PDSE Member Generations: Implementation and ISPF Exploitation

Speakers: Thomas Reed and Sam Reynolds /IBM Corporation

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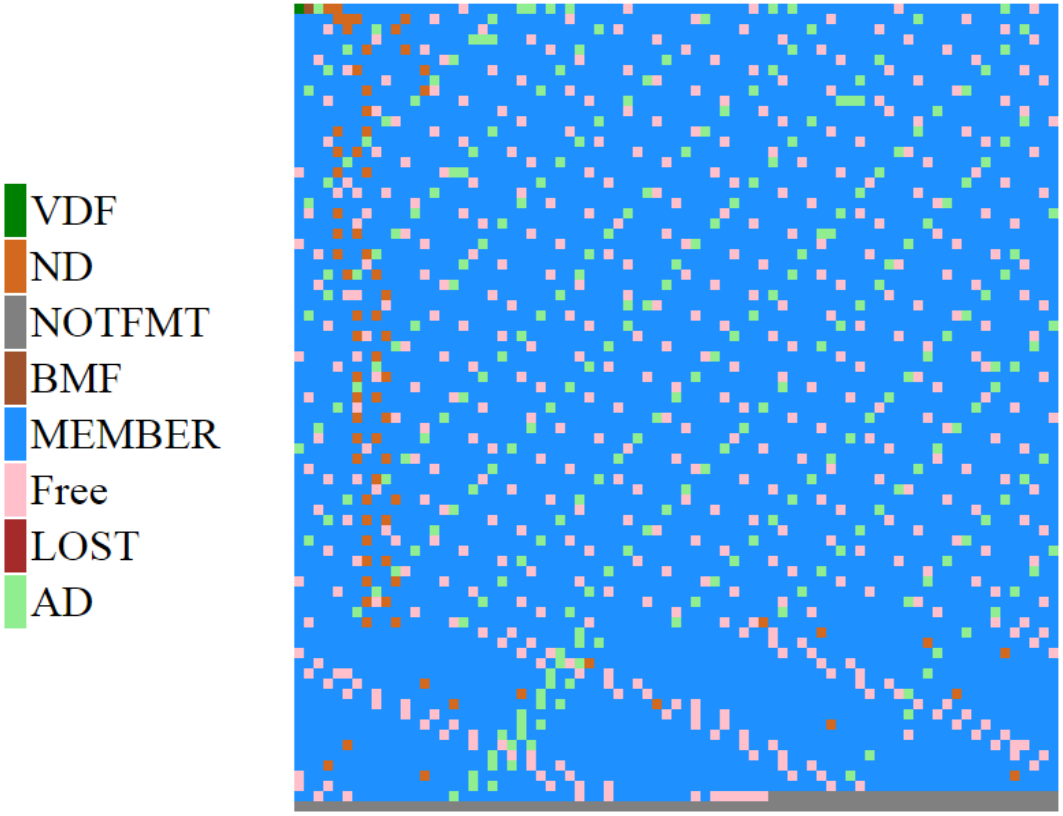
Agenda

- PDSE Member Generations Basics
- Working with Member Generations
- Member Generations Macro Support
- ISPF Support

What is a PDSE?

- PDSE: Partitioned Data Set Extended
- A PDSE is a collection of directory and data pages
- At V2R1 there are 2 data set formats V1 and V2 PDSEs
- PDSE server consists of one or two address spaces (SMSPDSE and SMSPDSE1)
- The SMSPDSE(1) address spaces serve client access requests for PDSE data sets
- Under the hood SMSPDSE(1) also manages PDSE serialization and buffering

PDSE Dataset Structure :
What Does a PDSE Look Like?



