

Migrating to a 64-bit operating system: Quick pointers

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ABSTRACT

The 64-bit operating environment becomes the new commodity platform and beginning with SAS 9.2, you can now choose to run 64-bit SAS on Windows x64. Since the 64-bit environment removes the 2GB of memory limit that exists on 32-bit machines, it may sound interesting to take advantage of it. It is certainly worth discussing and exploring what you are getting yourself into prior to migrating to such environment and how to best be prepared for a smooth migration in order to reduce the amount of unexpected surprises.

This paper discusses what you should consider when changing your current 32-bit Windows operating system to a new 64-bit Windows platform and potential impacts you should anticipate for your SAS programs and related data files.

INTRODUCTION

You may be a long way to your new 64-bit operating environment or just a few days, but how will you know if you are fully prepared and ready to move all your SAS programs and related files to this new environment? The purpose of this paper describes what I would have liked to know prior to getting myself into such a project. It will also help to answer the following questions:

- Will my programs continue running once on the new platform and will modifications be required?
- Will I need to "convert" my data files?
- Will the process of exchanging files within or outside my organization be impacted?
- Should I expect other differences?

The specific project I had to face was a migration of a 32-bit Windows PC environment to a 64-bit Windows Server platform. Some differences may exist between a 64-bit Windows 2008 R2 Enterprise platform and a 64-bit Windows 7 platform. Make sure you have the correct information about your environment when investigating the possible differences. In addition to a 64-bit platform, the version of the operating system can also make a significant difference. Luckily, the 2008 R2 operating system is similar enough to the popular XP version, limiting some of the undesired changes.

IMPLEMENTATION

It is now inevitable, your new operating system will be a 64-bit. Whether it was announced, imposed or planned (hopefully the latter), this makes you realize that everything you have done so far when using SAS was done using a 32-bit operating system and you didn't really have to worry about a thing.

What matters now is to ensure you will have sufficient amount of time and resources to fully test your existing programs under your new future environment. The more existing programs you have, the more testing you should plan. Having a test environment ahead of time is a good way to test and anticipate potential changes, before all systems are upgraded.

Finally, a new operating system will often be accompanied with a new version of surrounding applications, including Microsoft Office. While changing from Office 2003, 2007 and 2010 may not be directly related to a new 64-bit environment, it may contribute to new behaviors in your SAS programs and require some adjustments.

VALIDATION

Qualifying the new environment, especially when dealing with a new dedicated server, as opposed to a regular PC deployment, will be necessary. In such case, specific validation steps must be followed carefully and documentation (Validation Plan, User Requirements Specifications, Test Scripts, Acceptance Criteria, Validation protocols and reports for IQ/OQ/PQ, etc.) must be completed accordingly. Validation is not discussed in this paper and has been published elsewhere (Truong, Smoak, PharmaSUG 2011).

Ensure that proper documentation exists and complies with your organization's Standard Operating Procedures.

TESTING

The amount of testing you will need to perform is directly proportionate with the amount of existing processes, programs, macros, etc. you are currently using and interested to continue using and moving to your new environment.

Your tests should include some of the procedures surrounding data input/output (I/O) including reading and writing from and to Microsoft Excel, Microsoft Word, PDF, comma delimited files, etc. Test your usual output creation programs. Take a sample of a program that creates a Table, Listing, Graph, Patient Profile, etc. Beware of older programs using older programming techniques, as they may not be as easily adaptable on your new environment.

DATA HANDLING

PROC MIGRATE

When moving an entire software application built in SAS, consider using the MIGRATE procedure, that comes fully equipped for this type of migration. PROC MIGRATE not only copies or moves a library to the target installation, it also changes the members' file format to that of the most recent release of SAS, enabling you to exploit the full capabilities of the software. Additional information about PROC MIGRATE is available here:

<http://support.sas.com/rnd/migration/procmigrate/index.html>.

CEDA

The Cross-Environment Data Access (CEDA) is a Base SAS feature that enables a SAS file that was created in a directory-based operating environment to be processed on a platform that is different from the platform on which the file was created. For example, CEDA is useful if you have upgraded to a 64-bit platform from a 32-bit platform.

With CEDA, you do not need to create a transport file, use other SAS procedures or change your SAS program. CEDA is available for files that are created with SAS 7 and later releases. Starting in SAS 9, by default, SAS writes a message to the log when is used.

Log Sample

```
NOTE: Data file ADAM.ADAE.DATA is in a format that is native to another host, or
the file encoding does not match the session encoding. Cross Environment Data
Access will be used, which might require additional CPU resources and might reduce
performance.
```

Log 1. NOTE message displayed by CEDA

As noted in the log message, CEDA translations might require additional resources. In addition, CEDA has a list of restrictions that limits its use. To better understand when you can or not use CEDA, refer to <http://support.sas.com/documentation/cdl/en/lrcon/62955/HTML/default/viewer.htm#a002143983.htm>.

