

Paper 128-2010

Delivering Decision Support Information to Departmental Units

Using the SAS® BI Platform

Ryan Cherland, University of Kansas, Lawrence, KS

ABSTRACT

The University of Kansas (KU), like any large and decentralized organization, found that information was not always available in a timely manner to make effective decisions. To help solve this dilemma, KU's Office of Institutional Research and Planning (OIRP) developed a planning and management information system using the SAS® BI Server platform. This paper will discuss how OIRP has leveraged the BI toolset to deliver critical decision-support information during times of uncertainty and change.

INTRODUCTION

OIRP initially developed a planning and management information system called the *Departmental Executive Management Information System* (DEMIS). It used the SAS/Intnet product to deliver management and analytical information to departmental administrators since 1999. During the 2007-2008 academic year, OIRP migrated the existing DEMIS system into the new business intelligence (BI) architecture found with the SAS BI Server products and switched to the BI Server as our production system in July 2008. The original DEMIS system was created using a combination of SAS software and internal development. The migration to the BI server was done to move away from an "in-house" development model and use an enterprise-level integrated BI architecture, with toolsets for both web-based and workstation-based access, while leveraging OIRP's knowledge and experience with SAS.

This paper will briefly describe the new decision-support system that is now available to campus users and specifically discuss the ways in which the University of Kansas has leveraged what the platform provides. Three recent campus projects and initiatives will be discussed and used as examples to demonstrate how SAS and the BI Server platform were used to provide information to campus administrators.

WHAT IS DEMIS?

At KU, DEMIS is the term used for our decision-support or business intelligence system. KU is using the BI Server, version 9.1.3 and its client tools to deliver decision support information to departmental units. We do this primarily through the BI Portal application, although some desktop client tools are also used. There are five broad areas of information that we provide in the BI Portal: General, Academic, Human Resources/Payroll, Financials, and Student Administration -- with a few specialized areas also available. These subject areas are organized as pages in the BI Portal, and within each of the pages there will be various portlets or groupings of informational items or reports, as seen below in Figure 1.

The screenshot shows the 'Academic Subject' page of the DEMIS Portal. At the top right is the KU Institutional Research & Planning logo. Below it is a navigation bar with tabs: General, Academic (selected), HREO/Payroll, Financials, Student Admin, and Home. The main content area is divided into three sections:

- General Academic Queries** (Shared: DEMIS_AcadQuery):
 - Change in Student Credit Hour Query (Student credit hour data last refreshed on 02/18/2010)
 - Course Enrollments Query (Course enrollment data last refreshed on 02/18/2010)
 - Major Counts and Distributions (5 years of Academic Plan and Subplan Counts)
 - KUGS Application for Degree Query (KUGS datamart last refreshed on 02/18/10 at 2:52:24 AM)
- Enrollment Management** (Shared: DATA_AcadQuery):
 - Enrollment Counts (Student enrollment data last refreshed on 02/18/10)
- Academic Management Information** (Shared: DEMIS_AcadQuery):
 - FY 2010 Academic Information Management System (AIMS / Program Review - current school and department structure)
 - FY 2009 Academic Information Management System (AIMS / Program Review - FY 2009 school and department structure)
 - Undergraduate Time to Degree Reports - 2005 (Includes detail information for degrees awarded for fiscal years 1994 through 2004)
 - Senior Survey (Senior Survey results from 1977 to 2005)
 - National Survey of Student Engagement NSSE (Spring 2004 survey of undergraduates)

Figure 1: Academic Subject page from KU's DEMIS Portal

The pages, portlets, and items can all have various levels of security roles applied. For instance, at KU in our Academic subject area, we've created a security setup that allows "academic" users to have access to academic

items from a general to a more restricted level of access. Users with the more restricted level of access can access items that are of a more general nature, but not the other way around, as described in Figure 2:

Very general academic items to more restricted academic items	1. DEMIS_AcadGeneral (initial Academic access role, cannot access items in roles below) 2. DEMIS_AcadQuery (can access items in role above, but not below) 3. DATA_AcadQuery (can access items in roles above)
---	--

Figure 2: Academic Subject Area Security Levels

TYPES OF INFORMATION

To provide a framework on how KU has organized the various subject matters in our portal, I will use the Academic subject area for examples. There are three main portlets within the academic subject area. In the “Academic Management Information” portlet (Figure 3), you will find what we call the Academic Information Management System (AIMS) reports. These are used as part of KU’s academic program review process and aspects of the data are reported to the Kansas Board of Regents. Data are collected on an annual basis to provide an overview of the university overall, its schools, and each department and its academic programs. The statistical overview tables provide trend data and include information such as student enrollment and graduation counts, faculty workload, and student credit hour production. Many of these items are based on data that is updated infrequently; usually once or twice a year.



Figure 3: Items found in the Academic Management Information portlet

Figure 4 displays what a user would see from one of the department metric areas when looking at the current AIMS overview for a department on the portal. These reports are generated by SAS programs against analytical datasets by OIRP and then published to the BI Portal’s WebDAV system, where we can take full advantage of the user security layer that we already manage. These reports make use of the ODS system and we create both HTML and PDF output versions. The PDF version makes heavy use of the ODS LAYOUT syntax, with very satisfactory results, as seen in Figure 5 (see Lund, 2008, for many good ideas on enhancing PDF output).

But the real strength of what the BI Server provides is not in the delivery of annual reports, but in providing the decision support manager with a framework to give users the tools to answer their own questions. In the “General Academic Queries” portlet, we provide a series of queries that allow users to explore trends in credit hour productivity, course enrollments, student enrollments, and choices in majors. These queries are semi-structured with prompted inputs. These queries are Stored Processes and allow users to compare changes in items of interest between different semesters (e.g., Fall 2008 and Fall 2009) or time periods within a semester (e.g., the first day of classes in a semester with the official census point for head counts in a semester). One of the many advantages of the BI platform is that a Stored Process and its prompting framework can be surfaced through Microsoft Office products as well as through the BI portal. Examples of prompt forms for the same Stored Process, one when viewed from within the BI Portal and one when viewed using Add-In for Microsoft Office from within Excel, can be seen in Figure 6.