PDSE Versions

- The version 1 format is the historic PDSE format
- The version 2 format is a revision of the PDSE format
  - Brings better performance and efficiency
  - Reduces CPU and Storage utilization
  - **Supports PDSE member generations**

- Version 2 data sets use the same serialization and buffering subsystems as version 1
- The IMF/BMF performance enhancements at V2R1 apply to BOTH V1 and V2 datasets

PDSE Version 2: Member Generations

- What does it do?
  - PDSE Data sets can now retain multiple generations of members
  - Applies to BOTH Data Members and Program Objects
  - Retains generations up to the data set/system limit

- Implemented via DFSMS APAR OA42358
  - ISPF Support via APARs OA42247 and OA42248

PDSE Version 2: Member Generations

Terminology

- Generation (GEN)
  - A prior copy of a member
- Primary Generation/Member
  - The current member
  - Absolute and Relative 0
- MAXGENS_LIMIT
  - IGDSMSxx Parameter
- MAXGENS
  - Set at allocation time
  - MAXGENS <= MAXGENS_LIMIT

PDSE Member Generations: The Basics

- FIFO (First In, First Out) structure
  - Oldest generation is permanently deleted if it's over the generation limit
  - Old generations generally behave just like primary members
  - Aliases are retained for previous generations and can be recovered*

* When STOW RECOVERG is used

PDSE Member Generations: The Basics

- Generations are uniquely numbered
  - They can be referenced either by their **Absolute** or **Relative** generation
  - The Primary Member is always 0, both relative and absolute
  - Greatest number indicates the newest generation

- Generation Numbering
  - Absolute: GEN(n), GEN(n-1), GEN(n-2)….
  - Relative: GEN(-1), GEN(-2),….,GEN(-MAXGENS)
    - n being the nth generation created

PDSE Member Generations: The Basics

- Example: MAXGENS = 4 after 11 generations

ABS	0	1	2	3	4	5	6	7	8	9	10
	PRI	-	-	-	-	-	-	Gen	Gen	Gen	Gen
REL	0	-	-	-	-	-	-	-4	-3	-2	-1

- Note that the newest generation ALWAYS has the greatest value

PDSE Member Generations: The Basics

Parameters

- MAXGENS_LIMIT can be set dynamically via SET SMS=xx
  - Cannot be set dynamically with SETSMS
- MAXGENS_LIMIT upper limit is set at 2 billion
  - Limit is mostly theoretical.
  - In total, 2 billion generations can have ever existed in a V2 PDSE
- PDSE honors the MAXGENS on a PDSE regardless of the MAXGENS_LIMIT on that system
  - MAXGENS is set at allocation time and is stored in the PDSE
  - MAXGENS cannot currently be modified

PDSE Member Generations: The Basics

Usage Considerations

- Allow extra space for each generation
- Each generation retains the entire member
  - Generation creation is atomic
  - Mirrors the “normal” PDSE member replace process
  - Simply swaps pointers rather than doing IO for the whole member
- Deleting generations can result in pending deletes, just like primary members

PDSE Member Generations: The Basics

Copy Basics

- DSS
  - DSS Copy will retain generations with OA43729 or Concurrent Copy
  - Logical or Physical DUMP and RESTORE retains generations
- IEBCOPY and IDCAMS REPRO
  - Does NOT retain generations
  - ONLY copies primary members

PDSE Member Generations: Working with Generations

Enabling Member Generations

1. Ensure that the requisite APARs are applied
2. MAXGENS_LIMIT needs to be set >0 in your IGDSMSxx
3. Allocate a V2 PDSE dataset with greater than 0 generations (must be <= MAXGENS_LIMIT)

PDSE Member Generations: Coexistence

- Down level systems will tolerate V2 PDSE's with Generations and be able to open for INPUT of OUTPUT
- Down level systems will not be able to create or manipulate generations
- Down level systems are essentially unaware of generations while maintaining compatibility
- DFSMSdss/IEBCOPY support is identical to 2.1

PDSE Member Generations: Working with Generations

Allocating a PDSE with Generations Enabled via JCL!

```
//ALLOC     EXEC PGM=IEFBR14
//PDSE2     DD DSN=TREED.PDSE.GENS,
// DSNTYPE=(LIBRARY,2),MAXGENS=10,
// RECFM=FB,LRECL=80,
// UNIT=SYSALLDA,SPACE=(CYL,(1,1,1)),
// DISP=(,CATLG,DELETE)
```

- Note that LIBRARY,2 specifies a V2 data set
- MAXGENS must be <= the system MAXGENS_LIMIT

