

Reports at Your Fingertips: Displaying SAS-Generated Data on the World Wide Web

Gilbert Rodriguez and M. Rita Thissen

ABSTRACT

The World Wide Web provides SAS®-language programmers with a quick and easy way to display the output of their applications. Using a simple website, a wide variety of information can be presented in an organized manner, accessible to users at any location. The combination of new technology and traditional SAS-language reporting methods is ideal for use with production systems that generate large numbers of reports for a widespread audience. This paper describes a website which functions as an information management system (IMS) for a large-scale project, making status reports, budget information, projections and other routine reports available to users with a click of the mouse.

INTRODUCTION

Designing a website for management of business or research information is very different from designing one for personal or marketing use. At its most basic level, the purpose of an IMS is to provide access to as much useful information as possible in an understandable format, for the purpose of monitoring, evaluating or making decisions about current operations. SAS reports have often been used in information management, and they can be easily included in a web-based IMS.

The needs of an IMS are simple to state, but not necessarily simple to provide. First, it must be easy to use and intuitive for non-technical people. A high level of information density is preferred, giving access to as much data as is feasible in an understandable form. The information should be accessible by multiple concurrent users, and the organization of the IMS should reflect the organization of the operations, not the properties of the technology that supports it. Finally, it is best if the system is available from many locations, such as at central or remote work sites.

There have been several generations of IMS methodology, with each succeeding one improving on the previous approaches in some way. The first system, of course, was no formal system at all; for some operations, that situation is still adequate. Subsequently, information was distributed on paper, in the form of reports generated on demand or on a schedule. The information might be days or weeks old, but it was organized and presented consistently from one time to another. Generally, the layout would be textual or tabular, with monochrome fixed-space fonts and few or no graphics. With the decline in computing hardware costs and the related growth in electronic access for end-users, many operations began to distribute reports on-line or via e-mail. Now that desktop computers with graphical user interfaces are becoming common, it is time for a new generation of IMS.

New methods of distributing and displaying data are needed. Compared to the full-color images, point-and-click operations, training-free usability, and rapid access to source files, the old information systems look pretty uninviting. More importantly, those systems do not offer the flexibility of the newer designs with toolbars, pull-down or pop-up menus, graphic display and windowing. Websites offer one way of moving information into the hands of the user while taking advantage of the latest features available through browser software.

Throughout these generations of IMS methods, SAS reporting has been a useful tool for many organizations. Printed reports, on-line files or e-mail inclusions or attachments are easy to produce with SAS programs. Currently, SAS Institute is developing ways to produce hypertext markup language (HTML) output from various procedures, and a new product, SAS/IntrNet®, will allow interactive querying SAS datasets from

web scripts. These new additions to the SAS collection will make it easy to generate new styles of data distribution and display.

There is no need to discard the old applications, however. Many hours of planning and implementation went into the design of reports for the older IMS approaches, and often the content of those reports still may be useful. It is better to preserve the value of these reports without hindering the development of better data displays. Instead of reworking applications which are still functional, it makes sense to incorporate them into the new IMS while using programming time to replace any which are no longer effective.

One of the wonders of HTML and the World Wide Web is the flexibility of site design and linkage. Unbound from linear or hierarchical navigation, dissociated from particular hardware or operating system and independent of earlier reporting methods, web-based data display allows almost any information to be made rapidly accessible. The earlier generation of reports can be offered without change while later styles can be incorporated simultaneously. One click on a hyperlink can take you to a traditional data listing, and another can take you to the latest audiovisual offering.

To meet the requirements of a good IMS, a web browser can act as the front-end, or viewer, for all types of data display. The browser provides a visually appealing, up-to-date interface, with potential access to sites on the Internet or on an organization's internal network. These features meet the needs for easy access and usability that were mentioned above.

The remainder of this paper describes the design and implementation of a website that functions as the IMS for a national operation. The site incorporates existing SAS reports as frequently updated but static pages, while allowing for growth in new areas. Due to the confidential nature of the information in the site, it is not possible to provide its address to the public.

WEBSITE DESIGN

The layout of a web-based IMS should reflect the nature and structure of the operations that its information represents. In other words, decisions about what items to include and where to connect them should be made on the basis of importance and frequency of use, not primarily on an artistic or technological basis. Consideration of color, background patterns, images and other visual items must not take priority over the needs for clarity, efficiency and ease of use. In fact, use of decorative objects can detract from the performance of the site, either by slowing the presentation of pages on-screen, or by distracting the user to some degree.

The website described here was designed as a part of a research project. The represented operations include management of a large survey staff across the United States, with project management located in North Carolina and field supervisors in various regions of the country. Information to be offered in the site included maps, SAS reports, staff contact sheets, various other documents, and links to other national data sites. In accordance with the staffing structure of the project, the information was arranged hierarchically, allowing the project management to view any or all of the data, while the field supervisors can only view some of the reports. A further distinction was made between two groups of supervisors, allowing them to view only the reports for their own group.

