A Methodology for Truly Dynamic Prompting in SAS® Stored Processes
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ABSTRACT
Dynamic prompts in SAS® stored processes may be developed by selecting the “dynamic list” option during prompt construction. The list is usually sourced from a SAS dataset that is pre-defined in the metadata. However, the process of refreshing the dataset is usually independent of the stored process and must be included somewhere in the application. Using SAS views as a source for dynamic prompts will insure that the list will be truly dynamic. This paper illustrates the process with a cascading prompt example.

BACKGROUND
SAS Views
SAS Views were first introduced in SAS Version 6 in the 1990s. A SAS View is compiled SAS code that when executed produces a virtual dataset. There are three types of SAS Views - Data step views, PROC SQL views and SAS/ACCESS views. However, since the type of SAS View does not affect the basic premise of this paper, they are not differentiated and will be referred to as ‘SAS Views’ in general. One of the many benefits of using SAS Views is that it is provides access to the most current data.

SAS Stored Process (STP)
According to the official definition, a stored process (STP) is a SAS program that is stored on a server and defined in metadata, and which can be executed as requested by client applications. To many STP users, it is just SAS code that can be invoked by many SAS internal applications (SAS Enterprise Guide®, BASE SAS etc.) and external (Java, .NET) applications if being deployed as a web service. It can be implemented both as a data source or data target. It can also act both as an API, or a functional processor.

A REAL LIFE SCENARIO
When defining dynamic prompts for an STP, the Data Source for the Prompt (DSP) has to be predefined in the metadata server. When a DSP needs to be updated, a separate data refresh process is usually needed. One option is to set up a scheduled job that runs routinely. However, it may be troublesome when the updating of the DSP is not based on a fixed schedule. Another option is to chain two STPs. The first one would update the DSP, and end users will likely need to be involved. As one of the Business Intelligence (BI) components, STP’s could be used by business users who are not necessarily savvy in either SAS programming or understanding the mechanisms of STP’s. Therefore, a good STP is friendly to end users through both providing introductive interactions (prompts) and eliminating manual housekeeping procedures as much as possible. How do we accomplish the task of updating a DSP without end users having to do it explicitly? SAS views can come to rescue. The following steps illustrate the whole process of building an STP with dynamic cascading prompts using data from the SASHELP tables.

Preparing the sample dataset/views.
/*One will need a permanent library to host sample tables/views*/
LIBNAME SESUG '/frl/Users/SESUG/';
data SESUG.stp_1;
set sashelp.prdsal2;
/*The commented out portion can be switched back on to change the data source*/
/*if upcase(country) in ('U.S.A.' 'CANADA'); */
if upcase(country) in ('MEXICO' 'CANADA'); /*This can be also commented out to change the data source*/
run;
proc sql;
create VIEW SESUG.COUNTRY_VIEW as
select distinct COUNTRY from SESUG.stp_1;
quit;

proc sql;
create VIEW SESUG.STATE_VIEW as
select distinct COUNTRY, STATE from SESUG.stp_1;
quit;

Step 1. Define the metadata library
Define (or predefine) a SAS metadata library using any SAS applications that are capable of writing/modifying metadata, such as SAS Enterprise Guide, SAS Management Console (SMC), SAS Data Integration Studio or even BASE SAS. The following example is based on the SMC.

Open SMC >> Plug-ins >> Data Library Manager >> Libraries (Right click) >> New Libraries…

Display 1. Define the metadata library-1
The example is for SAS BASE Library.

Display 2. Define the metadata library-2
This metadata library name ‘SESUG 2015’ is not a Libref, and it does not have to comply with SAS Libref naming restrictions.

Display 3. Define the metadata library-3

This is to assign an application server for this library.

Display 4. Define the metadata library-4

Input ‘sesug’ as the SAS Libref. This is the libname as used in Base SAS, and it needs to follow SAS naming conventions. The length must eight (8) characters or less. Select New… and input the physical address of the library. Click ‘OK’, ‘Next’, ‘Finish’

Step 2. Pre-Assign the metadata library

Right Click the library name ‘SESUG 2015’ and choose Properties >> Options >> Advanced Options >> Check ‘Library is Pre-Assigned’. 
Display 5. Pre-Assign the metadata library

**Step 3. Registering Tables/Views**

Right Click the library name ‘SESUG 2015’ and choose Register Tables… >> (check all of the information) Next

Display 6. Registering Tables/Views

>> Select All Tables >> (using Browse… to select the folder location for metadata objects. This is the metadata folder, NOT the physical path) Next >> Finish
**Step 4. Building an STP.**

Since this paper does not include a STP tutorial, only a brief explanation is provided in general with the exception of dynamic prompting.