PDSE Member Generations: Working with Generations

Creating a Generation

- 2 requirements
  - (LIBRARY,2)
  - MAXGENS > 0
- New generations are automatically created on replace or delete of a member
- Update in place will not create a new generation
- Generation creation is atomic

PDSE Member Generations: Working with Generations

Reading Old Generations

- FIND macro will allow programs to connect to old generations
- Conventional READ and CHECK macros still apply
- Old generations cannot be accessed via JCL or dynamic allocation

PDSE Member Generations: Working with Generations

Deleting Old Generations

- Each generation must be deleted separately
- Deleted generations can be replaced by using STOW RG
- ISPF member delete will delete all generations

PDSE Member Generations: Working with Generations

Recovering Old Generations

- Read an old generation and then write it to either the same or a different member name
  - The old generation will become the current generation
  - Note: This method will not restore aliases
- Use the RECOVERG option for the STOW macro
  - The old generation becomes the current generation of the member of the same name
  - Note: Aliases ARE recovered by this method

PDSE Member Generations: Working with Generations

Backup Considerations

- HSM Backup
  - Uses DSS under the covers to move the PDSE
  - Retains all generations
- What is the difference between IEBCOPY and DSS Copy for PDSE?
  - DSS does a page copy of the entire dataset
    - Does not care about the contents of the PDSE
  - IEBCOPY process members individually from the index
    - Can merge sets of members
    - Merging of generations is beyond the scope of IEBCOPY

PDSE Member Generations: DESERV Macros

FUNC=GET_G (AKA Get Generation)

- Returns information for the selected generation
- Returns the same information as GET plus the relative and absolute generation numbers
- A dummy entry is returned if the selected generation does not exist
- Does not support CONNECT

PDSE Member Generations: DESERV Macros

FUNC=GET_G

,AREA=(buffer_area, buffer_area_size)

,DCB=data_control_block

,NAME_LIST=(generationname,1)

[,MF={(E,parmlist_name[,NOCHECK|COMPLETE])|S}]

[,RETCODE=return_code]

[,RSNCODE=reason_code]

PDSE Member Generations: DESERV Macros

FUNC=GET_ALL_G (AKA Get All Generations)

- Returns information for the selected generation for all members
- Returns the same information as GET_ALL plus the relative and absolute generation numbers
- A dummy entry is returned if the selected generation does not exist for a member
- Does not support all the same options as GET_ALL

PDSE Member Generations: DESERV Macros

```
FUNC=GET_ALL_G
    ,AREA=(buffer_area, buffer_area_size)
    ,DCB=data_control_block
    ,NAME_LIST=(generationname,1)
    [,MF={(E,parmlist_name[,NOCHECK|COMPLETE])|S}]
    [,RETCODE=return_code]
    [,RSNCODE=reason_code]
```

PDSE Member Generations: STOW Macro

DG (Delete Generation)

- Deletes an existing generation
- Takes a member name and generation number
- Leaves a gap in the generation list
- If issued with a generation of 0, deletes the member without creating a generation

PDSE Member Generations: STOW Macro

RG (Replace Generation)

- Replaces an existing generation
- Adds a generation if replacing a gap in the generation list

PDSE Member Generations: STOW Macro

RECOVERG (Recover Generation)

- Recovers an existing generation
- Removes the selected generation from the generation list and makes it the primary member
- Creates a new generation in the replace process from the former primary member

ISPF and PDSE Member Generations

PDSE Member Generations: ISPF Support

Panels

- ISPF has generations support with APARs OA42247 and OA42248 on z/OS V2R1
- Enhanced member list option must be selected

```
                    Data Set List Settings Main
                                                          More:     +
   General Options
   Enter "/" to select option
   /  Display Edit/View/Browse entry panel (*)
   /  Automatically update reference lists
   /  List pattern for MO, CO, D, and RS actions
   /  Show status for MO, CO, D, and RS actions
   /  Confirm Member delete
   /  Confirm Data Set delete
   /  Do not show expanded command
   /  Enhanced member list for Edit, View, and Browse
   _  Display Total Tracks
   /  Execute Block Commands for excluded Data Sets
   _  Display Expiration Date

 (*) Requires enhanced member list option to be selected
```

