No: 2
Date: 26/4/77

The File System for EMAS 2900

1. Introduction

This note is intended to give enough information about the file system to form an initial operational guide, but does not comprise a detailed description. The file system closely follows the philosophy of that for System 4 EMAS (see Rees: "The EMAS Director", Computer Journal Vol 18, no 2). The main principles and features are as follows:

a) Each disc-pack is treated as a unit; all the files (and the file index) for a given user reside on one disc-pack

b) The file system is implemented "in process" and comprises provision of the ~~the~~ following primitives, to be called by outer code (higher ACR, less privileged) - in particular the "Subsystem":

CREATE file

CHANGE file SIZE

DESTROY file

CONNECT file

DISCONNECT file

Interfaces to lower ACR code are limited to the following requests:

* MOVE or CLEAR section of disc space

* CLAIM or FREE semaphore number conventionally associated with a file index or "bitmap".

* For CONNECT and DISCONNECT, writing into or deleting from the "Master Page Tables" the relationships between the segment numbers of the virtual memory and groups of sections of disc space. The "Master Page Tables" reside in the "local controller" stack for the process, and the supervisor (local controller) organises the virtual memory hierarchy and the satisfying of page faults from the information therein.

c) Just as the "user" accesses a file by requesting that it be CONNECTed into his virtual memory and then referencing the virtual addresses so obtained, so the "DIRECTOR" code, which implements the file system, creates and accesses the indexes and the "bitmaps" by CONNECTing them also into the virtual memory (at a lower ACR level - more privileged - than that of the "subsystem" and "user").

2. File space allocation and index maintenance

The basic unit of store in the virtual memory is the "epage" (E-page), currently 4 Kbytes but possibly subject to change. DIRECTOR organises the file system in terms of these epage units. A 100 Mbyte disc pack contains 24000 epages (approx. X'5E00'), and currently DIRECTOR uses from X'2000' to X'5000' for the file system. (Epages below X'2000' are used for the IPL supervisor, 3 versions of a main supervisor, 4 versions of DIRECTOR and so on). The first 128 pages of the file system space are used for the "bitmap" for the disc pack, and for the file indexes (currently 1 epage per file index) for the users whose files reside on the disc-pack.

The "bitmap" is an area containing one bit representing each epage on the pack, numbered from 0 to X'5E00' approximately. A zero bit means that the epage is free; a one bit means that the epage is allocated. The bitmap is located at X'2000', the indexes start at X'2020', and the users' file pages start at X'2080'. These numbers are all constants in DIRECTOR's code.

DIRECTOR allocates the users' files in maximum-sized units of one "section", currently 16 epages or 64 Kbytes. A 256 Kbyte (or 1 segment-sized) file therefore has 4 sections. The index records the string name of the file, and a file descriptor in the index contains a chain of 4 list cells containing the starting epage number of each section of the file. When a CREATE request is made, DIRECTOR searches the bitmap for a group or groups of the required number of epages (sections) and sets the bits accordingly. For a CONNECT request, DIRECTOR extracts the starting epage numbers of the sections of the file from the index and inserts them into the "secondary segment" and "claimed block" tables. The addresses of the starts of these tables are passed to DIRECTOR at process start-up.

Users' indexes are numbered according to the epage number at which they start; currently each index comprises one epage. A file system request from user or "Subsystem" specifies the file owner (6 characters) and the file name (up to 15 characters). In order to reference the file index for the owner, DIRECTOR first connects it into the virtual memory. To do this, it first searches the "name-number table" which relates the owner names of the indexes on the pack to the index starting page numbers. The name-number table currently follows the bitmap on the disc. When the entry for the file owner has been found, the corresponding number indicates the disc section containing the file index, and DIRECTOR connects that section into the virtual memory.

N.B. DIRECTOR connects bitmaps, name-number tables and indexes "on demand" into segments numbered between 16 and 31. For efficiency, the bitmap and name-number table for the pack on which the process owner's files and index reside, and also the section containing his index, are left connected for the duration of the process.

3. File System creation and maintenance

Process number 1 currently takes the role of creating and maintaining the file system. Other processes are considered "normal processes" and the action of DIRECTOR on start-up is to read from the process owner's index the identifier of his "BASEFILE" (default SUBSYS.BASEFILE), to create contingency stack and BASEGLA files, and to CONNECT all these. It then enters (jumps to) the BASEFILE, having raised the ACR level to "Subsystem" ACR number (and having collapsed the stack), using the EXIT instruction.

Process number 1 awaits messages from an OPER console. These are typed as follows:

press "COMMAND"
type "1/message"
press "ENTER"

"message" is then passed to process 1.

N.B. The last two characters (assumed to be decimal digits) of each EMAS disc label (assumed to be 6 characters) are taken to be the (decimal) number of the disc pack (loosely, the file system number) for file system purposes. For example, if the disc label is EMAS15 then the pack is said to contain "file system 15" (considering the whole file system as a set of file systems, each of which resides on one disc pack).

The available messages are as follows:

1/CLEAR FSYS n

This must be given prior to creating or re-creating a file system. The bitmap, name-number table and file index areas are cleared to zero. The bitmap semaphore word (SW) is set to -1. n specifies the file system (disc pack).

1/CCK n

(Consistency check for file system n)
This is used to prove the self-consistency of the file system and the validity of the indexes within it. It also re-initialises the semaphore words in the indexes. The command should always be given, assuming file system n already exists, after the system is started and before any other file system activity is invoked (e.g. starting another process). If n is -1 or is omitted, a consistency check is performed for each EMAS disc currently on-line. On completion the fullness of the file system is reported on the OPER console.

