware date code
                   (ADCCs not used)

DL'DEVTYPE         The driver type, 16 for terminals

DL'SSTO            0 - If logon was not successful and
                       the configured logon timeout is
                       reached then disconnect the port.
                   1 - If logon was not successful and
                       the configured logon timeout is
                       reached, then reset and start new
                       speed-sense process.

DL'BRK'MODE        0 - NOT IN BREAK
                   1 - IN BREAK

DL'ERROR'CODE      ATP failure code

DL'UNFIXABLE       1 - port is unfixable, WARMSTART is required
```

While interrogating the MONDIT, the detective made the following observations. The first is that the port was not broken and it was "up". The logical device for this port is %56 (decimal 46). Pre-spacing was not enabled and a BREAK had not been seen or processed. The device type is 16, just what we would expect for a terminal. Most of the suspect's ramblings (other fields) were considered not to be relevant to the investigation. Verdict: innocent.

Port Protocol DIT

The characteristics displayed in the PPDIT can be altered by using HP's Workstation Configurator. Always check the current termtype number and if a termtype file was specified. (Termtype can be specified with FCONTROL or at logon by entering `:HELLO user.acct;TERM=nn` or `TERM=termtype filename`). After the PPDIT fields have been formatted, TERMDSM will also show what special characters are in effect. If the special characters have been modified (via FCONTROL), it is possible that many programs will not operate as expected.

```
***** Port Protocol DIT *****

Last termtype file name : none
Current term type : 10
 PP'2631B'FIX   = 0       PP'ENQACK      = 1       PP'ODD'ENAB    = 0
 PP'ACKCHAR     = ACK     PP'ENQBLOCK    = 80      PP'ODD'PARITY  = 0
 PP'BLOCK'TRIG  = DC1     PP'ENQCHAR     = ENQ     PP'PARITY'ENAB = 0
 PP'BLOCKMODE   = 3       PP'EVEN'ENAB   = 1       PP'STAT'WAIT   = 0
 PP'BSRESP      = 1       PP'EVEN'PARITY = 2       PP'STATUS'RETRY= 0
 PP'CHARSIZE    = 6       PP'FF'NEWCHAR  = NUL     PP'SW'XONXOFF  = 0
 PP'CONS'STRIP  = 0       PP'FFOK        = 1       PP'TAILTBUF    =%000000
 PP'DC3'CCTL    = 0       PP'FOPEN'PARITY= 0       PP'TBUFS'IN'USE= 0
 PP'DELAY       = 0       PP'HEADTBUF    =%000000  PP'TRIGGER'CHAR= DC1
 PP'DELAYCR     = 0       PP'INIT'DEV    = 0       PP'VFC         =%000000
 PP'DELAYFF     = 0       PP'LAST'SSBRK  = EM      PP'VFC'OK      = 0
 PP'DELAYLF     = 0       PP'MIN'SR      = 0       PP'WRITESTATUS = 0
 PP'DO'XON'TIMER= 0       PP'NAME'VALID  = 0       PP'XFLOW       = 1
 PP'DTR'LOW'TIME= 0       PP'NETWRK'DEV  = 0       PP'XOFF'DC1    = 0
 PP'ECHO        = 1       PP'NETWRK'WAIT = 0       PP'XON'TIME    = 60
 PP'EMSTRIP     = 1       PP'NOACKACTION = 1       PP'XSTRIP      = 1
 PP'ENQ         =%050005

*** Special Characters ***

Console attention     : SOH
Cancel 1 character    : BS
Linefeed              : LF
Type 1 EOR            : CR
Block-mode alert      : DC2
Cancel line           : CAN
Subsystem break       : EM
Strip and ignore      : NUL, DEL
```

Here are the inspector's notes from the questioning of this many-faced suspect:

```
PP'ECHO              0 - echo disabled
                     1 - echo enabled

PP'ENQACK            0 - disable ENQ/ACK
                     1 - enable ENQ/ACK

PP'DELAY             0 - disable delays
                     1 - enable delays after CR, LF, FF

PP'XFLOW             0 - disable XON/XOFF
                     1 - enable XON/XOFF
```

PP'XSTRIP	0 - do not strip XON/XOFF from read data 1 - remove XON/XOFF from read data
PP'EMSTRIP	0 - do not strip CTRL-Y from read data 1 - strip CTRL-Y from read data
PP'CONS'STRIP	0 - do not strip CTRL-A from read data 1 - strip CTRL-A from read data
PP'FFOK	0 - replace form feed (FF) with contents of PP'FF'NEWCHAR before output 1 - allow FF
PP'DC3'CONTROL	0 - do nothing 1 - Append DC3 to line after every CR, LF
PP'BLOCKMODE	0 - do not start read when DC2 is seen 1 - Line blockmode 2 - Page blockmode 3 - either line or page blockmode
PP'DO'XON'TIMER	0 - do not limit XOFF flow control 1 - start XON timer (see PP'XON'TIME)
PP'VFC'OK	1 - There is a VFC file for the device
PP'NAME'VALID	0 - Use HP FOS termtype files 1 - Use custom termtype file
PP'DELAYCR	time in .1 second for delay after CR
PP'DELAYLF	time in .1 second for delay after LF
PP'DELAYFF	time in .1 second for delay after FF
PP'ENQBLOCK	Size in characters of the ENQ/ACK block
PP'ENQCHAR	ENQ character
PP'ACKCHAR	ACK character
PP'BLOCK'TRIG	DC1 - read trigger character
PP'TRIGGER'CHAR	DC1 - normal character-mode trigger

```
PP'BSRESP           Action that will be taken for a BackSpace
                    1 - Nothing
                    2 - Send End-Of-Medium
                    3 - Send LF
                    4 - Send /
                    5 - Erase the character

PP'PARITY'ENAB      0 - Parity checking is disabled
                    1 - Enable parity checking

PP'FOPEN'PARITY     The parity which should be used
                    0 - Space
                    1 - Mark
                    2 - Even
                    3 - Odd

PP'ODD'ENAB         1 - If odd parity was sensed, parity
                        checking is enabled

PP'EVEN'ENAB        1 - If even parity was sensed, parity
                        checking is enabled

PP'EVEN'PARITY      Indicates what type of parity should be
PP'ODD'PARITY       generated if that parity was sensed.
                    0 - Space
                    1 - Mark
                    2 - Even
                    3 - Odd

PP'XON'TIME         The amount of time to wait for XON.
                    (in seconds)
```

The detective's analysis of the PPDIT revealed nothing unusual. The port was configured as type 10, typical for HP terminals. The special character table was what is considered normal. The trigger character PP'TRIGGER'CHAR was a DC1 as expected. I have included PPDIT displays for a spooled Laserjet II and a HP7750 plotter. Can you see any differences?

PPDIT for Laserjet II

