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An IT Perspective of SAS® at The University of Memphis

Robert Jackson, The University of Memphis

ABSTRACT

THE UNIVERSITY OF MEMPHIS HAS BEEN A SAS® CUSTOMER SINCE THE MAINFRAME COMPUTING ERA. OUR DEPLOYMENTS HAVE INCLUDED VARIOUS SAS PRODUCTS INVOLVING WEB-BASED APPLICATIONS, CLIENT/SERVER IMPLEMENTATIONS, DESKTOP INSTALLATIONS, AND VIRTUALIZED SERVICES. THIS PAPER USES AN INFORMATION TECHNOLOGY (IT) PERSPECTIVE TO DISCUSS HOW THE UNIVERSITY HAS LEVERAGED SAS, AS WELL AS THE LATEST BENEFITS AND CHALLENGES FOR OUR MOST RECENT DEPLOYMENT INVOLVING SAS® VISUAL ANALYTICS.

INTRODUCTION

The University of Memphis (UofM) has a long history of partnering with SAS to support our business intelligence (BI) strategy, and a renewed focus on data-based decision making is driving the need for continued enhancements to the University's use of BI.

Founded in 1912, UofM has an operating budget of $478 million and serves students at 8 sites containing 239 buildings located on 1,607 acres. 21,301 students were enrolled during Fall 2016. UofM uses SAS software to analyze data from a variety of stages in the student engagement lifecycle including admissions, retention, graduation, and development.

This paper uses an information technology (IT) perspective to discuss how the University has leveraged SAS software, as well as the latest benefits and challenges for our most recent deployment involving SAS® Visual Analytics. The paper concludes with a brief discussion of potential BI initiatives that could further leverage SAS products.

SAS AT UOFM

UofM has used SAS products dating as far back as the 1990's to support both academic and administrative needs. Although electronic vendor invoice records were not available to identify specific dates for the acquisition of various SAS products, the author was able to approximate time frames based on discussions with employees who previously supported SAS at UofM. A brief history of SAS software at UofM based on the reconstructed institutional knowledge follows.

The earliest institutional memory of SAS on campus was in the 1990's when UofM ran SAS version 6 on the VAX/VMS platform supported by the central information technology unit. Prior to and approaching this era, most data intensive computing was performed in the University's primary data center and supported by the centralized information technology unit.

Around 2000, platforms for administrative and academic use began to diverge. Administrative use of SAS products was moved to the Dell PowerEdge platform on Windows NT4 and maintained in the Office of Institutional Research (OIR). Diminishing space requirements, increased computing power, and lower costs meant OIR could accommodate a server outside the centralized data center. Multiple upgrades to the OIR Windows Server occurred over the life span of this design (e.g., Windows Server 2000, 2003, 2008, and 2012). The platform leverages SAS and SAS/IntrNET™ to support the ad hoc web-based report generators discussed later, and this architecture continues today in a virtualized environment.

As desktop computers continued proliferating in the 1990's, academic use of SAS software began to transition from the VAX/VMS platform to desktop computers. By the time UofM transitioned from the VAX/VMS platform to the Sun platform in the early 2000's, academic usage of SAS software had primarily

moved to the desktop computer platform. Academic licensing was available on a variety of platforms including Windows, Mac, Sun, and IBM z/OS. It was also during the early 2000's that administrative use of SAS software on desktop computers began to grow. Limited client-server usage via SAS/CONNECT® occurred in the mid 2000's but more powerful and cheaper desktop computers created opportunities for jobs to be run almost as efficiently on the desktop, rather than servers that were not designed to efficiently process multiple simultaneous job submissions.

In the early 2010's, UofM began offering academic use of SAS software through virtualization, but early access to virtualized software required access thru specific software on desktop computers. Improvements in virtualization made software provisioning more seamless with the computer desktop, but research-intensive users concerned with performance preferred local installations on their desktop computers. SAS Enterprise Miner™ and SAS Enterprise Guide® were also provided for academic use during this era.

In 2014, UofM launched a new initiative to identify and implement visual analytics software to assist with creating dashboards to improve information sharing. Based on UofM's relationship with SAS and Gartner's magic quadrant, OIR and Information Technology Services (ITS) implemented SAS® Visual Analytics to provide data visualization and drill-down capabilities via dashboards. SAS is represented in the 2017 Gartner Magic Quadrant for business intelligence with other "visionaries." "Visionaries have a strong and unique vision for delivering a modern BI and analytics platform" (Sallam, R., et al., 2017). SAS Visual Analytics is hosted on Windows 2012 physical servers maintained by ITS.

