PDSE Member Generations Overview

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PDSE Member Generations Overview

This document describes how to use z/OS 2.1 PDSE member generations with ISPF and IBM Data Set Commander for z/OS.

Section 1 - Overview

PDSE member generations support is provided in z/OS 2.1 DFSMS and ISPF, along with optional product IBM Data Set Commander for z/OS V8.1 (formerly known as IBM ISPF Productivity Tool for z/OS) - FMID HIQI810. PDSE member generations allows you to have multiple copies or versions of a member.

Section 2 - Prerequisites

In order to utilize PDSE member generations, you need to be running z/OS 2.1 with the following APARs (as always check for other APARs prior to implementation):

- ISPF APARs OA42247 and OA42248
- DFSMS APAR OA42358

If you wish to use IBM Data Set Commander (DSC) for z/OS for PDSE member generations, you need to run DSC V8.1 with APAR OA45103 (and pre-reqs).

Section 3 – Enabling PDSE Member Generations Support

Here are the steps needed to enable PDSE member generations support:

1. Activate DFSMS parameter MAXGENS_LIMIT in IGDSMSxx.
2. After MAXGENS_LIMIT has been activated, allocate a V2 PDSE dataset and specify the number of member generations.

We'll go into a little more detail on these two steps.

First, you will need to update IGDSMSxx MAXGENS_LIMIT. The default is 0.
Here is the description from the z/OS 2.1 Initialization and Tuning Reference manual:

```
MAXGENS_LIMIT(0-2000000000)
      Specifies an upper limit for the MAXGENS parameter on the DD
      statement in JCL. MAXGENS specifies the number of generations for
      version 2 PDSEs.

      For information about the MAXGENS parameter, see z/OS MVS JCL
      Reference.

      Default: The default is 0.
```

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MAXGENS_LIMIT can be activated dynamically via **SET SMS=xx**. To display the current SMS options, issue MVS command **D SMS,OPTIONS**. Here is a short procedure on dynamically setting the MAXGENS_LIMIT parameter (of course you can also IPL to pick up the parameter):

1. Issue **D SMS,OPTIONS** to display current settings. Take note of the IGDSMSxx member that is in use.
2. Update IGDSMSxx with MAXGENS_LIMIT=yy
3. Activate IGDSMSxx member with **SET SMS=xx**
4. Issue **D SMS,OPTIONS** to verify MAXGENS_LIMIT was set properly.

It is up to the installation to decide what value to set. We set MAXGENS_LIMIT=100.

Now, what if you have a sysplex and only activated MAXGENS_LIMIT on one system in the sysplex. If a V2 PDSE dataset with member generations is allocated on a system in the sysplex which has MAXGENS_LIMIT activated, you will still be able to use member generations on the other system(s) in sysplex which do not have MAXGENS_LIMIT activated (assuming the pre-reqs are met). Of course, you will not be able to allocate a V2 PDSE dataset with member generations on those other systems.

Once MAXGENS_LIMIT has been activated, you can allocate a version 2 PDSE and specify the number of generations you want for the dataset. You can do this through ISPF or through JCL. Here is an example of how to allocate a version 2 PDSE with the number of generations, MAXGENS, in JCL/batch:

```
//ALLOC    EXEC PGM=IEFBR14
//PDSE2    DD DSN=MROTTER.PDSE2.FB80,
// DSNTYPE=(LIBRARY,2),MAXGENS=10,
// RECFM=FB,LRECL=80,
// UNIT=SYSALLDA,SPACE=(CYL,(1,1,1)),
// DISP=(,CATLG,DELETE)
```

For our testing, we will use ISPF. Before allocating the dataset, you need to verify that the ISPF "Enhanced member list for Edit, View, and Browse" option is selected. To do this, go into ISPF 3.4, enter a dsname level, and press <Enter>. On the DSLIST panel - ISRUDSL0, select the Options pulldown and then select option 1 "1. DSLIST Settings..." and press <Enter>. On the ISRDLSET panel, verify "Enhanced member list for Edit, View, and Browse" is selected:

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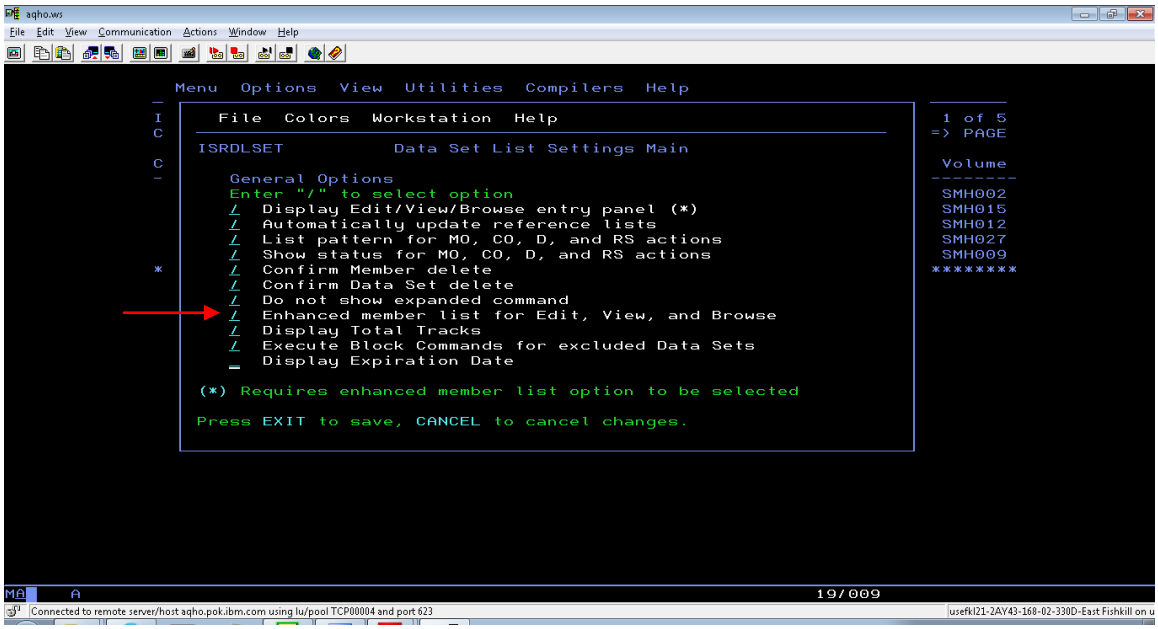

