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The Many Hats of the SAS[®] Administrator

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INTRODUCTION

The SAS administrator exists in all types of organizations: small, medium, large, etc. This paper focuses on medium-to-large scale SAS[®] System implementations. The SAS Administrator is not a position as much as it is a role. It can be a single individual or a team comprised of SAS-trained personnel, along with other IT staff within a company. While this role is very important, it is often not given the respect it deserves until something catastrophic happens. Additionally, organizations just don't know what to look for and to expect in defining the SAS administrator role. The goal of this paper is to define the SAS Administrator (SASADMIN) role from the perspective given below. These are the ingredients necessary for an effective SAS Administrator.

- (S) kills
- (A) rchitecture
- (S) ecurity
- (A) nalysis
- (D) ocumentation
- (M) aintenance
- (I) nstallation
- (N) on-SAS

The paper is intended for:

- 1) The organization searching for the individual who best fits the role of administering their SAS environment
- 2) The organization who wants to know more about the skills needed for a SAS administrator
- 3) The individual who has been granted the SASADMIN super powers and wants to find out more
- 4) The person who wants to become a SAS administrator

SKILLS

What are the skills that determine the SASADMIN role? The role of a SASADMIN is quite generic, but the responsibilities tend to be unique to each organization. Until recently, most SASADMINs did not start out as a SASADMIN. They often evolved from database administrators, system administrators, SAS programmers, analysts, application developers, and, in rare cases, even sales staff. What this indicates is that it does not always matter where the SASADMIN came from, but what they know, are interested in doing, and where they are going. So, to help align this information with the expectations of the organization and to have a safe Metropolis, here are some skills that the SASADMIN will need to possess:

- Have a working knowledge of the Base SAS language: Data Step, Procedures, SQL and SAS Macros
- Know the SAS toolset(s) used in the organization, most commonly: SAS Display Manager and Enterprise Guide
- Know the Setinit license cycle and be able to update the Setinit to avoid a lock out
- Have an investigative mind to be able to troubleshoot issues as they arise
- Strong knowledge of the operating system(s) that SAS is installed on, such as memory management, file system architecture, CPU utilization etc
- Be adept in the use of the SAS support website (<http://support.sas.com>) and SAS documentation for installation setup and troubleshooting
- Understand how to apply hot fixes, patches, service packs and do version upgrades

- Be patient and customer focused
- Have a working knowledge of relational databases being utilized
- Understand the security models (both for SAS and the organization) involved in administering the SAS installation
- Understand the SAS architecture at the site, e.g., PC only, client server, multi-tier, etc.
- Have a basic understanding and appreciation for project management
- Understand the backup and retention policy of the operating system and data
- Have some experience in developing performance metrics and monitoring a system environment
- Excellent communication both in the written and spoken word
- Knowledge of Change Management procedures and version control for SAS code

Determining which level and exposure to any of these skills is needed will depend on the organization. If you are looking for employment as a senior SASADMIN in a major multi-million dollar installation, you would expect that you need to have solid strengths in each of the skills with many years of experience. If someone was looking for a junior SASADMIN position, then having four or more of these skills will more likely apply. From the perspective of the organization, experience has shown that SASADMINs are in short supply. So accepting a few key skill sets and then utilizing a proper training and development plan will help the organization meet their requirements.

ARCHITECTURE

Before building a house a builder must consult an architect for a design and blueprints. The architect is involved in the planning, designing and oversight of a building's design, essentially translating the customer's needs into a solution. The architect must understand and adhere to the building and operational codes when designing any structure. Also, the architect must be knowledgeable in various methods so as to produce the best compromise possible between the customer's wants and needs, budget, costs, and time boundaries. The architect has to undergo specialized training and needs to be licensed to practice the occupation of architectural design. A SASADMIN is not that much different, practicing within the specialized area of systems architecture; i.e., the design and understanding of the relationship between different parts of the SAS system, which includes all the hardware and software components. This is where the strategic decisions are made to provide the best compromise between the customer's requirements and any operational and/or capital budget constraints. To do an effective job of architecting a SAS environment, the SASADMIN will need the following:

