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Parity Fixer (PFX)
**An RSX-11M/M-Plus Utility for
Creating Memory Parity Error Regions
in System-Controlled Partitions**

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PARITY FIXER (PFX)

1 INTRODUCTION

The Parity Fixer (PFX) is a privileged utility program used to decommission a block of memory in a system-controlled partition so that it will no longer be available. It does this by mimicking the behavior of the FXR task supplied with the operating system, which isolates and marks as unusable a portion of memory with parity errors.

The FXR task runs automatically, but only *after* a memory parity error has occurred. Even if a memory parity error does not occur in the executive (which causes an immediate system HALT), the system can still fail if, for example, it occurs in memory currently occupied by a critical system task, such as the Files-11 ACP for the system disk. Since there is no way to tell the operating system not to use the bad memory, the system will continue to be vulnerable to failure after rebooting.

If a portion of memory is known to be bad, or is suspected of causing problems, it is preferable to take it out of service until a more thorough diagnosis and repair can be scheduled. PFX provides this capability. By inserting the appropriate PFX commands at an early point in the system startup command file, chances are the offending memory can be disabled before the operating system has a chance to allocate it.

2 PFX COMMAND LINE

PFX must be invoked as a one-line MCR command. It does not accept continuation lines, does not prompt for a command line, and does not accept a command file name for issuing multiple commands.

The format of a PFX command line is shown below.

Format

PFX /HE

or

PFX base[:top] [/PAR=partition_name] [/NAME=region_name] [/[NO]LOG]
 GEN PARITY

Parameters

base

Specifies the 22-bit starting address of the memory to be disabled. PFX rounds **base** down to a 64-byte boundary before creating the memory parity error region. **base** may be specified in decimal by appending a trailing decimal point.

base must be specified; there is no default.

top

Specifies the 22-bit ending address of the memory to be disabled. PFX rounds **top** up to a 64-byte boundary before creating the memory parity error region. **top** may be specified in decimal by appending a trailing decimal point.

The default **top** address is the **base** address.

Switches

/HE

Prints a one-line help message with PFX's command line format. When **/HE** is specified, no other command arguments are allowed.

/PAR=partition_name

Name of the system-controlled partition in which the memory parity error region is to be created.

The default **partition_name** is **GEN**.

/NAME=region_name

Name of the memory parity error region to be created. All region names in the system must be unique; consequently, the **/NAME=** switch must be used if any conflicts exist (*e.g.*, if PFX has already been used to create a region named **PARITY**).

The default **region_name** is **PARITY**.

/LOG

/NOLOG

Specifies whether or not to print the region parameters before attempting to create the memory parity error region.

The default is **/NOLOG**.

2.1 Examples

To print a one-line summary of PFX's command-line format:

```
>PFX /HE
Usage: PFX base[:top] [/PAR=partition!GEN] [/NAME=region!PARITY] [/NO]LOG
```

To create a memory parity error region over location 1772522₈ with a log message:

```
>PFX 1772522/LOG
PFX -- Partition=GEN      Name=PARITY  Location=01772500:01772577
```

To create a memory parity error region over locations 1772520₈ through 1772532₈ with a region name of BADMEM and a log message:

```
>PFX 1772520:1772532/NAME=BADMEM/LOG
PFX -- Partition=GEN      Name=BADMEM  Location=01772500:01772577
```

To see that the region BADMEM has indeed been created in the GEN partition by the previous PFX command, type the MCR PAR command:

```
>PAR
SECPOL 117734 00171300 00100000 SEC POOL
SYSPAR 117670 00271300 00164500 MAIN
      117624 00271300 00111000 RO COM !DIR11M!
      117434 00402300 00005200 TASK  <...LDR>
      117230 00407500 00033000 TASK  <MCR...>
      117024 00442500 00010100 TASK  [TKTN  ]
      116620 00452600 00003200 TASK  [SHF...]
DRVPAR 116540 00456000 00130000 MAIN
      116474 00456000 00006600 RO COM !TTEXT !
      116410 00464600 00020600 RO COM !TTCOM !
      116324 00505400 00033700 DRIVER (TT:)}
      116260 00541300 00006200 RO COM !PUCOM !
      115160 00547500 00012700 DRIVER (DU:)
      114624 00562400 00011300 DRIVER (MU:)
      114434 00573700 00000100 DRIVER (WL:)
      114370 00574000 00000300 DRIVER (CO:)
      114324 00574300 00002500 DRIVER (VT:)
      114260 00577000 00001300 DRIVER (RD:)
      114030 00600300 00001300 DRIVER (VF:)
      113070 00601600 00004200 DRIVER (MT:)
MTPAR  112714 00606000 00172000 MAIN
GEN     112760 01000000 07000000 MAIN
      023474 01000000 00007100 TASK  <PMT...>
      112074 01007100 00054000 RO COM +...AT.+
      112434 01063100 00040000 RO COM !FCSRES!
      024110 01136000 00014400 TASK  <F11ACP>
      112650 01152400 00033000 RO COM +F11ACP+
      031700 01267700 00007000 RO COM +...MCE+
      026734 01302100 00014300 TASK  <COT...>
      025370 01532700 00057400 TASK  <HRC...>
      024540 01772500 00000100 RW COM !BADMEM!
      025720 02335100 00054100 RO COM !RMSRES!
      023430 02411200 00040300 TASK  <PART4 >
```

