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PEEK

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PEEK is a utility program designed to operate under the ITS time sharing system. It enables a user to monitor a variety of aspects of the time sharing system by providing, to the user, various periodicly updated displays.

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1. Introduction

PEEK is a utility program designed to operate under the ITS time sharing system. It enables a user to monitor a variety of aspects of the time sharing system by providing periodicly updated display output or periodic printed output to teletype or line printer.

Just what information is being presented to the user is controlled by PEEK's information mode. The available modes are listed in Section 3 below. Section 5 describes how PEEK determines which device to output on. Section 2 describes, in general, how the user can input commands to PEEK.

The first line of all pages output by PEEK is as follows:

ITS xxx PEEK yyy **mm/dd/yy hh:mm:ss** STIME=**DD:HH:MM:SS**

In this line xxx is the version number of the system in use and yyy is the version number of the PEEK in use (so bugs can be matched to exact version). At the time this memo was released, PEEK 271 was the version in use. **DD:HH:MM:SS** is the length of time that the particular ITS system running has been up and **mm/dd/yy hh:mm:ss** is the current date and time according to ITS.

For many modes (those with the mode letter just after the sub-Section number followed by a colon in Section 3) a standard second line is output for any core or disk memory error. This line lists the following three errors if any have occured:

1. Irrecoverable disk errors.
2. Core memory parity errors.
3. Core memory failures to respond (NXM).

The last line of all pages output to the 340 display by PEEK is a list of mode command letters which can be given by light penning them with effects identical to typing them.

2. Command Formats

PEEK is an unusual program in that it interprets all characters

typed at it immediately at the interrupt level. Commands to PEEK are all single letters or control characters, sometimes preceded by a numeric argument. The commands listed in Sections 5 and 6 of this memo take effect immediately and do not affect any number that PEEK may be accumulating from digits typed at it.

The commands listed in Section 3 change PEEK's information mode. They may or may not make use of a numeric argument but all clear any number PEEK may have accumulated. These commands normally start PEEK immediately displaying the information requested.

PEEK interprets digits typed at it as forming an octal number.

3. Information Modes Available

Below are listed alphabeticly all the different information modes of PEEK. Normally, the information specified by the current information mode is output to the currently selected output device (see Section 5). After PEEK has done this it waits a while and then repeats. This waiting period is fixed at ten seconds for some information modes that present information that is not expected to change. For most modes, the waiting time is initially ten seconds but can be changed by the Z command (see Section 6).

3.1 A ARPA Network Sockets

The active ARPA network sockets and pseudo-teletypes in the system are listed by this mode. After a heading line, one line of information is given for each socket with the following information: (1) the socket's logical index number, (2) the index, UNAME, and JNAME of the user associated with the socket, (3) the local socket number and the state of the socket, (4) the foreign host and socket number associated with the socket, and (5) the outstanding message and bit allocations on the socket.

If any pseudo-teletypes (STY) are in use, they are listed below all the sockets under a different heading line. On each line is listed the following: (1) the user index, UNAME, and JNAME of the procedure that has the STY open as a teletype, (2) the teletype number of the STY, and (3) the UNAME of the job that has the other end of the STY open.

3.2 C: Disk Channels

This mode lists the channels actually in use for the transfer of information between disk files and procedures. After an explanatory heading line, one line is displayed for each channel with the following information: (1) the logical channel number, (2) the index, UNAME, and JNAME of the user procedure that has the channel open, (3) various status letters as listed in the next paragraph, (4) a count of the number of words transferred, and (5) the system name and two file names of the file.

The following are the disk transfer status letters that can appear in the disk channels mode output:

A	File address altered by .ACCESS or otherwise.
B	Core transfer hung on active buffer.
E	Transfer has reached EOF.
F	Hung in directory full.
L	Channel locked.
M	Master directory read.
P	PDUMP mode transfer.
R	Read.
T	Track Usage Table read.
U	User directory read.
W	Write.
?	Parity error on read.
*	Delete file when channel closed.

3.3 D Disk Directory

This mode displays the disk master file directory ("M.F.D. (FILE)"), which lists the names of all the user directories, and then lists the user directory (".FILE. (DIR)") for the current default system name associated with PEEK. If output is to the 340 display, it may be possible to change this default system name by light penning one of the names in the master directory display.

