IBM Education Assistance for z/OS V2R1

Item: AMODE 64 support for 1M and 2G large pages
Element/Component: Language Environment

Agenda

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Trademarks

- See url http://www.ibm.com/legal/copytrade.shtml for a list of trademarks.

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Presentation Objectives

- Explain the purpose of and how to use the Language Environment Large Page support for AMODE 64 applications.

Overview

- **Problem Statement / Need Addressed**
  - Application programmers and middleware want to be able to exploit large pages in AMODE 64 in order to improve the performance.

- **Solution**
  - Provide a runtime option called PAGEFRAMESIZE64 which will allow the user to request storage be backed by either 4K or 1M pages for user heap, library heap, I/O heap and stack for Language Environment AMODE 64 applications.

- **Benefit / Value**
  - The ability to back storage with 1M pages may have a performance benefit for certain AMODE 64 applications.

Usage & Invocation

- Using this support, you can:

  - Request that pieces of Language Environment storage be backed by 1M pages for AMODE 64 applications.

Usage & Invocation

- Syntax

```
                    .-4K-----------------.   .-4K-----------------.   .-4K--------------------.
>>--PAGeframesize64--(-+-----------------+-,+-----------------+-,+--------------------+->
                    '-heap64_frame_size64'  '-heap64_frame_size31'  '-libheap64_frame_size64'

     .-4K--------------------.   .-4K-----------------.   .-4K-------------------.
>-,-+--------------------+-,-+-----------------+-,-+-------------------+-,->
    '-libheap64_frame_size31'   '-ioheap64_frame_size64'   '-ioheap64_frame_size31'

     .-4K-------------------.
>---+-------------------+--><
    '-stack64 frame size---'
```

Usage & Invocation

- `PAGEFRAMESIZE64(heap64_frame_size64, heap64_frame_size31, libheap64_frame_size64, libheap64_frame_size31, ioheap64_frame_size64, ioheap64_frame_size31, stack64_frame_size)`

  - `heap64_frame_size64/libheap64_frame_size64/ioheap64_frame_size64`
  Specifies the preferred page frame size in virtual storage for initial heap/library heap/I/O heap storage allocation and any subsequent heap/library heap/I/O heap increments above the 2GB bar. These value scan be specified as one of the following values:
    - 4K - Requests the default 4KB pages.
    - 1M - Requests the 1MB pages to be used if available.

Usage & Invocation

- `PAGEFRAMESIZE64(continued)`

  - `heap64_frame_size31`
    `/libheap64_frame_size31/ioheap64_frame_size31`
    Specifies the preferred page frame size in virtual storage for initial heap/library heap/I/O heap storage allocation and any subsequent heap/library heap/I/O heap increments above the 16MB line and below the 2GB bar. These value scan be specified as one of the following values:
    - 4K - Requests the default 4KB pages.
    - 1M - Requests the 1MB pages to be used if available.

  - `stack64_frame_size`
    Specifies the preferred page frame size in virtual storage for initial stack storage allocation above the 2GB bar. This value can be specified as one of the following values:
    - 4K - Requests the default 4KB pages.
    - 1M - Requests the 1MB pages to be used if available.

Usage & Invocation

- `PAGEFRAMESIZE64(continued)`

  - This runtime option can be specified:
    - On invocation of the application, including JCL PARM, TSO/E CALL and C/C++ invoke with options specified in the environment variable _CEE_RUNOPTS.

    - At invocation time through a DD card (DD:CEEOPTS).

    - In a CELQUOPT CSECT by assembling the CELQUOPT or specifying the C/C++ #pragma within a source program.

Usage & Invocation

- `PAGEFRAMESIZE64(continued)`

  - Usage Notes:
    - You cannot specify this option with the CEEBXITA assembler user exit interface.

    - If 1MB page frames are not available, 4KB page frame size will be used. No message is issued to indicate this behavior.

    - Page frame sizes larger than 4KB are not allowed below the 16MB line. If a PAGEFRAMESIZE64 parameter specifies 1MB but that storage type is allocated below the 16MB line, then the default 4KB page frames will be used. No message is issued to indicate this behavior, and the run-time option report will show what the user specified.

Usage & Invocation

- `PAGEFRAMESIZE64(continued)`

    - Usage Notes:
        - If any PAGEFRAMESIZE64 parameter specifies 1M, then all of the storage preallocated to the enclave will request 1MB page frames. The previous two usage notes apply as well.

Usage & Invocation

- Performance considerations

  - Large pages are a special purpose performance improvement feature, and therefore, switching to the use of large pages is not recommended for all workloads. For more information about large pages, see the following publications:
    - MVS Programming Assembler Services Reference Vol 2 (IARR2V-XCTLX)
    - MVS Programming Authorized Assembler Services Guide
    - MVS Programming Assembler Services Guide

Interactions & Dependencies

- Software Dependencies
  - None

- Hardware Dependencies
  - Large pages must be available on the hardware.

- Exploiters
  - AMODE 64 applications that access large amounts of large storage repeatedly.

Presentation Summary

- The new PAGEFRAMESIZE64 runtime option may be used to request pieces of Language Environment storage be backed by 1M pages for AMODE 64 applications.

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Appendix

- Publications:
  - Language Environment Customization(SA22-7564)
  - Language Environment Debugging Guide(GA22-7560)
  - Language Environment Programming Reference(SA22-7562)
  - Language Environment Programming Guide for 64-bit Virtual Addressing Mode(SA22-7569)
  - Language Environment Vendor Interfaces(SA22-7568)