Figure 1 - ISPF DSLIST options panel

To allocate the dataset in ISPF, you need to specify Data set name type = LIBRARY, Data set version = 2 and enter a value for the number of generations:

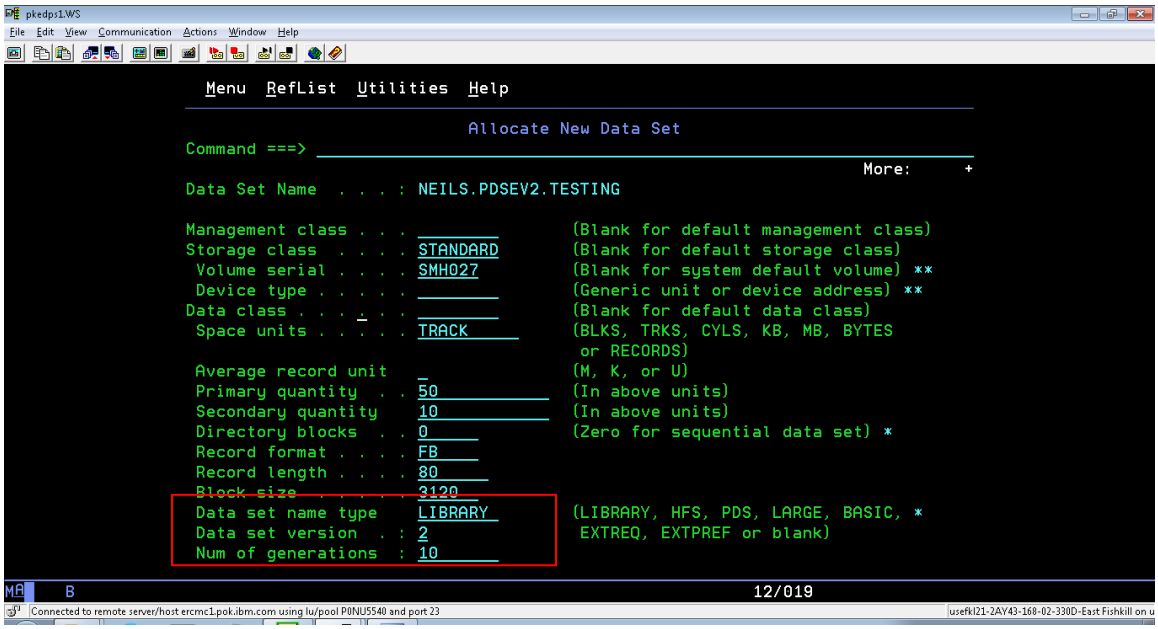

Figure 2 - ISPF 3.2 allocate new dataset panel

You need to specify the number of generations; if you leave it blank you will get an error. (At the time of this paper, APAR OA45426 has been created to allow a user to create a version 2 PDSE dataset without specifying "Num of generations", i.e. 0 member generations. Note: you can specify 0 for the "Num of generations" to allocate a V2

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PDSE without member generations. An obvious question would be why would you want to do that? V2 PDSE has performance improvements, see the SHARE presentation in the reference section).

If you don't have the MAXGENS_LIMIT parameter activated (i.e. the IGDSMSxx PARMLIB member), you will get the following error:

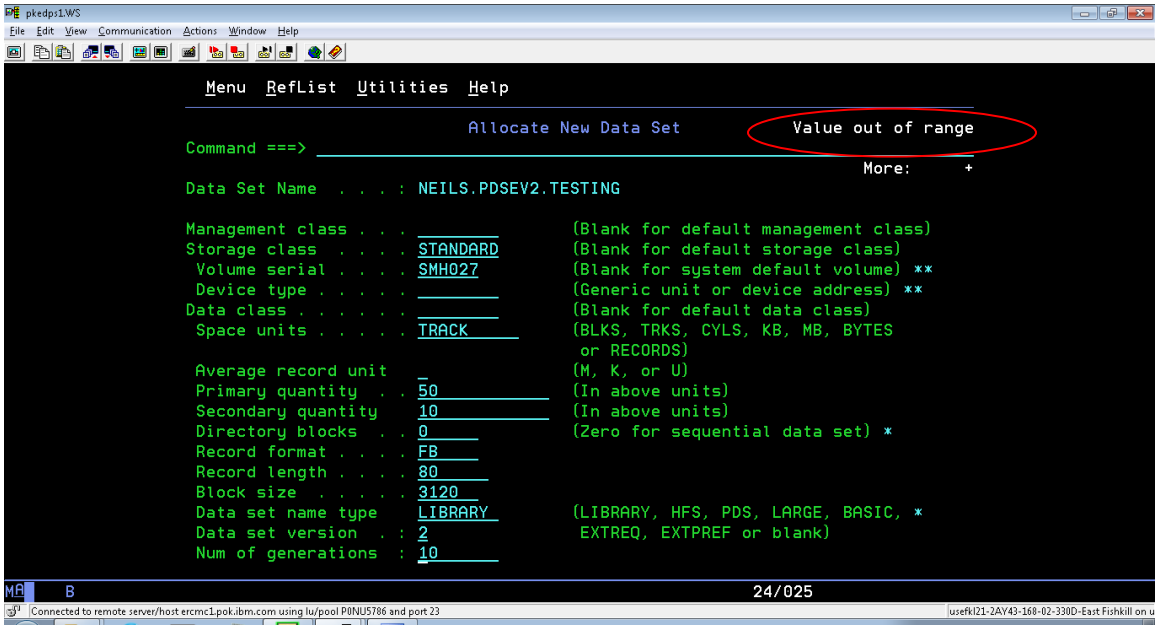

Figure 3 - ISPF 3.2 allocate error, MAXGENS_LIMIT not set

You can press <PF1> to get an expanded message description.