1/NEWUSER xxxxxx n

This is used to create an index and a name-number table entry for user xxxxxx (six alphanumeric characters) on disc pack n.

1/DELUSER xxxxxx n

This deletes the index and name-number table entry for user xxxxxx on disc pack n.

1/CIND xxxxxx n

This re-initialises (clears) the index for user xxxxxx on disc pack n.

1/DUMPI xxxxxx n

This prints, on the MAIN line printer, the index for user xxxxxx on disc pack n. The index appears as a hexadecimal dump which is partially annotated.

1/VALIND xxxxxx n

This validates the index for user xxxxxx on disc pack n, printing error messages on the MAIN line printer where internal errors are found. VALIND is also invoked by DUMPI.

1/BITMAP n

This prints the bitmap for disc pack n on the MAIN line printer (hexadecimal dump).

1/USERNAMES n.

This lists the users having indexes on disc pack n, with the starting epage number and number of epages for each index.

1/COLLECTG xxxxxx n

This performs a "garbage collect" on the index for user xxxxxx on disc pack n. This function will normally be invoked automatically, but currently needs to be done when File System Error number 15 occurs (e.g. in response to a CREATE request) for the user.

1/ERRORCODES

This prints the file system error codes on the MAIN line printer.

1/PRG
1/UNPRG

(Etymology uncertain)
This is provided for systems programmers to move copies of Supervisors, DIRECTORs etc. to and from the fixed disc sites from and to the file system.

'FILE FSYS'

is printed on the OPER, to which you respond

1/file n

e.g. 1/ERCC10.DIRFILEZ 1 (i.e. from or to disc pack 1)

'LABEL SITE'

is then printed on the OPER, to which you respond

1/label site

where 'label' is the disc label and 'site' is the start-page of the site allocated for the Supervisor or DIRECTOR code.

e.g. 1/EMAS01 X2C0

The contents of the file are moved to the fixed site, or vice versa. See also the document "Fixed sites on EMAS discs".

The remaining OPER input messages to process 1, seen on the listing of file XOPER, are mainly for (transient) testing purposes.

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Commands to Process Number 1, DIRECT

At System start-up process no. 1, DIRECT, performs a file system consistency check on each on-line EMAS disc pack, starts the VOLUMS and SPOOLR processes and connects the "control streams" to each FEP. Thereafter it is activated by logon messages from the interactive network, by batch job start requests from SPOOLR or by messages input from an OPER console. This note describes the last-named messages.

The command strings themselves may include space characters, although for the longest commands it is necessary to omit all spaces in order to limit the total line length. Parameters are delimited by space characters, and may not themselves contain spaces. Parameters marked with * in the descriptions below may be omitted if no ambiguity arises.

Note that <11-char filename> represents a name of not more than 11 upper case letters or digits, of which the first must be a letter.

In order to input a message to DIRECT:

press	COMMAND
type	D/<command>
press	ENTER

Commands D/PROMPT ON, PROMPT OFF may be used to initiate or terminate a "prompt" mode of input, in which a prompt "Direct:" appears on the OPER screen and an input line is despatched when ENTER is pressed.

List of Commands

ACR <user> <acr> <fsys>*

Sets the ACR field in the file index for <user> on <fsys>. To be used only exceptionally. Normally, use command SETACR in MANAGR.

BAD FSYS CYL TRK <fsys> <cyl> <trk>

Makes entries in the list of "bad" (unreadable, unwriteable) pages on <fsys>. <cyl> and <trk> define 3 EMAS pages on EDS100s and 200s, and so 3 entries are created by this command. The list comprises integers holding the logical page numbers of the bad pages. The list can be printed using the command LIST BAD PAGES in ENGINR. The command BAD FSYS PAGE (q.v.) to DIRECT can be used to make a single entry of a single logical page number.

BAD FSYS PAGE <fsys> <page>

Enters (logical) page number <page> into the list of bad pages on <fsys>. See BADFSYSCYLTRK above.

BASEF <user> <fsys>*

Reports the Subsystem "basefile" identifier for <users> on <fsys>. The identifier is recorded in the user's file index. The basefile is the file which is loaded and entered by Director at process start-up. The default basefile identifier is normally null, when a file which has been "PRGed" to a fixed site, currently X'380', on the SLOAD disc is used. The basefile to be used may be specified by the DIRECT command SETBASEF (q.v.), or by a call by a user process to its Director.

BROADCAST

Broadcasts a message, set up using DIRECT command SETMSG, to each interactive process.

CCK <fsys>*

Initiates the file system consistency check for <fsys> (or for all on-line discs if <fsys> is omitted).

CCK DONE <fsys>

Paged processes cannot normally reference any <fsys> for which the file system consistency check has not been done. Exceptionally it may be necessary to allow such access, however, and giving this command enables access as though the consistency check had been done. The file system should be regarded as dangerously vulnerable unless a consistency check has been performed, and an early IPL is desirable after this command.

CIND <user> <fsys>*

Re-initialises the file index for <user> on <fsys>. To be used only exceptionally; the MANAGR commands NEW USER and DEL USER are infinitely preferable, allowing the index owners surname to be entered and an archive index to be created.

CLEAR BAD PAGES LIST <fsys>

Clears (to zero) the list of recorded "bad" (unreadable, unwriteable) pages on <fsys>.

Note: it is necessary to omit intermediate spaces in this command (except the one delimiting <fsys>) unless the "prompt" mode of DIRECT input is being used, because of the unusual length of the command line.

