z/TPF V1.1

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Title: Improved z/TPF Diagnostic Capabilities

Name: Lisa Banks

Venue: Main Tent

AIM Enterprise Platform Software
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AGENDA

- TPF owner names
- General Enhancements
- Test Environment Modes
- ECB Tracing
- System Tracing
- Dump Tailoring
- Dump Management
- Dump Format

TPF OWNER NAMES

- **Owner names are used to associate resources (physical blocks) with a specific user**
- **Format**
  - 32 bytes character “string”
    - 8 byte high level qualifier
    - 8 byte mid level qualifier
    - 16 byte low level qualifier

TPF OWNER NAMES

- **ECB**
  - Default high-level owner qualifier of IECB
  - EOWNRC / tpf_eownrc
    - Query or set the ECB owner name
- **System heap**
  - Associated with 1-MB frames, which provide backing storage
  - Default high-level owner qualifier of ISYSHEAP
  - Default mid-level owner qualifier
    - 64-bit: ISYSH64
    - 31-bit: ISYSH31
  - Optional input parameter on GSYSC and tpf_gsysc

TPF OWNER NAMES

- **Physical blocks**
  - Required input parameter on the following macros:
    - DISBC
    - GCOMC
    - GETBC
    - GLFMC
    - GSWBC
  - An owner name is saved in the associated control table entry for the storage block
    - FCT for 4-KB frames
    - SCT for SWBs
    - CCT for common blocks
    - MFCT for 1-MB frames

TPF OWNER NAMES

- **IOB**
  - These names are set by the z/TPF system
  - There is no owner input parameter for GIOBC
  - High-level owner qualifier:
    - IDASD
  - Mid-level owner qualifier:
    - EBCDIC translation of the symbolic module number for the associated DASD device
  - Low-level owner qualifier:
    - EBCDIC translation of the symbolic device address

TPF OWNER NAMES

- **APIs**
  - OWNERC / tpf_ownerc
    - Provides resource information based on owner name:
      - Number of IOBs that are in use
      - Number of ECBs that are in use
      - Number of SWBs that are in use
      - Number of common blocks that are in use
      - Number of 4-KB frames that are in use
      - Number of 1-MB frames that are in use
      - Number of bytes of 31-bit system heap storage that are in use
      - Number of bytes of 64-bit system heap storage that are in
    - Owner names can be specified in full or by qualifiers
    - A qualifier can end with a wildcard “*”
    - Limit query to owners with the highest number of resources owned

GENERAL ENHANCEMENTS

- **ZSTAT Enhancements**
  - Display physical block information based on owner name
    - ZSTAT OWNER NAME
      - Can be further filtered by block type
  - Display information for a specific block type
    - ZSTAT OWNER BLOCK
      - ALL -- All of the following physical block types
      - CMB -- Common block
      - ECB -- Entry control block
      - FRM -- 4-KB frame
      - FRM1MB --1-MB frame
      - IOB -- I/O control block
      - SWB -- System work block

GENERAL ENHANCEMENTS

- **ZSTAT Enhancements**
  - Displays information about 31-bit and 64-bit system heap storage
    - ZSTAT SYSHEAP
      - Size of the preallocated storage (64-bit only)
      - Amount of preallocated storage in use (64-bit only)
      - Total storage in use
      - High-water mark of in-use storage
      - Amount of storage on the available list
      - Size of the heap
    - System heap information can be filter by owner name
  - Displays can be limited to owners that with the highest number of resources owned

GENERAL ENHANCEMENTS

- **ZDMAP enhancements**
  - E-type program link map includes both CSO and BSO
  - CP link map
    - ZDMAP CP
  - Determine program name and object based on an address
    - ZDMAP ADDRESS
- **ZSPER enhancement**
  - Ability to trace when specific data is stored at a location
    - New option parameter MDATA
    - Old parameter DATA is replaced by new parameter MINSTR

TEST ENVIRONMENT MODES

- **Block check -- ZSTRC BLKCHK**
  - Writing beyond the end of a block results in a page fault
  - Reference to a block after it is released results in a page fault
- **ECB Heap check -- ZSTRC HEAPCHECK**
  - If an application program overwrites the allocated buffer, it will receive a page fault for going beyond the end of the buffer.
  - Reference to a buffer after it is released results in a page fault
- **Branch target check -- ZSTRC BRCHECK**
  - System error is issued when a program has macro expansion code that contains branch relative instructions outside of the CRPA

ECB TRACING

- **Combined C function and macro trace**
  - Now called ECB trace
  - Toggled online using ZSTRC ALTER TRACE
- **C function trace**
  - No special compiles required
  - Captures input parameters, function name and load module
  - Optional extended trace
    - Where function was called
    - Captures return parameters

ECB TRACING

- **ECB heap trace**
  - Latest heap storage requests and releases
    - Macros:
      - CALOC,MALOC,RALOC,FREEC
    - C functions:
      - 31 bit:
        - Calloc, malloc, relloc, free
      - 64 bit:
        - Calloc64, malloc64, realloc64,free

