Challenges in Moving to a Multi-tier Server Platform

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ABSTRACT

Moving from a simple server to a multi-tier server environment poses many challenges. The multi-tier server environment in this paper includes a physical application (SAS® version 9.3) server and a virtual metadata server. No mid-tier (web) server is included in this configuration. The SAS Management Console 9.3 is used to administer the metadata (users, groups, roles and permissions). Two types of clients (SAS Enterprise Guide and the SAS Add-in to Microsoft Office) are used to perform various tasks using the data on the application server. Challenges include: (1) validating SAS on a multi-tier system, (2) understanding and administering metadata using SAS Management Console, and (3) training users on Enterprise Guide and the Add-in to Microsoft Office. The business need for moving to this type of environment was to allow non-SAS users to have read-only access to SAS datasets to monitor and query clinical trial data. This can be accomplished through the Add-in to Microsoft Office. For example, Microsoft Excel can be used to open SAS datasets (read-only) and query them. Furthermore, stored processes (SAS programs) can be written in Enterprise Guide and made available to non-SAS users to run monitoring reports in Excel.

INTRODUCTION

Work on migrating from SAS 9.1.3 to SAS 9.2 and validating SAS 9.2 has been presented at WUSS (Truong, Smoak 2010) and PharmaSUG (Smoak, Truong 2011). These two papers describe the validation of the server system for SAS 9.2 which involved one SAS application server. The mantra of these papers was "don't underestimate the resources needed for the validation effort!" In the SAS 9.2 system the users used PC SAS to develop code and then at the time of database lock, users used Remote Desktop Connection (RDC) to connect to the SAS application server and run their programs in batch mode. Practical tips on migrating from a 32-bit to a 64-bit operating system was presented at PharmaSUG (Thibault 2012).

This paper describes a more complex multi-tier server platform for SAS 9.3 using a physical SAS application server and a virtual metadata server. The application server is a six core, 64-bit machine with 64 GB RAM, 2 TB of data storage and uses Windows 2008 RS as the OS.

SAS Management Console 9.3 administers the metadata (e.g., users, groups, roles and permissions) for this system. No mid-tier (web) server is included in this multi-tier platform. The SAS product purchased from the SAS Institute is called Office Analytics. If a web-tier was added then a Business Intelligence solution would be needed.

Moving t this multi-tier server platform fulfills a primary business need by allowing non-SAS users read-only access to SAS datasets to monitor and query clinical trial data. The SAS Add-in to Microsoft Office (AMO) allows non-SAS users to use Microsoft Excel to open SAS datasets (read-only) in a spreadsheet. Users can then query the data in Excel to do their monitoring.

Furthermore, SAS programmers can make code available as a stored process in SAS Enterprise Guide (EG). Stored processes are simply SAS programs with a metadata wrapper allowing non-SAS users to run a SAS program from an application other than SAS. In this case, a non-SAS user can access the stored process in Microsoft Excel and run the SAS code. For example, if the non-SAS user needs two or three SAS datasets merged to monitor a clinical trial, then a SAS programmer writes a simple SAS program to merge the required SAS datasets and create this merge of SAS datasets as a stored process. The stored process can then be run by the non-SAS user so that they can see the merged SAS datasets in an Excel spreadsheet. The non-SAS user can also produce an actual SAS report by running a stored process.

CHALLENGES

Three challenges I faced in implementing this particular multi-tier SAS server platform: validating the system, learning platform administration and training the users of the system.

CHALLENGE #1 - VALIDATION

Usually, validation involves three components:

· Installation Qualification (IQ) – verifies that the application (SAS) has been installed correctly on the servers (application and metadata) using checksums.

- Operational Qualification (OQ) – verifies that the application (SAS) operates correctly on the servers. For example, an OQ could test that the SAS PROCs function correctly.

- Performance Qualification (PQ) – verifies that the SAS system meets the user's business needs. For example, a stress test could be done to verify that multiple users can use the system at the same time.

The first two components (IQ and OQ) are relatively easy to perform since SAS supplies IQ and OQ test scripts. The PQ is a bit more difficult because the validator has to develop their own test scripts.

However, the validation of SAS in this multi-tier system was more complex than any previous experience. The challenges of performing the IQ, OQ and PQ in a multi-tier server platform arise because more than one server is being validated and the business needs involve both SAS and non-SAS users. As mentioned, the IQ and OQ are relatively easy to perform. But meeting the needs of both SAS and non-SAS users then even another dimension is added to the OQ. The OQ has to verify that EG functions correctly for SAS users and that the AMO functions correctly for non-SAS users. My previous experience only involved validating that SAS functions correctly, not that AMO functions correctly. While the functioning of the AMO is not difficult, it is not normally performed by someone who has been a SAS user for more than 30 years.