CLEAR FSYS <fsys>

Re-initialises the file system on disc <fsys>.

CLOSE <time>

Specifies the System close-down time (0001 to 2400) at which the service is to be automatically closed. If <time> is specified as 0 (zero), any previously specified close-down time is cancelled.

CLOSE DOWN

Causes the service to be closed (within about 30 seconds).

CLOSE USERS <time>*

Operates analogously to CLOSE <time>, except that the three System processes DIRECT, VOLUMS and SPOOLR are not stopped, allowing (for example) system maintenance work to be performed after user processes have been stopped without the need for an IPL. If <time> is omitted, the System continues to run, but new log-ons are rejected with the message "NO USER SERVICE". The service may be re-opened using command OPEN USERS (q.v.).

CONNECT FE <fe no>

May be used after a re-load of FEP software to re-establish the "log-on control stream", without an IPL of the mainframe.

DDUMP <fsys> <index no>

Used exceptionally to dump a page from the file system index area on <fsys>. Frequently command DUMPI can be more profitably used.

DELIVER

Used to set delivery information (by default equal to "Machine Room") for main log files sent to SPOOLR's LP queue as a result of DIRECT command PRINT. DIRECT prompts for an input string of delivery information, a null string causing the default to be reinstated. Delivery information remains set until a further call of DELIVERY, or until IPL.

DEL USER <user> <fsys>

Deletes a user's file index. To be used exceptionally, MANAGR command DELUSER being preferred.

DIRVSN <user> <fsys>* <vsn>*

Used either to report the Director version currently set in the user's file index (in this case one or both optional parameters are omitted), or to set the Director version (0, 1, 2 or 3) for the user to <vsn>. To be used exceptionally, for Director testing. (Supervisor command DIRVSN should also be noted in this context.)

DISCONNECT FE <fe no>

Disconnects the "log-on control stream" for the specified FEP.

DUMPI <user> <fsys>*

Used to dump out the file index for <user> on <fsys>, both in hexadecimal and partially formatted.

FSYS <user> <fsys>*

Reports the file system number on which <user> resides, or "user not known". If the optional parameter <fsys> is supplied, the search for <user> is restricted to that file system. Only discs for which the file system consistency check has been performed are searched.

INT: <user> <character>

Relays a "single-character" interrupt message to <user>, exactly as though the (Escape) INT: mechanism had been invoked from an interactive terminal. Note that if two or more processes currently exist belonging to <user> it is not possible to determine which process will receive the interrupt message.

MAIN LP

Used to direct main log output from the system to the main line printer (determined at IPL), instead of to files which are ultimately to be spooled to the LP or JOURNAL queues of the SPOOLR process. DIRECT command PRINT re-instates the spooling of main log data.

MSG <user>

Used to send a one-line text message (an operator message) to <user>. DIRECT prompts for the one-line message. Note that if two processes currently exist belonging to <user> it is not possible to determine which will receive the message. If there is no process belonging to <user> currently active, the message is stored for the next invocation of an interactive process by <user>.

NEW USER <user> <fsys> <nkb>

Creates a file index of size <nkb> for <user> on <fsys>. To be used only exceptionally, MANAGR command NEWUSER being preferred, since the latter allows for attachment of the user's surname and the creation of an archive index.

OPEN TO <usergroup>

Allows a username (6 characters) or a user group (6 characters including some '?' characters) to be appended to a list of usernames and usergroups for which log-ons are allowed even if the service is generally closed to users. Currently a maximum of 10 separate entries may be stored. Individual items cannot be removed from this list, but the whole list is destroyed by the DIRECT commands OPEN USERS and CLOSE USERS.

OPEN USERS

Allows users to (re-)commence logging on after the service has been closed (e.g. by command CLOSE USERS, q.v.).

PASS <user> <pass>

Used to specify a password by which <user> may log-on to the System (even if the service is generally closed to users). Only one <user>/<pass> combination is stored; subsequent PASS commands cause replacement of the current pair. The special password is otherwise cancelled by the DIRECT command PASS OFF.

PASS OFF

Cancels any stored special password specified earlier by DIRECT command PASS (q.v.).

PRG

Used to move System programs (supervisors, Directors, subsystems) from a file to a chosen fixed disc site. DIRECT prompts for two input lines, the first giving the <file> and <fsys>*, the second the disc <label> and disc <site>. <site> must be a X'40'-aligned numeric value.

PRINT <n>*

A value of 1 is implied if the parameter is omitted. For n>0, the current main log file is closed and copied to SPOOLR's LP queue (as well as to the JOURNAL queue).

For n>1, the subsequent n-1 main log files are additionally spooled to the LP queue (as well as to the JOURNAL queue), unless a subsequent PRINT command overrides this effect. For n=0, the current main log file is closed and spooled to the JOURNAL queue (only). Any PRINT command to DIRECT (re-)initiates spooling of main log data to disc if it was currently being printed directly on the main line printer.

Note: main log files belong to VOLUMS's file index, and commence "M#" (destined for JOURNAL) or "L#" (destined for LP). Just before any file is spooled, DIRECT renames the file (first two characters remain unchanged) so that the last four characters give the current time of day. This may help to identify files in SPOOLR's queues, for exceptional copying/printing.

PRM <file> <fsys>*

Attaches read, write and execute access permissions to <file>, specified as <user>.<11-char filename>. To be used only exceptionally.

PROMPT OFF

Cause DIRECT to remove the prompt "Direct" from the OPER screen so that the COMMAND key and "D/<command>" may subsequently be used to input commands to DIRECT.

