z/TPF V1.1

TPF Users Group - Spring 2009

Title: Core Resident Program Area (CRPA) Enhancements

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Venue: SCP Subcommittee

AIM Enterprise Platform Software
IBM z/Transaction Processing Facility Enterprise Edition 1.1.0

Purpose

- **Improve performance**
- **Reduce memory needed**
  - Copy-on-write support requires ECB unique page – segment tables for both 31-bit and 64-bit CRPA
  - Prior to CRPA enhancements 64-bit CRPA is the same size as the 1-meg frames pool
  - Number of bytes needed for page – segment tables for the 64-bit CRPA is:
    - 2048 bytes * nbr of 1 meg frames * nbr of ECBs

What are the primary changes?

- **4 CRPAs**
  - Copy-on-write (31-bit and 64-bit) CRPA
    - Similar to current z/TPF CRPAs
    - Programs that use static variables, imported data, or constructors
    - NORENT assembler programs
  - Standard (31-bit and 64-bit) CRPA
    - Similar to TPF 4.1 CRPAs
    - Key ‘F’ protected storage; no copy-on-write
    - All other programs
    - Do not need ECB unique page – segment tables
    - Use common bit in segment table entries
      - Improve Translation-Lookaside Buffer (TLB) performance

What are the primary changes?

- **Ability to define the size of all CRPAs, including the 64-bit CRPAs**
  - SIP definition on CORREQ

    CORREQ AP31=80,AP31CW=90,AP64=200,AP64CW=90

    Note: RAMFILE APSIZE31 is obsolete

  - On-line support to display/alter with ZCTKA command

```
CTKA0020I 14.39.23 STORAGE ALLOCATIONS ON PROCESSOR B
KEYWORD        ALLOCATION
 MEM CONFIG      IBMWPMC
  AP31                 80
  AP31CW               90
  AP64                200
  AP64CW               90
```

Ability to see how much space is used in the CRPA

- **ZDCRP on-line display**

```
DCRP0002I 10.31.22 CORE RESIDENT PROGRAM AREA STATUS
                        31-BIT CRPA   31-BIT C-O-W CRPA
TOTAL ALLOCATION          83 886 080          83 886 080
CURRENTLY BACKED          11 534 336           6 291 456
PROGRAM USAGE             10 481 664           4 698 112
FREE CHAIN AREA                    0                   0
NUMBER OF FRAGMENTS                0                   0
SMALLEST FRAGMENT                  0                   0
LARGEST FRAGMENT                   0                   0
AVERAGE FRAGMENT                   0                   0
                        64-BIT CRPA   64-BIT C-O-W CRPA
TOTAL ALLOCATION          83 886 080         188 743 680
CURRENTLY BACKED           6 291 456          36 700 160
PROGRAM USAGE              4 464 640          35 258 368
FREE CHAIN AREA                    0                   0
NUMBER OF FRAGMENTS                0                   0
SMALLEST FRAGMENT                  0                   0
LARGEST FRAGMENT                   0                   0
AVERAGE FRAGMENT                   0                   0
END OF DISPLAY+
```

Data Collection/Reduction Reports

- **System Summary Report**

```
PROGRAM STORAGE UTILIZATION

STORAGE RESERVED FOR 64-BIT STANDARD CRPA          104857600 BYTES   ( 100.0 MEGABYTES)
STORAGE AVAILABLE IN THE 64-BIT STANDARD CRPA       62914560 BYTES   (  60.0 MEGABYTES)

STORAGE RESERVED FOR 64-BIT C-O-W CRPA             104857600 BYTES   ( 100.0 MEGABYTES)
STORAGE AVAILABLE IN THE 64-BIT C-O-W CRPA          62914560 BYTES   (  60.0 MEGABYTES)

STORAGE RESERVED FOR 31-BIT STANDARD CRPA           83886080 BYTES   (  80.0 MEGABYTES)
STORAGE AVAILABLE IN THE 31-BIT STANDARD CRPA       62914560 BYTES   (  60.0 MEGABYTES)

STORAGE RESERVED FOR 31-BIT C-O-W CRPA              83886080 BYTES   (  80.0 MEGABYTES)
STORAGE AVAILABLE IN THE 31-BIT C-O-W CRPA          62914560 BYTES   (  60.0 MEGABYTES)

STORAGE RESERVED FOR PAT                             7264320 BYTES   (   6.9 MEGABYTES)
PAT SLOTS ALLOCATED                                     9868 SLOTS
STORAGE RESERVED FOR EXTRA PAT                       1472024 BYTES   (   1.4 MEGABYTES)
EXTRA PAT SLOTS ALLOCATED FOR E-TYPE LOADER              2000 SLOTS
```