3.4 G Swap/Schedule Variables

This mode displays information very similar to mode **N** with certain additional data related to the ITS scheduler & swapping routines. In particular, the interrupt request words in the per job information are replaced by the number of page swap in requests and the total run time used is replaced by the average recent load represented by the job in page-milliseconds.

In addition, an extra line is displayed for each top level job showing the average percent of machine time used and load in page-milliseconds for the tree topped by that job (but note that all disowned jobs are combined).

3.5 H: Memory Graph Display

This mode is only available on output to the 340 display. It shows a graph of actual core memory usage. Horizontal position represents absolute address and vertical position represents type of use. Words are displayed on the left edge of the screen describing the use shown to their right. An occurrence of a block of memory at several vertical positions represents a shared block. (See also mode **M**.)

3.6 I Available I/O Devices

The symbolic devices implemented in the ITS system in use are listed by this mode. Output is repeated after a ten second delay.

3.7 L Console Lines

This mode simply outputs the system supplied directory for device TTY. Currently this contains a header line, and, for each teletype line in use, its TTY number, the UNAME and JNAME of the procedure actually connected to the console, core of this procedure, total core of that user, and user index. A final line lists free core and swapped out pages.

3.8 M: Memory Use List

A display is provided by this mode of all of the uses to which actual core memory is being put. After an explanatory heading line, one line is shown for each use in decreasing order by actual core memory occupied.

Each line begins with the type of use, either the UNAME and JNAME of a procedure or a single descriptive word such as "FREE" for unused

actual memory or "DSKBUF" for disk transfer buffers. A "*" is displayed just after the names of a stopped job. After the type of use, the total number of actual core blocks dedicated to that use is listed, followed, for procedures, by the following: (1) the number of the highest virtual page slot in use in that procedure, (2) the number of its pages that are shared with any other procedures, (3) the number of its pages that are not in actual memory but have been swapped out, (4) the total number of page slots in use by the procedure, and (5) the resources in use by the procedure (see Section 4.1).

3.9 N: Normal Mode

This is the initial and most commonly used information mode in PEEK.

3.9.1 The Top

After the normal top of display lines (see Section 1), N mode displays one line of special information in the form of several variable names followed by their values. These names are as follows:

MEMFREE Number of blocks of unused actual core memory.

USRHI Number of blocks of user variables currently allocated in the system.

RNABLU Number of runable users (including the PEEK displaying it).

TRUMM Total user memory blocks of active users.

AUSOPG Number of active user swapped out blocks (pages).

3.9.2 The Middle

After the special information listed in the Section above, a heading line is displayed followed by one line of information per job. The tree structure of jobs is shown by the indentation of the first few items after the user index number on each line. Top level console controlled, disowned, or system jobs are leftmost. Under each appears its inferiors with its immediate inferiors indented one space, its second level inferiors indented two spaces and appearing after their immediate superiors, etc.

The information appearing for each job is as follows: (1) the user index, UNAME, JNAME, and current system name, (2) the run status,

teletype status, and resources seized (see Section 4), (3) the number of blocks of memory in use by the job and the number of such blocks that are swapped out, (4) the average percent of available machine time used recently by the job, (5) two words of possible pending interrupts for the job, and (6) the total amount of actual run time that has been used by the job. The preceding list applies to output to the line printer or 340 display (see Section 5). Other output is abbreviated by dropping some of the information. In particular, the JNAME is dropped for top level non-disowned jobs and the UNAME dropped for their inferiors.

3.9.3 The Bottom

Space permitting, two lines of special information are output at the bottom of the **N** mode display. The first is a line of totals which gives the total memory in use by all listed jobs (no deduction is made for shared pages), the average total percent of machine time used recently by listed jobs, and the total amount of run time for all listed jobs.

The last line shows the total amount of run time for all users that have logged out during the system run so far, the amount of machine time used by jobs killed by users who are still logged in, and the amount of run time for the null job.

3.10 **S** Single Tree

This mode outputs the same information in the same format as the **N** mode except that only procedures in a single job tree are included. The **S** command should be preceded by the user index of a job in the tree to be displayed. If no argument is given the tree containing the PEEK will be displayed.

3.11 **T** Translation Table

The from and to device, system name, file names, and applicability of the system translation table entries are listed by this mode.

3.12 **U**: DEC Tape Channels

This mode is similar to the **C** mode for disk except that it applies to the DEC tape drives. As well as listing information for open channels, it lists various information for each drive. This per drive information includes the directional motion status of the drive,

the tape block the system is trying to move it to, and the current believed position of the tape. Also listed for each drive is a directory pointer, the UNAME of the user who last caused a directory to be read in for that drive, and the UNAME of the user, if any, to whom the drive is "assigned".