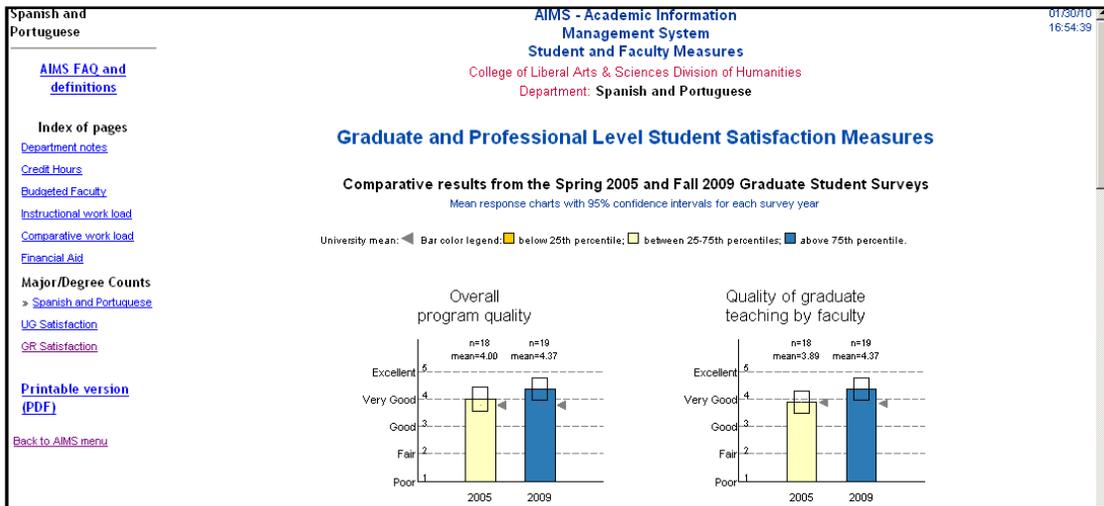


Figure 4: Screenshot of one department metric area as displayed in the portal

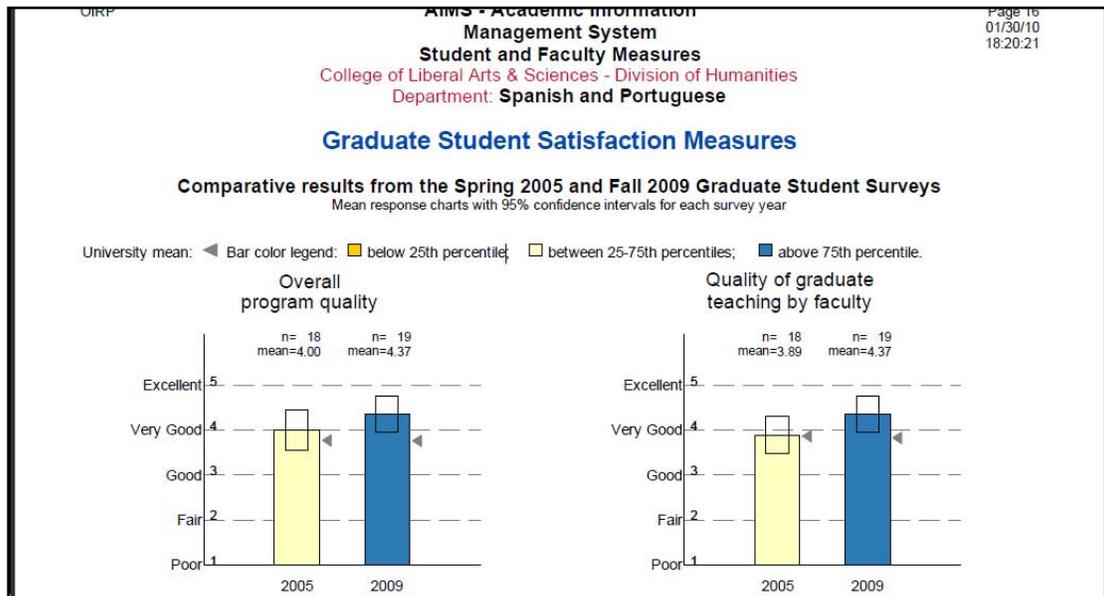


Figure 5: Screenshot of ODS PDF version of same information as seen in Figure 4

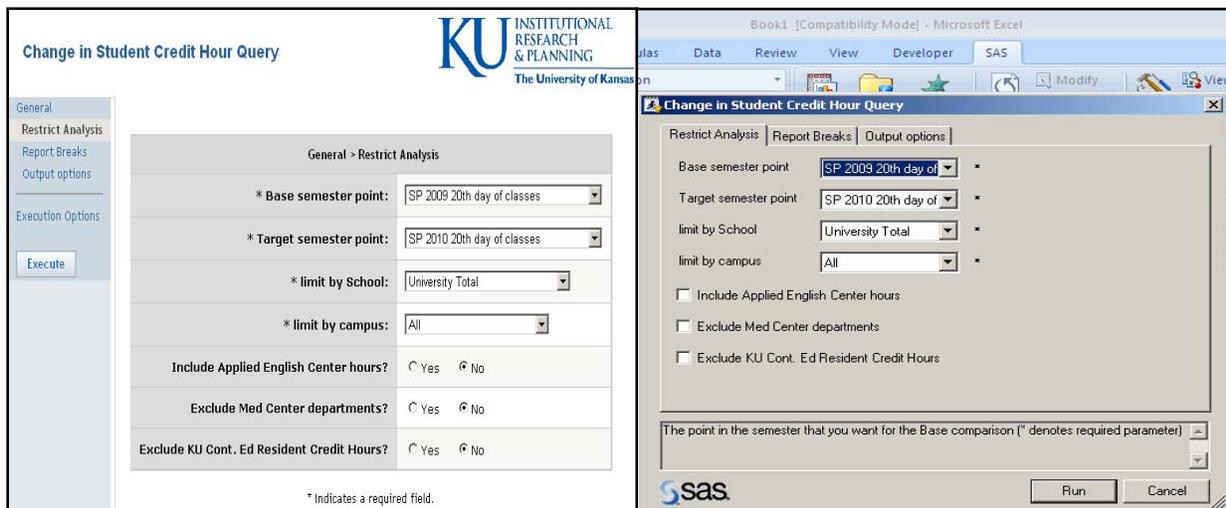


Figure 6: Screenshot of Stored Process prompt forms in web and Add-In for Microsoft Office Excel

With our stored process queries, we allow users to choose multiple types of output formats: HTML for web browser reports, CSV for Excel data files, HTML for formatted Excel reports, and PDF or RTF for formatted print reports. These options allow users to use the most appropriate output style for their need. Examples of what the output looks like from a simple query can be found in the side-by-side screenshots for a web output version run from the portal and what the same Stored Process run from Add-in to Microsoft Office returns (see Figure 7).