```
***** Port Protocol DIT *****

Termtype filename     : TTPCL18.PUB.SYS
 PP'2631B'FIX    = 0       PP'ENQACK       = 0       PP'ODD'ENAB     = 0
 PP'ACKCHAR      = ACK     PP'ENQBLOCK     = 0       PP'ODD'PARITY   = 0
 PP'BLOCK'TRIG   = DC1     PP'ENQCHAR      = ENQ     PP'PARITY'ENAB  = 0
 PP'BLOCKMODE    = 0       PP'EVEN'ENAB    = 1       PP'STAT'WAIT    = 0
 PP'BSRESP       = 1       PP'EVEN'PARITY  = 2       PP'STATUS'RETRY= 0
 PP'CHARSIZE     = 7       PP'FF'NEWCHAR   = NUL     PP'SW'XONXOFF   = 0
 PP'CONS'STRIP   = 0       PP'FFOK         = 1       PP'TAILTBUF     =%000000
 PP'DC3'CCTL     = 0       PP'FOPEN'PARITY= 0        PP'TBUFS'IN'USE= 0
 PP'DELAY        = 0       PP'HEADTBUF     =%000000  PP'TRIGGER'CHAR= NUL
 PP'DELAYCR      = 0       PP'INIT'DEV     = 1       PP'VFC          =%000247
 PP'DELAYFF      = 0       PP'LAST'SSBRK   = NUL     PP'VFC'OK       = 1
 PP'DELAYLF      = 0       PP'MIN'SR       = 0       PP'WRITESTATUS = 0
 PP'DO'XON'TIMER= 1        PP'NAME'VALID   = 1       PP'XFLOW        = 1
 PP'DTR'LOW'TIME= 0        PP'NETWRK'DEV   = 0       PP'XOFF'DC1     = 0
 PP'ECHO         = 1       PP'NETWRK'WAIT  = 0       PP'XON'TIME     = 60
 PP'EMSTRIP      = 1       PP'NOACKACTION  = 1       PP'XSTRIP       = 1
 PP'ENQ          =%000005

*** Special Characters ***

Console attention     : SOH
Cancel 1 character    : BS
Linefeed              : LF
Type 1 EOR            : CR
Cancel line           : CAN
Subsystem break       : EM
Strip and ignore      : NUL, DEL
```

PPDIT for spooled 7550

```
***** Port Protocol DIT *****

Termtype filename     : TT7550.PUB.SYS
 PP'2631B'FIX    = 0       PP'ENQACK       = 0       PP'ODD'ENAB     = 0
 PP'ACKCHAR      = ACK     PP'ENQBLOCK     = 0       PP'ODD'PARITY   = 0
 PP'BLOCK'TRIG   = DC1     PP'ENQCHAR      = ENQ     PP'PARITY'ENAB  = 0
 PP'BLOCKMODE    = 0       PP'EVEN'ENAB    = 1       PP'STAT'WAIT    = 0
 PP'BSRESP       = 1       PP'EVEN'PARITY  = 2       PP'STATUS'RETRY= 0
 PP'CHARSIZE     = 6       PP'FF'NEWCHAR   = NUL     PP'SW'XONXOFF   = 1
 PP'CONS'STRIP   = 0       PP'FFOK         = 1       PP'TAILTBUF     =%000000
 PP'DC3'CCTL     = 0       PP'FOPEN'PARITY= 0        PP'TBUFS'IN'USE= 0
 PP'DELAY        = 0       PP'HEADTBUF     =%000000  PP'TRIGGER'CHAR= NUL
 PP'DELAYCR      = 0       PP'INIT'DEV     = 1       PP'VFC          =%000267
 PP'DELAYFF      = 0       PP'LAST'SSBRK   = NUL     PP'VFC'OK       = 0
 PP'DELAYLF      = 0       PP'MIN'SR       = 0       PP'WRITESTATUS = 0
 PP'DO'XON'TIMER= 0        PP'NAME'VALID   = 1       PP'XFLOW        = 1
 PP'DTR'LOW'TIME= 0        PP'NETWRK'DEV   = 0       PP'XOFF'DC1     = 0
 PP'ECHO         = 1       PP'NETWRK'WAIT  = 0       PP'XON'TIME     = 60
 PP'EMSTRIP      = 1       PP'NOACKACTION  = 1       PP'XSTRIP       = 1
 PP'ENQ          =%000005

*** Special Characters ***

Console attention     : SOH
Cancel 1 character    : BS
Linefeed              : LF
Type 1 EOR            : CR
Cancel line           : CAN
Subsystem break       : EM
Strip and ignore      : NUL, DEL
```

VFC TABLE

VFC tables are used for spooled devices. The dump in this case was of a device configured as a terminal.

```
No VFC entry associated with LDEV #46
```

VFC claims not that he was not anywhere near the scene of the crime. His alibi holds up. Terminals do not associate with VFCs. I have therefore taken the opportunity to include additional VFCs for a Laserjet II and an HP7550.

VFC entry for Laserjet II

```
***** VFC Entry *****

VFC Filename : VFCPCL.PUB.SYS

 VFC'DATABUF0   =%022515  VFC'INITBUF    =%022410  VFC'USE'COUNT  = 1
 VFC'DATABUF1   =%022622

***** VFC Initialization Buffer *****
WORD
0    000000 140000 015532 015505 015446 066061 046000 000000   .....Z.E.&l1L...
10   000000 000000 *** SAME TO 77 ***                           ................
100  000000 000000 000000 000000 000000                         ..........

***** VFC Data Buffer *****
WORD
0    000000 015446 066060 030526 000000 000000 000000 000000   ...&l01V........
10   000000 015446 066060 031126 000000 000000 000000 000000   ...&l02V........
            *** VFC DATA BUFFER DISPLAY SHORTENED ***
```

VFC for spooled 7550

```
***** VFC Entry *****

VFC Filename : VFC7550.PUB.SYS

 VFC'DATABUF0   =%023034  VFC'INITBUF    =%022727  VFC'USE'COUNT  = 1
 VFC'DATABUF1   =%023141

***** VFC Initialization Buffer *****
WORD
0    000000 100000 015456 024033 027116 032473 030471 035461   ......(..N5;19;1
10   034472 015456 044470 030073 035461 033473 030467 035111   9:..180;;17;17:I
20   047073 000000 000000 000000 000000 000000 000000 000000   N;..............
                *** SAME TO 77 ***
100  000000 000000 000000 000000 000000                         ..........


***** VFC Data Buffer *****
WORD
0    000000 000000 000000 000000 000000 000000 000000 000000   ................
               *** VFC DATA BUFFER = 0 ***
```

Protocol and Data Manager DIT (PDDIT)

The PDDIT brings us closer to the actual port hardware. In the PDDIT we are finally able to see if a "powerfail" has been encountered, whether or not we are dealing with a modem, and if so, what the modem status is. The investigator can easily determine the port speed. If the terminal is processing a V/3000 read, that too is visible.