3 PFX OPERATION

3.1 Memory Management Overview

On all RSX-11 systems (RSX-11M, RSX-11M-Plus, and Micro/RSX), physical memory beyond that used by the executive is divided into *partitions*. Some memory partitions are used for special purposes, such as *device* partitions for accessing device registers on the I/O page or the *secondary pool* partition on RSX-11M-Plus and Micro/RSX. The remaining memory partitions are used for executing programs and for loadable device drivers and shared code libraries or common blocks. These task partitions (or partitions, for short) may be either *system-controlled* or *user-controlled*. RSX-11M calls system-controlled partitions *system* partitions, and user-controlled partitions *task* partitions. RSX-11M-Plus and Micro/RSX support only system-controlled partitions, which are called *main* partitions.

Memory partitions can be further divided into one or more *subpartitions*. The system manager manually divides task partitions into subpartitions. In system-controlled partitions, the operating system controls the allocation and deallocation of memory using dynamic memory *regions*, which are created on demand and destroyed when no longer needed.

Since the system manager has full control over the division of a task partition into subpartitions, memory locations suspected of generating parity errors in a task partition can easily be avoided by using the MCR SET /PAR and SET /NOPAR commands. However, there is no corresponding MCR command to create a region over a memory location suspected of generating parity errors in a system-controlled partition (except as a side effect of another operation, such as loading a device driver).

PFX provides this capability. A discussion of PFX's operation follows.

3.2 Theory of Operation

After obtaining a command line from the MCR command interpreter, PFX validates the syntax of the command, converts numeric values to binary and character values to radix-50, and supplies default values for unspecified parameters and switch values. If any syntax errors are found, PFX prints an appropriate error message and exits.

Next, PFX converts the base and top addresses to 64-byte block numbers and compares these values against the system memory size stored in executive memory location \$SYSIZ. If either exceeds the value in \$SYSIZ, PFX prints an error message and exits. Otherwise, if requested, PFX prints out the log message, then enters system state to finish its work.

From system state, an attempt is made to locate a region with the same name as the memory parity error region. If one is found, PFX exits system state with an error status to avoid creating a region with a duplicate name.

Then, an attempt is made to locate the system-controlled partition that will contain the memory parity error region. If the partition is found, PFX compares the base and top 64-byte block numbers against the memory limits of the partition, obtained from its partition control block (PCB). If they are within the partition, the list of PCBs of the

subpartitions (regions) in the partition is scanned. This list is singly-linked and ordered by memory address. (It is, in fact, the data structure used by the executive to store occupancy information for memory allocation.)

For each region, PFX compares the base and top 64-byte block numbers against the memory limits in the corresponding PCB. If any regions overlap with the address range of the memory parity error region, PFX exits system state with an error status.

If no regions overlap with the memory locations to be disabled, a PCB for the new memory parity error region is allocated from primary pool. If a PCB cannot be allocated from primary pool, PFX exits system state with an error status.

To prevent the operating system from deallocating and then reusing the memory occupied by the memory parity error region, the PCB is initialized to "freeze" it in place. (On RSX-11M, the region status word (P.STAT) in the PCB is initialized with the "check-point in progress" (PS.CHK), "fixed in memory" (PS.FXD), "parity error has occurred" (PS.PER), "non-shuffleable" (PS.NSF), "library or data common" (PS.COM), and "system controlled" (PS.SYS) bits set. On RSX-11M-Plus and Micro/RSX, the region status word (P.STAT) in the PCB is initialized with the same bits set, except for PS.SYS, which does not exist (memory partitions on RSX-11M-Plus and Micro/RSX are always system-controlled). On RSX-11M-Plus and Micro/RSX, there is a second region status word (P.ST2), which is initialized with the "FXR task has been here" (P2.PAR) bit set.) The new PCB is then inserted into the PCB list and PFX exits system state.

If an error occurred while PFX was executing in system state, an appropriate message is printed. Then PFX exits. PFX does not exit with status.

The memory parity error region that has been created cannot be removed without rebooting the system. (It is not entered into the common block directory (CBD) on RSX-11M-Plus and Micro/RSX, so it is not possible to eliminate it with the REM/REG MCR command.)

4 PFX ERROR MESSAGES

PFX — Address range outside partition boundaries

Explanation: The address range specified from the base address to the top address is not within the named partition (or GEN, if partition_name was not specified).

User Action: Correct the value of the base and/or top address and reenter the command. (Use the MCR PAR command to obtain the address range of the partition.)

PFX — Base address conversion error

Explanation: PFX encountered an error converting the base address from octal (or decimal) to binary. By default, the base address is octal; a decimal base address must be terminated with a period.