- A well documented set of requirements from the users, preferably categorized into short, medium and long term goals
- The current and future number of users where possible
- A systems design document developed with the involvement of the system and network architects. This part is very critical to the foundation of the environment
- A SAS or SAS Reseller sales and technical representative to narrow down the product needs and costs
- A security requirements document. The hardware and software has to be compliant with the current infrastructure
- Knowledge of the current landscape with a network systems diagram; i.e., the other source systems that SAS will be accessing on a batch and adhoc basis
- Knowledge of all third party software that will be required
- Knowledge of what type of access the users will require. For example, web based, client-server, thick-client or some combination of these, etc.
- Definition of roles for SASADMIN team members where possible

SECURITY

Once the house is built the home owner will have to consider various security questions such as: is a fence necessary? What type of gate will be used? Who will get keys? Where is the architectural blueprint located? What type of security system is/will be installed? The answers to these questions will also vary depending on the size of the home.

Access to the SAS system has to be secured somehow, so access via authentication and authorization must be crucial in the mind of the SASADMIN. With Statement on Auditing Standard No. 70 (SAS 70) security audits, penetration testing and social engineering, the job of the SASADMIN has become more complicated in recent years. The SASADMIN, operating system administrators, and IT Security teams need to coordinate and develop an effective SAS security model for administration of access to the SAS environment. Depending on the type of operating system, this can range from windows active directory groups to UNIX access control lists and Lightweight Directory Access Protocol (LDAP) for single sign on type of activities. Database roles and SAS Access control lists need to be considered as well. Included in the SAS security document are clear definitions of the types of permissions users and application ids will have. The document should speak to group-level access so that administration and update does not become a nightmare, especially in cases where there are numerous users. It is a living document, which means it should allow for exceptions and be flexible to change as the technology and organization changes.

One major problem observed in many SAS environments has been the freewill unencrypted use of database and system passwords within the SAS code. One novel solution is to develop a SAS password utility which utilizes the SAS function PROC PWENCODE to store (encrypt) and retrieve (decrypt) passwords in an efficient way. This nifty little utility would then allow the users to store and retrieve their password using SAS macros in their code which hides the actual password from being displayed in the SAS logs. This functionality could also be extended to FTP type applications as well.

Something else to remember is that any model being implemented must take into consideration that security should not be a bottleneck and prevent the daily operation of an organization.

ANALYSIS

When working in a medium to large SAS setup, organizations commonly have a variety of system problems. The key to the resolution of these issues lie within the SASADMIN's method of problem solving. The SASADMIN must find the root cause of problems such as: user sessions becoming locked, the backups fail, no SAS session can be started, etc., and where possible resolve them in a short time. These problems often occur because of resource constraints such as low RAM, high I/O, not enough CPU time, and/or network bottlenecks. Ideally, the SASADMIN should be proactive in developing performance metrics for forecasting, planning and identification of bottlenecks within the environment. Third party system monitoring tools (for example, TeamQuest and Perfmon for Windows servers) display near real-time system utilization metrics in the form of canned and ad hoc graphical reports. These reports become extremely useful during troubleshooting efforts because they allow for forensic and deductive analysis to identify the root cause of an issue. For example, high CPU and low RAM utilization coupled with slow performance might indicate an I/O problem. Another example is that a user session may be using the majority of the CPU on the server but has no I/O. This could be a sign of a stray/rogue session that needs to be terminated.

From the software side, the SASADMIN needs to be able to test and tweak the configuration file to get the best performance. The use of the metrics and SAS logs will give them a clear picture of what is happening. On the development side, application and ad hoc user code needs to be reviewed so that it can be improved to make the best use of the available system resources. Testing these applications and monitoring them using the performance reports will also help to identify bottlenecks within the code and the environment. Base SAS versions 8 and later ship with the ^βApplication Resource Measurement (ARM) API which is useful for application monitoring. This is especially helpful for home grown applications where transaction steps need to be tracked.