SAS IN THE CLASSROOM

As previously mentioned, the use of SAS in academics dates back as far as the 1990's. The proliferation of desktop computing from the 1990's thru early 2000's created additional demands for SAS talent.

To support the needs of local corporate partners, UofM launched the SAS Center in 2005 to improve SAS skills of the local workforce (The University of Memphis, 2017). As time passed, curriculum was adjusted to address needs in data mining and big data analytics, and skills taught by the SAS Center transitioned into certificate programs that are still available today including the Health Analytics Graduate Certificate and the Graduate Certificate in Business Intelligence and Analytics.

SAS FOR ADMINISTRATIVE BI SUPPORT

Gartner defines business intelligence as "an umbrella term that includes the applications, infrastructure and tools, and best practices that enable access to and analysis of information to improve and optimize decisions and performance" (Gartner, 2017).

ITS at UofM views SAS products as key components of the University's BI strategy, and partners with OIR to support the University's BI needs. UofM utilizes tools such as Hyperion, Argos, and Microsoft Excel to inform decision-making and ITS provides basic training on the Hyperion and Argos tools. Although ITS provides some support for BI tools and reporting, OIR does the heavy lifting for dashboarding and statistical analyses.

OIR is recognized across campus for their data expertise and expertise in SAS products. OIR uses SAS to provide many services such as ad hoc reporting, self-service reporting (e.g., table generators), static reports produced each semester (e.g., student evaluations of teaching effectiveness), data auditing and cleansing, and data certifications for state reporting (e.g., enrollment data).

In response to increasing demands for data, OIR has created automated tools to assist users as much as possible via self-service. Web-based table generators and dashboards are two examples that provide self-service capabilities.

Table generators were written in-house using PHP, SAS server, and SAS/IntrNET and allow users to specify filter criteria for report generation. Sample table generator filter criteria is indicated in Figure 1.