Security levels were also considered at the design stage, addressing questions such as: Will the public be allowed to view the site? Will the approved audience include individuals who gain access through Internet service providers or only through a

secure Intranet? Should commercial search engines be notified of the existence of the site? If the public has access, what measures must be taken to ensure the continued integrity of the contents? In designing a site, the answers to these questions will affect the location of the files, determining whether they need to be on a server that is protected by a firewall, by password protection, or with no formal security measures.

Our decision was to locate the website outside the company firewall so that off-site personnel and clients could browse the information without logging into the company's own network. However, the data being displayed are confidential, so the site was placed under password protection and not registered with any search service. All data in the site are copies of information stored elsewhere, minimizing the loss in case of accidental or deliberate damage done to the site. Data quality and integrity were guaranteed by automated daily refreshing of the site.

Figure 1 shows the layout of the major pages, with the three home pages as distinct entry points into the website, each with its own password. The arrows indicate directions of navigation that are allowed. For instance, the project management may move to any of the pages freely, returning at will to the management home page. The field supervisors may only move to their report group. The website has links to other sites on the World Wide Web, and users can return to the project home page from them. However, users who enter from other sites must know the address and password to gain access to the project website.

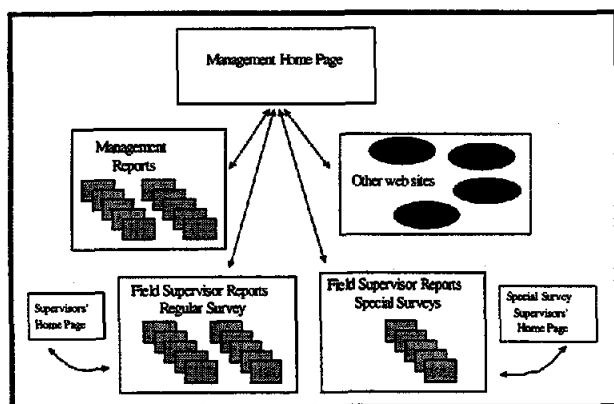


Figure 1. Layout of the project website.

The appearance of the management home page is given in Figure 2. It provides simple links to several categories of reports and to some additional non-project data sources. From this page the project management can proceed to either of the field supervisor report collections. The contents of the pages were designated by the project manager and his staff. Each local link on the home page leads to another menu page, not to the reports themselves, providing a visual categorization of the data. The plain background of the pages was chosen to maximize transmission speed, while minimizing visual interference.

The reports themselves are accessible from the next level of the website. The Management Reports and Field Supervisor Report pages offer menus of links to SAS output files. The Management Reports are linked by a menu, similar in design to the list shown in Figure 2. Additional pages or lists of links can be added as needed. The number of levels was deliberately held as low as possible, in order to reduce the number of mouse clicks needed before viewing the data. Though this may seem trivial, most users appreciate the ability to view the data with fewer steps.

Figure 3 shows the design of the page used by the national field supervisory staff. Each cell in the grid offers a link to one report, and the reports in each row are tailored to show the data for a particular supervisor. In the project website, the row labels are replaced with the names of the supervisors, and the envelope

icon beside each name offers a direct e-mail link to that person. As the number of supervisors changes, additional rows may be added to or removed from the grid, without affecting the others. This page offers a particularly dense display of links, without losing functionality or ease of use.

The cells of the pillbox grid of Figure 3 connect to traditional SAS report files. The report programs have not been modified for web-based display. Instead, the output is linked to the website through use of the standard HTML tags <pre> and </pre> for preformatted text. Font size can be controlled outside of those tags. A sample SAS report is shown in Figure 4.