```
Protocol and Data level DIT *****

***** Fixed Area *****

PD'ALL'PARITY  =%000000  PD'DSRTIMER    = 0      PD'PORTSTATE   = 1
PD'ALTCHARSET  = 1       PD'DTRTIMER    = 0      PD'POWERFAIL   = 0
PD'BROKEN      = 0       PD'HARDWARE'TYP=%000000 PD'PPENTRYNUMB = 10
PD'CF'CNT      = 0       PD'IODITP      =%012341 PD'PPROTOCOL   =%012520
PD'CFTIMER     =%000000  PD'LINETYPE    = 0      PD'RPARITY     = 0
PD'CHARSIZE    = 0       PD'MODEM'SIGNAL= 174    PD'RWPORTSTATE = 1
PD'CLEARF      = 0       PD'MODEM'STATE = 6      PD'SPEED'SPECIF= 0
PD'CONNECTTYPE = 1       PD'PARITYENAB  = 0      PD'TERMTYPE    = 10
PD'CONTROLLER  = 2       PD'PENDING'STAR= 0      PD'WPARITY     = 0
PD'DC'MODEM    = 0       PD'PORTSPEED   = 120    PD'XONTIMER    =%000000
PD'DPORTSPEED  = 120

***** Variable Area *****

PD'2631B'RESET = 0       PD'ESCPAIR     = 0      PD'READFLAGS   =%000003
PD'ABSOFFSET   =%000002  PD'FILLING     = 0      PD'READLOC     = 1
PD'ALTCHARS    =%00000C  PD'HEADOFFSET  =%000002 PD'READTIME    = 0
PD'ALTEOR      = NUL     PD'HEADTBUF    =%054076 PD'READTYPE    = 1
PD'ALTSSBREAK  = NUL     PD'IOQEOR      = NUL    PD'SBUF1       =%054076
PD'BANKNUMB    =%054076  PD'LAST'STATUS = 0      PD'SBUF1'STAT  = 0
PD'BANKOFFSET  =%054076  PD'LASTEOR     = NUL    PD'SBUF2       =%054076
PD'BINARY'MODE = 0       PD'LBLOCKMODE  = 0      PD'SBUF2'STAT  = 0
PD'BINARYREAD  = 0       PD'LDMDIT      =%063244 PD'SBUFREADCOMP= 0
PD'BLOCKMODE   = 0       PD'LDMOPCODE   = 7      PD'SPDSENSE    = 1
PD'BREAK       = 0       PD'LLDMC       = 2      PD'SSBREAK     = 0
PD'BREAKENAB   = 1       PD'LOGONDEV    = 1      PD'SSBRKENAB   = 0
PD'BREAKMODE   = 0       PD'LOPCOMPLETE = 0      PD'STAT'COUNT'2= 0
PD'BRKTBUF     =%000000  PD'LOPSTATE    = 1      PD'STATUS      =%000000
PD'BROKRCNT    = 0       PD'NETWK'SR'MOD= 0      PD'STATUS'RETRY= 0
PD'BTANKED     = -1      PD'NETWRK'WAIT = 0      PD'STATUS'WCNT = 0
PD'CHARSET     = 1       PD'NEWLINE     = 0      PD'SUSPLOPSTATE= 0
PD'CNTRLX      = 1       PD'NEWTOP      = 0      PD'TAILOFFSET  =%000002
PD'CONSENAB    = 0       PD'NO'READECHO = 0      PD'TAILTBUF    =%054076
PD'CONSMODE    = 0       PD'NOLF        = 0      PD'TBUFS'IN'USE= 0
PD'CRITICALW   = 0       PD'OLDXFERCNT  = 0      PD'TBUFWAIT    =%000000
PD'DC2READ     = 0       PD'OWNREAD     = 0      PD'TIMINGREAD  = 0
PD'DEVLINK     =%000000  PD'PCC'XON'XOFF= 1      PD'TRANSPARENT =%000000
PD'DISCNCT'DEV = 0       PD'PENDLOPSTATE= 0      PD'VIEWREAD    = 0
PD'DO'STATREQ  = 0       PD'PREADTIMING =%000000 PD'WAITFORTBUF = 0
PD'EOF         = 3       PD'PRINTER     = 0      PD'WWC         = 0
PD'EOFCNT      = 0       PD'RDTIMEOUTVAL= 0      PD'XFERCNT     = 0
PD'EOFTBUF     =%000000  PD'RDTIMERINDEX=%000000 PD'XON'RETRYS  = 0
PD'ERROR       = 0       PD'READCNT     = 279    PD'XONWAIT     = 0
PD'DISCADDR    = (D)%00000000000  PD'RDSTARTIME  =%(D) 00000000000
```

These are some of the diplomatic terms favored by this suspect:

```
PD'PORTSTATE        1 - Reading
                    2 - Writing
                    3 - Idle
                    4   Input save
                  5-8   NOT USED
                    9 - Selftest
                   10 - Speed-sensing
                   11 - Setting up port protocol
                   12 - Set up special characters
                   13 - Control Modem
```

PD'CONTROLLER	1 - ATP 2 - ADCC
PD'LINETYPE	0 - asynchronous 1 - synchronous
PD'CONNECTTYPE	0 - Direct connect, subtype 14 1 - Modem, subtype 1 or 15 2 Modem, subtype 9 or 13
PD'BROKEN	0 - PORT OKAY 1 - PORT BROKEN
PD'POWERFAIL	0 - No powerfail 1 - Powerfail detected
PD'CF'CNT	nn - number of times data carrier has failed HP3000 will disconnect after 50 times.
PD'PENDING'STAR	0 - OKAY 1 - (MODEMS only) A carrier fail was detected and an operation (port controller command) is pending. The operation cannot be started until we have a carrier.
PD'MODEM'SIGNAL	0 - NOT USED 1 - Clear to Send 2 - Signal Quality 3 - Data Set Ready 4 - Call origin status 5 - Secondary carrier detect 6 - Ring indicator 7 - Carrier Detect
PD'PORTSPEED	The terminal (port) speed (Characters per second)
PD'PENTRYNUMB	The terminal type number; if a termtype file was specified, then this will be 31.
PD'TERMTYPE	The terminal type now in effect; 0 = termtype file was specified.

PD'LOPSTATE	Port Logical Operation State 0 - No operation in progress 1 - Reading 2 - Writing 3 - Status Request for a device 4 - Reading Status 5 - Responding to CTRL-X 6 - Waiting for ENTER or RETURN 7 - Write data and wait for read 8 - Setup pending read 9 - Write and then ask for status 10 - Speed-sense 11 - Set up port protocol 12 - Set up special characters 13 - Set up modem control lines 14 - Not Used 15 - Set up V/3000 read
PD'NO'READECHO	0 - Echo is enabled 1 - Echo is disabled
PD'BREAK	0 - BREAK has not been seen 1 - BREAK key has been detected
PD'SSBREAK	0 - CTRL-Y has not been seen 1 - CTRL-Y has been detected.
PD'VIEWREAD	0 - NOT A V/3000 READ 1 - V/3000 READ
PD'BINARYREAD	0 - Not a binary read 1 - Binary read
PD'ALTEOR	EOR character as specified in FCONTROL 41
PD'ALTSSBREAK	Alternate subsystem break; (it will not be stripped from read buffer)
PD'NEWTOP	0 - not at top of form 1 - at top of form
PD'BREAKMODE	0 - Not in break 1 - In break
PD'SSBRKENAB	0 - Ignore subsystem breaks (FCONTROL 16) 1 - Subsystem breaks are processed (FCONTROL 17)
PD'BREAKENAB	0 - BREAK is disabled (FCONTROL 14) 1 - BREAK is enabled (FCONTROL 15)

```
PD'WAITFORTBUF      0 - All okay, not waiting for TBUF
                    1 - Waiting for TBUF!