Faculty and Staff Report Generator

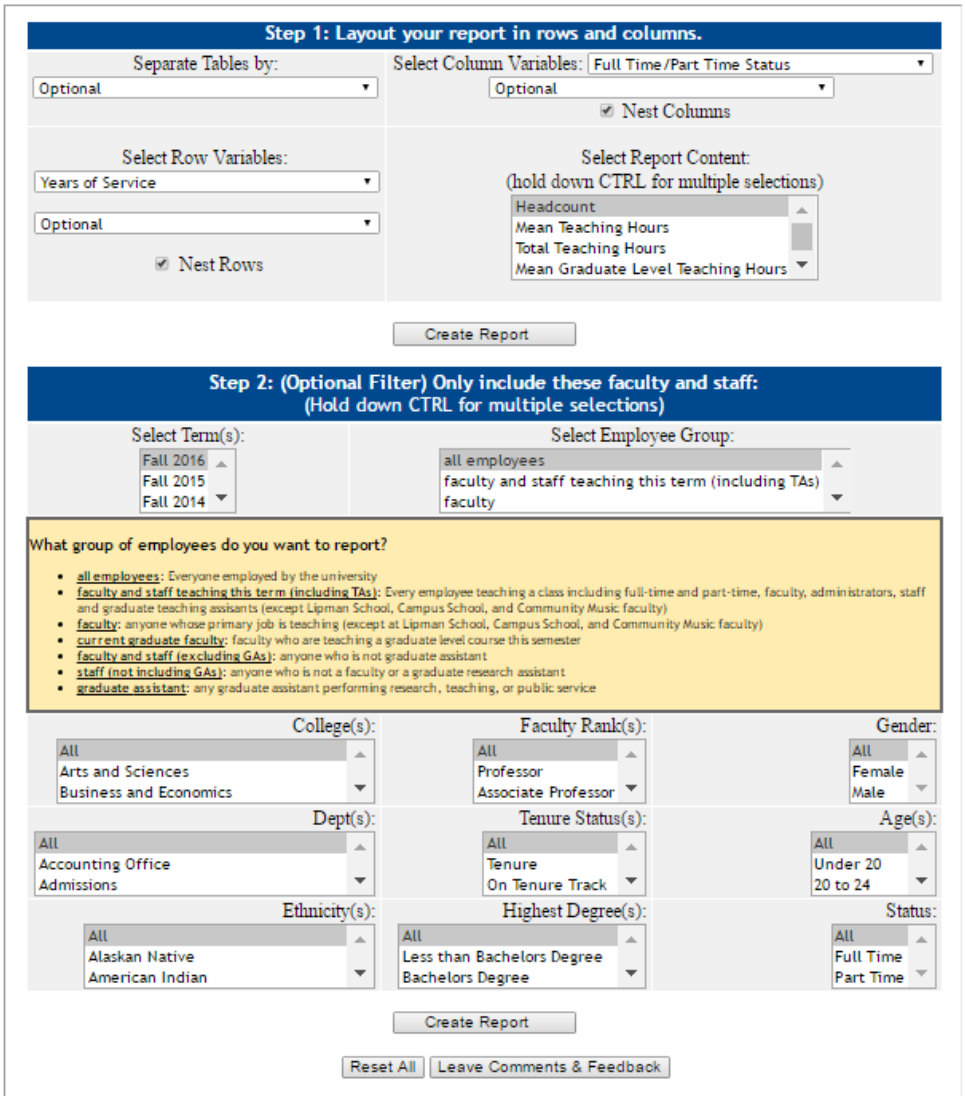

Figure 1. Sample Table Generator Filter Criteria

Table generator output is demonstrated in

Figure 2.

Summary of Record Selection Criteria

Characteristic	Selected Values
Term	Fall 2016

	Total Headcount		
	FT/PT Status		
	Full Time	Part Time	Total
Years of Service			
1 to 4 Years	681	93	774
5 to 9 Years	493	25	518
.Less than 1 Year	275	41	316
10 to 14 Years	339	7	346
15 to 19 Years	230	2	232
20 to 24 Years	127	.	127
25 to 29 Years	130	1	131
30 to 34 Years	99	.	99
35 to 39 Years	54	.	54
40 to 44 Years	24	.	24
45 to 49 Years	5	.	5
50 Years and Longer	3	.	3
Unknown	1	1,874	1,875
Grand Total	2,461	2,043	4,504

Figure 2. Sample Table Generator Output

As previously mentioned, table generators enable self-service creation of ad hoc reports by users. This frees OIR resources to work on other projects. Table generators also require use of predefined fields and reports that ensure data is being consistently provided. However, table generators do not provide any drill-down capabilities and table generators rely on snapshot data that is "frozen" at specific points during the semester.

SAS Visual Analytics has been quickly adopted within the UofM culture as executives turn to dashboards for drill-down capabilities to explore data and provide insight into University operations. Sample dashboard criteria is indicated in Figure 3.

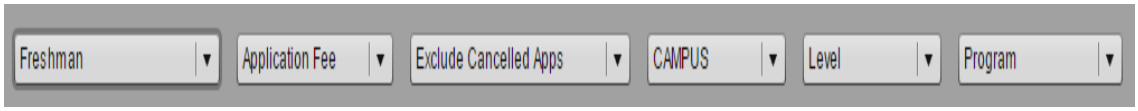

Figure 3. Sample Dashboard Criteria using SAS Visual Analytics

Figure 4 demonstrates output using the sample dashboard criteria. Circles on the map may be clicked to drill-down into granular data such as number of students admitted from particular states.

