

A Generalized SAS® Management System for Online Data Entry Applications

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ABSTRACT

The only thing that is consistent in the world is inconsistency. With new products and more computer power at our fingertips, application developers can accomplish more in less time. Furthermore, more capabilities can be given to the user in a much more standardized and generalized format. Along with the benefits for the user, the application developer gains because maintenance can become easier. At the Mayo Foundation over 60 on-line data entry systems have been developed in version 5 for medical research projects. Many of these projects were under a generalized system while others were individual entities. With version 6.08 SAS/AF,® SAS/EIS,® SAS/FSP,® and SAS/SCL® we can now bring these systems under one generalized system with many more capabilities and options. This generalized system standardizes across the board functions, makes system maintenance and project management updating within the system easier, and lets each entry system keep their customization that is unique to each project.

INTRODUCTION

The Mayo Foundation is the largest group practice of medicine in the world. Along with patient care, Mayo supports medical, educational, and research programs. In the area of Biostatistics, data is captured for retrospective and prospective research. The data is captured in a variety of ways, one of which is on-line data entry. One role of an analyst/programmer in support of this kind of work is to provide data management functions. Building project systems that give users the

functionality they need to accomplish their every day tasks is just one way analyst/programmers fill that role.

With the newest version of SAS, these project systems needed to be converted. The approach of a generalized on-line management system was again used as it was during the days of version 5. This paper describes the process and findings of defining what that system is comprised of.

METHODS OVERVIEW

The generalized on-line database management system is a system comprised of two separate pieces working together to complete its tasks. One piece of the system is the database management piece which includes a database that enforces standardized database naming conventions, the process of managing many databases under one management system, and the information needed for the second piece of the system to operate. That second piece, the generalized portion of the system contains standardized functionality such as the process of variable and screen declaration, data input, data retrieval, data analysis, and others. Furthermore, of all the functions users have requested and need to accomplish their work, a core group have been identified as those needed by every project. With the identification of these core functions, a common function menu can be created. Maintenance for this system is reduced by implementing data driven techniques which result in less hard code and non-duplication of code. Project management procedures have been standardized, implemented and enforced

for any project that uses this management system.

A defined project is one that collects information for medical research. The purpose of this research is for discovering answers to questions or verifying the work of others. The outcome of this analysis is to write papers about the collected information and their findings.

Information Engineering (IE) methodology was used in system analysis and design. Questionnaires were sent out to end-users, programmers, statisticians, and doctors who currently have on-line entry (project) systems. This was done to get a better understanding of how these people use their system, what they like and do not like about their current system, what their needs are to get their work done, and if possible, what other perks they would like. The compilation of the questionnaire data drove the direction of the joint application development (JAD) sessions. These sessions, attended by a subset of those completing the questionnaire, were conducted to focus on the hot spots of the questionnaire results and define what it takes to get the work done for these medical research projects. Once a better understanding was obtained of what functions are standard across all projects, what pieces are optional, and what pieces are customized, the system design was defined and presented to the group of users for approval.

The main goal of the on-line database management system was to focus on the needs of the users, providing functionality to support their everyday tasks. Because of the vast knowledge of using the SAS version 5 and 6 releases, users know best what worked and what did not. They know what it takes to get their work done, and they can focus on those areas where improvement is needed. It was found that there existed three areas that needed improvement. First of all, users may

work on one or many projects. They may also work physically close to users working on completely different projects. In the past, different programmers were developing project systems in different manners. Users learned two or three different ways of doing the same function. What resulted was user confusion and the inability to help co-workers.

A second concern of users was that communication of what functionality was available could be improved. A user may have asked for a particular function and received it. However, it was not shared with all users to let them know the function exists. Other users may need the function, but because they did not know it was available to them, they could not use it.

Lastly, users felt that procedures for making decisions within a project were not defined. Users needed to have decisions made, did not feel they had the authority to make those decisions, and did not always know where to turn.

For these reasons a system needed to be developed to manage these projects. A goal of the database management piece of the total system is to give the system administrator the ability to standardize, control, and document each project that has ever used the system. Maintenance of this piece of the system should also not become a full time job of the administrator. The final goal of this system portion is to give each project access to all standard functionality objects, and also to allow for customization.