PD'PCC'XON'XOFF     0 - I/O driver will perform XON/XOFF handshake
                    1 - Hardware will perform XON/XOFF handshake

PD'READTIME         Elapsed read time (FCONTROL 22)

PD'TIMINGREAD       0 - Terminal input timer disabled
                        (FCONTROL 20)

                    1 - Terminal input timer enabled
                        (FCONTROL 21)

PD'RDTIMEOUTVAL     Number of .1 seconds for timed read
                        (FCONTROL 4)

PD'ERROR            Driver sensed an error!
                    1 - Out of buffers
                    2 - Data Overrun
                    3 - Framing error
                    4 - Not Used
                    5 - Parity error
                    6 - Not used
                    7 - Modem error ??
                    8 - Not used
                    9 - Not used

PD'DC2READ          0 - DC2 not read [ENTER]
                    1 - DC2 has been read, will initiate
                        a blockmode or linemode read

PD'XONWAIT          0 - Not waiting for XON
                    1 - XOFF was seen, waiting for XON
                        (only set up software is performing
                         the XON/XOFF handshake)

PD'LBLOCKMODE^@      1 - Line Blockmode read was made

PD'BLOCKMODE        1 - Blockmode read

PD'BINARY'MODE      0 - Not in binary mode (FCONTROL 26)
                    1 - Binary transfers enabled
                        (FCONTROL 27)
```

```
PD'READTYPE         (Type of read in progress)
                    0 - No read in progress
                    1 - Character mode read
                    2 - Spooled read
                    3 - Idle read
                    4 - transparent read (no editing)
                    5 - V/3000 read
                    6 - Binary read

PD'PRINTER          1 - device is a printer

PD'READLOC          0 - Not Used
                    1 - Read into TBUF
                    2 - Read into system buffer
                    3 - Read into frozen segment (NO-WAIT I/O)

PD'STATUS           status returned from printer
                    (Only if port was configured as a
                     printer)
```

The detective's review of the PDDIT showed that the port was setup as a 1200 baud modem (subtype 1 or 15). The port was not broken, and no powerfail had been encountered. The terminal type is 10, (it matches the other tables), and we are not in a V/3000 read (PD'VIEWREAD=0). The field PD'LOPSTATE says that we are reading or waiting for a read. The PD'MODEM'SIGNAL is %174 which decodes to "clear to send", "signal quality", "data set ready", "call origin status", and "secondary carrier detect", BUT NO CARRIER DETECT! Why? This is very unusual. This suspect will require closer surveillance, but we should not make a judgement yet because we still have several more suspects to question.

Hardware DIT (HWDIT)

The HWDIT will reflect the "opinion" of the actual computer hardware. Generally the contents of the HWDIT should be in agreement with the more sophisticated DITs already discussed. However keep in mind that in some cases such as XON/XOFF, the actual handshaking may be done by the software driver and not the hardware. (In that case the flags may actually disagree!) Remember that the HWDIT is a mechanic, so we are especially interested in the mechanical work that he has performed. A good inspector will look for data format (8 bit mode), which parity is in effect, any errors, what delays will be used, port speed, has [BREAK] been seen, echo on or off, and if a modem - what the modem line values are.

```
***** ADCC Hardware-level Dit *****

HW'8'BIT'MODE  = 1       HW'FLAGS'4     =%147340  HW'PRISPCL     = 1
HW'ACK'CHAR    = ACK     HW'FRAMING'ERRO= 0       HW'RD'RIGHT'LEF= 0
HW'ACK'WAIT    = 0       HW'INSAVE'BITS =%000000  HW'READ'ADDR   =%054127
HW'BREAK'DETECT= 0       HW'INSAVE'BREAK= 0       HW'READ'BANK   =%000003
HW'BROKEN      = 0       HW'INSAVE'BUF  =%010600  HW'READ'BUFR   =%020117
HW'CHAR'BUFFER =%003000  HW'INSAVE'FE   = 0       HW'READ'CNT    = 134
HW'CHAR'MAP    =%140344  HW'INSAVE'MODEM= 0       HW'SAVE'MODEM  =%000372
HW'CONTROL'TYPE= 2       HW'INSAVE'NOACK= 0       HW'SAVE'READ   =%000000
HW'CP'P        =%062731  HW'INSAVE'OE   = 0       HW'SEC'SCHRS   =%000422
HW'CR'DELAY    = 26      HW'INSAVE'PE   = 0       HW'SENSE'TIMER =%000000
HW'CURR'CPVA'NU= 3       HW'INT'TRACE   = 23523   HW'SET'PROTOCOL= 1
HW'CURR'INT'COD= 32      HW'LAST'CPVA'NU= 3       HW'SETUP'WAKE  = 0
HW'DELAY'CHAR  = NUL     HW'LAST'INT'COD= 14      HW'SPEC'CHAR   = LF
HW'DELAY'ENAB  = 0       HW'LDIT'P      =%063244  HW'SPEC'SPEED  = 0
HW'DELAY'INT   = 0       HW'LF'DELAY    = 5       HW'STATE       = 1
HW'DIAG'INTERRU= 0       HW'LINE'SPEED  = 11      HW'STATUS'BITS = 0
HW'DIAG'REASON = 0       HW'LSTSTATE    = 11      HW'STATUS'FE   = 0
HW'DIAGNOSTIC  = 0       HW'MODEM'CTL   =%000052  HW'STATUS'OE   = 0
HW'DO'XON'XOFF = 0       HW'MODEM'OUT1  =%000014  HW'STATUS'PE   = 0
HW'DRT         = 31      HW'MODEM'OUT2  =%000014  HW'UART        =%000233
HW'ECHO        = 1       HW'MODEM'REF   =%000012  HW'UNUSED'3    =%000000
HW'EDIT'SCHRS  =%000000  HW'MODEMPANEL  = 1       HW'WRI'SCHRS   =%000431
HW'ENQ'BLOCK   = 80      HW'NEXT'STATE  = 1       HW'WRITE'ADDR  =%012437
HW'ENQ'CHAR    = ENQ     HW'NON55       = 1       HW'WRITE'BANK  =%000003
HW'ENQ'COUNT   = 26      HW'PARITY'CHECK= 0       HW'WRITE'BUFR  =%010400
HW'ENQ'TIMER   =%000000  HW'PARITY'GEN  = 0       HW'WRITE'CNT   = 0
HW'FF'DELAY    = 6       HW'PDIT'P      =%012503  HW'WT'RIGHT'LEF= 0
HW'FF'ENAB     = 1       HW'POWERFAIL   = 0       HW'XON'WAIT    = 0
HW'FLAGS'3     =%101613  HW'PRI'SCHRS   =%140344  HW'XONENAB     = 1
```

Here are some our social introvert's favorites topics of conversation:

```
HW'CONTROL'TYPE 1 = ATP
                2 = ADCC

HW'MODEMPANEL   0 = The port is configured as a direct connect,
                    subtype 14
                1 = The port is configured for a modem,
                    subtype 15

HW'WAIT'REASON  1 = Abort Pending
 (ATP ONLY)     2 = The port is being reset
                3 = Modem disconnect in progress
                4 = ?
                5 = Port just initialized, waiting for modem
                6 = Hung

HW'ECHO         0 = Echo is disabled
                1 = Echo is enabled
```

```
HW'STATE          1 = reading
                  2 = writing
                  3 = speed-sensing
                  4 - 9 = ?
                 10 = reading modem inputs
                 11 = idle read
                 12 = setting up modem
                 13 = monitoring modem signals

HW'POWERFAIL      0 = Normal, no powerfail
                  1 = Powerfail has occurred

HW'BROKEN         0 = The port is not broken
                  1 = The port is broken

HW'DELAY'ENAB     0 = Delays will follow CR,LF or FF
                  1 = No delays are added (NULs)

HW'FF'ENAB        0 = Replace FormFeed (FF) with a Linefeed
                  1 = Pass FF through without editing

HW'XONENAB        0 = Hardware will not perform XON/XOFF handshake
                  1 = XON/XOFF will be performed

HW'8'BIT'MODE     0 = data is 7 bit with 1 bit parity
                  1 = data is 8 bit data

HW'PARITY'GEN     (FOR 7 BIT DATA ONLY, SEE HW'8'BIT'MODE)

                          ADCC                  ATP & TIC
                    ---|-----------------------------------
                     0 |    EVEN                BIT8 =0
                     1 |    ODD                 BIT8 =1
                     2 |    EVEN                 EVEN
                     3 |    ODD                  ODD


HW'PARITY'CHECK   0 = do not check parity for received characters
                  1 = check received character parity
```

HW'LINE'SPEED

	ADCC	ATP & TIC
0	NOT USED	110 baud
1	NOT USED	300 baud
2	?	600 baud
3	?	1200 baud
4	?	2400 baud
5	?	4800 baud
6	600 baud	19200 baud
7	2400 baud	9600 baud
8	9600 baud	NOT USED
9	4800 baud	9600 baud
10	NOT USED	1200 baud
11	1200 baud	300 baud
12	2400 baud	?
13	300 baud	?
14	150	?
15	110	?

HW'READ'CNT byte count, reset to 0 after CR

HW'WRITE'CNT byte count, written thus far, reset at CR

HW'FRAMING'ERRO the number of framing errors seen thus far

HW'SPEC'CHAR contains the last special character detected.

HW'MODEM'OUTPUT (ATP) These are the output lines from the HP3000 to the modem

HW'MODEM'OUT1 & 2 (ADCC)

Bit	ADCC	ATP & TIC
0	NOT USED	speed select
1	NOT USED	?
2	?	?
3	?	?
4	Request-To-Send	Secondary Request-To-Send
5	Data-terminal-ready	call request
6	speed select	Request-To-Send
7	Secondary Request-To-Send	Data-Terminal-Ready

HW'MODEM'REF (reference MASK; "1" = check for change in state)

Bit	ADCC	ATP & TIC
0	NOT USED	NOT USED
1	NOT USED	Clear-To-Send
2	?	Signal Quality
3	Clear-To-Send	Data-Set-Ready
4	Data-Set-Ready	Call Origin Status
5	Ring indicator	Secondary Carrier Detect
6	Data Carrier Detect	Ring Indicator
7	Secondary Channel Detect	Carrier Detect

**** ADCCs ONLY ****

HW'SAVE'MODEM — Same format as HW'MODEM'REF but indicates actual status of the signal lines from the modem

HW'XON'WAIT — XOFF has been seen; we are waiting for an XON

HW'ACK'WAIT — ENQ was sent; we are waiting for an ACK to be returned

HW'ENQ'BLOCK — The number of characters which will be sent in between ENQ and ACK. "0" disables ENQ/ACK

HW'ENQ'COUNT — The number of characters to be sent to the terminal before another ENQ will be sent. (Decreases as each character is sent).

HW'CR'DELAY — nn * .1 second delay after each CR

HW'LF'DELAY — nn * .1 second delay after each LF

HW'FF'DELAY — nn * .1 second delay after each FF

After a long discussion with the mechanic and a close examination of his work, the detective has concluded that the agent (LDEV) has been instructed to work with 8 bit data, no parity detection or generation, no delays will be added to the data. The port speed is set to 1200 baud. The modem states were quite intriguing! The HP3000 had set the "clear-to-send" and "data-terminal-ready" control lines. What is so interesting is that the modem output states are what you would expect for a port that is either currently connected (it was not) or a port that has had the carrier drop was disconnected and is now waiting for another call! Something is very fishy! This suspect will also require closer surveillance.

ATP CNTRLPROG and ADCC CHANPROG

CNTRLPROG and CHANPROG both take their orders from the other DITs and I/O

process. Since we know that these two suspects do only as they are asked and never have done anything on their own initiative, the inspector feels that they are innocent.

The ADCC channel & ATP control programs are beyond the scope of this paper.

IOQ

The IOQ is the boundary where we leave the realm of the file system (FOPEN, FCONTROL, FREAD, FWRITE, etc.) The higher order file system intrinsics act as guardians to the underworld, checking and ensuring that the user requests are reasonable. Once past the guardians the user's request is translated into parameters for an internal procedure called ATTACHIO. After entering the world of ATTACHIO, life is much more difficult, for a simple error in the calling sequence will result in a SUDDEN DEATH! ATTACHIO looks at the parameters it was passed, consults the appropriate tables and once again translates the user's request into another format. This last translation has a new twist. ATTACHIO will direct the translated command to one of many formats. If the user requested terminal I/O, the command becomes a Terminal IOQ entry. When the new command has been successfully added to the IOQ, ATTACHIO will send a message to the monitoring process for terminals to awake. This monitoring process will reference both the IOQ and the MONDIT for the requested device. It should be more apparent why our MONDIT was looking frayed and tired!

What should our detective look for? What command or function was being requested, general status, was a [BREAK] being processed, etc.