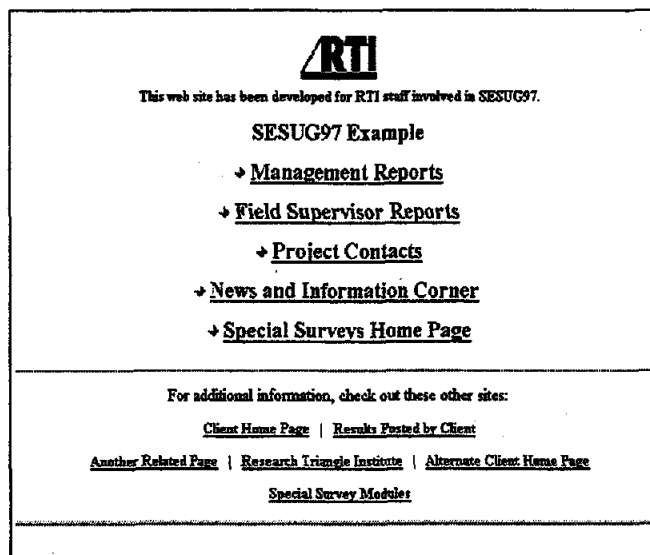


Figure 2. Project Management Home Page

FS	E-Mail	OL	PLE	SI	PIE	Short	F	Over	Prob	OL Status	SI Status	Team	Team Sum	Un-active	Cases	Not Here
FS #1	[icon]	[icon]	[icon]	[icon]	[icon]	[icon]	[icon]	[icon]	[icon]	[icon]	[icon]	[icon]	[icon]	[icon]	[icon]	[icon]
FS #2	[icon]	[icon]	[icon]	[icon]	[icon]	[icon]	[icon]	[icon]	[icon]	[icon]	[icon]	[icon]	[icon]	[icon]	[icon]	[icon]
FS #3	[icon]	[icon]	[icon]	[icon]	[icon]	[icon]	[icon]	[icon]	[icon]	[icon]	[icon]	[icon]	[icon]	[icon]	[icon]	[icon]
FS #4	[icon]	[icon]	[icon]	[icon]	[icon]	[icon]	[icon]	[icon]	[icon]	[icon]	[icon]	[icon]	[icon]	[icon]	[icon]	[icon]
FS #5	[icon]	[icon]	[icon]	[icon]	[icon]	[icon]	[icon]	[icon]	[icon]	[icon]	[icon]	[icon]	[icon]	[icon]	[icon]	[icon]
FS #6	[icon]	[icon]	[icon]	[icon]	[icon]	[icon]	[icon]	[icon]	[icon]	[icon]	[icon]	[icon]	[icon]	[icon]	[icon]	[icon]

Figure 3. Field Supervisor Report Page

You may note that in Figure 3, icons are used for several functions: email, returning and linking to reports. While using art solely for decoration may not be desirable in an IMS, using pictorial indications of functions may make the page more effective for the user. In this instance, the icons are better representations of their links than text would be, since the practiced user grasps the information immediately.

Through use of menus or grids like the ones above, a single website can be made to present links to hundreds of reports. Viewing one after another is as simple as using the browser's

toolbar and clicking the mouse. Other than the effort of designing and implementing the website itself, no programming was needed to make these traditional text files available as part of a web-based IMS.

FI ID	FI Name	Case ID	Final Who Code Part	Case ID	Final Who Code Part
411944	PERSON1, CATHERINE R.	0320450006A	77 2		
417995	PERSON2, LESLIE J.	03403010061A	70 5		
450502	PERSON3, HORACIO	03424500115A	70 2		
453159	PERSON4, SILVIA	03421060020	30 3		
479030	PERSON5, DANN	0342345A006A	70 2	03422510120A	70 1
480424	PERSON6, GUADALUPE	03423270060B	79 9		
483634	PERSON7, THOMAS T.	03423110037	30 3		
489120	PERSON8, JUDY A.	03720860023A	70 5	02720860023B	70 5
489236	PERSON9, JACK B.	03421450047B	79 4		
491512	PERSON10, ELORITA	03421060008	10 4	03421060104	30 3
491533	PERSON11, PATRICIA	03421130077	18 2		

Figure 4. A standard textual report, produced by a SAS application and viewed as part of a website.

FEEDBACK

Our website has been in use for a number of months, and the response we have received from the management and field staff has been strongly positive. Compared to receiving reports via e-mail, dialing into a remote system and viewing them singly on the screen, or handling printed copies, presentation of information through the internet has been seen as a real advancement. Supervisors can easily refer to recent documents without needing to assemble and assimilate all the information at once, and discussions of report content can be held with each party viewing the same information. In general, the move to web-based data distribution was highly successful.

The advance work of designing the site with the needs of the users in mind proved to be worthwhile, as the basic layout has not needed change since implementation. Some changes were made, including removing all background color from pages, since browsers and computer configurations varied in the appearance of the final product, and background color did not contribute in a meaningful way to the functioning of the IMS. Additional reports were added as we saw the benefits of viewing documents via a single interface, and requests have been received for more graphical data display. Future development work will be directed toward meeting these needs.

One drawback of the web-based report presentation has come to light. HTML features are aimed at visual electronic display and do not include comparable control for printing the contents of pages. While SAS application output routinely includes page break controls for printing output, these printer instructions are ignored by browsers. HTML does not include any tags which specifically indicate printer actions. As a result, multi-page reports cannot be printed from the website with content-controlled paging. We hope that future improvements to the HTML standards and browser design may help this situation.

We also encountered some browser-specific difficulties. HTML is handled a little differently by the popular browsers, and we found it necessary to view each page in several versions and varieties of browsers before we released the layout to the website. Older versions in particular are less reliable at displaying tables and 80-character-wide reports; the rightmost character would be truncated in some circumstances. Colors and font control also vary from one browser to another.

Overall, the effort put into developing a website as a means of looking at existing reports has proven to be worthwhile. The

amount of effort needed for learning how to set up and run the site was small compared to other options, and all of the existing applications could be kept intact. As a strategy for meeting the information access needs of the project management and field supervisors, this website has been well received.

ACKNOWLEDGEMENTS

The authors wish to acknowledge the support of members of the Computer and Applications Design Center at RTI, especially G.G. Frick.

The authors may be contacted as follows:

Gilbert Rodriguez
Research Triangle Institute
P.O. Box 12194
Research Triangle Park, NC 27709
grd@rti.org

Rita Thissen
Research Triangle Institute
P.O. Box 12194
Research Triangle Park, NC 27709
rthissen@rti.org

SAS and SAS/IntrNet are registered trademarks of SAS Institute, Inc., Cary, N.C.