User Action: Correct the value of the base address and reenter the command.

PFX — Base address exceeds system size

Explanation: The base address is larger than the amount of memory available.

User Action: Correct the value of the base address and reenter the command.

PFX — Base address greater than top address

Explanation: The base address is greater than the top address.

User Action: Correct the value of the base and/or top address and reenter the command.

PFX — Base address missing

Explanation: The base address was not found; it is the only required argument and must immediately follow the PFX command.

User Action: Reenter the command using the proper syntax.

PFX — Get command line failure

Explanation: PFX was invoked using a RUN command, instead of as an MCR command.

User Action: PFX must be installed by the system manager so that it can be invoked as an MCR command.

PFX — Get executive vectors failure

Explanation: PFX encountered an error issuing the GIN\$ executive directive to resolve the executive entry point vectors.

User Action: Be sure that you are running the correct version of PFX for your system. See your system manager to assemble and link a new version, if necessary.

PFX — Illegal argument

Explanation: The value for the /PAR= or /NAME= switch was not a legal partition_name or region_name, respectively. Legal names are from 1 to 6 upper case characters and numerals, with no intervening spaces.

User Action: Correct the value of the /PAR= and/or /NAME= switch and reenter the command.

PFX — Insufficient pool for PCB

Explanation: PFX encountered an error attempting to allocate primary pool for the memory parity error region's partition control block (PCB).

User Action: Retry the command when additional primary pool becomes available.

PFX — Keyword syntax error

Explanation: The PFX command contained an illegal or misspelled switch.

User Action: Reenter the command using the proper syntax.

PFX — Memory occupied

Explanation: The address range specified from the base address to the top address is currently occupied by another memory region or a task region.

User Action: Retry the command when the memory is no longer occupied. (Use the MCR PAR command to determine if the memory can be easily freed (*e.g.*, if it is a task region), or if the system must first be rebooted (*e.g.*, if it is a loadable device driver or a fixed memory region).)

PFX — No command given

Explanation: No command line was entered.

User Action: PFX cannot be run without a command line. Enter a complete PFX command line.

PFX — Partition not found

Explanation: The named partition (or GEN, if `partition_name` was not specified) does not exist. This message is also returned on RSX-11M if the named partition was found, but is not a system-controlled main partition.

User Action: Determine the correct `partition_name` for the `/PAR=` switch and reenter the command. (Use the MCR PAR command to obtain the names of the memory partitions.)

PFX — Privilege violation

Explanation: The issuing terminal is not privileged; PFX must be run by a privileged user, such as the system manager.

User Action: Login to a privileged account and reenter the command.

PFX — Region name already in use

Explanation: The name for the memory parity error region is already in use. You must use the `/NAME=` switch to specify a unique `region_name`.

User Action: Choose a unique `region_name` for the `/NAME=` switch and reenter the command. (Use the MCR PAR and CBD commands to obtain the names of the existing memory regions.)

PFX — Top address conversion error

Explanation: PFX encountered an error converting the top address from octal (or decimal) to binary. By default, the top address is octal; a decimal top address must be terminated with a period.

User Action: Correct the value of the top address and reenter the command.

PFX — Top address exceeds system size

Explanation: The top address is larger than the amount of memory available.

User Action: Correct the value of the top address and reenter the command.

PFX — Top address missing

Explanation: The base address was terminated by a colon, but the top address did not immediately follow.

User Action: Reenter the command using the proper syntax.

5 REFERENCES

- [1] Digital Equipment Corp., 1987, *RSX-11M-Plus and Micro/RSX Crash Dump Analyzer Reference Manual*: Order no. AA-JS13A-TC, Digital Equipment Corp., Maynard, Massachusetts.

Contains the format of a partition control block (PCB), as well as other useful information for the systems programmer.

- [2] Digital Equipment Corp., 1987, *RSX-11M-Plus and Micro/RSX Error Logging Manual*: Order no. AA-JS19A-TC, Digital Equipment Corp., Maynard, Massachusetts.

Describes how to identify the locations in memory where parity errors have occurred.

- [3] Digital Equipment Corp., 1987, *RSX-11M-Plus MCR Operations Manual*: Order no. AA-JS12A-TC, Digital Equipment Corp., Maynard, Massachusetts.

Describes the MCR commands cited in the text, such as PAR and SET.

- [4] Digital Equipment Corp., 1988, *RSX-11M-Plus System Generation and Installation Guide*: Order no. AA-H431F-TC, Digital Equipment Corp., Maynard, Massachusetts.

Describes the system generation procedure.

- [5] Digital Equipment Corp., 1987, *RSX-11M-Plus and Micro/RSX System Management Guide*: Order no. AA-JS14A-TC, Digital Equipment Corp., Maynard, Massachusetts.

Gives an overview of the management of system memory and documents the virtual MCR utility (VMR), which is used during the system generation procedure [4] to define the system memory layout.

6 DISTRIBUTION

Machine-readable copies of PFX are available from the author at:

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