The decision was made to totally rewrite the new generalized portion, rather than try to use any of the version 5 code. With the new object capabilities and revamped screen control language (SCL), it only made sense to rewrite and take advantage of what 6.08 had to offer. This portion was built using SAS/AF and SAS/EIS making it look and feel

the same to all users, and to provide point and click capability as much as possible. SCL was incorporated with a data driven object oriented objects/methods based format that links into the database management portion to give every project the access to the standard functional objects. SAS/ASSIST® is used as a retrieval and statistical analysis tool.

ENVIRONMENT

To be totally generic, the system must be able to be ported to any user supported platform. The system must also be able to find information that may be in different hardware/software environments and make it available to the requesting project. The attached entity/relationship (E/R) model, Appendix I, shows how the management system was modeled to incorporate this idea. A second environment diagram, Appendix II, shows the trafficking between the different platforms. To make this type of environment work, the on-line database management system and its supporting database must be ported to all environments used. The porting of the system means that a majority of the code does not get changed. It is only the interfaces between the connecting environments that need to be customized. Each project can then store and/or have access to data, format libraries, macro libraries, etc., that it needs in any environment.

THE DEVELOPMENT OF THE GENERALIZED MANAGEMENT SYSTEM

With the results of the questionnaires and the JAD sessions, implementation was divided into many steps. The first step in developing the on-line database management system was to define the range of total functionality that any user might want to access. From there, a core group of functions was identified for inclusion in the generalized portion that all project systems receive. The rest of the functions would be optional and would only be

included in their project system if the user requests it.

With the group of functionality objects defined, it was then decided how each one would be implemented. Some of the requests of the users turned out to be procedures that were outside the scope of the on-line database management system. Even though these procedures were outside the scope, they still needed to be defined and enforced. Other functions could be taken care of by SAS/ASSIST, while the rest were developed into objects. These functions were built using SAS/AF, SAS/SCL, and the object oriented capabilities available.

While the generalized portion of the management system was being developed, the procedures of how these projects would be managed, and the model of the supporting management database was designed. Both the generalized and management pieces needed to be defined and implemented during the same time period to make sure no important pieces were omitted and to get a better feeling of how the management system and the objects would work together.

The next step was converting all project systems to version 6.08 using the naming conventions to fit into the management system. Along with the conversion, adding all the necessary data into the management tables was done.

The final step was training all of the users about the new procedures that need to be followed and how to use the new objects of the generalized portion.

USER OPERATION OF THE SYSTEM

Each project has its own unique project number. From this project number the management system knows who are the valid users, the responsible programmers, and other

things important to that project.

Once the user logs onto the generalized piece, the management portion takes over to see if this user is valid for more than one project. If the user is valid for more than one project, the management system prompts the user to choose which project she/he is interested in. If not, then the management system picks the valid project. Once that has been decided, the system can then move on to allocate the appropriate project database and give the user access to the needed objects.

Through macro variables or object oriented objects/methods all needed databases and screens are allocated. These statements standardize the system screens. Therefore, no matter what investigator is using the system, all the screens, procedures, and functions are the same for any project. The system takes the user to the valid options for that project by building the menuing system based upon the functions needed.

SAS/ASSIST, which is an option for end users, gives users the ability to do simple retrievals and analysis against their own data. The reason for having this capability is two-fold. The first reason is that end-users request ad hoc retrievals. By having this system in-place, it gives them the ability to do most of those requests themselves. The result is less work for programmers and faster turn around time for the request results. The second reason is that with SAS/ASSIST, the users have a standard tool that is already built and requires no maintenance.

To initialize a project, the following procedures are followed. These preliminary steps include obtaining a project number and entering it and all pertinent information for that project into the system management tables. The system administrator will also need to allocate tables for the project, request backup, and request a user logon if needed.

The user also needs to fill out a project needs sheet where all optional functions are listed. When these steps are completed the project is up and running. A programmers time involved to get a project up and running is one hour maximum.

EXPERIENCE AND LESSONS LEARNED FROM THIS SYSTEM

The generalized portion of the on-line database management system gave users one standard way of doing their work. Users who work on many projects complete the functions needed in the same manner no matter which one they are working on. It also gives users the ability to share information and train other co-workers. A functional needs sheet provides users with one place to look for all the functions available to them. JAD sessions helped to resolve those concerns that were a part or not a part of the scope of the management system.