Data Collection/Reduction Reports

- **Program Module Report**

```
COPY-ON-WRITES BY PROGRAM MODULE                                BSS SUBSYSTEM
PROGRAM    #C_O_W    C-O-W/sec   CWREL%    CWCUM%
-------    =======   =========   ======    ******
CFVS          195       1.158   36.312    36.312
CISO          174       1.033   32.402    68.714
JCI3           48       0.285    8.938    77.652
CNG0           32       0.190    5.959    83.611
CTIS           25       0.148    4.655    88.266
CMQS           25       0.148    4.655    92.921
********************************************** CUT OFF AT 90 PERCENT
TOTALS:       537       3.189
```

Determination of which CRPA to use

- **Default - Determined automatically by offline loader**
  - Program will reside in copy-on-write CRPA if it has any of:
    - Programs with static data or
    - Imports data from another program or
    - Process scope constructors
  - Else program will reside in standard CRPA
- **Programs that are not reloaded after applying PJ34760 will reside in copy-on-write CRPA**
  - Full load required to ensure all programs that can go into standard CRPA are loaded there

Determination of which CRPA to use, cont'd

- **Override – User can specify CRPA for any program**
  - Makefile option to control CRPA
    - -Xlinker –defsym –Xlinker CGCC_COW_CRPA=0
      - Causes program to be loaded into standard CRPA
    - -Xlinker –defsym –Xlinker CGCC_COW_CRPA=1
      - Causes program to be loaded into copy-on-write CRPA

Determination of where a Program was loaded

- **ZDPAT QSBE COPY-CORE**

```
DPAT0106I 07.50.15 BEGIN DISPLAY OF CORE COPY
PROGRAM           QSBE
SUBSYSTEM SHARED  NO
AUTHORIZATION     RESTRICT
FETCH             DEMAND
QUALIFIERS        NONE
TIMEOUT           50
DUMP GROUP        DRVSOLD
TRACE GROUP       IBM_DEFT
AFFINITY          NONE
DISPLAY OF PAT SLOTS FOR QSBE
VV LOADSET  ACT NUM STAT  FILE ADDR CORE ADDR         COW LINK PAT ADDR
-- -------- ------- ----- --------- ----------------- --- ---- --------
RD QSBEMV1         8 ACT    CC040915  00000003967F8000 Y64 BSO  1084A798
I4 QSBEMOVE        6 ACT    CC04099C  000000038064B000 N64 BSO  1084A4B8
   BASE            0 ACT    D405D205  0000000004E61000 N31 BSO  1033D140
END OF DISPLAY
```

Determination of CRPA Sizes

- **Possible future enhancement**
  - Offline loader report from TLDR to display CRPA storage requirements for programs loaded
  - May look like:

```
This load will require
STD CRPA-31 14247696 bytes
COW CRPA-31 14247696 bytes
STD CRPA-64 14247696 bytes
COW CRPA-64 34320384 bytes
```

Issue

- **Use of standard CRPA may result CTL-3 errors**
  - Programs that modify themselves (non-reentrant) will take a CTL-3 in the standard CRPA
  - Investigate:
    - Programs assembled with NORENT
    - Programs defined as PRIVATE in TPF 4.1
    - Use ZDCOW in z/TPF to identify programs that are using copy-on-write
      - Some programs may be doing modifying themselves incorrectly
  - Put these programs in the copy-on-write CRPA, or
  - Correct programs that are modifying themselves incorrectly

APAR numbers

- **Co-requisites**
  - PJ34760 – CRPA Enhancements
  - PK78657 – TPFDF changes for CRPA Enhancements
  - PJ35031 – Software profiler changes for CRPA Enhancements
- **Other Support**
  - PJ35842 – Online command to display programs using copy-on-write support (ZDCOW)

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