```
***** Terminal IOQ *****

Q'ABORT        = 0        Q'FUNC         = 0        Q'RPLEVEL      = 0
Q'ACCESS       = 0        Q'GEN'STAT     = 0        Q'SET'RESET    = 3
Q'ADDR         =%000001   Q'ITEM         = 3        Q'SPEED1       = 3
Q'BINARY       = 0        Q'LDEV         = 46       Q'SPEED2       = 0
Q'BLOCKED      = 1        Q'LINK         =%000000   Q'STAT'WORD    =%000000
Q'COMPLETED    = 0        Q'LOGON'TYPE   = 3        Q'STATE        = 0
Q'CONTINUE     = 0        Q'MISC         =%000001   Q'STATUS       =%000000
Q'COUNT        = -279     Q'OLD          = 1        Q'SUBSYS'BRK   = NUL
Q'CRITICAL     = 0        Q'OWN'READ     = 0        Q'SUPRESS'LF   = 0
Q'CTRL'RTRN    =%177351   Q'PARITY       = 3        Q'SYS'BUF      = 0
Q'DATA'SEG     =%100544   Q'PARM1        =%000003   Q'SYSBF'PTR1   =%100544
Q'DB'BASED     = 1        Q'PARM2        =%000000   Q'SYSBF'PTR2   =%000001
Q'DSTN         = 356      Q'PCBN         = 49       Q'SYSBUF'PTR   =%000001
Q'EOF'COND     = 3        Q'PRESPACE     = 0        Q'TERM'TYPE    = 3
Q'EOR'CHAR     = ETX      Q'QUALIFIR     = 0        Q'TOKEN        =%000003
Q'FLAGS        =%006000   Q'RD'TO'VALU   = 3        Q'V3000'READ   = 0
Q'FLUSH        = 0        Q'READ'EOR     = NUL      Q'WAKE         = 1
QD'SPOOL'ADR   = (D)%00000600000
```

The inspector general's staff has intercepted the cipher from the ATTACHIO organization. He has provided the following explanation to assist your investigation:

```
Q'ABORT    1 = Abort IOQ entry for device

Q'BINARY   1 = Binary read/writes
```

```
Q'BLOCKED 1 = Wait for I/O to complete

Q'COMPLETED      1 = IOQ request has completed

Q'FLUSH   1 = Subsystem break being processed

Q'FUNC    0 - read (FREAD)
          1 - Write (FWRITE)
          2 & 3 - File open/close (FOPEN/FCLOSE)
          4 - Device close
          5 - Set time-out interval (FCONTROL 4)
          6 - Set speed (FCONTROL 10)
          7 - Set speed (FCONTROL 11)
          8 - Enable echo (FCONTROL 12)
          9 - Disable echo (FCONTROL 13)
          10 - Disable system [BREAK] (FCONTROL 14)
          11 - Enable system [BREAK] (FCONTROL 15)
          12 - Disable subsystem [BREAK] (FCONTROL 16)
          13 - Enable subsystem [BREAK] (FCONTROL 17)
          14/15 - Enable/disable tape mode
          16 - Disable read timer (FCONTROL 20)
          17 - Enable read timer (FCONTROL 21)
          18 - Get timer value (FCONTROL 22)
          19 - Disable parity checking (FCONTROL 23)
          20 - Enable parity checking (FCONTROL 24)
          21 & 22 - ?
          23 - set termtype (FCONTROL 38)
          24 - Allocate terminal (FCONTROL 37)

Q'GEN'STAT
          0 - Not started or completed
          1 - Completed Okay
          2 - EOF detected
          3 - Unusual condition
          4 - irrecoverable error

Q'LOGON'TYPE
          0 - :DATA
          1 - :HELLO
          2 - :JOB

Q'PARITY  same as PP'FOPEN'PARITY

Q'PRESPACE       Perform Carriage Control before writes
                 (FCONTROL 1)

Q'QUALIFIER
            0 - none
           11 - Read terminated by special character
           13 - parity error
           23 - Read timed out
```

```
            24 - Block mode transfer time out
            33 - :ABORTIO / :ABORTJOB
            43 - Data overrun
            53 - Data set not ready
            63 - Power fail
           163 - Read timer overflowed
           173 - [BREAK]
           213 - Powered on, lost environment
           273 - VFC reset

Q'STAT'WORD       Q'GEN'STAT and Q'QUALIFIER combined

Q'TOKEN    1 = use first character in buffer
           %53 - CR, no LF, "+"
           %55 - triple space
           %60 - double space "0"
           %61 - go to top-of-form, "1"
           (for more information see CCTL in File system manual)
```

After minutes of tedious deciphering the detective discerned that the last entry made into the IOQ for this agent was a "read" request (Q'FUNC) which is still pending (Q'BLOCKED). The [BREAK] key has not been depressed and we are not in a V/3000 read. The IOQ entry does not appear to contain any incriminating evidence. For now we will assume that the IOQ is innocent.

Logical-to-Physical Device Table (LPDT)

The LPDT is used to map a request for an LDEV into the physical hardware. We personified the LPDT as a psychoanalyst. The LPDT is where we can check to see if the device is "real" or imaginary (virtual) - LPDT'VIRT. Real devices are terminals; virtual devices do not actually perform I/O but pretend to. Spooled device files and INPs are virtual devices. LPDT can also tell us the state of its mind: interactive - LPDT'INTR, job accepting - LPDT'JOBDATA, or duplicative.

```
***** Logical-to-Physical Device Table *****

 LPDT'BREAK     = 1       LPDT'DV'INFO   =%000000  LPDT'SSBREAK   = 0
 LPDT'DATA      = 1       LPDT'EOR       = 0       LPDT'ST'INFO   =%073041
 LPDT'DITP      =%063244  LPDT'INTR      = 1       LPDT'SUBTYPE   = 1
 LPDT'DRSTATE   = 1       LPDT'JOBDATA   = -1      LPDT'VIRT      = 0
 LPDT'DUP       = 1

LPDT'BREAK          1 = [BREAK] seen OR  C.I. ignore [BREAK]

LPDT'DATA 1 - Data accepting

LPDT'DRSTATE
           0 - Not owned by any process
           1 - Owned by a process
           2 - Service request (DEVREC), a [RETURN] has been
               pressed on a port that had been logged off.
           3 - Device reserved, (:STARTSPOOL in progress)
```

```
LPDT'DUP  1 - device is duplicative

LPDT'EOR  End-of-file type
          0 - No EOF
          1 - Hardware EOF (tape mark), (:EOF: ??)
          2 - :DATA
          3 - :EOD
          4 - :HELLO
          5 - :BYE
          6 - :JOB
          7 - :EOJ

LPDT'INTR 1 - device is interactive

LPDT'JOBDATA      1 - device is Job accepting

LPDT'SSBREAK      1 - [CTRL-Y] has been detected

LPDT'SUBTYPE      device subtype (from system configuration)

LPDT'VIRT 1 - virtual device, spooled device file, INP, etc.
```

After meeting with the LPDT, the detective left with a warm and comfortable feeling that the LPDT was okay. The detective verified that he was dealing with a real, interactive device and that the device had not encountered any unusual end-of-file condition. Verdict: probably innocent.

Logical Device Table (LDT)

Our accountant, the LDT, takes pride in his work. The LDT maintains a count of the number of FOPENs or allocations made for his device. He calls this number the FILE'USE'CNT; (it is also visible from :SHOWDEV.) A value of one is typical for spooled printers, two for devices with interactive sessions waiting with the Command Interpreter (C.I.) prompt (":"), and more than two generally means that there is a user program running/accessing the LDEV. Three other fields that interest the detective are AVAIL'TO'SYS, DOWN'REQUESTED and SPECIAL'FORMS.