ECB TRACING

- **ECB data level trace**
  - Name of program that obtained and released a block
- **ECB socket level trace**
  - All socket APIs issued by a given ECB
- **Free form text in ECB trace**
  - tpf_trace_info()
- **Ability to toggle register tracing without an IPL**

ECB TRACING

- **ECB trace groups**
  - Ability to separate application and system trace data
  - Multiple trace buffers
    - Limits buffer wrapping
  - Assigned at the program level
    - Assigned through control file or ZAPAT
    - Flexibility in how applications are grouped
    - ECB can span multiple trace groups

ECB TRACING

- **Trace log facility**
  - Trace application data to a file or real-time tape
  - Logs everything in the trace buffer -- No wrapping
  - Allows application debugging in a non-disruptive manner
  - TLOGC/tpf_tracelog_on/tpf_tracelog_off
  - Controlled online by ZASER
    - TRLOG
      - Defines how many trace log can be active at one time
    - TRLOGTH
      - Acts as a threshold to stop writing to the trace log tape if that tape queue rises above the threshold

SYSTEM TRACING

- **I/O trace facility -- ZIOTR**
  - Command to define number of trace entries to use
  - Command to change number of trace entries for a specific SDA
  - Command to display I/O trace
- **Socket trace**
  - Trace all socket APIs issued for a given socket

SYSTEM TRACING

- **Debug facility -- DEBUGC**
  - Test for a specific condition:
    - AMODE31 or AMODE64
    - KEY0 or NOTKEY0
    - SUPERVISOR or PROBLEM
    - SVM/DATHOME
    - EVM/DATPRIMARY
    - REAL
    - FETCHAUTH or NOFETCHAUTH
    - STOREAUTH or NOSTOREAUTH
    - 31BITADDR or 64BITADDR

SYSTEM TRACING

- **Debug facility -- DEBUGC**
  - Take the specified action if a condition is met Take the specified action if a condition is met:
    - RESTART
    - EXIT
    - INFO
    - NONE
  - Grant opportunity for operator intervention on virtual machine
  - Log update 96 bytes of user data

SYSTEM TRACING

- **Debug facility -- DEBUGC**
  - Condition testing can be toggled online
    - ZSTRC DEBUGUT/NODEBUGUT
  - Data logging can be toggled online
    - ZSTRC DEBUGUL/NODEBUGUL

SYSTEM TRACING

- **VFA Debug facility -- DEBUGV**
  - VFA trace can now be toggled using a SYSTC bit
    - Use ZSYSG Alter DEBUGV
    - Should not be used in production
  - Buffer control area (BCA) trace
    - Buffer state
    - Lock state
    - Displacement of next sequential instruction following DEBUGV macro
  - Collated BCA trace
    - Latest BCA trace info
    - BCA address
    - File address or TMCR
    - Partial timestamp

DUMP TAILORING

- **SNAPC enhancement**
  - Option to include last 40 ECB trace items
- **Ability to only dump in-use blocks that belong to a high-level owner name qualifier**
  - ZIDOT INCLUDE command OWNER parameter
  - IDOTB macro OWNER parameter
- **Dump extensions**
  - Allows a BAL shared object (BSO) or C shared object (CSO) to be called during dump processing to determine additional areas to be dumped and formatted.
  - Using dump formatting extensions allows easy customization of dumps.
  - Coded using IDATG macro

DUMP TAILORING

- **SERRC enhancements**
  - Option to include or suppress 31-bit and 64-bit ECB heap buffers
    - HEAP = NO
      - Do not dump ECB heap buffers
    - HEAP = YES
      - Dumps in-use ECB heap buffers
    - HEAP = ALL
      - Dumps both in-use and available ECB heap buffers
  - Option to include or suppress application stack
  - Ability to customize dumps taken in the control program based on CP CSECT

DUMP TAILORING

- **Dump Controls -- ZASER enhancements**
  - When the following trace data is available it is always included in OPR dumps that are associated with an ECB
    - ECB trace
    - Branch trace
    - ECB socket trace
  - COLTRACE/NOCOLTR for OPR dumps
    - Collated ECB trace
    - I/O trace
    - SYSLOG trace
  - OTHERIST/NOOTHERI for OPR dumps
    - Prefix page and collated ECB trace for non-failing I-streams
  - REGAREA/NOREGA for OPR dumps
    - 4K area surrounding registers

DUMP TAILORING

- **Dump controls -- ZASER enhancements**
  - MAXBLKS
    - Percentage of frames and system work blocks dumped in CTL dumps
  - MAXEHEAP
    - The maximum number of bytes for each ECB heap buffer being dumped
  - SKIPBLK
    - Dumps a specified number of blocks when blocks are included in a dump
    - Ignored when dumping in-use blocks

DUMP MANAGEMENT

- **Dump Buffer Area -- DBA**
  - An area that is used to buffer system error dumps until they can be written to the system dump tape
  - Display information about the contents of the DBA
    - ZDBAI DISPLAY
  - Delete dumps from the DBA
    - ZDBAI DELET
      - Selective dumps
      - All dumps
  - The size of the DBA is maintained in a memory configuration
    - ZCTKA ALTER MEMORY DBA