Once you have allocated the dataset, you can go into ISPF 3.4 and place an “S” next to the dataset to confirm that the dataset version is 2 and the number of generations is correct:

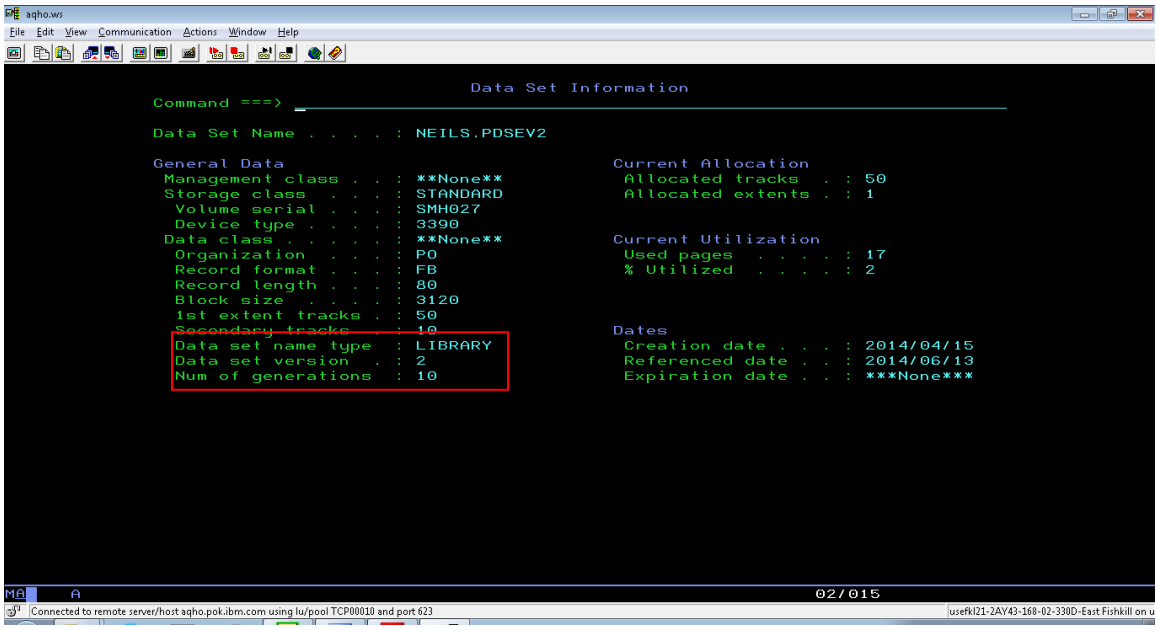

Figure 4 - ISPF 3.4 Data Set Information panel

Now we can create a new member and use the member generation support. Go into ISPF to edit/create the new member. After you are done editing the member and you are ready to save, issue SAVE NEWGEN. Then press <PF1> right after you get the message that the member has been saved. You will see a pop-up message on the bottom:

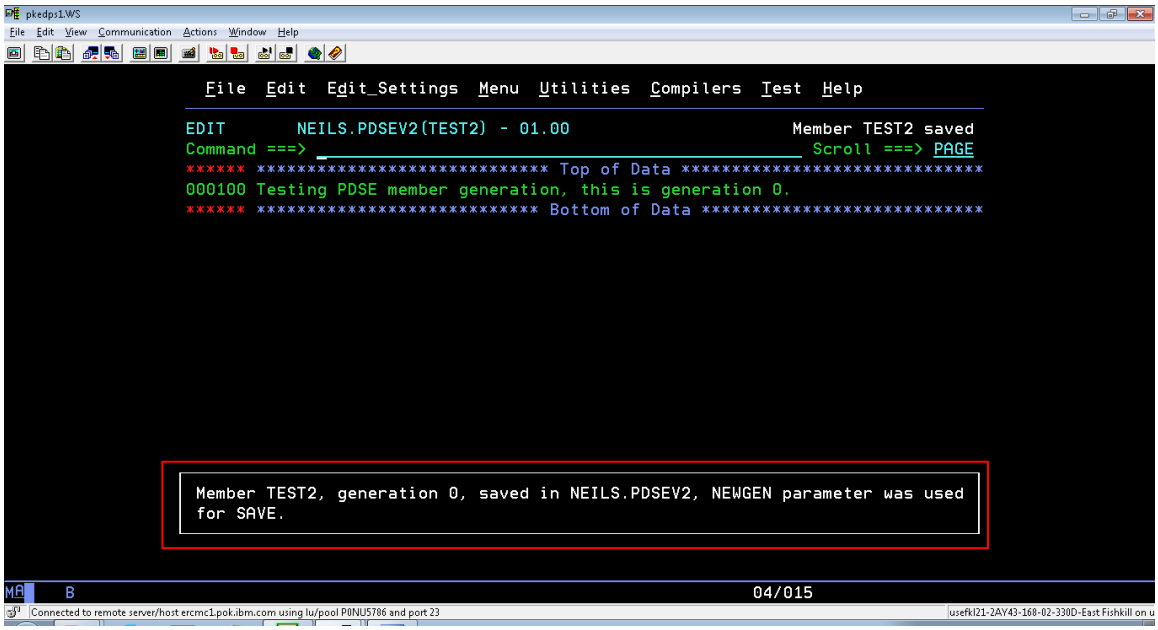

Figure 5 - ISPF pop-up message with SAVE NEWGEN

Generation 0 is always the latest or current generation. Unfortunately with ISPF, there is no way to display all the generations you have created. You will need to use the IBM

Data Set Commander for z/OS product (DSC); which is a separately orderable product. We will discuss DSC later on in this document.