```
***** Logical Device Table (LDT) *****

AVAIL'TO'DIAG  = 0      DFT'OUTPUT'DEV = 46     SPECIAL'FORMS  = 0
AVAIL'TO'SYS   = 1      DFT'TO'CLASSIDX= 0      SPOOL'STATE    = 0
BAUD'RATE'CODE = 11     DOWN'REQUESTED = 0      SPOOLING'ENAB  = 0
CHANNEL'ID     =18011   FILE'USE'CNT   = 2      TERM'TYPE'DFT  = 10
CS'DEVICE      = 0      HEADER'ON      = 0      TRAILER'ON     = 0
CTL'Y'PIN      = 0      MAIN'PIN       = 49     VDD'INDEX      =%000033
DEVICE'TYPE    = 16     RECD'WIDTH     = 40
```

The following acronyms are used by our accountant:

```
AVAIL'TO'DIAG     1 - The LDEV has been down so TERMDSM can run
                      diagnostics

AVAIL'TO'SYS      1 - The device is not "owned" by a session
```

```
                    (:SHOWDEV displays "A")

BAUD'RATE'CODE      same as HW'LINE'SPEED in HWDIT

DEVICE'TYPE         device type defined in your system configuration

DOWN'REQUESTED      1 - The operator has issued a :DOWN nn on this
                        device.  As soon as it is available to the
                        system it will be marked as "down".

FILE'USE'CNT        number of active FOPEN calls for port

HEADER'ON           1 - Print preceding banner (HEADER)
                        For spooled printers only.  Turned
                        on by :HEADON and off by :HEADOFF

RECD'WIDTH          nn = number of words in each record.
                        (From the system configuration)

SPECIAL'FORMS       1 - Special forms have been requested or are
                        in use by this printer

SPOOL'STATE
                  0 - Not spooled
                  1 - Input spooled
                  2 - Output spooled

SPOOLING'ENAB       1 - Spool queues are open (I believe this
                        means that there is actually output on
                        the way.)

TRAILER'ON          1 - Print trailing banner. (See HEADER'ON.)
```

The detective's examinations of the accountant's books turned up a big zero. The detective verified that the agent (LDEV) was in use by a session (apparently only the C.I.). A down was not pending. Verdict? INNOCENT!

I have included a DISPLAY of an LDT for a spooled Laserjet II. Can you seen any difference?

```
***** Logical Device Table (LDT) *****

AVAIL'TO'DIAG  = 0      DFT'OUTPUT'DEV = 0      SPECIAL'FORMS  = 0
AVAIL'TO'SYS   = 1      DFT'TO'CLASSIDX= 0      SPOOL'STATE    = 2
BAUD'RATE'CODE = 8      DOWN'REQUESTED = 0      SPOOLING'ENAB  = 0
CHANNEL'ID     =!8011   FILE'USE'CNT   = 1      TERM'TYPE'DFT  = 18
CS'DEVICE      = 0      HEADER'ON      = 1      TRAILER'ON     = 1
CTL'Y'PIN      = 0      MAIN'PIN       = 14     VDD'INDEX      =%000051
DEVICE'TYPE    = 32     RECD'WIDTH     = 110
```

DRT, DLT, ILT, ILTX

The DLT, DRT, ILT, ILTX tables are beyond the scope of this paper. For more

information consult the MPE V tables manual. (The real adventurous may wish to investigate the MPE Internals Classes offered by HP.)

Terminal Buffers (TBUF)

TERMDSM displays what are actually two separate pieces of information when you specify TBUF. The first is the TBUF table and the second is the actual TBUF. *The TBUF table contains one very important field, the TBUF'DENIED'WRD.* If the value of this field is not 0, then you need to consider changing your system configuration. Data overruns, poor system performance and HUNG ports may result (or have in the past) when insufficient TBUFs are available. TBUF photographic memory can sometimes be misleading, for often TBUF presents a picture not of what currently is happening to the session in question but of what's happened to somebody else. (This occurs because MPE does not blank the TBUF before assigning it to the next terminal read or write.) This photographic memory presents a possible security breach (even for the security monitor) since it will display the actual key strokes that were typed.

```
***** TBUF Table *****

 TBUF'BUFSIZE   = 69      TBUF'LISTHEAD'P=%024635  TBUF'NUM'WRD   = 252
 TBUF'DENIED'WRD= 0       TBUF'LISTTAIL'P=%053240  TBUF'READ'SAVED= 36
 TBUF'INUSE'WRD = 8       TBUF'MAXUSED   = 43      TBUF'SIZE'WRD  =%022105
 TOTALREQUESTS  = (D) 312445

***** Terminal Buffer ( TBUF ) *****

WORD
0    000000 020062 034440 020040 020040 020503 047516 052111   .. 29     !CONTI
10   047125 042440 042117 020065 030060 020111 036461 026113   NUE DO 500 I=1,K
20   042531 020114 042516 043524 044015 005040 020062 033466   EY LENGTH..  276
30   027067 031440 020065 030060 020040 020113 042531 020126   .73  500   KEY V
40   040514 052505 020102 052506 024111 024475 045505 054440   ALUE BUF(I)=KEY
50   041125 043106 042522 024111 025511 051524 040522 052051   BUFFER(I+ISTART)
60   006412 020040 031067 033056 033464 020040 041415 005040   ..  276.74  C..
70   020062 033466 027070 020040 020040 020040 020040 020111    276.8        I
100  051524 040522 052040 036440 000000                        START = ..
```

The detective's notes for the TBUF were:

```
TBUF'BUFSIZE       size of each buffer

TBUF'DENIED'WORD   number of times there were insufficient TBUFs

TBUF'INUSE'WRD     number of TBUFs currently in use

TBUF'REQUESTS      number of requests for TBUFs since last startup

TBUF'MAXUSED       maximum number of TBUFs used since last startup

TBUF'NUM'WRD       number of TBUFs in TBUF data segment

TBUF'READ'SAVED    number of TBUFs reserved for terminal reads
```

The detective liked what he saw. Plenty of TBUFs available and no TBUFs ever

denied. The actual contents of the TBUF were from a terminal write to a port which we were not interested in. The actual number of valid bytes in the TBUF must be obtained from the other DITs. Verdict: innocent.

Process Control Block & Logical Process Control Block (PCB & LDTPCB)

The PCB and LDTPCB have the same format. Only the LDTPCB is available for spooled devices. Most of the fields are beyond the scope of this paper; however because of its importance, I have displayed a complete PCB and then highlighted the LDTPCBs for a terminal and a spooled device.