PROMPT ON

Causes DIRECT to place the prompt "Direct:" on the OPER screen so that subsequent commands to DIRECT can be entered without the "D/" prefix and without using the COMMAND key.

S <file> <fsys>*

Reports (on the OPER screen) the logical page number of the first page of each disc section of <file> on <fsys>. <file> must be specified as <user>.<11-char filename>.

SEND MSG <user>

Provided that a message has been stored using command SET MSG (q.v.), the message is sent to <user>. Note that if two processes currently exist belonging to <user> it is not possible to determine which will receive the message. If there is no process belonging to <user> currently active, the message is stored for the next invocation of an interactive process by <user>.

SET BASEF <user> <fsys>*

Sets the Subsystem "basefile" identifier to be used by <user>, whose file index is on <fsys>. The default identifier is normally null. See DIRECT command BASEF.

SET MSG

Used to store a text message to be dispatched subsequently to one or all interactive processes by command SEND MSG or BROADCAST. DIRECT prompts (with a ":") for text input; several lines may be typed, up to a maximum of 255 characters or until a line containing only ":" is typed. Implied newline characters are replaced by spaces, in building up the stored string. When the message is complete, it is printed out in full on the OPER screen for checking before possible dispatch.

SNOS

Reports the following data on the OPER screen: the disc number from which the main supervisor was loaded, the current setting of DIRVSN (supervisor command) and the "sync1", "sync2" and "async" service number bases for local processes.

START <user> <fsys>* <dirvsn>*

Starts a process for <user>, whose file index is on <fsys> using Director version <dirvsn>. (The latter parameter is to be used only when the implications are fully understood.)

STOP

Disconnects all FEP control streams and stops the DIRECT process. (Used only exceptionally - CLOSEDOWN preferred).

TRANSFER

May be used to move a file from ownership of one user to another. DIRECT prompts for two lines of input, each containing two parameters:

<file1> <fsys1>

<file2> <fsys2>

The first determines the identity of the file to be moved; the second determines its destination. <file1> and <file2> must be specified in the form <user>.<11-char filename>.

UNPRG

Used to move System programs (supervisors, Directors, subsystems) from a specified disc site into a file (which must not already exist). Parameters are specified exactly as for DIRECT command PRG (q.v.).

USERS <usergroup> <n> or
USERS <n>*

This command is used to set limits on the numbers of interactive processes belonging to various groups of users, or to display current numbers and limits. <usergroup> is specified as a 6-character string in which '?' characters (if any) are interpreted as standing for any alphanumeric character.

USERS	<n>	sets the maximum number of interactive processes.
USERS	<usergroup> <n>	sets the maximum number of interactive processes whose owners belong to <usergroup>.
USERS		displays the current numbers in the usergroups which have been specified, with the corresponding current limits, on virtual OPER screen number 2. The corresponding display is also generated after input of the other forms of the USERS command.

VSN

Reports on the OPER screen the Director version.

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Proposed Director facilities for Testing GPC Peripherals

1. Introduction

In EMAS, all GPC peripherals are driven by interfacing to a resident routine called GPC, whose functions are:

a) allocation of devices (described in mnemonic form, e.g. CRO) to device service routines.

b) initiation of command chains expressed in RCB/LB/ALs supplied by the service routines.

c) notification to the service routines of termination, attention, program-controlled and request initiation interrupts.

Service routines may be resident or non-resident, but in either case communicate with the GPC routine by sending and receiving 32-byte messages to and from it. In addition to the 32-byte messages, work areas may be provided at device allocation time; these areas contain the RCBs, LBs and ALs and perhaps also the data areas for transfers.

The provisional specification of the GPC routine (as implemented at October 1977) is given in EMAS 2900 Supervisor Note no 5. Changes are expected in detail rather than in structure.

2. Testing of peripherals

Provision has not yet been made for general testing of peripherals, nor is design for such complete. However, the following guidelines will obtain:

a) Facilities will be provided to give one or more paged processes the level of privilege necessary to establish communication with the GPC routine.

b) Provision will be made for pages of such processes to be locked down as necessary (in particular the pages containing RCBs/LBs and ALs and the data area will clearly need to be made resident for the duration of transfers).

c) A set of procedures (part of the so-called DIRECTOR interface, and implemented as system calls) will be provided, to be used by the paged process:

i) to establish communication with the GPC routine;

ii) to allow messages to be sent to and received from the GPC routine, possibly with a modicum of validity checking of associated data;

iii) to specify the extent of necessary locking down of pages, as described above.

A provisional specification for these procedures is attached.

d) It is expected that all programs which are to run in these privileged processes will be coded in IMP (see reference), so as to afford compatible parameter passing with the procedures provided, and achieve fast compilation and good run-time diagnostics using existing, proven software.

3. Detailed specification of procedures (provisional)

(This section is subject to change.)

externalintegerfn LOCK (integer PAGE ADDRESS)
external UNLOCK (integer PAGE ADDRESS)

Causes the specified "logical page" (currently 4K bytes) of the calling process's virtual memory to remain resident (cease being resident) in main store.

Possible error results:

56 PAGE ADDRESS is not connected in the virtual memory or is invalid.

externalintegerfn GET EPAGE (integername VIRTUAL ADDRESS)
externalintegerfn RETURN EPAGE (integer VIRTUAL ADDRESS)

Allocates (de-allocates) a page of main store to (from) the process. The (local) virtual address of the page is returned in the parameter.

Possible error results:

57 (for GET EPAGE) Page not allocated to this process.