If the directory pointer for a drive is -1 it means that the system is not retaining a directory for that drive and the tape can be safely flapped by hand. Otherwise, the directory pointer gives the location in memory of the tape's directory. Even after a tape has been flapped and no directory is being retained for it, this mode displays the UNAME of the last job to cause a directory to be read in from that drive.

3.13 V Single Procedure Variables

Many of the user variables for a single procedure can be inspected with this mode. After showing the procedure's names, run status, and resources, the octal values of a number of named variables are displayed. Then, under a heading line, the contents of the procedure's ACs, input-output channel words and input-output status words are listed. For open channels, the device and mode symbol is also shown.

3.14 X: A/D and D/A Multiplexors

This mode outputs the digitalization of all the multiplexed analog to digital input channels and the value being output to each of the multiplexed digital to analog channels.

3.15 Y DEC Tape Directory

This mode simply outputs the system supplied directory for a particular DEC tape. It should be preceded by a drive number.

3.16 % Scheduler History

Users that have recently caused schedules by being blocked are listed by this mode. Because the percent of overhead time in its is related to the frequency of schedules, this mode may be useful in finding the cause of excessively frequent schedules.

After a heading line, it lists procedures recently scheduled in order of decreasing number of schedules. For each procedure it gives (1) the user index, UNAME, & JNAME, (2) the number of recent schedules,

(3) the average run time per schedule, (4) the percent of schedules caused by blocking caused by page faults, (5) the most common PC when scheduled (with an * in front if executive mode) and the number of schedules at that particular PC.

3.17 ? Explanation Mode

This mode outputs a list and brief explanation of PEEK's commands. Output is repeated after a ten second delay.

→ 4. Special Output Field Formats ←

4.1 Resource Letters

The following are the system resource letters used in modes **G**, **N**, **M**, **S**, and **V** explained above:

G The procedure has control of the PDP-6.

B The procedure has control of the IBM compatible magnetic tape drive (MT0).

C The procedure is now using, or was the last to use, the ITS core allocator.

D The procedure has control of the DEC 340 display (DIS).

I The procedure is in "IOT-user" mode (.IOTLSR). This letter can be present for more than one procedure.

L The procedure has control of the line printer (LPT).

M The procedure has seized the master user facility (.MASTER).

P The procedure has control of the CalComp plotter (PLT).

R The procedure has control of the paper tape reader (PTR).

S The procedure has control of the Sylvania tablet (TAB).

I The procedure has control of the paper tape punch (PTP).

V The procedure has control of the vidisector (NVD).

% The procedure is in real time mode (.REALT).

4.2 Process Run Status

The following Sections explain the procedure run status field output by modes **G**, **N**, **S**, and V:

4.2.1 Prefix

One of the following characters will appear at the beginning of the status code:

> Swap blocked. This procedure is being blocked from running by the swap scheduler to stop thrashing.

_ Desired out. This procedure is not swap blocked but the swap scheduler has decided to swap it out.

* PI in progress. This procedure is not swap blocked or desired out but is processing a software interrupt.

(Space) None of the above apply.

4.2.2.1 Body If Stopped

If a procedure is stopped, the body of its status field is a number output in an unusual format. The first two octal digits of the number are printed as an unsigned number, then an "!" is output, then the rest of the number with leading zeros eliminated. The resulting figure to the right of the "!" is the count of transient reasons for the procedure to be stopped. If this count is persistently non-zero, an internal system error has probably occurred.

In the figure to the left of the "!", the top four bits have special meaning. The 40 and 20 bits are used by the core allocator when it is moving or modifying the core image of procedures. The 10 bit is the most common and is the only bit directly controllable by user procedures to start and stop other procedures. The 4 bit is used as a temporary stop bit by some system calls. If the 40, 20, or 4 bits stay on persistently, there is probably something wrong.

4.2.2.2 Body If Hung

A procedure can be hung (execution temporarily blocked) either due to waiting for a page of its core image to be swapped in or due to a wait for some condition in the execution of a system call.

In the case of a hung system call, PEEK simply displays the name of the system call or, for an input-output transfer, the device name and transfer type. If the procedure is blocked waiting for a page to be swapped in, the word "PAGE" is displayed, unless the page is needed to handle a software interrupt to the user in which case "IPAGE" is displayed.