The PQ goes even further in testing the business needs of the SAS and non-SAS users. For example, a PQ could include a stress test. The purpose of the stress test is to demonstrate that multiple users can use the system at the same time without any performance issues. Acceptance criteria should be set to determine what meets the business need in terms of server performance. The PQ should also include running programs which the normal user would perform as a daily part of their job, e.g., creating analysis datasets and reports. Again, the PQ is not difficult to perform. It does require coordination of several users, but the actual tasks are not difficult.

CHALLENGE #2 – PLATFORM ADMINISTRATION

Understanding and administering metadata using SAS Management Console 9.3 (see Display 1) is complex and I needed training. The SAS Management Console is a powerful tool which can be used by an administrator to create users, groups, roles and permissions. Each SAS user and non-SAS user must be created as a user in the Management Console. In the SAS Management Console, I created two groups – EG and AMO. Then I assign SAS users to the EG group and non-SAS users to the AMO group. The EG group has read-write access so that they can create analysis datasets. However, the AMO group will only be granted read access so that they can view and query, but not modify SAS datasets. Additionally, the EG group can make SAS programs available to the AMO group via what is called Stored Processes. This means that the AMO users can run SAS code within an application like MS Excel. For example, a stored process could allow a simple merge of several SAS datasets or an actual report by the AMO user to monitor the progress of a clinical trial.
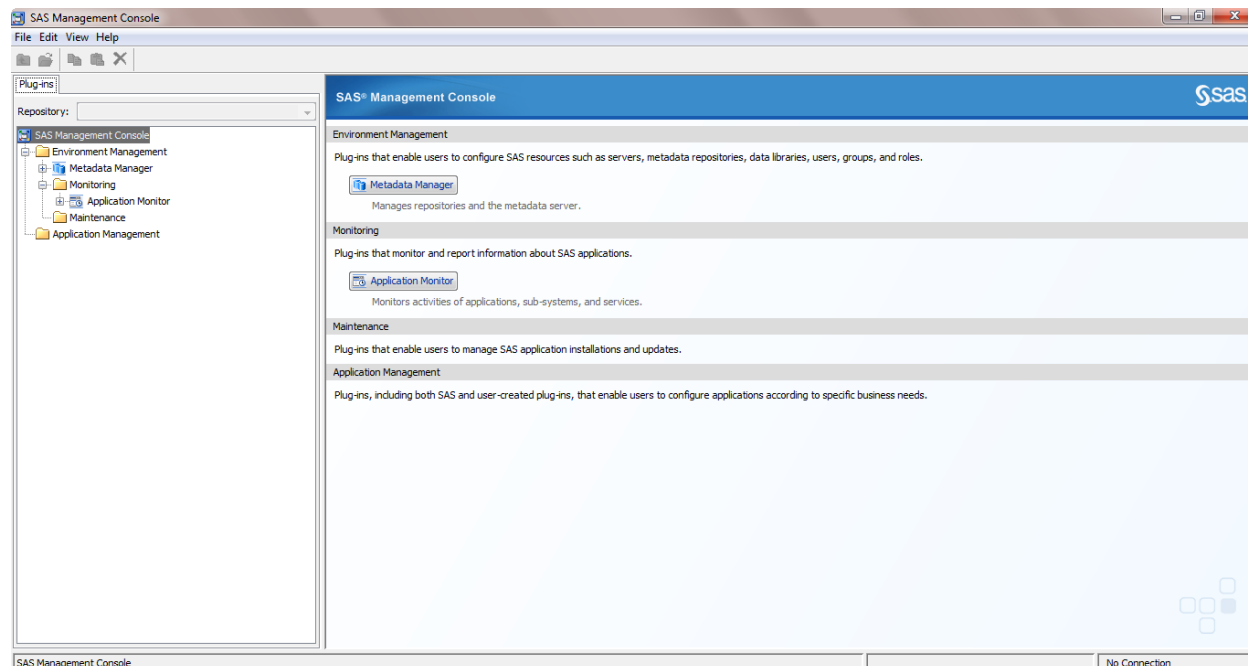
Display 1. Main Interface for SAS Management Console 9.3

SAS platform administration can be learned. People who have a computer science background in systems administration may not have SAS training. The strength of this type of person is that they would be very strong in systems administration, but possibly weak in SAS programming skills. An experienced SAS programmer who has little training in system administration would be strong in understanding the business needs of SAS users, but weak in understanding a multi-tier server platform. Fortunately, the SAS Institute provides platform administration training.

At SAS Global Forum 2013, a panel discussed who makes a good platform administrator. There were opinions on both sides, but most of the panelists were of the opinion that system administrators with SAS training make better platform administrators than SAS programmers who get trained in SAS platform administration. However, at PharmaSUG 2013, I met a couple of SAS platform administrators who started out as SAS programmers and learned how to be SAS platform administrators. In reality, it depends upon the qualities of the person. A computer scientist can learn SAS and a SAS programmer can learn platform administration.