---

externalintegerfn ALLOCATE (integer MNEMONIC, integername IDEN)
externalintegerfn DEALLOCATE (integer MNEMONIC)

Makes a request on the GPC routine to allocate (de-allocate) the GPC peripheral denoted by MNEMONIC (as a multi-character IMP value, e.g. M'CRO') to (from) the calling process.

IDEN is set to an identifier to be used in execute chain requests (see below).

Possible error results:

1 Parameter invalid or device not known.

2 Device already allocated (unallocated).

externalintegerfn EXECUTE CHAIN (integer RCBA,IDEN,PAWFN,SAWFLAGS)

A 'SEND CHANNEL FLAG' is issued for the device specified by IDEN (as returned by the ALLOCATE request). RCBA gives the address of the RCB to be used. PAWFN and AWFLAGS are the PAW function and SAWFLAGS fields (right-justified in these parameters) for the controller PAW word and stream SAWO word.

Possible error results:

58 Invalid parameter or RCB/LB/ALE not accessible.

---

externalintegerfn AWAIT RESPONSE (integername IDEN, RESPO, RESP1)

The process is suspended until a response is available from the GPC. IDEN, RESPO and RESP1 are then set with the device identifier obtained from th ALLOCATE and the stream response words 0 and 1, respectively.

Possible error results:

None.

4. Conclusion

It is intended that the facilities broadly described above will enable any desired operation to be carried out "on-line" on peripheral devices not currently allocated for other purposes.

Reference

"Edinburgh IMP Language Manual", edited by R.R. McLeod (2nd Edition, 1974). Edinburgh Regional Computing Centre.

J.K. Yarwood

Operation of file system consistency check

Following IPL and the SLOAD command, a process 'DIRECT' is created, which performs the following functions:

1. file system maintenance

2. checking of log-in messages from the network and creation of other processes

3. dispatch of operator messages and broadcast messages to other processes.

'DIRECT' comprises some special routines set aside for these purposes, although it is still (currently) part of the DIRECTOR, whose code is shared by all processes.

There are four versions (0-3) of DIRECTOR on a system disc. Version 0 is the normal 'service' version, and is used by default. The DIRVSN command (e.g. DIRVSN 1) causes the DIRECTOR version specified to be used by processes started subsequently.

If the DIRVSN is 0 (the default), the DIRECT process performs the file system consistency check, starts the VOLUMS and SPOOLR processes, and connects the 'control streams' to front-end processors so that log-on messages can be received. If the DIRVSN is 1, 2 or 3 the consistency check is not done, nor are VOLUMS and SPOOLR started.

DIRVSN 1 will normally be an adequate 'back-up' for the current service version (frequently the 'previous' version); versions 2 and 3 are normally test versions.

Date and time

When the consistency check is invoked (either automatically or by command 1/CCK, which should be given only when no other process is running), the date currently set, by the DT command, is checked against the date of the previous IPL. If the current date is not within 6 days of the previous IPL, the consistency check does not proceed.

If the 'within 6 days' rule is to be overridden, either because of a previous error in 'DT' or because more than 6 days have elapsed, a specific CCK command, 1/CCK n, where n specifies the 'SLOAD' disc, must be used; in this case the date of the previous IPL will be over-written regardless. Otherwise the system should be IPLed again and a correct 'DT' given.

Consistency check error messages

A log of each consistency check is maintained on each disc, in file VOLUMS.CCKMESS. Many lines in the file commence

DT dd/mm/yy hh.mm.ss

Each username process is mentioned. Each file destroyed is mentioned. Names of files destroyed are preceded by 'FILE='.

The CCKMESS files are 'circular' text files, of size 256 Kbytes. The files may be copied to ordinary text files by the MANAGR command

```
CCKOUT (f/filename)
```

where f is the number of the disc concerned and filename is the file to contain the messages extracted. The 'f/' may be omitted, in which case all file systems are processed. 'filename' may be '.LP'.

The CCKMESS file header contains a 'READ TO' (past tense) pointer, which is updated by the CCKOUT program. If the CCKOUT program is not run before new consistency messages overrun the 'READ TO' pointer, the latter is updated with the 'START OF TEXT' pointer of the circular file header.

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No: 10
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Creating a new file system

On a newly-formatted disc, or where a complete file-system is to be reprimed, the following procedures should be applied. Spaces are not significant in these commands except as delimiters.

1/CLEAR FSYS n

where n is the decimal number which is the last two digits of the disc label. n may not be omitted. The response is 1/DONE. Indexes are created on the disc for VOLUMS and SPOOLR.

1/CCK DONE n

This has the effect of marking the disc table entry for the disc as being "consistency-checked". It is currently necessary only to allow the CLEAR BAD PAGES LIST command to be effected (see below). Hence it may be omitted if that command is not to be executed. The response is 1/DONE.

1/CLEAR BAD PAGESLIST n

This is necessary for a newly-formatted disc, because the count of bad pages is uninitialised. For a reprime to a disc which has not been reformatted, this may be omitted if the bad pages list is to be retained (it is not affected by CLEAR FSYS). The reponse is 1/SUCCESSFUL.

1/CCK n

A file system consistency check should now be performed on the disc.

1/NEWUSER ERCC00 n 4

should be given for as many usernames as are required. n is the FSYS number. ERCC00 is an example of the username. 4 is the number of Kbytes to be allocated to the index. Please only type 4 for the time being. You can start the reprime after 2 or 3 of these, if you start with the first users on the tape: you will be able to keep ahead! (This will not be necessary in later versions of the system - a magnetic tape will be used.)

After the reprime, an IPL and new consistency check may be a good idea, though it is not logically necessary.