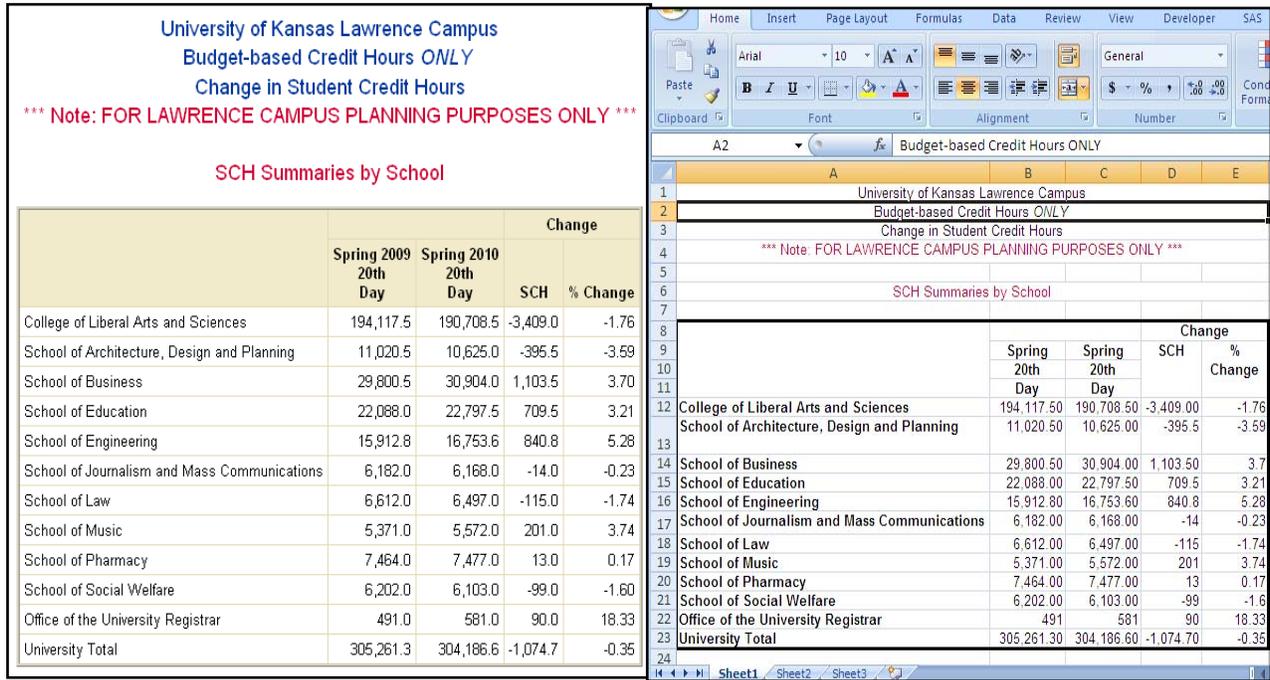


Figure 7: SAS Stored Process output from portal and from SAS Add-in to Microsoft Office

Another aspect of the BI Server environment that we use is the row-level security found with Information Maps and Web Report Studio (for information on setting such a system up, see SAS Sample 31563). An example of this can be found with our system to provide an academic department with access to a listing of their enrolled students. A campus staff person can only have access to student contact information if there is an educational need, so it is critical to limit users of this report access to only students in their department and after they have received appropriate approvals by student system security administrators. The row-level security that has been developed allows us to limit a user to just see students for a single academic major all the way to all the majors on campus and their associated students. A screen snapshot of such a listing, with masked student information, is found in Figure 8.

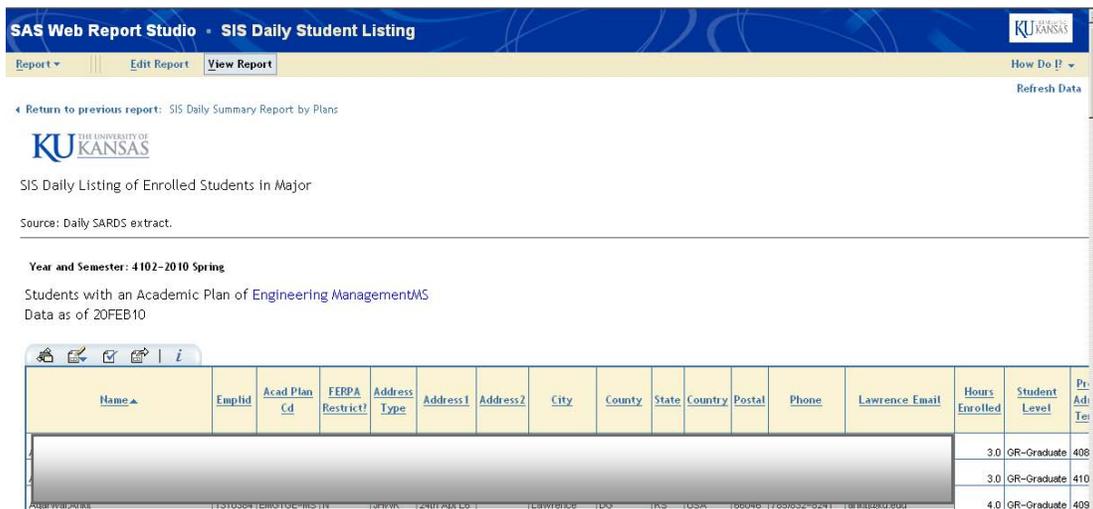


Figure 8: SAS Web Report listing of enrolled students using row-level security

What I have briefly described is but a small subset of the various subject areas and reports that we provide to our user community. The daily usage profile of the queries that run from our system shows that the majority of our queries are around operational business functions. Financial expenditures, from general department needs to those from research grants, are the areas with heaviest customer usage. Figure 9 shows the breakdown by general subject query areas by percentage of use. Figure 10 shows the type of business area of the departmental users of DEMIS.