My personal experience is that I have been a SAS user for more than 30 years. For the past several years, I have been a manager of SAS programming. I do not have any official training in computer science. I have taken the "SAS Platform Administration 1: Essentials" class and have been working with the SAS Management Console for only a few months. The SAS Institute has also provided me a lot of support through their validation services, customer loyalty program and technical support. Thus, I can see where I could potentially become very good at the basics of platform administration such as creating users, groups, roles and permissions. However, there are other tasks which may be better done by IT personnel, such as monitoring servers, restarting services, etc. Thus in my situation, the SAS Platform Administration role can be split between SAS users and IT technicians who have been properly trained in platform administration. For a small environment this scenario may be feasible to maintain. Currently, we have about 20 SAS users in the EG group and about 30 non-SAS users in the AMO group. However, for larger SAS programming environments I can see where dedicated SAS platform administration personnel would be useful.

CHALLENGE #3 – TRAINING

SAS and non-SAS users need to be trained in the use of Enterprise Guide and the SAS Add-in to Microsoft Office, respectively. Most of the SAS users in my department have used SAS Display Manager for many years. Thus training in SAS Enterprise Guide was necessary. Everyone in my department took a two day on-site class in "Enterprise Guide for Experienced SAS Users" and a one-day on-site class in "Creating Stored Processes using Enterprise Guide." Enterprise Guide has many features which may seem strange at first to experienced SAS programmers, such as the query builder and a point-and-click approach to generating analyses. For SAS users used to Display Manager, there is a window within EG which functions much like the old, familiar Display Manager. The training in creating stored processes for the SAS users was necessary to make available SAS programs to the AMO group. The AMO group received training in "Using the SAS Add-in to Microsoft Office." Thus the AMO group learned how to query data and run stored processes.

The biggest challenge, however, in training is getting used to working in a multi-tier environment. For years our SAS users have been used to using PC SAS to develop code and then using RDC to connect to a SAS server and run SAS programs in batch mode on the application server. Now the SAS users have to use EG as a client to connect to a server and run programs on an application server through the client. No longer do they use RDC to connect to the application server and run programs in batch mode. Making this transition from the old programming environment to the new one takes time to put into practice.

The non-SAS users, on the other hand, have never had a tool where they could view and query SAS datasets. They have relied on SAS users to provide them with monitoring reports. Thus this type of tool is completely new to them and will also take time for them to put into practice their training. The advantage of putting this tool into the hands of the AMO group is three-fold:

·   They can query a single SAS dataset through the SAS tab in MS Excel. Thus they can monitor data as it comes in during the clinical trial.

·   A simple SAS program to merge two or more SAS datasets can be written by a SAS user and made available to the AMO group as a stored process. Since MS Excel cannot merge datasets, this type of stored process can help the AMO group to monitor data from more than one source.

·   More complex monitoring reports (e.g., the number of subjects enrolled by site) can be created as stored processes.

Thus non-SAS users in the AMO group can view, query and run monitoring reports on-demand. This saves time in contacting a SAS user and asking them to run a monitoring report and the SAS user sending it to the person in the AMO group. Display 2 shows the options that the non-SAS user has in Microsoft Excel. For example, clicking on the SAS Data icon allows the user to open SAS datasets that they have access to on the application server. It should be noted that the SAS Platform Administrator (using the SAS Management Console) can control access to the SAS