4.2.2.3 Body If Running

If a procedure is running in user mode, the word "RUN" is displayed as the body of its status field. If it is executing a system call, the same word is displayed as if it were hung in that system call (see Section 4.2.2.2) except that a "+" is added in front. There are several reasons, however, that a procedure can be running in executive mode without haveing executed a normal system call. For example, if the procedure has just executed an illegal instruction, "XXX" will be displayed, and if it has just executed a UUO that will be relected back to it as a user UUO, the word "UUO" will be displayed.

4.2.3 Suffix

Under some circumstances, a system call being executed by a procedure, say P1, will have to make sure that a second procedure, P2, is temporarily not running in executive mode. This may necessitate P1 waiting until P2 is interruptible if P2 is initially running in executive mode. If PEEK is run during this waiting state, a ">" followed by the user index of P2 will appear at the end of the status field for P1 and a "<" followed by P1's index correspondingly after P2's status. This situation is referred to as P1 PCLSRing (P-Closering) P2.

This state should be extremely transient. If you see this suffix display even once, you should suspect some problem.

4.3 Process Teletype Status

The teletype status field displayed for a procedure will be one of the following five things:

DISOWN The procedure is disowned and can not have a console associated with it.

Tn The procedure is immediately controlling and being controlled by "teletype" number n.

> The procedure has assigned its teletype downward in its procedure tree. The number should be displayed by one of its inferior procedures.

< The procedure has had its console taken away by a higher level procedure. The number should be displayed by some other procedure in its procedure tree.

? There is no evidence of a console ever being directly associated with the procedure. (It might be a newly created inferior.)

→ 5. I/O Control ←

PEEK has four different modes of output (not to be confused with the information modes listed in Section 3.) Two of these, which provide the most verbose output, are intended for output to the line printer and the 340 display. The remaining two modes are for printing consoles (teletypes) and alpha-numeric display consoles (Datapoints).

The exact information displayed for various information modes is affected by this output mode. Especially for the more complex information modes, like N, there is an abbreviated version of the output for printing consoles, an intermediate one for alpha-numeric displays, and a complete version for the line printer and 340 displays. In the descriptions of information modes, usually the most complete output form was explained.

PEEK starts in either the printing or alpha-numeric display modes, depending on the nature of the user's console, unless it finds that the user's console is at a 340 screen or it can not open device TTY for output. In either of these two cases it tries to use the 340 display output modes. (If the 340 display is not tried, a flag is set that is cleared only by ^Y which inhibits further attempts at using the 340.) The following commands can be used to change PEEK's output mode:

^B This switches output to the line printer if it is available. If it is not available, the output device will be unchanged.

^E This command releases the line printer if PEEK is using it. It then resets the output mode through the same procedure as is used when PEEK is first started.

^N This command releases the 340 display, if PEEK is using it, and then it sets a flag which inhibits any PEEK attempt at using the 340. This flag is cleared only by ^Y. Finally, PEEK changes to type out or alpha-numeric display mode.

^Y PEEK will try to seize the 340 display for output on receipt of this command. If it succeeds, the output mode will be set to the 340. Otherwise, output will revert to the user's console. In either case, the flag mentioned under ^N above is cleared.

6. Miscellaneous Commands

The following are miscellaneous PEEK commands:

P This is the proceed command.
If PEEK is running under a HACTRN, this command will return control of the user's console to HACTRN but leave the PEEK running. If 340 display or line printer output is selected, it will continue. If the PEEK is running as a top level job, this command will cause it to logout.
The P command uses .VALUE to return the string ":PROCED " to PEEK's superior procedure.

Q This is the quit command.
If PEEK is running under a HACTRN, this command will destroy the PEEK it is typed at and return control of the user's console to HACTRAN. If the PEEK is running as a top level job, this command will cause it to logout.
The Q command uses .VALUE to return the string ":KILL " to PEEK's superior procedure.

Z This is the doze command.
It takes a numeric argument and sets the standard update delay to that number of seconds (see Section 3).

(Space) This is a sort of null mode command. It does not change PEEK's information mode but causes it to immediately begin updating the current output.

References

See also the following AI memos:

##238	ITS Status Report, D. Eastlake, et al
##161A	ITS 1.5 Reference Manual, D. Eastlake, et al
##147A	DDT Reference Manual, Eric Osman