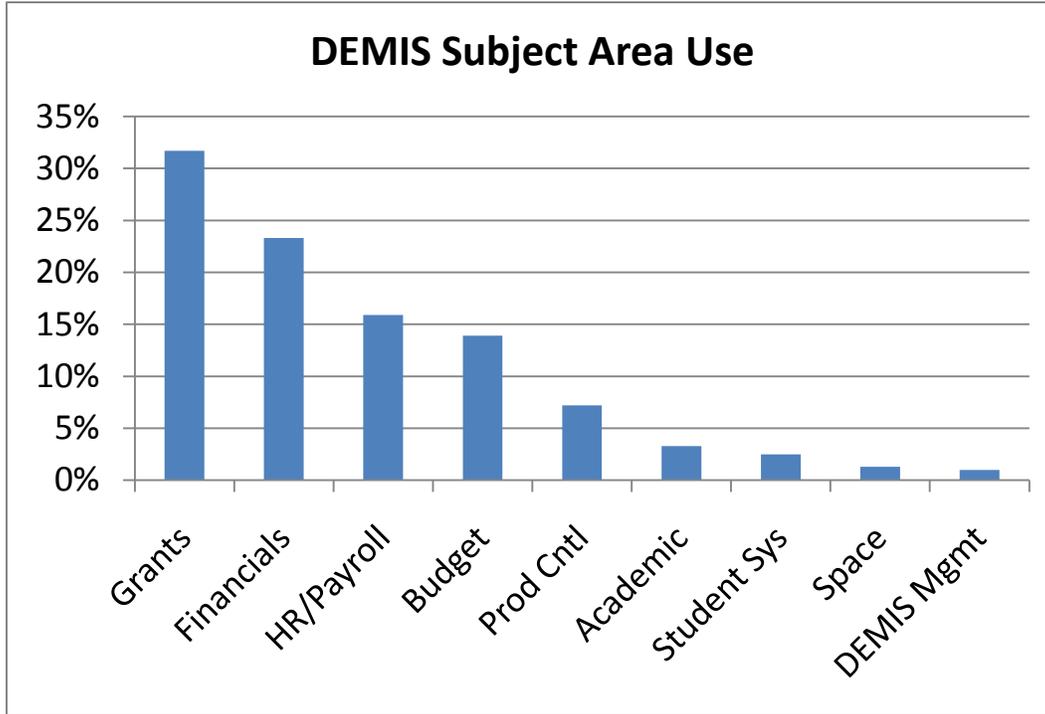


Figure 9: DEMIS Subject Area usage

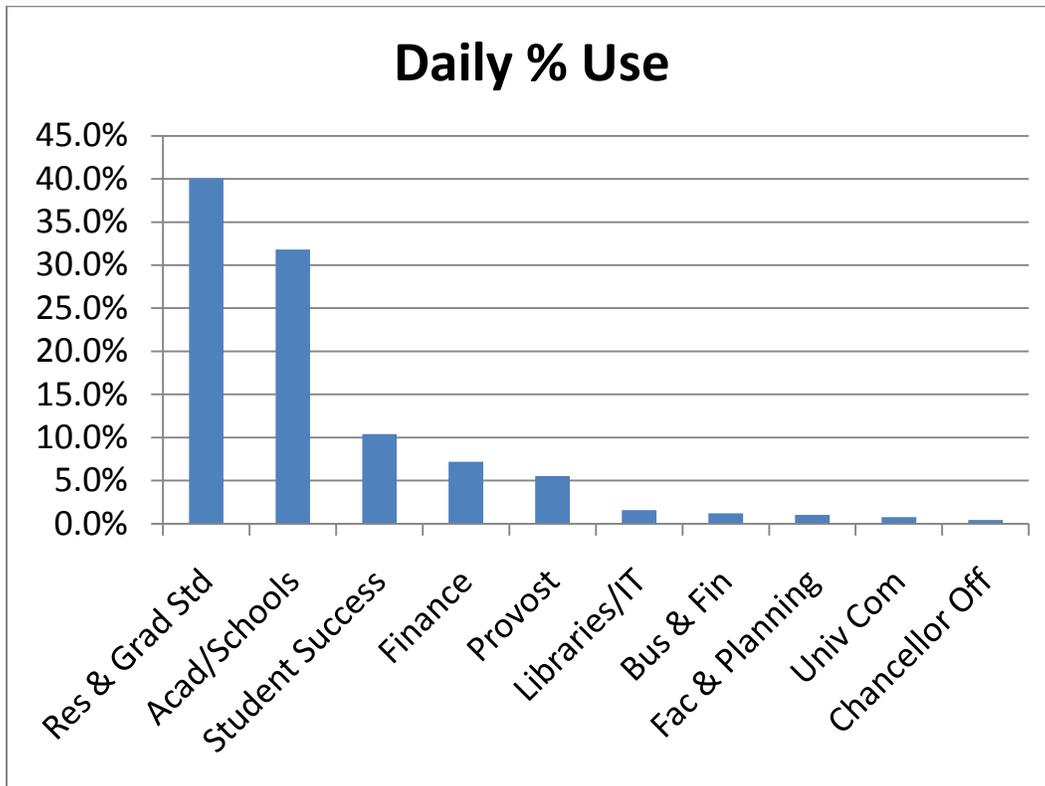


Figure 10: DEMIS Usage by Campus Area

The BI Server platform allows us to leverage the right tools with the right security and access restrictions to quickly address new reporting challenges and unexpected challenges for our institution in today's environment. I will now provide three recent examples of how we have partnered with units on campus and made use of DEMIS and the BI Server platform to help campus decision-makers. The first project I will discuss what we have done in conjunction with the Office of Student Financial Aid to support the management of student scholarship as well as profile our overall financial aid picture on campus. Second, I will describe our work with the Office of Admissions and Scholarship to understand recent changes in undergraduate application patterns. And finally, I will profile our work with the Office of Human Resources and Equal Opportunity where we work to leverage a PeopleSoft user security tree and, through a nightly process, automatically provide those users with access to DEMIS and a Web Report Studio report that uses a row-level Information Map based on the PeopleSoft security tree.

STUDENT FINANCIAL AID PROJECT

The Office of Student Financial Aid (OSFA) was interested in providing department scholarship managers with the ability to look for students who meet the requirements of their department's scholarships. Many of these scholarships have criteria that must be met before the scholarship can be granted to a student. In addition, there was a desire to allow individuals to run a financial need analysis for any students, review and report on students who are already receiving a department's scholarships, and review a student's current and past financial aid awards. A critical factor needed to be that a department scholarship manager could only see those scholarships within their department, and no others. We worked with OSFA to setup a system where we interfaced their MS Access database of scholarships, scholarship criteria, and the department scholarship managers and what scholarships they can access with our data warehouse. We setup a nightly update into our data warehouse to provide us with a user security framework as well as providing the criteria of student characteristics for various scholarships. We then created a nightly extraction process of the awarded financial aid data and various bio-demographic characteristics from our student information system to create datamarts of scholarship balances, students with awarded financial aid, and the unmet financial need for all students who have filed for student financial aid. My unit then developed Information Maps, Web Report Studio reports, and Stored Processes to surface the information to users with the appropriate access. For one of the Web Report Studio reports, we even needed to have a Stored Process run before hand (see *SAS Sample 26175* on how to do this). Below in Figure 9 is the portlet that contains the various links we have surfaced for managers of department scholarship on campus.