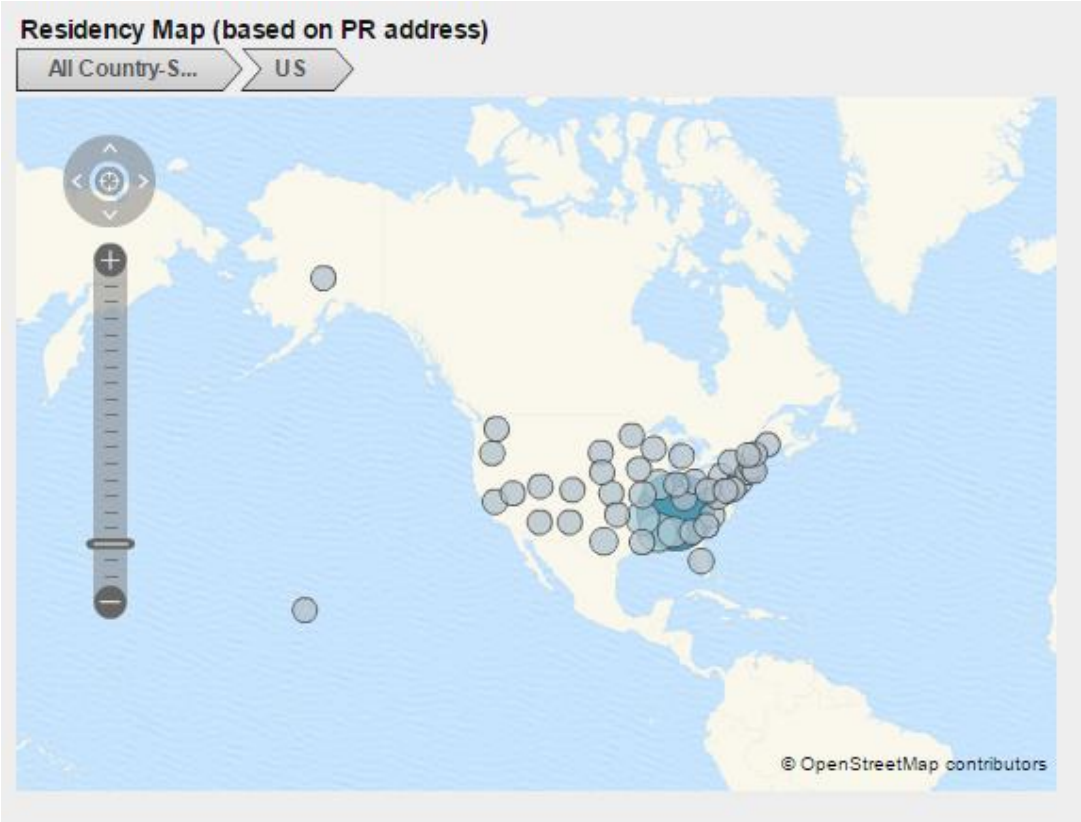

Figure 4. Sample Dashboard Output using SAS Visual Analytics

In addition to the benefits provided by drill-down capabilities and visualization, data for SAS Visual Analytics dashboards is refreshed daily in the UofM's current BI architecture.

CHALLENGES OF SUPPORTING SAS

The challenges for supporting SAS at UofM are similar to other products, and include desktop support, change management processes, data governance, and collaboration.

As previously stated, UofM has been a long-time user of SAS products. Our organizational knowledge of supporting SAS on the desktop has matured and most issues with installation or configuration are usually quickly resolved by working with SAS technical support. Although UofM's support for SAS and SAS/IntrNET products is also well established through use of the customized in-house table generators, recent staff changes have resulted in loss of institutional knowledge regarding installation and configuration of the services, thereby creating the potential for inefficiencies during upgrades or disaster recovery.

As with any new technology implementation (e.g., SAS Visual Analytics) challenges occur as the organization struggles with understanding patching requirements, data load issues, etc.

The following recommendations are provided to help readers support complex SAS implementations:

- Change management processes for enterprise SAS deployments should be clearly defined to prevent unintended outages during service or server upgrades.
- Data governance is required to define data definitions and to ensure consistent use of data definitions throughout the organization.

- Collaboration between centralized IT units and functional departments is critical to ensure consistent delivery of services. Clearly define support roles for complex enterprise services. For example, UofM support roles for SAS Visual Analytics are indicated in Table 1.

Role	Primary
General Application Support	Office of Institutional Research
Installation & Upgrades	ITS Enterprise Application Services
Configuration	ITS Enterprise Application Services
Accounts/Security	ITS Enterprise Application Services
System/OS Support	ITS Enterprise Infrastructure Services

Table 1. Support Roles for SAS Visual Analytics

FUTURE OF SAS AND BI AT UOFM

UofM plans for the future use of SAS and BI are supported by recent findings of Educause and Gartner. The Educause 2017 Top 10 IT Issues report identified data management, data-informed decision making, and information security as key issues. (Grajek, 2017).

The Gartner 2017 CIO Agenda for higher education also identified 3 key issues supporting BI initiatives at UofM. Gartner surveyed higher education Chief Information Officers regarding the top 10 strategic priorities for the next two years. Both "new customers/retention/sales" and "analytics/data/information" were identified as priorities by 25% and 12% of respondents, respectively. Additionally, "security, safety, and risk" was identified by 10% of respondents (Lowendahl, 2017).

Some ways that UofM could leverage SAS software to support future BI initiatives include:

- Mine UofM's data environment to identify new factors supporting student success. Factors might include data from recruitment, retention, graduation, and development stages of the student engagement lifecycle. Figure 5 illustrates UofM's data environment that could be examined for myriad data mining and analysis opportunities.
- Continue development of dashboards and centralized tools to provide ad hoc reports to departments to assist with data-informed decision making. These dashboards and tools will support transparency and fiscal accountability as part of our strategic resource investment initiative based on responsibility centered management.
- Increase use of centralized SAS and BI tools to support a risk mitigation strategy for data loss prevention by decreasing the frequency with which users must download data to their desktop computer or other devices.