DOCUMENTATION

For the effective planning and maintenance of any SAS installation, documentation is very critical, so it is imperative for the SASADMIN to create such documentation. The documentation requirement for SAS will vary across each organization depending on their requirements. Based on our experience we recommend that the SASADMIN maintain the following documents:

- SAS Standard

- SAS Security Model
- SAS Installation Guidelines
- SAS Programming Guidelines
- SAS Disaster and recovery
- SAS Issues Log

The **SAS Standard** document explains the typical SAS environment setup such as configuration, products, key staff, and service level agreements at the site. It gives an understanding of the various SAS licenses, SAS Servers (DEVELOPMENT, TEST, AD HOC, and PRODUCTION, etc.) and the methods and tools of access to SAS.

The **SAS Security Model** document explains the authentication, authorization and access granted to users within the SAS environment.

The **SAS Installation** document combines the SAS recommended installation procedures with an organization's standards for installations and security policies.

The **SAS Programming Guidelines** recommends the regulatory requirements when developing SAS applications run in a production environment. This document acts as a good resource for new and seasoned programmers to get an understanding of project documentation, program logic/flow, program maintenance and error tracing for debugging purposes.

The **SAS Disaster Recovery** document provides the necessary information on who to contact, and what steps to take in the event of major disaster. It also explains the current backup procedures and retention policies that are in place in the organization.

The **SAS Issues Log** documents the common to the most complex issues encountered by the SASADMIN and their methods of resolution.

MAINTENANCE

The ship is up and sailing, so at this point the goal is to keep the ship running smoothly without falling apart. The first step is to follow the maintenance guide provided by the manufacturer. Check for loose cables, check seals, check for corrosion and leaks in the engine and hull, check gears, etc. Also, if the ship is sailing in different conditions such as icy and cold water versus warm water, stormy regions, high salinity or polluted water, the crew and the ship has to be prepared for the trip. Often times it is the maintenance crew who are the first responders for emergencies such as fires, floods, or illness aboard the ship. The SAS environment is no different from a ship: regular updates and maintenance have to be performed to keep the system from falling apart. Knowledge of the operating conditions such as high and low usage periods, and anticipated growth helps the SASADMIN to plan for the future. The SASADMIN is also the first responder in the event of user problems such as user lock outs, system unavailability as well as for help and advice on issues like SAS coding. Below are some of the things a SASADMIN needs to be adept at to maintain the SAS installation so the ship does not fall apart.

Hardware

- Capacity planning to address growth in items like storage, memory, CPU utilization
- Develop service level agreements with the OS, database and network administrators and their departments for the SAS system, web and source data servers
- Periodically review and test disaster recovery procedures

Software

- Routine application of SAS Hotfixes and service packs
- Follow up on operating system patches
- Do version upgrades of both server and client components
- Update the SAS configuration file to make the best use of the hardware resources
- Install third party monitoring and forecasting software tools for e.g. TeamQuest to monitor CPU, memory and storage utilization in real time
- Upgrade drivers e.g. Oracle, Java Virtual Machine etc

Customer service

- Create an email group that speaks to SAS Support within the organization e.g. sassupport@xyz.com to communicate with the user
- Develop service level agreements between the users to address the level of support
- Host or participate in an internal SAS users group
- Identify key business users and develop a liaison network with these users. Additionally have this group participate in future plans and developments
- Develop key performance metrics (e.g., Average SAS environment uptime of 99.9%)
- Schedule periodic maintenance outages; e.g., combine patch application to minimize downtime
- Update the SAS standard referenced in the documentation section

INSTALLATION

This area includes both installation and configuration. These are probably the secondmost critical steps next to the architecture and planning that a SASADMIN will either do or oversee. This step directly affects the user experience and potentially the entire analytical operation of the organization. A poorly performed installation and configuration can lead to system downtime, system inaccessibility, delayed and/or incomplete processing, inappropriate access to confidential data among others. It is imperative that this job be performed correctly. Once upon a time, this task was somewhat simple when it was a single disc or a set of diskettes. All SAS products were installed in one go and the configuration was limited to the SAS configuration, autoexec and configuration files for the remote servers. The documentation was not too complex and could be easily followed. Installation and configuration was also not difficult, especially if the SASADMIN knew the operating system they were using fairly well. Now with SAS version 9 for Business Intelligence, all that has changed, especially in multi-tiered platform installations. These environments can include Windows clients, UNIX servers, and various web servers with multiple BI (Business Intelligence) components. Installation and configuration becomes a lot more involved in order to have these systems communicate effectively and efficiently. Generally the SASADMIN should be adept in the following areas:

Server side:

- Verify that the correct setinit or SAS installation data (SID) license file is readily available
- Review all SAS installation documentation provided with the media and from the SAS Support website (install center support.sas.com)
- Prepare a checklist of all the items needed for the installation and pre-installation steps (SAS provides a pre-installation checklist)
- Have the SID and installation media ready
- Involve the OS system administrators when needed
- Do a dry run installation in the Research and Development environment first
- Review the organization's security model because this may prevent various components from working
- Do screen shots and if possible, record the installation
- Test connectivity, access and functionality
- Document the installation and configuration process in an Installation document (referred to in the documentation section)
- Maintain the installation document so that as components are added and versions change the procedures are updated
- Also update the SAS standard document referred to in the Documentation section of this paper

Client side:

- Verify that the correct setinit or SID is readily available if necessary
- Review all SAS installation documentation provided with the media and from the SAS Support website (installcenter.support.sas.com)
- In distributed installations develop a user install package so that the users can do the install themselves with as minimal manual intervention as possible e.g. an SMS install package

If the SASADMIN is just not familiar or comfortable with this, then seeking help from SAS or a SAS preferred partner to assist on-site might be more costly initially, but the chance of failure is reduced, thus lessening the negative impact to the organization.

NON-SAS SOFTWARE (THIRD-PARTY)

With the growing business needs in almost every industry, applications are being developed in an n-tier architecture where there are a multitude of tools and techniques to produce the end product. Hence it becomes more and more necessary to integrate SAS with third-party tools and techniques such as Java, Visual Basic, and ASP. On the other end, there are databases such as Oracle, SQL Server, SYBASE, and DB2, which might have more efficient data storage techniques, but lack the analytic power of SAS. In these cases, the company might decide to use ORACLE as their data storage tool and SAS as their analytic tool. Application developers now have the ability to choose industry standard programming tools/languages and combine them with the analytic and data management strengths of the SAS system. Hence, now there is a need for the organization to have someone choose or decide the appropriate method or technology to combine these third-party tools and client applications with the SAS system. This is definitely something to consider when designing the architecture as mentioned previously.

The SASADMIN comes to the rescue in this situation. The SASADMIN needs to play an integral part in deciding which method to use for connecting SAS to these third-party tools. A SASADMIN needs to have a basic understanding of JDBC (Java Database Connectivity), IOM (Integrated Object Model), ODBC connectivity, and SAS Integration technologies. With this knowledge, the SASADMIN can recommend the best way to connect to the SAS system depending upon the application requirement. The SASADMIN could also familiarize users with performance monitoring tools such as TeamQuest. The SASADMIN would configure the TeamQuest reports, which are then shared with users so that they can view the dashboard on their workstations. These reports display the status of SAS processes (CPU and memory usage) in near real-time for every user logged onto the server. An understanding of the CPU and memory costs gives the users an opportunity to either tune their processes, run fewer processes at any given time, or contact other users who they know have idle sessions to clean up their sessions. This helps both the SASADMIN and the users to work with each other and to understand the limitations of the servers on which SAS is installed, thus saving the time and resources.

CONCLUSIONS

We have exposed some of the key hats of the SAS administrator with the intention that a non SASADMIN person can appreciate both the importance of, and responsibilities entailed by, the role of a SASADMIN. Depending on the size of the organization or the type of SAS install at a specific site, the responsibilities of a SASADMIN may vary. This paper only looked at the surface of the core, high-level requirements; it gets more complicated as each specific area is unraveled. For this reason, the SASADMIN(s) role undoubtedly cannot be fulfilled by one single individual. In most organizations which have a medium-to-large, multi-tiered SAS deployment, it is necessary to have a group of individuals highly skilled in the areas mentioned in this paper to support the environment. Please use this as a reference to help define the requirements of the SASADMIN at your organization if they don't already exist. We welcome any feedback or comments on this topic in the interest of refining the role of the SASADMIN.

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