DATA REPRESENTATION

When you start dealing with data traveling across environments, it is worth learning about the Data Representation of a data set. Its value is displayed each time you perform a PROC CONTENTS. In the example below, the value "WINDOWS_64" indicates the file was created under a Windows 64-bit operating environment. A complete list of values is available at (look for *Compatibility across Environments* table):

<http://support.sas.com/documentation/cdl/en/lrcon/62955/HTML/default/viewer.htm#a002143983.htm>

Output Sample

The CONTENTS Procedure			
Data Set Name	WORK.TEST	Observations	1
Member Type	DATA	Variables	1
Engine	V9	Indexes	0
Created	Tuesday, August 23, 2011 07:20:07 AM	Observation Length	8
Last Modified	Tuesday, August 23, 2011 07:20:07 AM	Deleted Observations	0
Protection		Compressed	NO
Data Set Type		Sorted	NO
Label			
Data Representation	WINDOWS_64		
Encoding	wlatin1 Western (Windows)		

Output 1. PROC CONTENTS – Data Representation

OUTREP

By default, when you create a new file, SAS uses the data representation of the CPU that is running SAS. You can specify the OUTREP= option to override this default.

The OUTREP= option is both a SAS data set option and a LIBNAME statement option. The data set option applies to an individual file. The LIBNAME statement option applies to an entire library.

Example of OUTREP in a data set option, forcing the creation of a 32-bit data set, from a 64-bit SAS application:

```
data two(outrep=WINDOWS_32);
  set one;
  <more SAS statements>;
run;
```

Example of OUTREP in a LIBNAME statement option, copying an entire 32-bit library to a 64-bit library:

```
libname source '~pathname-to-source-library'; * 32-bit library;
libname target '~pathname-to-target-library' outrep=WINDOWS_64;
proc copy in=source out=target noclone memtype=data;
run;
```

The CLONE|NOCLONE specifies whether to copy the following data set attributes: size of input/output buffers, whether the data set is compressed; whether free space is reused; data representation of input data set, library or operating environment; encoding value; etc.

In this example, we want to create a new 64-bit version of the data sets. Because the data representation must be changed, it is why the value is set to NOCLONE.

FILE TYPES COMPATIBILITY

There is no general answer to whether or not your SAS files will be fully compatible across environments without knowing which features are used in your data sets. Some features can easily be avoided in order to make a more

flexible environment while maintaining an efficient environment in the pharmaceutical industry: integrity constraints, audit trails and indexes are example of features which can limit the use of CEDA and generate additional work for your organization when exchanging data in or outside your function groups.

SAS DATA SET FILES (SAS7BDAT)

In general, SAS data sets are compatible across 32-bit and 64-bit environments. In most cases*, CEDA can transparently process your files without any required changes to your existing programs.

* See restrictions of CEDA at:

<http://support.sas.com/documentation/cdl/en/lrcon/62955/HTML/default/viewer.htm#a002143983.htm>

If necessary due to CEDA restrictions, you can use the following methods in order to move files across operating environments:

- XPORT engine with the DATA step or PROC COPY
- XML engine with the DATA step or PROC COPY
- CPORT and CIMPORT procedures
- Data transfer services in SAS/CONNECT software
- Remote library services in both SAS/CONNECT and SAS/SHARE

SAS CATALOGS (SAS7BCAT)

SAS Catalogs are not compatible between 32-bit and 64-bit environments (and vice-versa). While SAS catalogs can contain different type of entries (key definitions, window definitions, help windows, formats, informats, macros or graphic output), in our case, catalogs contained only Formats or compiled SAS Macros. In either case, a transport file will need to be created in order to replicate the information in the new environment.

Because Catalogs are not supported in the XPORT library, you must create transport files using CPORT and CIMPORT procedures.

For compiled macro catalogs, you have a couple of options: re-compiling your macros in a new 64-bit catalog. This methods may require maintaining two parallel set of macros (at least until you are completely done with your former 32-bit environment), which may not be optimal. Another solution is avoiding compiled macro catalogs by referencing the source code, for example with the SASAUTOS system option. This solution is by far the most efficient for our organization but may not always be available if you do not have the source code. If you have received a compiled macro catalog from an external vendor, ask them to provide you with the source code or a 64-bit compiled catalog.

SAS ITEM STORE FILES (SAS7BITM)

Your organization may have decided to create Item Store files to store their standard templates (e.g. PROC TEMPLATE for RTF outputs). Item Store files are not compatible across 32-bit and 64-bit environments. A fast solution is to re-create them under your new environment, using the same program that created the original file and by changing the output destination of your new files, preferably a different directory to avoid mixed cases of 32-bit and 64-bit in the same directory.

SAS TRANSPORT FILES (XPT)

When exchanging files across organizations or when submitting data to the Agency, the XPORT Transport file format is the most reliable method. It is platform independent and will honor the platform where it will be extracted.