Temporary

To reprime the biggest files, you may need to have done the command

```
SETMAXFILE (VOLUMS,4000)
ERCC10.DIRTESTY
```

This program will need modifying, too, to take an FSYS other than the "SLOAD" disc. You will also need file ERCC10.NEWSERVY to go with DIRTESTY.

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EMAS 2900 DIRECTOR NOTE

No: 11
Date: 14/11/79

Director Error Messages at the Main OPER Console

This note describes messages of the form

**<username> ERROR xxx <param>

which Director sends to the main OPER console on certain error conditions, together with action to be taken (if any).

<username>	gives the owner of the process from which the message originated
xxx	are 3 hexadecimal digits identifying the error condition
<param>	If present is a decimal or hexadecimal number further qualifying the error condition

In general, these messages are of a non-urgent, non-critical nature. Special action, except where otherwise stated below, is not normally required unless the condition is persistent, when the author of this Note should be advised. In addition, notification would be appreciated of occurrences of errors marked *, which "should not occur".

Error	Condition
001*	A file is being created with the (unusual) option of being zeroed at time of creation. In the event of failure to write zeroes to the file, a re-allocation takes place. If this procedure fails 10 times, this error is given and the create operation fails.
002*	Director failed to fill stack DA entries.
003*	Director failed to find a VM gap in which to connect a segment of file indexes.
004*	Stack of ASYNC INHIBits in Director is in error.
005	Director failed to find an expected index at its correct location on disc. Action: Notify Systems staff. An early IPL and file system consistency check is indicated.
006	At DDISCONNECT, Director failed to find the correct generation of a file in the file owner's index. This can occur if a user has been deleted (DELUSER), or his file index moved to another disc, while one or more of his files were in use by another process. No adverse side effects should result.

007* Director failed to fill stack DA entries.

008 Director's file system claim-semaphore routine was called before the free-semaphore routine had been called to release the semaphore previously held.

Action: An early IPL is probably desirable to avoid possible file index corruption.

009 Director's file system release-semaphore routine was called without a preceding corresponding call of the claim-semaphore routine.

00A Accounts overflow: 1=instrs; 2=OCP; 3=pturns; 4=connect.

00B DIRECT failed to destroy a workfile belonging to a user whose process has just terminated.
PARAM = Director flag from DDESTROY.

00C DIRECT failed to find the username in its process list for a process which has just terminated.

00D DIRECT's list of active processes is full. There is currently space for 255 active processes.

00E An FCHECK file system consistency check process failed to create the consistency-check record file VOLUMS.CCKMESS.
PARAM = Director DCREATE flag.

Action: Systems staff to scrutinise VOLUMS index to discover the reason.

00F* At process start-up, the process was unable to connect a relevant disc-site (e.g. the default BASEFILE) into its virtual memory.
PARAM = flag from Director's DISC SEG CONNECT routine.

010* At process start-up, the process was unable to connect its System call table segment (for access to Director routines). PARAM = flag from Director's DISC SEG CONNECT routine.

011* At batch process start-up, the process failed to disconnect-and-destroy the file passed to it by SPOOLR giving the batch job details.
PARAM = Director's flag from DDISCONNECT.

012* At interactive process start-up, the process failed to connect its interactive terminal data streams.
PARAM = flag from Director routine CONNECT STREAM.

013* DIRECT failed to find the file index for the owner of a process just terminated.
PARAM = flag from Director's routine CONNECT INDEX.

Action: An early IPL is indicated.

014* DIRECT failed to find the file index for a valid username for whom a process was to be started.
PARAM = flag from Director's routine CONNECT INDEX.

015 At completion of the consistency check for an FSYS, the FCHECK process was unable to create a file VOLUMS.LOSTFILES in which to record filenames destroyed by the consistency check.
PARAM = flag from Director routine DCREATE.

Action: Systems staff to scrutinise VOLUMS file index to ascertain reason.

016* At completion of the consistency check for an FSYS, the FCHECK process was unable to connect the VOLUMS.LOSTFILES file in which to record filenames destroyed by the consistency check.
PARAM = flag from Director's routine DCONNECT.

Action: Systems staff to scrutinise VOLUMS file index to ascertain reason.

017* At completion of the consistency check for an FSYS, the FCHECK process was unable to connect the VOLUMS.CCKMESS file, in which a record of the consistency check is to be placed.
PARAM = flag from Director routine DCONNECT

Action: Systems staff to scrutinise VOLUMS file index to ascertain reason.

018* At completion of the consistency check for an FSYS, the FCHECK process was unable to permit the VOLUMS.CCKMESS file to DIRECT.
PARAM = flag from Director's routine DPERMISSION

Action: Systems staff to scrutinise VOLUMS index to ascertain reason.

019 DSEGMENT fails.

01A DCHSIZE new SCONNECT fails.

01B DIRECT stack extend fails.

01C REF NEW BLOCKS not zero.

01D-01F Spare.

020-035 These relate to maintenance by DIRECT of a pool of 64K-sized files for use as mainlog files by the Supervisor routine PRINTER. In each case, PARAM is a flag from the relevant Director routine. The error message is preceded by a message "LOG TROUBLE" on the main OPER console.

020 Create logfile failed.
021 Get (logfile) Disc Address failed.
022 Permit logfile to DIRECT failed.
023 Connect logfile failed.
024 Re-connect logfile failed.
025 Set file status=temporary failed.
026 Disconnect logfile failed.
027 Rename logfile failed.
028 Connect logfile failed.
029 SPOOLR logfile copy to LP failed.
02A Create and/or connect logfile copy for LP failed.
02B Disconnect logfile failed.
02C SPOOLR logfile to JOURNL failed.