PDSE Member Generations: ISPF Support

Allocation

- Allocates like any other PDSE
- MAXGENS must be >0
- Be sure you're using version 2!

```
 Directory blocks  . . 0       (Zero for sequential data set) *
 Record format . . . . FB
 Record length . . . . 80
 Block size  . . . . . 27200
 Data set name type    LIBRARY  (LIBRARY, HFS, PDS, LARGE, BASIC, *
 Data set version  . : 2         EXTREQ, EXTPREF or blank)
 Num of generations  : 50
 Extended Attributes   ___      (NO, OPT or blank)
 Expiration date . . . _________ (YY/MM/DD, YYYY/MM/DD
Enter "/" to select option       YY.DDD, YYYY.DDD in Julian form
```

PDSE Member Generations: ISPF Support

- Accessing generations through the member list

```
BROWSE            TREED.GENTST                          Row 0000001 of 0000002
Command ===> _____________________________________________ Scroll ===> PAGE
            Name     Prompt       Size   Created          Changed          ID
____e____  AMEMBER   /               1   2014/07/30   2014/07/30 13:57:19  TREED
__________ BMEMBER
           **End**
```

Don't forget the '/'

```
 Menu  Functions  Confirm  Utilities  Help
 Workstation  Help                                                          02
                                                                            GE
                          EDIT Entry Panel
                                                          More:      +      D
 Object Name:
 'TREED.GENTST(AMEMBER)'
 * No workstation connection
   Initial Macro  . . ________
   PDSE Generation. . ________
   Line Command Table ________
   Profile Name . . . ________  (Blank defaults to Type)
   Format Name  . . . ________
   Panel Name . . . . ________  (Leave blank for default)

   Options                          Data Encoding
   _  Confirm Cancel/Move/Replace   _  1. ASCII
   _  EDIT Mixed Mode               _  2. UTF-8
      EDIT host file on
      Workstation
   /  Preserve VB record length
 F1=Help      F2=Split     F3=Exit      F7=Backward  F8=Forward
 F9=Swap      F12=Cancel
```

PDSE Member Generations: ISPF Support

Restrictions

- ENQUEUEing on one generation applies to all generations of that member
  - This is not a PDSE serialization restriction
  - The native API's allow for editing of multiple generations of the same member
- ISPF Options 1 and 2 do not support a GEN parameter
- ISPF 3.1 and 3.4 do support a GEN parameter

PDSE Member Generations: ISPF Support

Editing

- Editing the current member without specifying a generation (GEN 0) results in a new generation being created
- Editing prior generations does NOT result in a new generation
- Supports referencing generations by either absolute or relative generation number
- Deleting a member in ISPF deletes all generations
  - This is an ISPF implementation feature
  - TSO DELETE pdse(member) deletes only the primary
- Renaming a member deletes all generations except the base generation
- COPY only copies the base generation

PDSE Member Generations: ISPF Support

Editing Cont'd

- Generation creation behavior can be forced
  - SAVE NEWGEN – Creates a new generation (default action for base generation)
  - SAVE NOGEN – Does not create a new generation when saving base generation
- Edit will tell you which absolute generation you are working with

```
EDIT       TREED.GENTST2(TST1) - 01.00                          Columns 00001 00080
Command ===> ____________________________________________________ Scroll ===> CSR
****** ******************************** Top of Data ********************************
==MSG> -Warning- The UNDO command is not available until you change
==MSG>           your edit profile using the command RECOVERY ON.
==MSG> -CAUTION- Edit session has been invoked for generation 1
==MSG>           High generation number is currently 2
000100 Generation1                                                      00010000
000200 this is a test                                                   00020000
****** ******************************** Bottom of Data *****************************
```

PDSE Member Generations: Example

- Original set of generations:

Generation 0
The cat in the hat comes back

Generation -1
The cat in the hat

Generation -2
The cat

- We edit generation -2, changing it to “My cat”
- SAVE NEWGEN
- Now the generations are:

Generation 0
My cat

Generation -1
The cat in the hat comes back

Generation -2
The cat in the hat

PDSE Member Generations: Example …

- We edit the base generation, changing it to “My cat in the hat”
- SAVE NOGEN
- Now the generations are:

Generation 0
My cat in the hat

Generation -1
The cat in the hat comes back

Generation -2
The cat in the hat

- If we rename the file, all generations except for the base are deleted:

```
 Menu  Functions  Confirm  Utilities  Help
 ------------------------------------------------------------------------
BROWSE            DEMO.TEST.PDSEMG                    Invalid GEN parameter
Command ===>                                                Scroll ===> PAGE
          Name     Prompt       Size   Created          Changed          ID
B        NEWSEUSS /                1  2015/02/24  2015/05/24 14:35:46  USER2
```

PDSE Member Generations: PDF Support

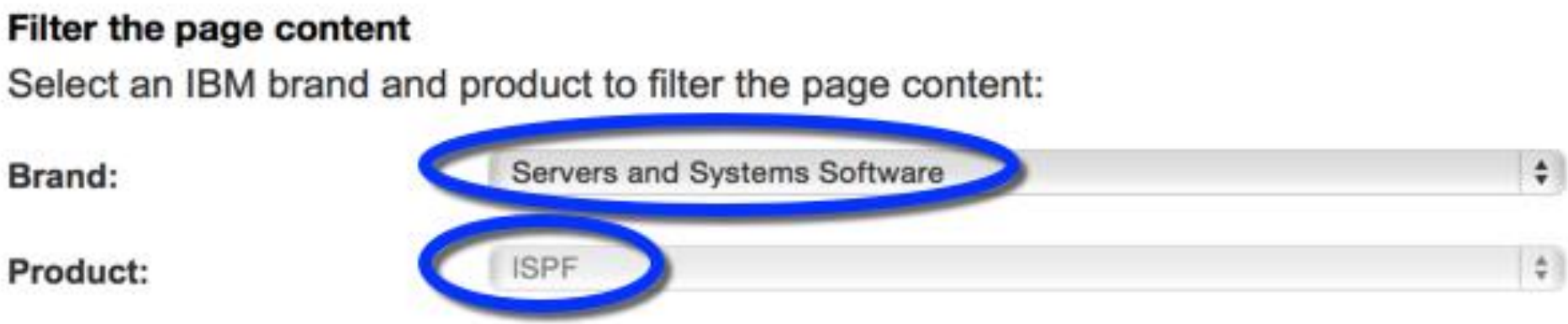
- PDF API Changes for Generations
  - DSINFO
    - ZDSDSNV = The version of the PDSE
    - ZDSNGEN = The number of generations specified (MAXGENS) on allocation of the PDSE
  - LMDLIST
    - ZDLDSNV = The version of the PDSE
    - ZDLNGEN = The number of generations specified (MAXGENS) on allocation of the PDSE
  - EDIT, VIEW, and BROWSE support the GEN parameter
    - GEN(n) = Either relative or absolute generation
  - EDIT SAVE supports NOGEN and NEWGEN

PDSE Member Generations: Future Enhancements to ISPF Support?

- We would like to improve the usability of the ISPF support for PDSE Member Generations in the future
- Currently two RFEs are open requesting enhancements to the support:
  - RFE 55041: ISPF SAVE NEWGEN add message indicating number of generations
  - RFE 55908: ISPF edit member generation message
- We would welcome additional RFEs in this area with your suggestions for improvements

PDSE Member Generations: Future Enhancements to ISPF Support?

- By now most of you should be familiar with the RFE (Request for Enhancements) process for submitting and voting on requirements against ISPF, z/OS, and many other IBM products.
  - We are in the planning stage for the next release (V2R2+). So, now is the time to vote and/or let us know of any new requirements.
  - Go to: https://www.ibm.com/developerworks/rfe/
  - Select Brand = Servers and Systems Software, and Product = ISPF



PDSE Requirements Survey

- PDSE is looking for your feedback!

- Survey and item descriptions are in the handout section for this presentation.

Questions? Comments?

Please Fill Out the Survey!

Complete your session evaluations online at www.SHARE.org/Orlando-Eval