PC FILES SERVER

SAS running on 64-bit Windows on a local host traditionally cannot access PC files on the local host. The required 32-bit ODBC drivers are incompatible with SAS on 64-bit Windows PC Files Server. This can happen if you work with SAS 64-bit on a 64-bit Windows 7 environment. Installation of PC Files Server on the same PC will be required. For additional information, read here:

<http://support.sas.com/documentation/cdl/en/acpcref/63184/HTML/default/viewer.htm#a003353773.htm>.

PROGRAMMING CHANGES

Changes attributable only to a new 64-bit operating environment are not easy to single out due to the fact that your new operating environment will most likely come with a different set of applications (e.g. Microsoft Office). So it becomes a mission of testing your existing programs under this new environment and comparing the results to determine the impact of your migration.

READ/WRITE PROCEDURES

Test every Input/Output procedures/programs you already have. Bring a test case for each different method to ensure proper functionality under your new operating environment. Compare your new results with the results obtained on your 32-bit platform and make sure you have the same results or that differences are expected or can be explained and fixed. Here is a short list of those methods I recommend you test: PROC EXPORT (dbms option), PROC IMPORT (dbms option), LIBNAME using Excel engine (PCFILES engine and mixed option), ODS features to output files (RTF, PDF), INFILE, FILE and INPUT.

In addition, other programs carrying older programming techniques may bring some surprises. For example, when using the PIPE engine. An error message might appear and the data step will not run completely. The same behavior has been observed on a Windows 7 x64 and Windows 2008 R2 Enterprise x64 bit server version. For more information, consult the Problem Note #41863: <http://support.sas.com/kb/41/863.html>. If necessary, consider replacing the code with newer available SAS functions (e.g. filename, dopen, dread, etc.) and avoid using PIPE altogether.

SAS OPTIONS

Make sure your system options (whether you make them global in your configuration file or buried inside your programs) are well tested for consistent results. This was the case for the option HELPBROWSER, which has a default value of "SAS" on the 32-bit system, but was changed to "REMOTE" on the 64-bit server. The change of value generated a Connection Failed error when creating output files using ODS features. To avoid this message, we needed to change the value back to "SAS".

FLEXIBLE PROGRAMMING METHODS

Allowing flexibility in some programs can be a valuable approach while maintaining more than one running operating environments within your organization. For example, test the value of the automatic macro variable SYSSCPL and introduce some conditional branching that will take care of some differences in programming from one platform to another.

For the full list of SYSSCPL values, refer to the following page:

<http://support.sas.com/documentation/cdl/en/mcrolref/61885/HTML/default/viewer.htm#z3514sysscp.htm>

CONCLUSION

Testing a new operating environment is a fastidious and challenging task. Whether you have a deployment of Windows 7 x64 PC or transfer your 32-bit SAS application to a new 64-bit server, ensure you have a chance to test this new environment ahead of time. Determine what will contribute to a successful list of acceptance criteria, test and compare your results across operating environment, adapt your code with flexible solutions (e.g. by using the automatic macro variable SYSSCPL) and train your team of programmers on expected changes.

Do not underestimate time and resources to allocate to such a project. Allow for some time post-deployment to adapt to any unexpected issues you may and will probably encounter.

REFERENCES

- SAS® 9.2 Language Reference: Concepts, Second Edition; "SAS File Processing with CEDA". Available at: <http://support.sas.com/documentation/cdl/en/lrcon/62955/HTML/default/viewer.htm#a002143983.htm>

Migrating to a 64-bit operating system: Quick pointers, continued

- SAS/ACCESS® 9.2 Interface to PC Files: Reference, Second Edition; “PC Files Server Autostart”. Available at: <http://support.sas.com/documentation/cdl/en/acpcref/63184/HTML/default/viewer.htm#a003353773.htm>
- Support.sas.com: KNOWLEDGE BASE / FOCUS AREAS; Migration, PROC MIGRATE Documentation. <http://support.sas.com/rnd/migration/procmigrate/index.html>
- PROC MIGRATE: How to Migrate Your Data and Know You've Done It Right, Diane Olson, SAS Institute Inc. http://dc-sug.org/ProcMigrate-DCSUG_files/frame.htm
- Migrating a SAS Deployment to Microsoft Windows for x64, Technical Paper, SAS Institute Inc. <http://support.sas.com/rnd/migration/papers/windows32-x64.pdf>
- Problem Note 41863: Problems using the PIPE engine in Windows 7 x64 operating system, available at: <http://support.sas.com/kb/41/863.html>
- Support.sas.com: Macro Language: Reference; SYSSCP and SYSSCPL Automatic Macro Variables <http://support.sas.com/documentation/cdl/en/mcrolref/61885/HTML/default/viewer.htm#z3514sysscp.htm>

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