02D Failed to create spare logfiles.
02E Spare.
02F Disconnect logfile failed.
030 Rename logfile failed.
031 Connect logfile failed.
032 No ready file in DIRECT's logfile pool.
033 File disc address offered by PRINTER for spooling does not belong to a file in DIRECT's logfile pool.
034* Create VOLUMS.LOGMAP file (holding DIRECT's map of logfiles and its process list) failed.
035* Connect VOLUMS.LOGMAP file failed.

036-03F Spare.

040* DIRECT fails to start VOLUMS at System start-up.
PARAM = flag from Director routine STARTP

041* DIRECT fails to start SPOOLR at System start-up.
PARAM = flag from Director routine STARTP.

042 At batch process startup, the process failed to connect the file passed to it by SPOOLR giving the batch job details.
PARAM = Director's flag from DCONNECT.

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912 UNF ASYNC DEST is zero (more startup actions)

Format of File Index Header

```
%RECORDFORMAT HDRF(%STRING (6) OWNER, %BYTEINTEGER  %C
   FLAG, SECTSI, ALNK, USE, IMARK, %C
   IUSE, BUSE, ISESSM, SURNAME, %C
   IMAX, TMAX, BMAX, STKKB, %C
   %INTEGER LNKSTART, CELSTART, FREEBYTES, TRYING, %C
            NAMSTART, NEXNAM, LOFDAD, TOP, %C
            DWSP, BWSP, SEMA, MSGSEMA, %C
            SEMANO, IINSTRS, BINSTRS, NKBOUT, %C
            DINSTRS, IPTRNS, BPTRNS, NKBIN, %C
            IMSECS, BMSECS, CHKSUM, ASEMA, %C
   %BYTEINTEGER CODES, SIGMON, DEPTH, CONCURR, %C
            ACR, DIRVSN, MSGSPRIV, BATCHSS, %C
            BASEF, DELY, STARTF, ADRTELE, %C
            LOGFILE, SPECIALSS, SPFF1, GPHOLDR, %C
   %INTEGER USED AFDS, AFILES, AKB, USED FDS, %C
            FILES, TOTKB, ATOP, SPAO   , DATE, %C
            MAXFILE, MAXKB, DIRMON, %C
            CHERFILES, CHERKB, CONNECTT, ARESTORES, %C
            ZASL, ZFREEC, ZNCELLS, TEMPKB, %C
            FILES0, FILES1, FILES2, FILES3, %C
            BNUTS, INUTS, XLNKST, XCELST, %C
            XTOP, XNAMST, ISTOP)
```

Note: This format applies both to the on-line and the archive indexes. Each entry in the description is marked 1 if used in the on-line index and 2 if used in the archive index.

Field	Note	Description
OWNER	12	The index owner's username.
FLAG	—	Not used; previous function was to be set non-zero when an error condition (inconsistency) in the index was found. Subsequently no routine would alter or look at the index until cleared "manually".
SECTSI	1-	The (maximum) size in epages of disc sections for files described by the indexes, set up (permanently) at index creation. Currently envisaged values: 16 or 32.
ALNK	12	List-head of whole-index-permission cells in list-pool zero.
USE	—	Not used; formerly current number of processes active in this username (i.e. OWNER).
IMARK	—	Not used; intended to assist with forward/backward compatibility considerations during development.

Field	Note	Description
IUSE	1-	Current number of interactive processes active in this username.
BUSE	1-	Current number of batch processes active in this username.
ISESSM	1-	Length of current session in minutes. Zero represents the default value, currently "very large".
SURNAME	1-	Listhead of cells in list-pool zero containing the initials and surname of the index owner.
IMAX	1-	maximum number of interactive processes which may be concurrently active for OWNER. Zero represents the default, currently 1.
TMAX	1-	Maximum number of interactive and batch processes which may be concurrently active for OWNER. Zero represents the default, currently 1.
BMAX	1-	Maximum number of batch processes which may be concurrently active for OWNER. Zero represents the default, currently 1.
STKKB	1-	Number of Kbytes of the processor stack (temporary) file for invocations of the process. (This file is connected as local segment 4 during process start-up.) Zero represents the default, currently 64.
LNKSTART	12	The offset, in bytes, from the start of the index of the link bytes for pool zero of list cells. (If any of pools 1, 2 or 3 exist they commence 256, 512 and 768 bytes beyond this point respectively.)
CELSTART	12	The offset, in bytes, from the start of the index of the list cells for pool zero. (If any of pools 1, 2 or 3 exist they commence 1024, 2048 and 3072 bytes beyond this point respectively.)
FREEBYTES	12	The number of bytes between the most recent (highest) file-name (identifier) and the corresponding (and hence lowest) file-descriptor.
TRYING	—	Not used.
NAMSTART	12	The offset in bytes from the start of the index of the area for storing file-names.
NEXNAM	12	The offset in bytes from the start of the index of the position where the identifier will be put for the next-created file.
LOFDAD	12	The offset in bytes from the start of the index of the lowest (most recent) file-descriptor.
TOP	12	The size of the index in bytes.
DWSP	1-	Reserved.