DUMP MANAGEMENT

- **Dump Statistics -- ZSTAT Enhancement**
  - ZSTAT DUMP
    - The start time of the first dump that is included in the current dump statistics.
    - The amount of time that was required to process the last dump.
    - The average time that was required to process a CTL dump and the number of dumps that were processed.
    - The average time that was required to process an OPR dump and the number of dumps that were processed.
    - The longest time that was required to process a dump and the associated number of that dump
  - ZSTAT DUMP HISTORY
    - Displays the last eight dumps that have been issued for system error dumps
  - ZSTAT DUMP SNAP HISTORY
    - Displays the last 10 SNAPC dumps
  - ZSTAT DUMP CLEAR
    - Resets the dump statistical information used by ZSTAT DUMP

DUMP MANAGEMENT

- **Dump controls -- ZASER enhancements**
  - MAXCPSE
    - The maximum number of CPSE messages that occur in 1 minute
  - MAXCTL
    - The maximum number of CTL dumps that occur in 1 minute

DUMP MANAGEMENT

- **Dump groups**
  - Programs are assigned to a dump group through a control file or by using ZAPAT
  - Dump overrides can be defined for an entire dump group
    - IDOTD
  - It is easier to include overrides on an application-wide basis instead of having to give an override for each program
- **More dump override options**
  - Define overrides for system errors that occur in a particular program, CP CSECT, or Dump group
- **Named manual dumps**
  - Create a dump using ZIDOT INCLUDE or IDOTM macro
  - Define storage areas to be included in the dump
  - Issue ZDUMP to generate the dump

DUMP MANAGEMENT

- **Duplicate dumps**
  - Increase size of duplicate dump table
    - Now holds 500 entries
  - Display duplicate dump table
    - ZDSER DUPL
  - Remove dumps from duplicate dump table
    - ZASER REMOVE
      - Selective dumps
      - All dumps
  - Force a specific duplicate dump to be taken despite NODUPL ZASER setting
    - ZIDOT FORCE

DUMP MANAGEMENT

- **SNAP dump overrides**
  - Suppress specific SNAP dumps
    - ZIDOT SNAP SUPPRESS
  - Force specific SNAP dumps
    - ZIDOT SNAP FORCE
  - Reset SNAP dump overrides
    - ZIDOT SNAP RESET
  - Display SNAP dumps that are being forced or suppressed
    - ZIDOT SNAP DISPLAY

DUMP MANAGEMENT

- **Additional ZIDOT Enhancements**
  - ZIDOT can now be used on OPR dumps
  - New display options
    - ZIDOT DISPLAY FORCE
      - Display a list of system errors that are currently being forced
    - ZIDOT DISPLAY MANUAL
      - Display a list of named manual dumps
  - ZIDOT (NO)CPADDR
    - Specifies whether the dump will use the overrides coded in the IDOTC macro for the CP CSECT in which the dump takes place
    - Valid only dumps that occur in the control program (CP)
  - ZIDOT (NO)SYSDUMP
    - Specifies whether a dump of system storage will be performed
    - Valid only for associated with an ECB

DUMP MANAGEMENT

- **z/TPF Dump Viewer**
  - GUI view of information -- TPF Toolkit
    - ECB stack
    - Modules, parts, and functions in a source view
    - C/C++ and assembler variables and expressions
    - Contents of storage at the time that the dump file was issued
    - Registers at the time the dump file was issued
  - To use the z/TPF Dump Viewer
    - ZASER option: DBUG/NODBUG
      - Pass certain dump data to debug dump storage for online retrieval.
    - Debugger registration via TPF Toolkit
  - Import option lets you move a dump file
    - View dumps on the z/TPF system most suitable even if its no the system on which the dump occurred

DUMP FORMAT

- **Owner name for physical block**
- **Memory configuration name**
- **Data displayed in both Hex and Text**
  - Ability to do ASCII or EBCDIC translations or have a user defined code page
- **Link map of failing program**
  - CTL-3 and OPR-4 dumps
- **Location information for last 10 branch trace items**
  - Program or CP CSECT name
  - Displacement into the program

DUMP FORMAT

- **Formatted version of SW00SR**
- **Architectural changes**
  - 64-bit core addresses
  - 64-bit registers
  - 128-bit PSWs
  - Floating point control register
  - Breaking event register

DUMP FORMAT

- **PUT00**
  - TPF owner names
  - All ZSTAT enhancements except those listed below
  - ZDMAP
  - Block check
  - ECB heap check
  - All ECB trace features shown
  - All system trace features shown
  - ZIDOT, IDOTB, IDOTC, IDOTD, IDOTM, IDATG
  - All ZASER enhancements shown except those listed below
  - Dump buffer area
  - Dump format enhancements
- **PUT02**
  - ZSPER
  - ZASER REMOVE
  - ZDSER DUPL
  - ZSTAT DUMP (SNAP) HISTORY
- **PUT04**
  - Branch target check

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