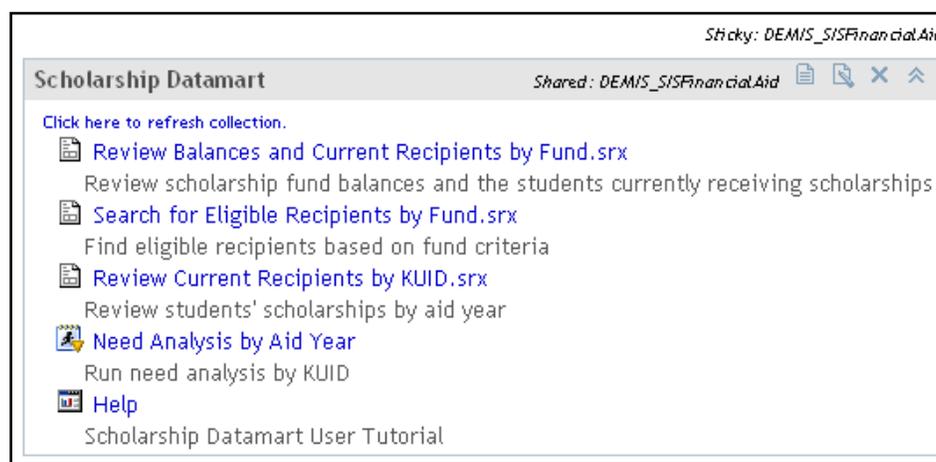


Figure 11: Scholarship Datamart portlet

A few screenshots of output from the reports are provided in Figures 10 and 11 as examples. With this exposure to student financial aid data, we consulted with the OSFA to create aggregate trend reports of the amount and types of financial aid that students are using by department. These reports were provided in the AIMS system that has previously been discussed. But anyone who is familiar with the issues surrounding the cost of higher education and student loan debt knows how valuable it would be to access information on the subject. We provide information for the students within a single department, for students within a whole school, as well as for all students at the University. These reports allow directors and chairs of academic programs and University leaders to be informed about the issues surrounding this subject. Figure 12 displays a small portion of one of these reports provided in AIMS.

Enrollment Criteria: UG- 1 : GR- 1 : LAW-

Required: acad_plan IN ('AEGE-DE','AEGE-ME','AEGE-MS','AEGE-PHD','AEROE-BS') / Preferred: -none- / Uncaptured criteria: -none-

Fund Description

Kuea Fund Comments
Income only to assist worthy and able young persons enrolled, or graduate fellow, in the Department of Aerospace Engineering.

Uncaptured Criteria

Required Criteria Uncaptured Preferred Criteria Uncaptured

Listing of Eligible Students

Record Source	Meets Preferred	Student Id	Name	Term Cd	Student Level	Total Hours Enrolled	Cum. Gpa	Cost Of Attendance	Expected Family Contribution	Original Need	Total Gifts	Total Need-based Loans	Work Study	Unmet Need	Current Amount From This Fund
[Empty rows for student listings]															

Figure 12: Search for eligible students of a scholarship based on criteria

Aid Year	2009			2010		
	Offer Amount	Accepted Amt From Fund	Disbursed Amount	Offer Amount	Accepted Amt From Fund	Disbursed Amount
Item Type	Item Type Descr					
Fed Subsidized Direct Loan				\$4,500	\$4,500	\$4,478
Fed Unsubsidized Direct Loan	\$3,500	\$3,500	\$3,484	\$2,000	\$2,000	\$1,990
Fed Unsubsidized Direct Loan 2	\$2,000	\$2,000	\$1,990			
Fed Unsubsidized Direct Loan 3	\$1,000	\$1,000	\$996			
KU Tuition Grant Ugrd				\$2,700	\$2,700	\$2,700
Alternative Loan	\$8,172	\$8,172	\$8,172	\$2,500	\$2,500	\$2,500
Federal Work Study	\$3,786	\$3,786	\$1,877	\$4,500	\$4,500	\$728
SW Multicultural Scholarship				\$1,000	\$1,000	\$1,000
Coca-Cola Scholarship	\$250	\$250	\$250			
	\$18,708	\$18,708	\$16,769	\$17,200	\$17,200	\$13,396

Disbursed Amount

Aid Year: 2009, 2010

Item Type Descr:

- Alternative Loan
- Coca-Cola Scholarship
- Fed Subsidized Direct Loan
- Fed Unsubsidized Direct Loan
- Fed Unsubsidized Direct Loan 2
- Fed Unsubsidized Direct Loan 3
- Federal Work Study
- KU Tuition Grant Ugrd
- SSW Multicultural Scholarship

Figure 13: Review students' scholarships by aid year

Measure	FY 2006	FY 2007	FY 2008	FY 2009
Total Aid Awarded (All Types)				
% of Students in this Unit Receiving				
Avg Amt Received (Kansas residents)				
Avg Amt Received (Nonresidents)				
Total Federal Grants				
% of Students in this Unit Receiving				
Avg Amt Received (Kansas residents)				
Avg Amt Received (Nonresidents)				
Total Need-Based Loans				

Figure 14: AIMS Summary report on Financial Aid

UNDERGRADUATE ADMISSIONS PROJECT

The Office of Admissions and Scholarship (OAS) was interested in gaining an understanding of the changes that were happening with our undergraduate application patterns, particularly within the state of Kansas. Partnering with OAS, within one month we had developed a datamart of undergraduate applicant information using five years worth of applicant data, with weekly date points for the distribution of official reports. In addition, we gathered Kansas high school enrollment totals by grade level and by county for over five years from our state board of education's web site, using SAS to send a URL query string and input and parse the returned HTML report (see Helf, 2005, for some discussion beyond the basics of such programs). We also developed a multi-year datamart of the enrollments by grade level for KU's top forty "feeder" high schools, which account for seventy percent of our undergraduate applicants. From these resources, we have developed a group of weekly reports for distribution by email, daily reports published to the portal's WebDAV and surfaced on the portal for a small group of users, and have set the data framework in place for the development of an ad hoc query system using these data resources.