In conclusion, a majority of the time spent on building the on-line database management system was spent with the users and defining the system before implementing it. With the system well defined before implementation, implementation was simple and fast, resulting in a stable product.

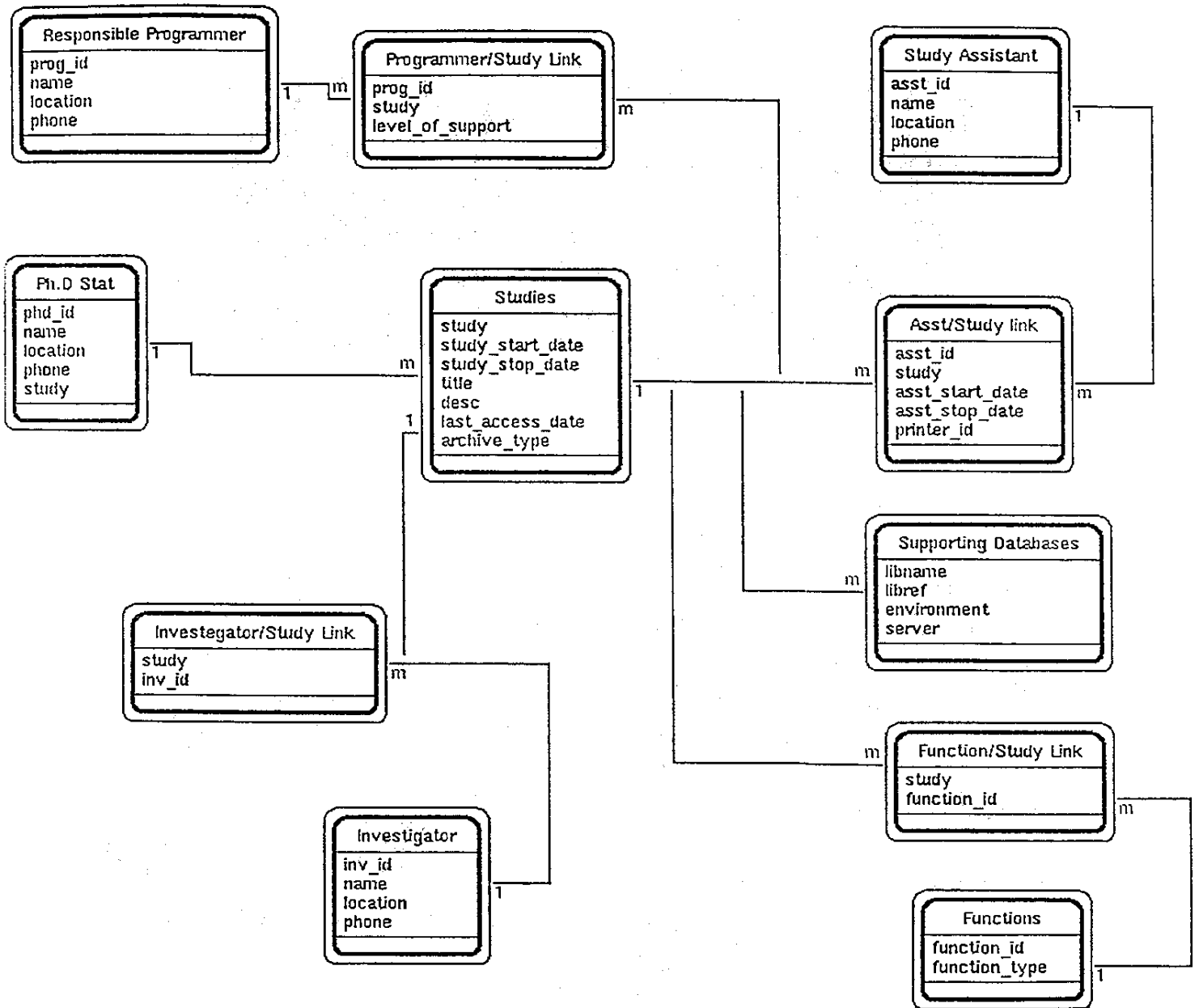
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Appendix I



CURRENT RESEARCH COMPUTING ENVIRONMENT