Field	Note	Description
BWSP	1-	Reserved.
SEMA	1-	The semaphore word for the index (set to -1 at consistency check).
MSGSEMA	1-	The semaphore word for the owner's message-file (#MSG), set zero at consistency check.
SEMANO	1-	The semaphore number for the index, being the number of kbytes between FSYSSTART (the start of the file-system area on the disc) and the start of the index.
IINSTRS	1-	Number of thousands of machine instructions executed in interactive sessions for OWNER (cumulative over sessions).
BINSTRS	1-	Number of thousands of machine instructions executed in interactive sessions for OWNER (cumulative over sessions).
NKBOUT	1-	Number of kbytes of data "spooled out of the index" (cumulative).
DINSTRS	1-	Number of thousands of machine instructions executed in Director procedures. (Cumulative, but currently not updated).
IPTRNS	1-	Number of pageturns made on behalf of OWNER in interactive sessions (cumulative over sessions).
BPTRNS	1-	Number of pageturns made on behalf on OWNER in batch sessions (cumulative over sessions).
NKBIN	1-	Number of kbytes "spooled into the index" (cumulative).
IMSECS	1-	Number of milliseconds of OCP time attributed to OWNER in interactive sessions (cumulative over sessions).
BMSECS	1-	Number of milliseconds of OCP time attributed to OWNER in batch sessions (cumulative over sessions).
CHKSUM	-2	Checksum for the archive index.
ASEMA	1-	Semaphore word for accesses to the archive index (set -1 at consistency check).
CODES	—	Not used.
SIGMON	1-	Signal monitoring level to apply from next start-up of a process on behalf of OWNER (set zero on consistency check).
DEPTH	1-	Depth of monitor to be applied when DIRMON is non-zero (set zero at consistency check).
CONCURR	—	Not used.
ACR	1-	The ACR level at which the subsystem is to be started when a process is next created for OWNER. Zero represents the default, currently 6.

Field	Note	Description
DIRVSN	1-	The Director version (0, 1, 2 or 3) to be used at the next invocation of a process for OWNER (unless a D/START command specifies a Director version). A value of 255 represents the current default Director version (zero or as set by the DIRVSN command). When this value has been read at process start-up, it is then set to 255.
MSGSPRIV	—	Not used.
BATCHSS	1-	List-head of cells in list-pool zero to contain the name of a subsystem ("basefile") to be used for batch processes for OWNER. Currently unused.
BASEF	1-	List-head of cells in list-pool zero to contain the name of a subsystem ("basefile") to be used for interactive processes for OWNER. Currently used also for batch processes. A null filename implies use of the fixed site on the System disc. (See EMAS 2900 System Note No. 1).
DELY	1-	List-head of cells in list-pool zero to contain the default delivery information for data "spooled out of the index".
STARTF	1-	List-head of cells in list-pool zero to contain the identifier of a file of commands to be executed at process start-up. Currently unused, as the Edinburgh Subsystem keeps the identifier in the "option file".
ADRTELE	1-	List-head of cells in list-pool zero to contain the address and telephone number of the index owner.
LOGFILE	1-	List-head of cells in list-pool zero to contain a filename to be used as a Director process-monitoring file. (See EMAS 2900 Subsystem Writer's Manual).
SPECIALSS	1-	List-head of cells in list-pool zero to contain a filename to be used as a test subsystem. Reset to null filename after a process start-up using that subsystem. (Not yet implemented).
SPFF1	—	Spare list-head, currently set to ENDLIST at consistency check.
GPHOLDR	1-	List-head of cells in list-pool zero to contain a username to be used as the group-holder of OWNER'S scarce-resource units.
USED AFDS	1-	Number of file-descriptors in the archive index.
AFILES	1-	Number of files in the archive index.
AKB	1-	Number of epages in the archive index (perhaps to become the number of kbytes at a future date).
USED FDS	12	Number of file-descriptors in the on-line index.
FILES	12	Number of files in the on-line index.
TOTKB	12	Number of kbytes of data described by the index.

Field	Note	Description
ATOP	1-	Size of the archive index in bytes (currently not maintained).
SPA0	—	Spare.
DATE	1-	Compressed date and time at which a process belonging to OWNER was most recently started.
MAXFILE	1-	Maximum size (kbytes) of non-temporary files belonging to OWNER. Zero represents the default value, currently 1024 kbytes.
MAXKB	1-	Maximum total file-space (kbytes) belonging to OWNER. Zero represents the default value (currently 32768 kbytes).
DIRMON	1-	A bit-mask specifying which Director calls are to be monitored (see also the DEPTH field of this format). Set to zero at consistency check. More detail in the EMAS 2900 Subsystem Writer's Manual.
CHERFILES	1-	Number of cherished files in the on-line index (not yet implemented - the field is zero).
CHERKB	1-	Number of kbytes of cherished filespace in the on-line index (not yet implemented - the field is zero).
CONNECTT	1-	Number of seconds of terminal connect-time for interactive processes belonging to OWNER (cumulative over sessions).
ARESTORES	1-	Number of files restored from archive (cumulative over sessions).
ZASL	12	Free-list pointers for list-pools 0, 1, 2 and 3.
ZFREEC	12	Numbers of free cells in list pools 0, 1, 2 and 3.
ZNCELLS	12	Numbers of cells in list-pools 0, 1, 2 and 3.
FILES 0-3	-2	Number of types 0-3 files described by the archive index. Type 0 is archive files, type 1 is back-up files. Types 2 and 3 are unassigned.
INUTS	1-	Number of scarce-resource units assigned to the index.
BNUTS	—	Reserved for possible use as batch-resource.
XLNKST XCELST XTOP XNAMST	12	Copies of LNKSTART, CELSTART, TOP and NAMSTART (copied at consistency check), present as a prelude to moving the semaphore fields (SEMA, MSGSEMA, ASEMA) nearer to the front of the index.
ISTOP	—	Dummy entry marking the end of the record format.

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