The weekly reports were previously done in a manual multi-step manner that required many steps. We have simplified that process to use SAS batch programs to create the week's snapshot of application activity and then generate a PDF report ready for email distribution. We also added in a few additional analyses to this report, including a report using population tree graphs to display test score distributions (I used PROC GCHART and ideas from "Robert Allison's SAS/Graph Examples"). A few screen snapshots are displayed in Figure 15 and 16.

		Dates Compared		Fall 2010 to Fall 2009	
		Fall 2010 02/15/10	Fall 2009 02/16/09	Difference	% Difference
Applications Received	Freshmen				6
	Transfers				3
Overall Total					2
Admitted (ADMT and COND)	Freshmen				4
	Transfers				7
	Total				1
Admission Denied (DENY)	Freshmen				1
	Transfers				5
	Total				5

Figure 15: Weekly comparative report on undergraduate admissions

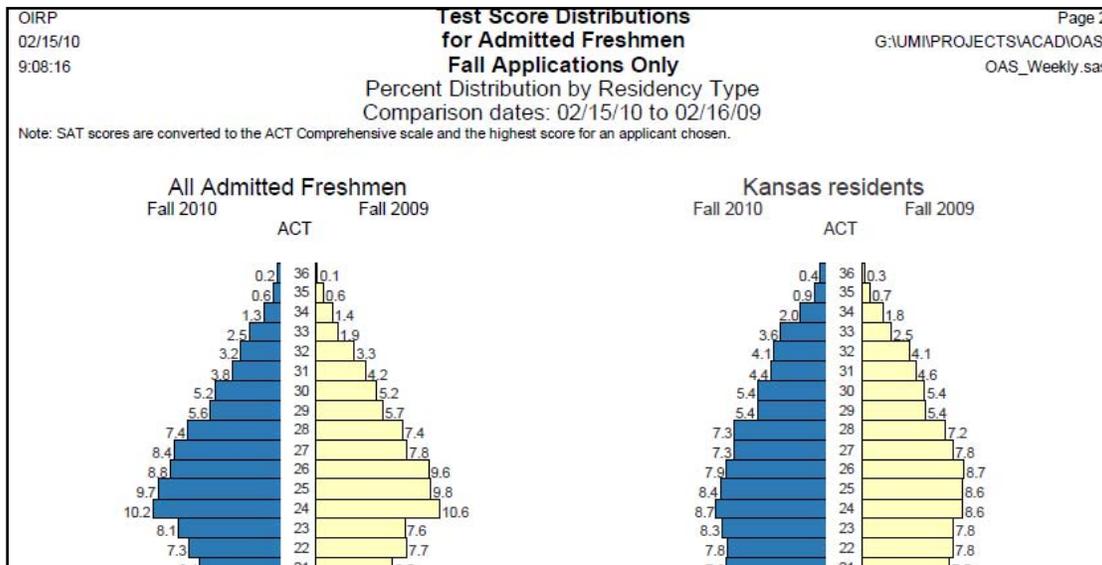


Figure 16: Two year comparative population tree graph of admitted freshmen test scores

We then started the development of an applicant daily report, based on the same report framework as the weekly report, but also included additional breakdowns by geographic regions within Kansas and by the top feeder high schools. This report is published directly to the WebDAV that is part of the BI Portal and it can only be accessed by a

small group of users on campus for now. This report package will allow us to add new analyses and reports to a single link that an administrator can quickly review, print, or email knowing that they are seeing the most recent comparison data available. Screen snapshots of the report link in the portal, as well as some of the reports, are provided below.

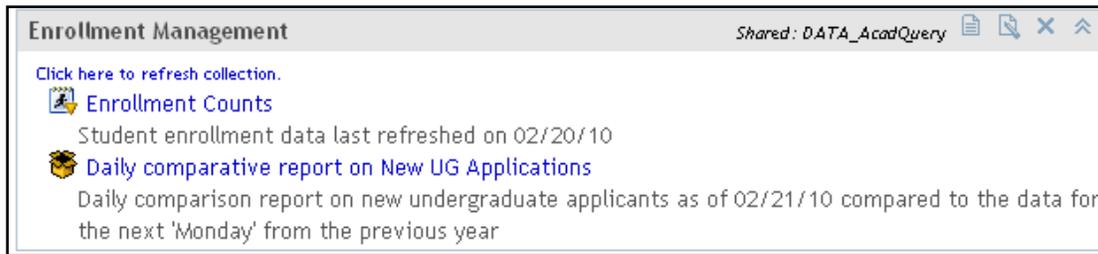


Figure 17: Portal link to a report package available to a limited number of users