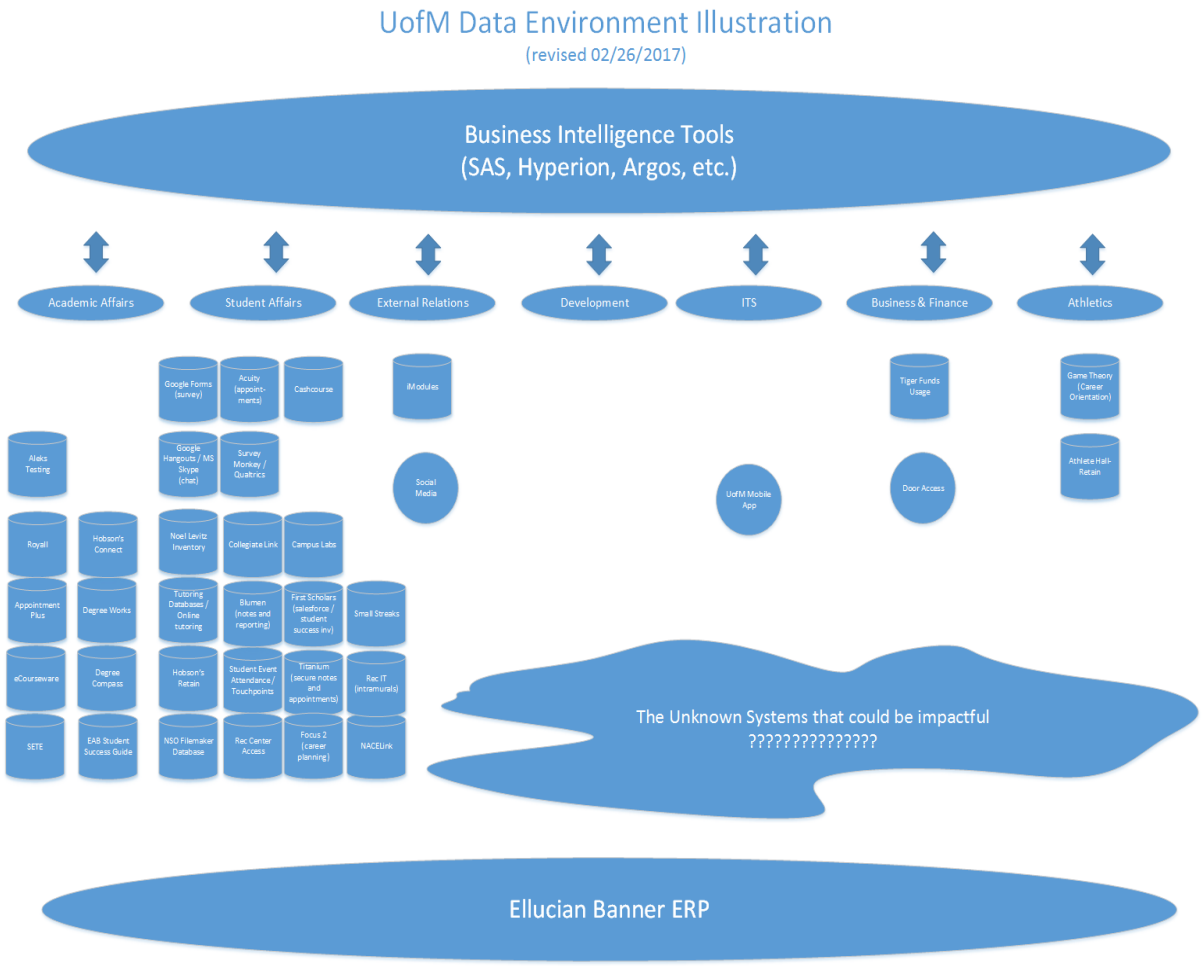

Figure 5. UofM Data Environment Illustration

CONCLUSION

UofM partners with SAS as a key business partner to provide BI solutions for administrative needs, and also to provide access to software in the classroom environment to equip students with skills for successful and productive careers.

This paper provided an overview of UofM's use of SAS, including a timeline of historical events surrounding SAS usage and the recent deployment of SAS Visual Analytics. The paper also provided examples of how UofM leverages SAS to meet specific BI needs as well as possible future uses of SAS.

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CONTACT INFORMATION

Your comments and questions are valued and encouraged. Contact the author at:

Robert Jackson
rjax@memphis.edu