Now, if we edit the same member, add a line and issue SAVE NEWGEN, then press <PF1>, notice we get the same message on the bottom – that ISPF saved the member to generation 0. Generation 0 is the latest or current generation, so updates are saved to that generation:

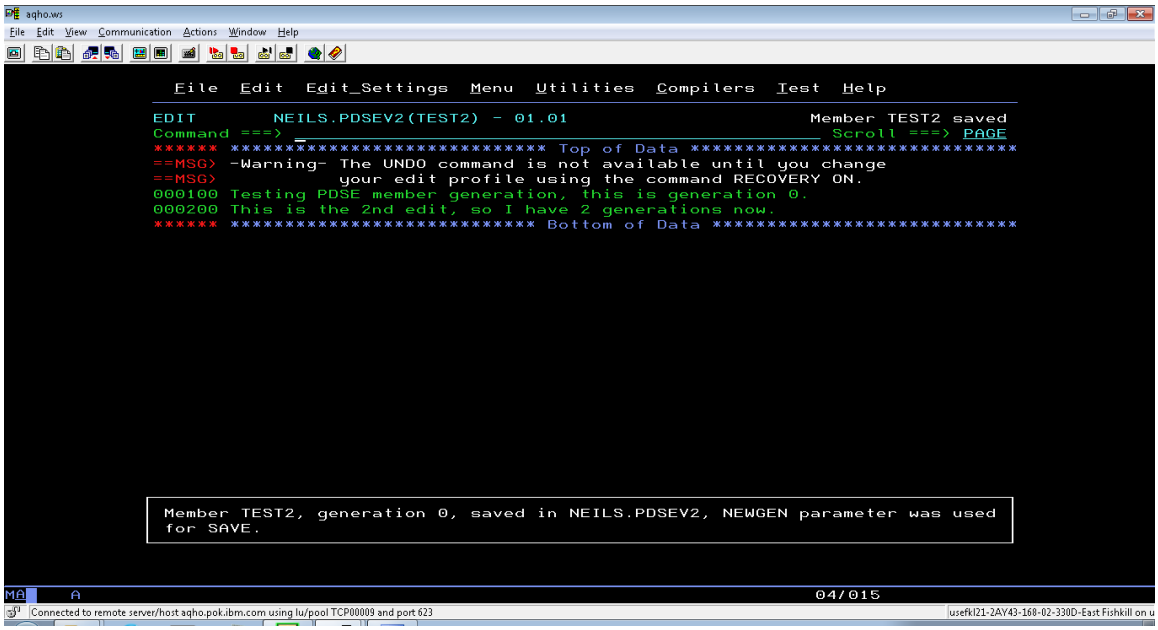

Figure 6 - ISPF pop-up message with SAVE NEWGEN

At the time of this document, ISPF does not indicate how many versions have been saved, but this can be done with DSC.

The new member has been saved and we now have 2 generations (generation 0 and relative generation -1) of the member called TEST2.

If we want to edit the first version (original version); which will be relative generation -1, go into ISPF 3.4 (note you cannot use ISPF 2), edit the dataset, then edit the member by placing an ‘e’ next to the member, and then place a / in the prompt field:

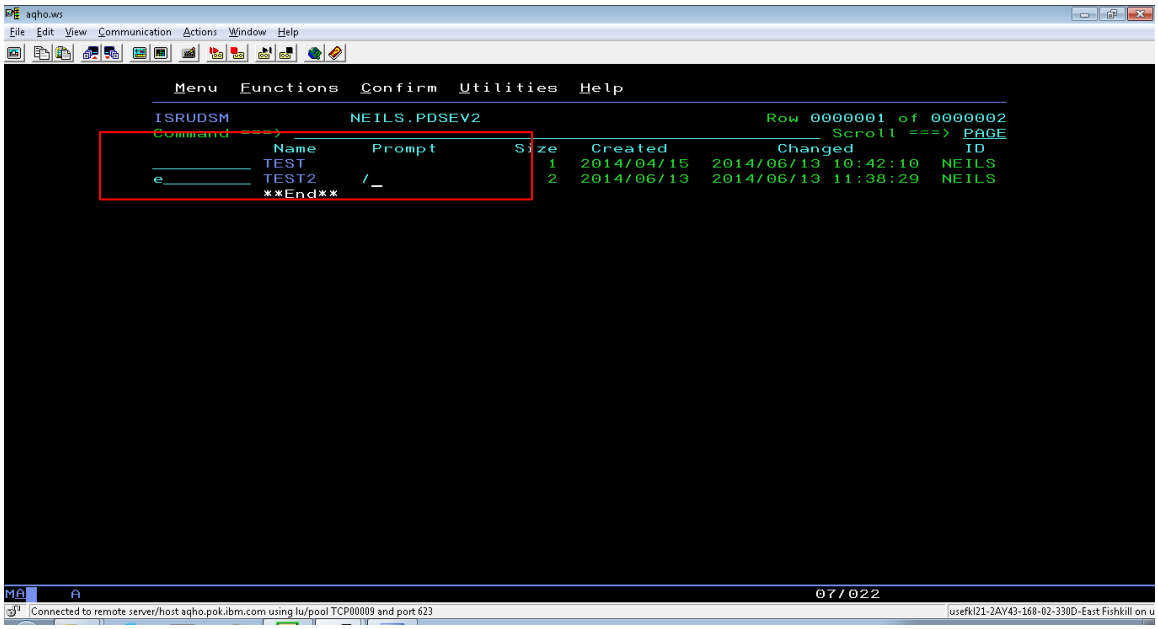

Figure 7 - ISPF 3.4 enhanced member list panel

This brings up the pop-up edit screen. Now we will specify which relative generation we want, in this case -1:

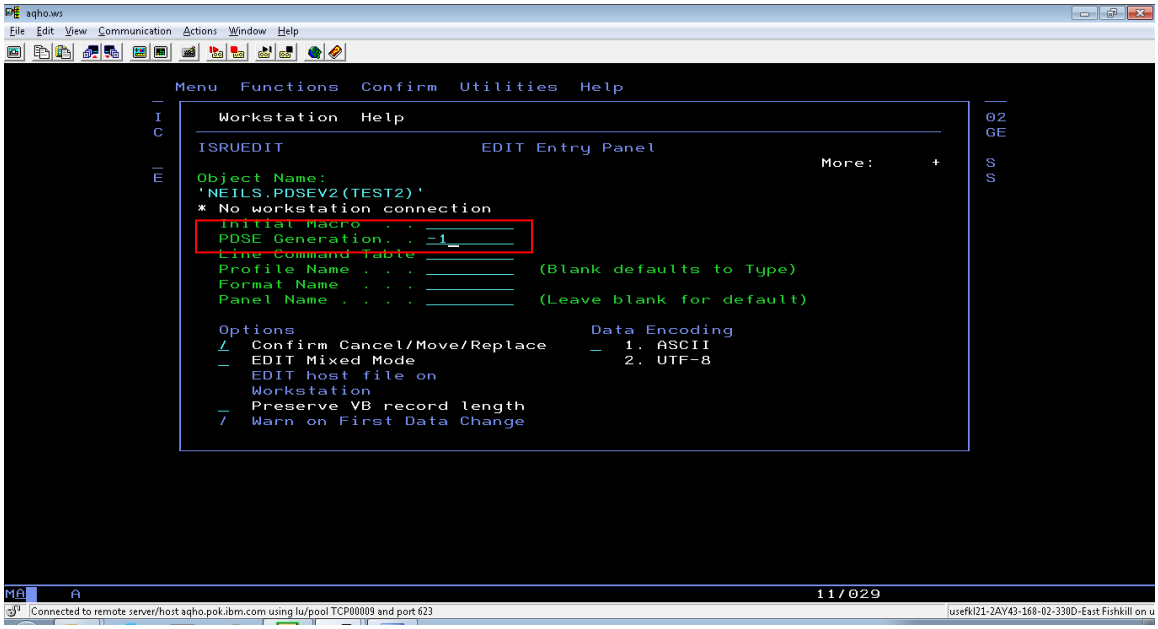

Figure 8 - ISPF 3.4 Edit Entry Panel – specify relative PDSE Generation number

Press <Enter> and we get the original member! Also note that ISPF issues a warning message, letting us know that there is a more recent version:

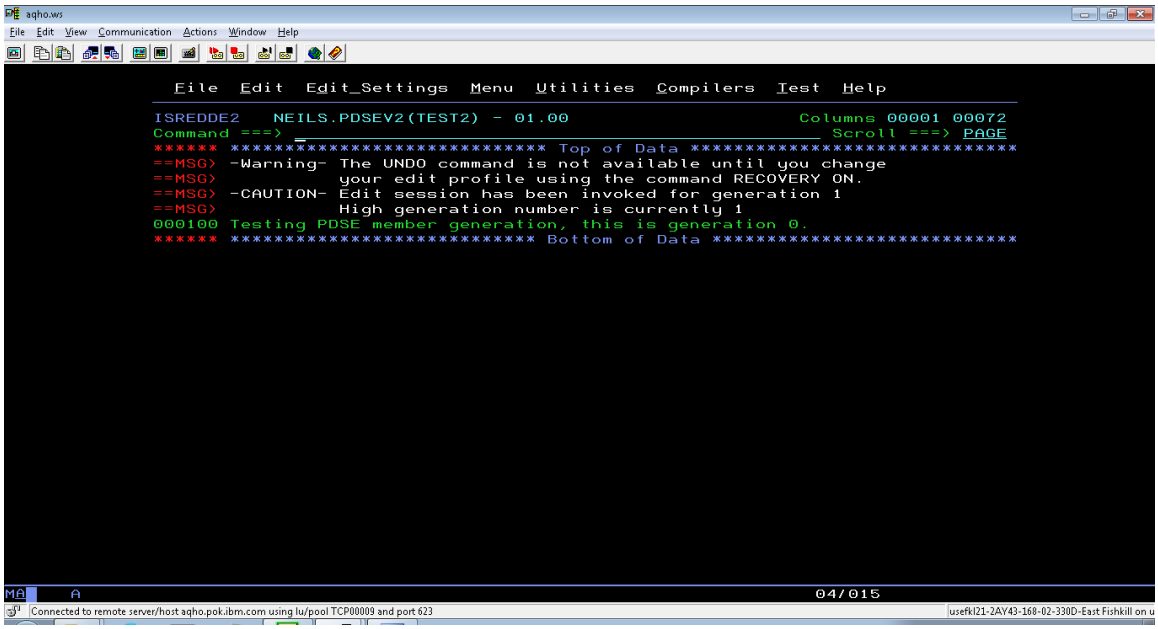

Figure 9 - ISPF Edit warning - higher generation available

You probably noticed that the ISPF warning message states generation 1, but we specified relative generation -1 on the edit panel. There are two types of generation concepts, absolute and relative. The absolute numbering scheme is GEN(n), GEN(n-1), GEN(n-2) and the relative numbering scheme is GEN(-1), GEN(-2), GEN(-n); where n is nth generation created. For absolute generations, generation n is closest to the most recent version and generation 1 is the oldest version. For relative generations, generation -1 is closest to the most recent and –n is the oldest version. See the Share presentation in the reference section for further details. Review table 1 in the next section for the numbering schemes. The ISPF warning message displays the absolute generation number.

So on ISPF panel ISRUEDIT, you can specify either the absolute generation or the relative generation number. See figure 13 on how to display the absolute and relative generation numbers in DSC.

Section 4 – Data Set Commander for z/OS Member Generation Support

Now, we will move on to the IBM Data Set Commander for z/OS (DSC). Once you are in DSC, enter command **ISET M** to get the Member Selection List options. Ensure that the PDSE member generations support is enabled, by placing a “Y”:

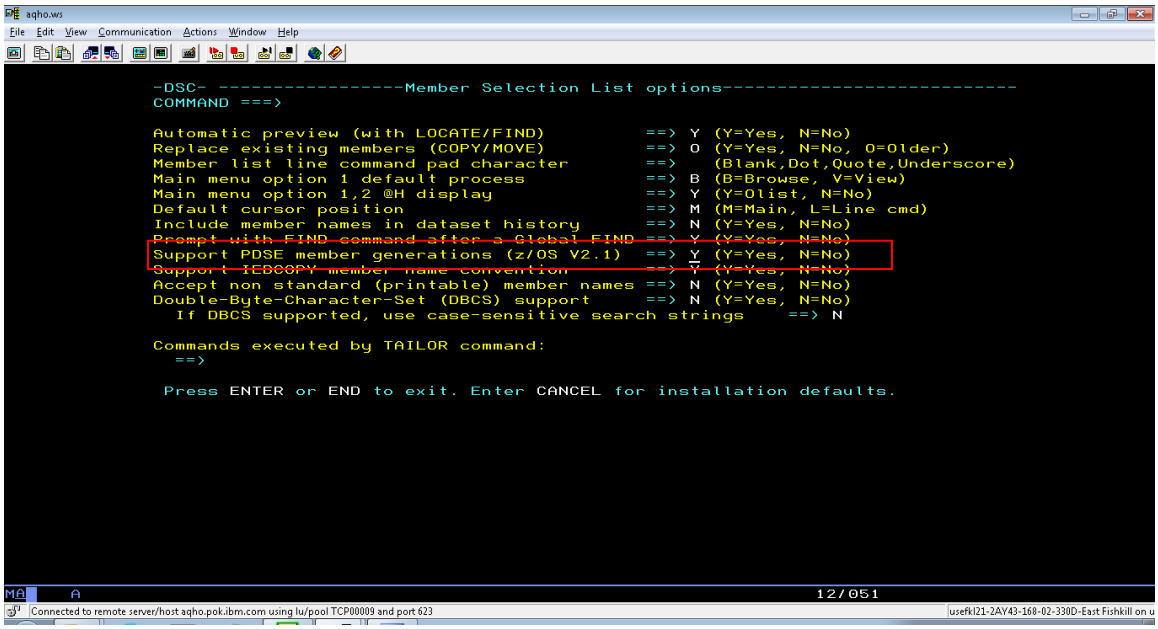

Figure 10 - DSC ISET Member Selection List panel

Press <Enter> to exit the screen. Now, go into ISPF 3.4 and edit the member. On this screen, DSC will show you all the different member generations you created. Column GENER displays the relative generation number:

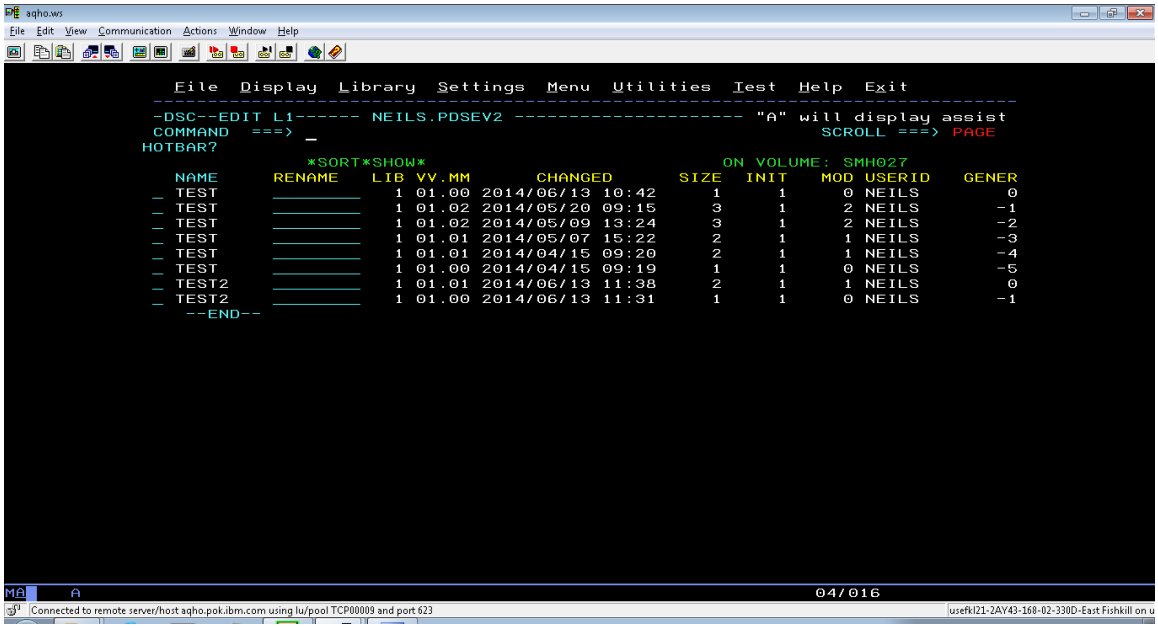

Figure 11 - DSC Edit panel - multiple generations

And then you can edit the appropriate member generation.

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If you want to see the relative and absolute generation numbers, go into the dataset member list and place an 'I' next to the member and press <Enter>:

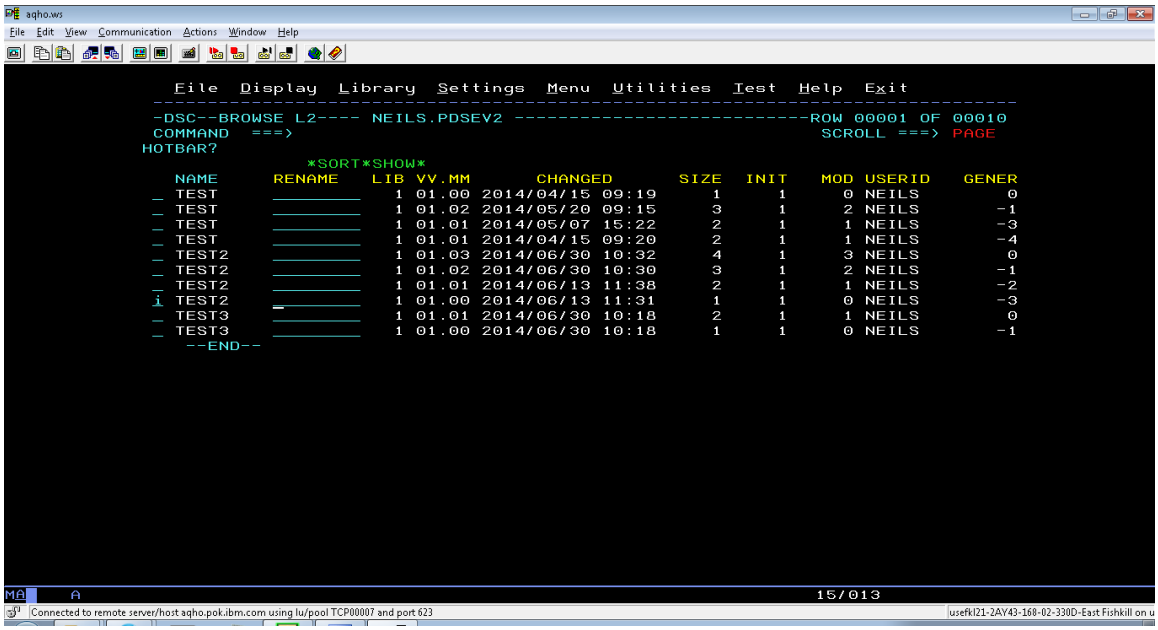

Figure 12 - DSC member list

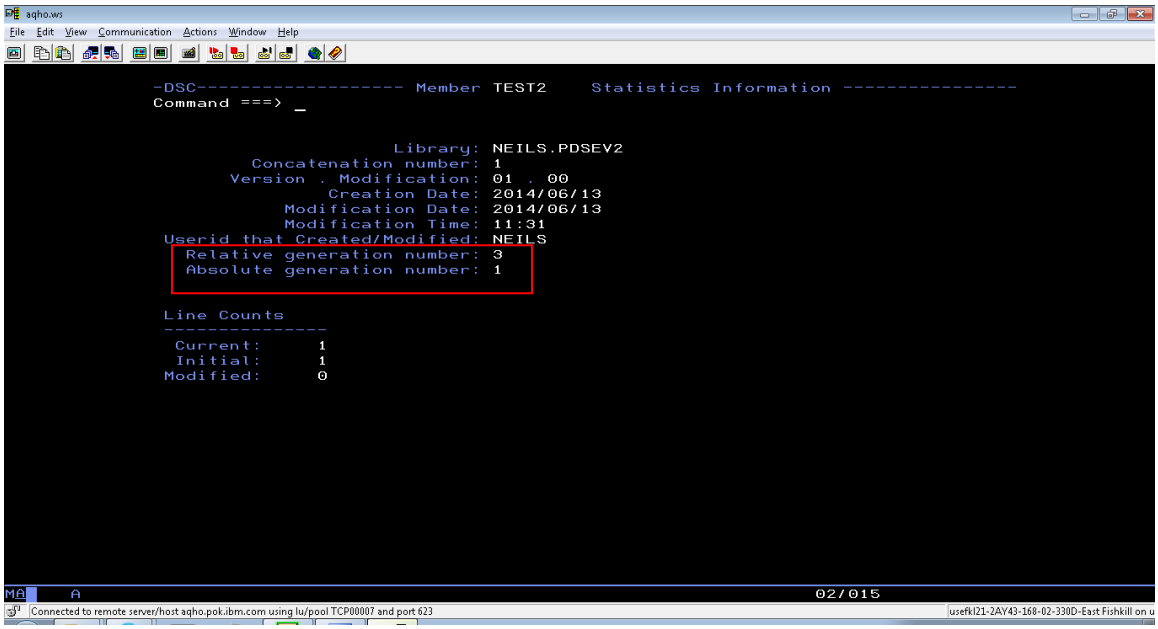

Figure 13 - DSC member list information

Table 1 shows an example of the relative and absolute numbering schemes for member called TEST (note DSC does not show the leading minus sign for the relative generation number). Notice that for generation 0, DSC displays the absolute generation number as the highest generation number:

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TEST member version #	Relative #	PDSE Absolute #	DSC Absolute #
Latest/current version or 4th version	0	0	4
3rd version	-1	3	3
2nd version	-2	2	2
1st version/oldest or original	-3	1	1

Table 1 - Relative and absolute generation numbers

Let's take this further and discuss what happens when the number of generations wraps. In this example the number of generations = 5 for the PDSE and member ABC001 has been saved with SAVE NEWGEN 9 times:

ABC001 member version #	Relative #	PDSE Absolute #	DSC Absolute #
Latest/current version or 10th version	0	0	10
9th version	-1	9	9
8th version	-2	8	8
7th version	-3	7	7
6th version	-4	6	6
5th version	-5	5	5

Table 2 - Relative and absolute generation numbers wrapping

Now, we'll go back to DSC settings. If you want to have the default SAVE setting set to SAVE NEWGEN, use the DSC command ISET E to set your edit preferences:

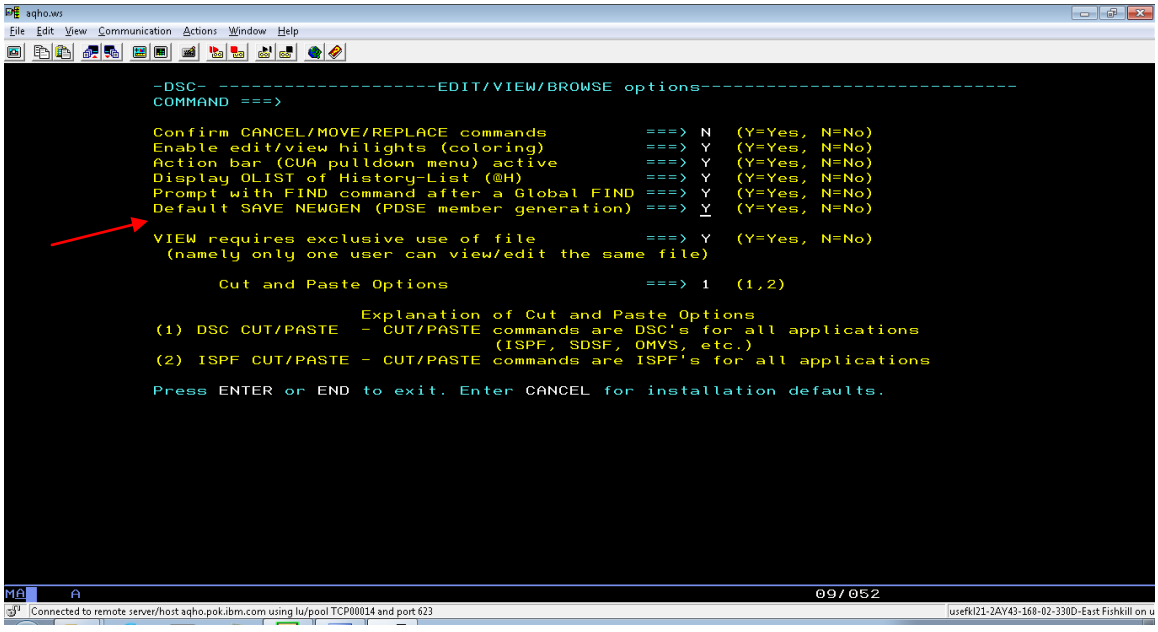

Figure 14 - DSC ISET E panel

The following DSC MSL commands can manipulate member generations:

COPY MOVE DELETE EDIT BROWSE VIEW GENRECOV
Note: use the MSL A command to get online assist of those commands and use them with member generations.