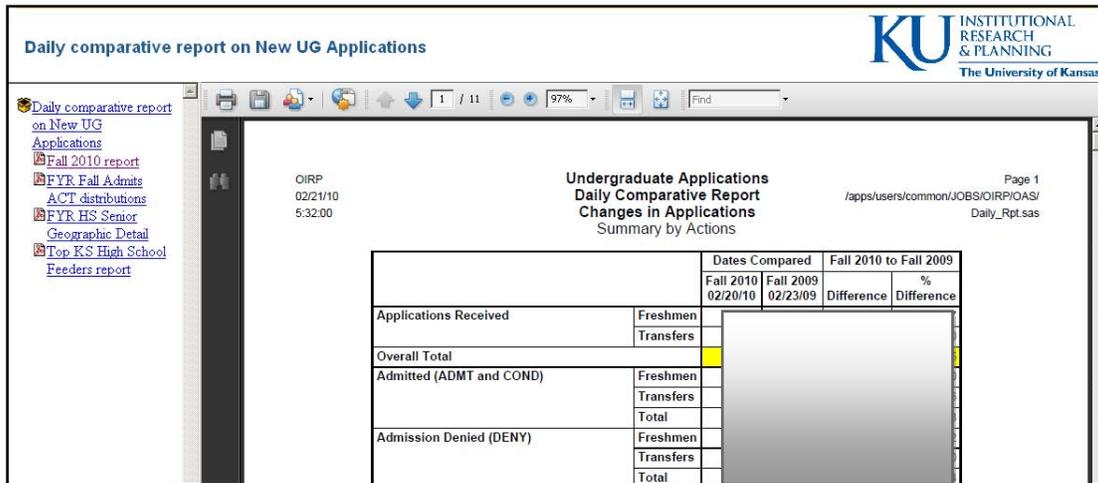


Figure 18: Index of reports and first page of daily comparative report

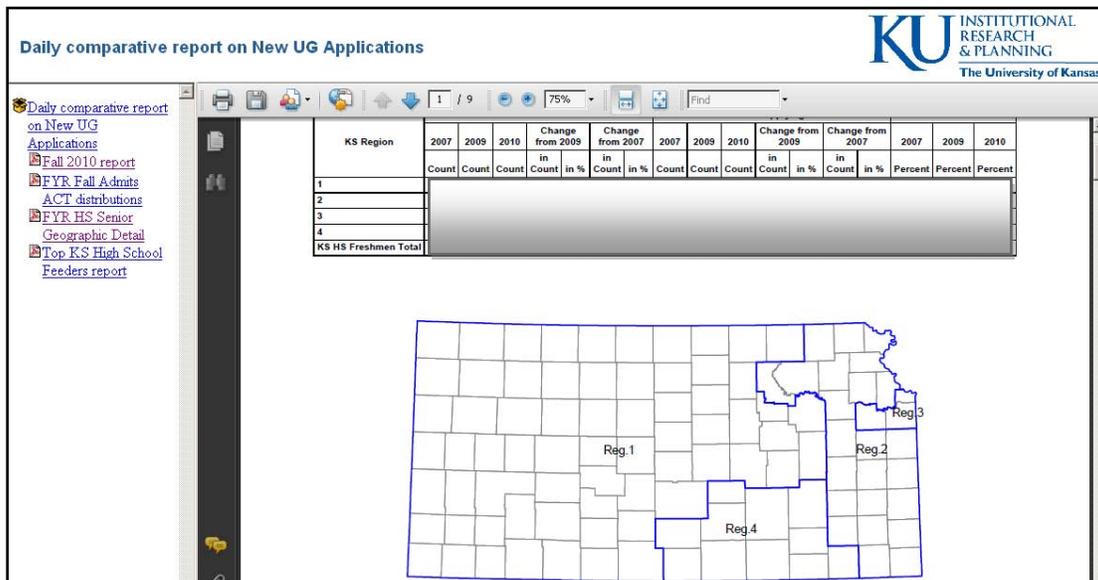


Figure 19: New geographic region and county breakdown report of undergraduate yields

The next step with this project will be to develop a query setup that will allow the user to slice-and-dice the characteristics of the undergraduate applicants across various dimensions and look for additional understanding of what factors are influencing changes in student applications.

DEPARTMENT PERSONNEL PROJECT

The final project that I will discuss in this paper is one where we worked with the department of Human Resources and Equal Opportunity (HREO). The goal of this project is to allow departmental payroll and human resource managers the ability to review various types of information for all the active personnel in their departments, without developing or maintaining a separate user security framework. Although a department personnel manager can look-up the information on their personnel in the transaction system itself, it would have to be done person by person, and panel by panel. We wanted to provide the department manager with a listing of all the active personnel associated with their department (and not just who *they* viewed as active), and provide it in easy-to-work-with subject area blocks.

We worked with the system administrator of the human resources database and created a method to extract the security tree from PeopleSoft that is used to associate timekeepers with the departments that they manage. We then created a daily personnel datamart, based on existing daily staff extracts, but augmented with a few additional items that contained the information that HREO wanted to be able to provide to department managers.

With those systems in place, we developed an Information Map with row level security restrictions and a Web Report Studio report framework to test and review. This report was demonstrated and we made various revisions based on the feedback from human resources and those they worked with to test the system. The final step was to create, as part of our nightly data and user refresh, an update to the BI Metadata Server of any changes to user profiles that we needed to make based on the information we extracted from the security tree that night. In order to do this, we made some modifications of the *Bulk-Load Processes for Identity Management* macros that one finds in SAS documentation and in the delivered SAS macros library (see Appendix 2, of *SAS® 9.1.3 Intelligence Platform: Security Administration Guide, Second Edition*). Any new users found in the security tree are automatically defined in the metadata server and given access to the user role that will allow them to run the report. Any user who we find already with a profile in the metadata server, we will append an association of the new report role to their userid. Any DEMIS user who has the timekeeper role in DEMIS, but no longer in the security tree from the human resources system, will have the role association removed from their DEMIS userid. The initial report page of contact information that a user will see is displayed below. The report is a tabbed report, with different information being displayed when the user clicks on the various subject tabs across the top (circled in red on Figure 20).

Portal

SAS Web Report Studio - Daily_Employees

Report | Edit Report | View Report

[Contact Info](#)
[Job and Positions](#)
[Earnings Funding](#)
[Evaluation / Service](#)

Employee Contact Information

 11000-Provost

ARSP	HR Dept	Name	Pref Name	HR Dept Name	Prf MailDept	Room
------	---------	------	-----------	--------------	--------------	------

Figure 200: Initial page of daily employees listing, with various subject tabs across the top

Within any of these tabs, the user has options to interactively remove (or add) additional columns for the tab's subject area. One advantage with Web Report Studio's framework is that it is also quite easy to export the data to an Excel spreadsheet with a click of a button. Figure 21 shows the basic report, Figure 22 displays the table options where the user can add or remove fields from their display, and Figure 23 illustrates the dialog box in preparation for the export to Excel.