datasets that the AMO user can view and query. This is important because non-SAS users do not necessarily need to access the same SAS datasets as SAS users need to do their work (e.g., generate reports).
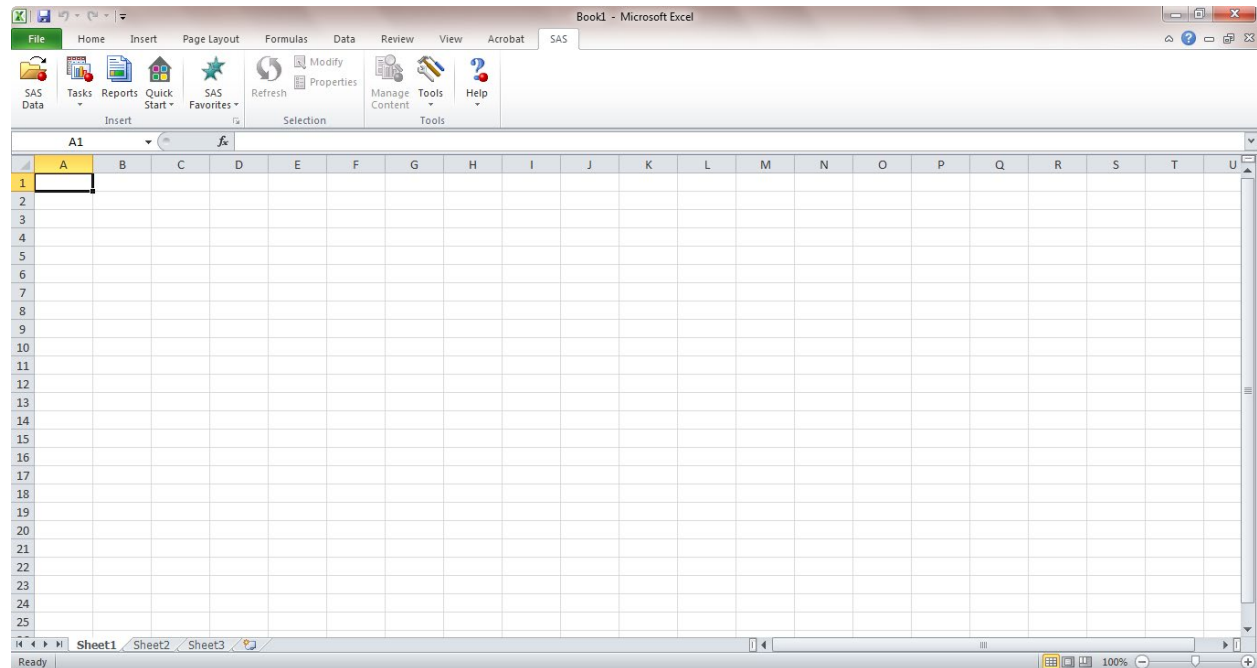
Display 2. The SAS Add-in to Microsoft Excel

LESSONS LEARNED

If the mantra of my previously validation efforts (SAS 9.2) was "don't underestimate the resources needed for the validation effort!" Then the mantra of this project (a multi-tier server platform using SAS 9.3) would be "don't underestimate the amount learning and training that will be needed." As I mentioned in the first challenge, the validation effort for this project was more complex than my previous validation effort. While the validation effort was more complex, it wasn't necessarily a lot more difficult due to my previous validation experience. For this current project, I contracted with the SAS Institute to use their validation services for the SAS IQ/OQ. A contractor (provided by the SAS Insitute) came on-site and did the IQ/OQ for the physical application server and the virtual metadata server. This process went fairly smoothly. I then used the services of another consultant for installation of third party software.

Where I needed the most help was in the learning of how to administer metadata via the SAS Management Console. This was definitely a challenge for me. I learned a lot at SAS Global Forum 2013 and PharmaSUG 2013. Right after PharmaSUG, I took a six day (4 hours per day) on-line class in SAS Platform Administration. I also received assistance in platform administration from the SAS customer loyalty group and SAS technical support. Armed with this new knowledge, I began working with SAS Management Console to learn how to create users, groups, roles and permissions. This part of platform administration was relatively easy to learn. However, there are many more complexities to platform administration such as monitoring the servers and restarting services when needed. For that I am relying on the assistance of IT personnel. Ultimately, I will likely delegate the task of platform administration to other team members in my SAS programming group. As a manager, I like to be a resource for my staff. So, I am glad for the experience that I have gained so far with platform administration so that I can support my staff when needed.

The last lesson learned was in the training of SAS and non-SAS users in the use of this new system. Fortunately, the SAS Institute provided on-site training. Furthermore, the SAS customer loyalty department is provided remote lunch and learn sessions to further help us with learning how to use this system. We also have an in-house SAS users group and the SAS Institute can provide remote speakers at no cost (covered by your SAS license fee). Recently, the SAS Institute announced an initiative to increase their support of in-house SAS user groups because many SAS users cannot afford to attend regional SAS user groups (http://blogs.sas.com/content/sgf/2013/09/12/whats-happening-to-sas-regional-users-groups/ - accessed 21Sep2013). As I mentioned, we only have about 20 SAS users at the place where I work. Yet, the SAS customer loyalty group has provided us with an on-site SAS day and quarterly speakers (remote) through our in-house SAS user group. Thus 20 SAS users do not have to travel to regional conferences to get quality, focused training. Thus, my recommendation is that companies (no matter how

small) to take advantage of your SAS licensing fees and use the services provided by the customer loyalty group. Form an in-house user group and bring SAS presentations to your users!

CONCLUSION

Moving to a multi-tier SAS server platform can help to meet business needs for non-SAS users to monitor clinical trial data. The implementation of such a platform is more complex in terms of validation, platform administration and training. While there are challenges in implementing a more complex programming environment there are advantages in meeting the business needs of the company. One of the primary benefits is the ability of non-SAS users to view data, query data and run reports on-demand. This alleviates clinical monitors from relying on SAS users to run monitoring reports for them. Thus a critical business need is met through this multi-tier server platform and the challenges in implementing this system are worth the time and effort.

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