In addition to manipulating PDSE member generations interactively, the DSC batch utility IQIBUTIL also supports PDSE member generations. The following are some examples of invoking IQIBUTIL:

Example 1 – Copy dataset members prefixed with MEM and their PDSE member generations:

```
//*****************************************************************
//* COPY members along with all their generations.
//*
//*@Note: ALLGEN keyword also implies REPLACE same name members
//*
//*****************************************************************
//IQIBUTIL EXEC PGM=IQIBUTIL,REGION=0M,
//         PARM='LIST=YES'
//STEPLIB  DD   DISP=SHR,DSN=SYS1.SIQILOAD
//IQIBUDFL DD   DISP=SHR,DSN=SYS1.SIQIPLIB
//SYSPRINT DD   SYSOUT=*
//OPDSE    DD   DISP=SHR,DSN=MROTTER.PDSE2.SRC2
//IPDSE    DD   DISP=SHR,DSN=MROTTER.PDSE2.SRC1
//SYSIN    DD *
  COPYGRP I=IPDSE,O=OPDSE,ALLGEN
  S M=MEM*
//
```

Figure 15 – Example 1 - DSC IQIBUTIL - copy members and their generations

Example 2 – Delete dataset members prefixed with MEM and their PDSE member generations:

```
//*****************************************************************
//* DELETE members along with all their generations.
//*
//*@Note: ALLGEN keyword may be specified in PARM
//*@Note: target dataset may be dynamically allocated via OUTDSN=
//*
//*****************************************************************
//IQIBUTIL EXEC PGM=IQIBUTIL,REGION=0M,
//         PARM='LIST=YES,ALLGEN'
//STEPLIB  DD   DISP=SHR,DSN=SYS1.SIQILOAD
//IQIBUDFL DD   DISP=SHR,DSN=SYS1.SIQIPLIB
//SYSPRINT DD   SYSOUT=*
//SYSIN    DD *
  DELETE OUTDSN=(MROTTER.PDSE2.SRC2,OLD)
  S M=MEM*
```

Figure 16 – Example 2 - DSC IQIBUTIL - delete members and their generations

Example 3 – Copy dataset members prefixed with MEM and their generations, then delete all members including generation 0, but leave the member generations. Note – this will leave orphaned member generations without generation 0. You can recover the most recent member generation as generation 0 in batch with the DSC RECOVGEN command (see Example 4).

```
//*******************************************************************
//* COPY members along with all their generations.
//* DELETE members (generation 0) without their generations.
//*
//*@Note: ALLGEN keyword specified in EXEC PARM is the default
//*@Note: NOGEN keyword specified in statement overrides the default
//*
//*******************************************************************
//IQIBUTIL EXEC PGM=IQIBUTIL,REGION=0M,
//         PARM='LIST=YES,ALLGEN'
//STEPLIB  DD   DISP=SHR,DSN=SYS1.SIQILOAD
//IQIBUDFL DD   DISP=SHR,DSN=SYS1.SIQIPLIB
//SYSPRINT DD   SYSOUT=*
//OPDSE    DD   DISP=SHR,DSN=MROTTER.PDSE2.SRC2
//IPDSE    DD   DISP=SHR,DSN=MROTTER.PDSE2.SRC1
//SYSIN    DD *
STEP1  COPYGROUP I=IPDSE,O=OPDSE
         S M=MEM*
STEP2  DELETE O=OPDSE,NOGEN
         S M=MEM*
//
```

Figure 17 – Example 3 - DSC IQIBUTIL - copy all members and their generations, then delete generations, including generation 0, but leave member generations

Example 4 – Recover most recent generation (if no member generations were deleted, relative generation -1 would be recovered as generation 0) for member names prefixed with MEM

```
//*
//*******************************************************************
//* RECOVGEN of most recent previous version
//*
//*@Note: most recent relative generation will become generation 0
//*
//*******************************************************************
//IQIBUTIL EXEC PGM=IQIBUTIL,REGION=0M,
//         PARM='LIST=YES'
//STEPLIB  DD   DISP=SHR,DSN=SYS1.SIQILOAD
//IQIBUDFL DD   DISP=SHR,DSN=SYS1.SIQIPLIB
//SYSPRINT DD   SYSOUT=*
//OPDSE    DD   DISP=SHR,DSN=MROTTER.PDSE2.SRC2
//SYSIN    DD *
       RECOVGEN O=OPDSE
         S M=MEM*
//
```

Figure 18 – Example 4 - DSC IQIBUTIL - recover most recent generation

Example 5 – List directory members and their PDSE member generations:

```
//*********************************************************************
//* List directory entries of all members and generations
//*********************************************************************
//IQIBUTIL EXEC PGM=IQIBUTIL,REGION=0M,
//         PARM='LIST=YES'
//STEPLIB  DD   DISP=SHR,DSN=SYS1.SIQILOAD
//IQIBUDFL DD   DISP=SHR,DSN=SYS1.SIQIPLIB
//SYSPRINT DD   SYSOUT=*
//IPDSE    DD   DISP=SHR,DSN=MROTTER.PDSE2.SRC1
//MEMLIST  DD   SYSOUT=*
//SYSIN    DD *
       LISTDIR  O=MEMLIST,I=IPDSE,ALLGEN
//
```

Figure 19 – Example 5 - DSC IQIBUTIL - list member generations

Note: IQIBUTIL is fully compatible to IEBCOPY and provides additional functions as well.

If SYS1.SIQILOAD is in LINKLIST and member SYS1.SIQIPLIB(IQIDFLTS) is stored in PARMLIB you can remove DD IQIBUDFL and STEPLIB from the JCL.

Section 5 - References

APAR OA42247 ISPF PDSE Member Generation SPE overview:
ftp://public.dhe.ibm.com/software/websphere/awdtools/ispf/OA42247.pdf

SHARE 2014 Anaheim presentation: “The Future of PDSE: The Version 2 Format”:
https://share.confex.com/share/122/webprogram/Session15083.html

IBM Data Set Commander for z/OS library:
http://www-01.ibm.com/software/awdtools/data-set-commander/library/