```
***** Process Control Block *****

 ALLOW'SOFT'INT = 0        PI'PENDING'CRIT= 0        STACK'DST'INDEX=%000544
 AWAKE'SOFT'OK  = 0        PPC            = 0        STACK'OVF'ABORT= 0
 BLKIDX         = 0        PREEMPT'CAPABLE= 0        STACK'OVF'ALLOC= 0
 BMS            = 0        PREV'IMPED'PIN = 0        STOV           = 0
 BOUNDS'FLAG    = 0        PREV'Q'PTR     =%000000   SYS'CODE'EXEC  = 1
 BPTLINK        = 0        PRIORITY       = 152      WAIT'BLOCKED'IO= 1
 BROTHER'PIN    = 735      PROCESS'ALIVE  = 1        WAIT'FATHER    = 0
 CORE'RESIDENT  = 0        PROCESS'DEAD   = 0        WAIT'FOR'TIMER = 0
 CRITICAL       = 1        PROCESS'TYPE   = 2        WAIT'FOR'TIMOUT= 0
 CST'MAP'DST    = 0        PSEUDO'BREAK   = 0        WAIT'GLOBAL'RIN= 0
 CSTX'MAP'INDEX =%000000   PSEUDO'HARDKILL= 0        WAIT'IMPEDED   = 0
 DB'IS'ABSOLUTE = 1        PSEUDO'HIBERNAT= 0        WAIT'IO        = 0
 DELAYED'SOFT   = 0        PSEUDO'INT'MODE= 7        WAIT'JUNK      = 0
 EVENTFLAGS     =%000000   PSEUDO'SOFTKILL= 0        WAIT'LOCAL'RIN = 0
 FAC            = 0        PSEUDO'SSBREAK = 0        WAIT'LONG      = 1
 FATHER'PIN     = 147      PSEUDO'STOP    = 0        WAIT'MAIL      = 0
 HAS'SIR        = 0        QUANTUM'USED   = 0        WAIT'MEMORY    = 0
 HOLD'IMPED'PRI = 0        QUEUE'CQ       = 1        WAIT'MESSAGE   = 0
 HOLD'SIR'PRI   = 0        QUEUE'DISPQ    = 0        WAIT'MOURNING  = 0
 INCORE'PROT'EXP= 0        QUEUE'DQ       = 0        WAIT'SHORT     = 0
 INTERACTIVE    = 1        QUEUE'EQ       = 0        WAIT'SIR       = 0
 LASTSWAPSEG'CST=%000000   QUEUE'LQ       = 0        WAIT'SON       = 0
 LASTSWAPSEG'NUM=%000000   RITBK          = 0        WAIT'TERM'READ = 1
 LASTSWAPSEG'TYP=%000000   SCHED'ATTN'REQD= 0        WAIT'UCOP      = 0
 NEXT'IMPED'PIN = 0        SI             = 0        WS             = 0
 NEXT'Q'PTR     =%000000   SLL'PTR        =%006636   XDS'DST'INDEX  =%000000
 OA             = 2        SON'PIN        = 0
```

Terminal LDTPCB

```
***** LDT Process Control Block (LDTPCB) ****
      ...                       ...                       ...
      ...                       ...                   WAIT'BLOCKED'IO= 1
      ...                   PROCESS'ALIVE  = 1            ...
      ...                   PROCESS'DEAD   = 0            ...
      ...                      ...                        ...
      ...                      ...                   WAIT'IMPEDED   = 0
      ...                      ...                   WAIT'IO        = 0
      ...                      ...                      ...
      ...                      ...                   WAIT'LONG      = 1
      ...                      ...                      ...
      ...                      ...                   WAIT'MOURNING  = 0
      ...                      ...                      ...
 INTERACTIVE    = 1           ...                   WAIT'SIR       = 0
      ...                      ...                   WAIT'SON       = 0
      ...                      ...                   WAIT'TERM'READ = 1
      ...                      ...
```

LDTPCB for spooled Laserjet II

```
***** LDT Process Control Block (LDTPCB) *****

     ...                ...                ...
     ...           PROCESS'ALIVE  = 1      WAIT'FATHER    = 1
     ...           PROCESS'DEAD   = 0         ...
     ...           PROCESS'TYPE   = 4         ...
     ...                ...                WAIT'IO        = 0
     ...                ...                WAIT'LONG      = 1
     ...                ...                   ...
     ...                ...                WAIT'SON       = 1
```

Notes on the LDTPCB and PCB:

```
INTERACTIVE        1 - The process is interactive

PROCESS'ALIVE      1 - The process is still considered
                       active by MPE

PROCESS'DEAD       1 - The process is being eliminated by MPE

PROCESS'TYPE
                   0 - user process (CREATEPROCESS)
                   1 - user (:RUN x)
                   2 - user main (C.I.)
                   3 - user main task???
                   4 - system (spoolers, DEVREC, etc)
                   5 - ?
                   6 - system, UCOP (user controller, it processes
                       the :HELLO command)
                   7 - ?

WAIT'BLOCKED'IO    1 - waiting for terminal Read or Write to
                       complete

WAIT'FATHER        1 - waiting to be awoken by father process
                       (spooler waiting for data to print)

WAIT'IMPEDED       1 - waiting for a resource to become available

WAIT'IO            1 - waiting for disc I/O

WAIT'LONG          1 - long term wait, remove from dispatch queue

WAIT'MOURNING      1 - process is mourning the loss of a son

WAIT'SIR           1 - waiting for a system internal resource

WAIT'SON           1 - waiting for son process to wake me up

WAIT'TERM'READ     1 - waiting for a terminal read to complete
```

The detective was left in awe after meeting with the PCB and his cousin the LDTPCB. He has not been able to classify these individuals. With the help of the inspector general, he did ascertain that the "process" was alive, waiting only for a

terminal read. He also recognized that if additional help with the suspects was required, INTERPOL (HP SE & CE) would need to be involved.

CONCLUSION

After a detailed investigation our detective was left with two suspects, the PDDIT and the HWDIT. Both argued that they were innocent victims. Their attorneys pointed out that the prosecution only had circumstantial evidence and suggested that both were being framed! The inspector general could not deny this and therefore authorized a "wire tap" (data communication analyzer). The wire tap confirmed the innocence of the suspects and identified the real criminal as an incorrectly configured Support Link modem. (The modem was never dropping DSR, as it should when the carrier is lost.)

TERMDSM is a valuable tool for the system manager. We have seen that through its use we are very quickly able to look at an LDEV from the operating system's viewpoint. This becomes necessary when foreign (non-HP) devices are installed as part of your data communications network. TERMDSM allows the user to quickly verify the termtype (in actual use) that has been customized with the Workstation Configurator. The system manager may even use TERMDSM to view system tables such as the PCB while looking for the cause of system performance problems. You will find that with practice TERMDSM will become a valuable tool in your shop. Your success with TERMDSM can be further enhanced by keeping a log (or diary) of problems you have seen, the effects, causes and cures. By taking DUMPs of properly working terminal and printer ports you can build a reference library for later comparison when problems arise.

Good luck and happy sleuthing...

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BIOGRAPHY

Dennis Heidner received his BSEE degree from Montana State University, Bozeman, Montana. Mr. Heidner has written and presented numerous papers at the HP International Users Group Conferences. Mr. Heidner is a co-author of *The IMAGE/3000 Handbook* and the *TurboIMAGE Supplement*, published by WordWare, Seattle, Washington. He has written technical articles which have been published in several magazines. Mr. Heidner is a member of the Association for Computing Machinery (ACM) and the Institute for Electrical and Electronic Engineers (IEEE).