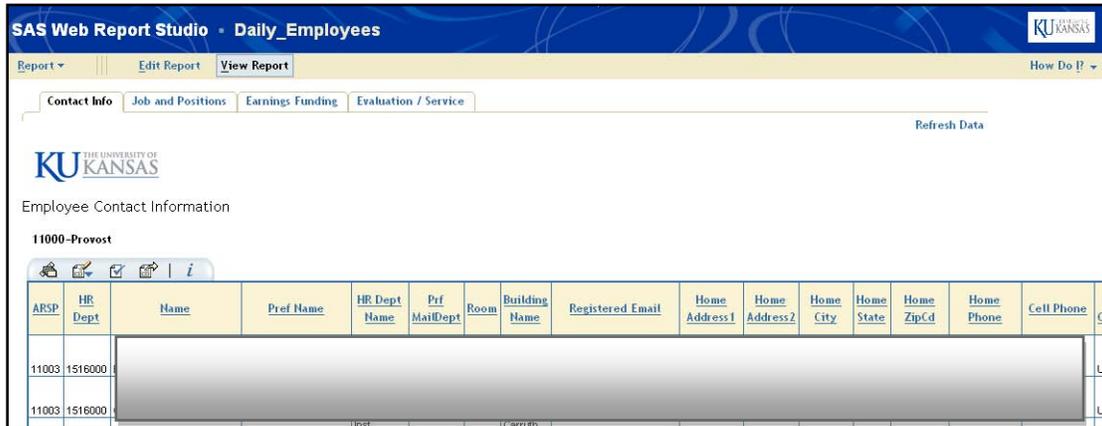


Figure 21: Basic report layout of the employees contact information

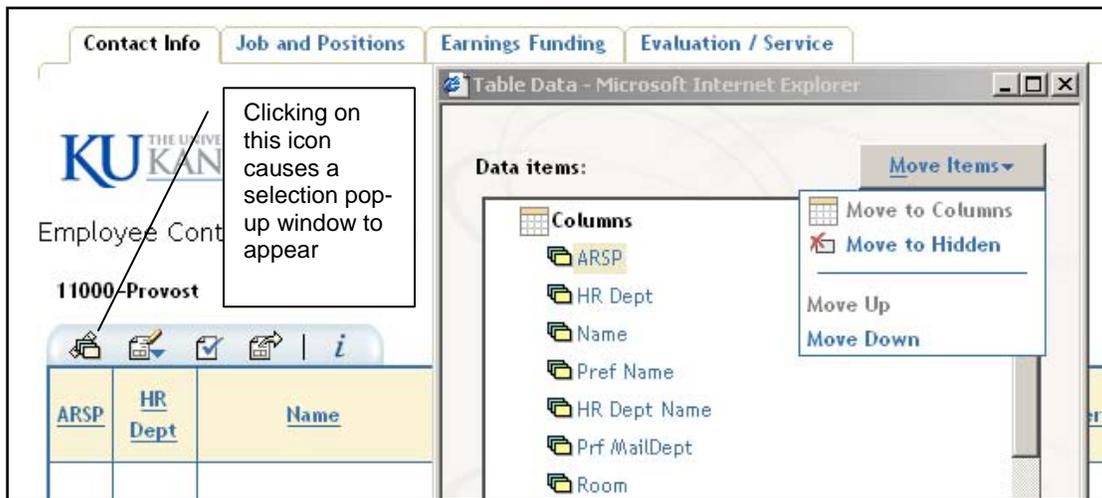


Figure 22: Data items selection dialog where fields can be added or hidden

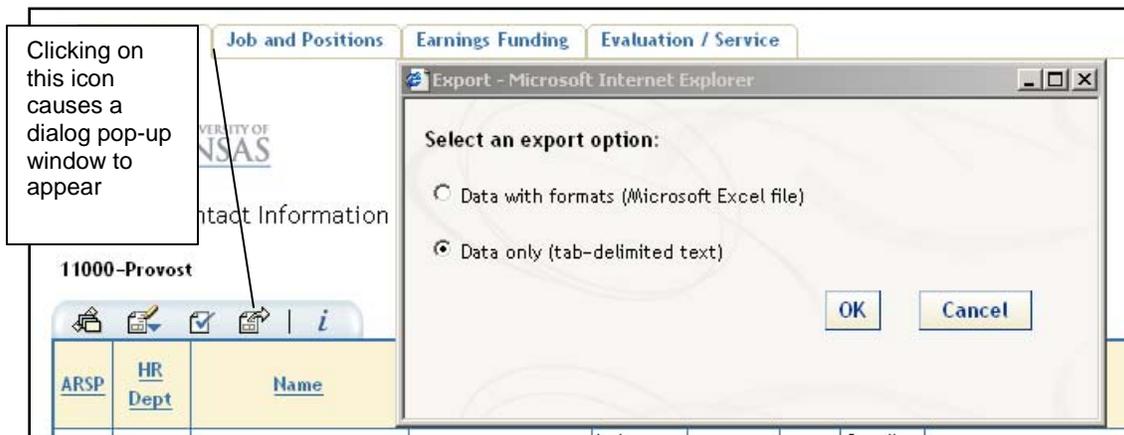


Figure 23: Dialog to export the report's data to Excel

CONCLUSION

At the University of Kansas, we have found that the SAS® BI Server platform provides us with a convenient and integrated delivery system for our decision-support application, DEMIS. With this product, we have been able to provide over 800 users with a system that handles about 1,100 queries on a daily basis. Not only can we provide the standard reports for campus business processes, but we can make use of the platform to work on specialized needs. These specialized needs often require a row-level security layer, which the platform readily provides our developers.

But more importantly, we can quickly and efficiently create systems that provide our campus decision-makers with the information that they need. The recent projects that we have undertaken have:

- helped our departments find funding for their students as well as allow our academic programs to understand the financial impact students undertake to get their education
- helped University leaders identify areas where unexpected changes in student application patterns are occurring
- leveraged systems and resources while providing campus managers with important information on personnel

We will soon be undertaking the upgrade and migration from the SAS 9.1.3 BI platform to the SAS 9.2 BI platform and are eager to take advantage of the improvements and additional features that come with that system. In addition, there are new projects on the horizon that will add to what we have in place and provide our institution with the decision-support information it needs to continually improve its functions and services.

REFERENCES

- Appendix 2, SAS® 9.1.3 Intelligence Platform: Security Administration Guide, Second Edition.* (2006) Cary, NC: SAS Institute Inc.
- Helf, Garth W. (2005), "Extreme Web Access: What to Do When FILENAME URL Is Not Enough," Proceedings of the 30th Annual SAS® Users Group International Conference. Cary, NC: SAS Institute Inc.
- Lund, Pete (2008), "PDF Can be Pretty Darn Fancy: Tips and Tricks for the ODS PDF Destination," Proceedings of the SAS® Global Forum 2008 Conference. Cary, NC: SAS Institute Inc.
- "Robert Allison's SAS/Graph Examples!" <http://robslink.com/SAS/Home.htm>. Particularly, the *Foreign -vs- Native Born* example at http://robslink.com/SAS/democd37/nativity_info.htm.
- SAS Sample 26175. "How to Create a SAS® Stored Process and Then Associate It with a SAS® Information Map," <http://support.sas.com/kb/26/175.html>.
- SAS Sample 31563. "Creating a SAS® Information Map that filters using identity-driven, row-level permissions," <http://support.sas.com/kb/31/563.html>.

CONTACT INFORMATION

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

Name: Ryan Cherland
Enterprise: University of Kansas, OIRP
Address: 1246 West Campus Road, Rm 339
City, State ZIP: Lawrence, KS 66045
Work Phone: (785) 864-4412
Fax: (785) 864-5324
E-mail: ryan-cherland@ku.edu
Web: <http://www.oirp.ku.edu>

SAS and all other SAS Institute Inc. product or service names are registered trademarks or trademarks of SAS Institute Inc. in the USA and other countries. ® indicates USA registration.

Other brand and product names are trademarks of their respective companies.