This is the SAS code for the STP, and the output is a simple pie chart. As you can see, two possible prompts are COUNTRY and STATE.

```sas
title "&COUNTRY. - &STATE.";
PROC GCHART DATA=SESUG.stp_1 (where=(COUNTRY = "&COUNTRY." AND STATE="&STATE."))
   PIE PRODUCT /
      SUMVAR=ACTUAL
      TYPE=SUM
      NOLEGEND
      SLICE=OUTSIDE
      PERCENT=NONE
      VALUE=OUTSIDE
      OTHER=4
      OTHERLABEL="Other"
      COUTLINE=BLACK
   NOHEADING
   ;
RUN; QUIT;
```

Display 7. Building a STP-1

In your Program Editor, Create >> Stored Process
Display 8. Building a STP-2

The name of the STP and where to store it, >> Next

Display 9. Building a STP-3

Display 9 illustrates the SAS code portion of the STP, which can be edited or imported code here. >> Next
The definition of the STP execution options and where the source code is stored are illustrated in Display 10.

Display 10. Building a STP-4

The method for populating prompt >> User selects values from a dynamic list >> Browse… to choose the COUNTRY_VIEW from the metadata folder where this metadata object is stored. >> Column >> COUNTRY

The process is repeated to create a new prompt STATE. Prompt STATE is a cascade prompt, whose value will depend on the value of prompt COUNTRY.
New >> Prompts from SAS code >> COUNTRY >> Prompt Type and Values >> Method for populating prompt >>
User selects values from a dynamic list >> Browse... to choose the STATE_VIEW from the metadata folder where
this metadata object is stored. >> Column >> STATE >> Dependencies >> Add >> Prompt COUNTRY >>
Dependency Column: COUNTRY >> Operator: Equal >> OK

Display 12. Building a STP-6
>> Next >> Next >> Finish

Step 5. Testing the STP.
Now when the STP 'SESUG 2015' is executed, the following window will pop up:

Display 13. Testing STP-1
Under COUNTRY, only Canada and Mexico can be selected, which is the result of the following SAS code when we
prepare the source table:

```sas
data SESUG.stp_1;
set sashelp.prdsal2;
/*The commented out portion can be switched back on to change the data source*/
/*if upcase(country) in ('U.S.A.' 'CANADA'); */
if up  "MEXICO' 'CANADA'); /*This can be also commented out to change
the data source*/
run;
```
After COUNTRY is set to ‘Canada’, only provinces of ‘Canada’ can be select under STATE, select ‘Ontario’. The following is the final outcome for this particular selection:

![Diagram of Canada - Ontario]

Display 14. Testing STP-2

Now to test if the VIEW works, modify the SAS code to update the source data. In the example, all of the filters have been commented out.

```sas
data SESUG.stp_1;
set sashelp.prdsal2;
/*The :tion can be switched back on to change the data source*/
/*if upcase(country) in ('U.S.A.' 'CANADA'); */
/*if upcase(country) in ('MEXICO' 'CANADA');*/ /*This can be also commented out to change the data source*/
run;
```
Display 15. Testing STP-3

Had we used tables instead of SAS Views as the DSP, we will still get the same prompts as in Display 13. We are able to see ‘U.S.A’ under COUNTRY, after that, many US states under STATE.

Display 16. Testing STP-4

The outcome is exactly what we are expecting: U.S.A – California.

DISCUSSION

There is something of a generation gap between users of SAS Views and users of STP’s in both literal and metaphoric terms. There were more than ten years between the introduction of these two tools, and the user
populations are likely to have distinct features as well. SAS View users tend to be skilled old school programmers/analysts focusing on data management. They are more likely to come from the era where hardware resources (CPU/Storage) were scarce. STP developers are likely to be new generation programmers/analysts who have more resources at their disposal, and reporting is usually emphasized. Now by using these tools together, we know that the there is an advantage that can be realized.

Some items worth addressing of this application are presented in the form of Q & A:

Q1. Does the library for source data and SAS Views have to be pre-assigned?
A1. Yes. Prompts, in BASE SAS terms, are macro variables. Long before SAS code is compiled, the macro variables must have values which come from SAS Views. Those values in turn come from source data. Therefore it is not possible to wait for defining this particular library during the execution of STP. We are aware that doing so will result in an overhead for application server, but we also believe this can be one of the reasons that pre-assigned libraries exist along with non-pre-assigned libraries. One feature of pre-assigned library is that the data source do not have to be registered by metadata server in this context, as a result, it will facilitate easier maintenance.

Q2. Do the SAS Views have to be registered?
A2. Yes. Registering SAS Views will generate metadata objects upon which dynamic prompts are defined. The metadata libraries that hosts SAS Views need to be pre-assigned, and they can be different from the libraries that host source data in both physical location and metadata folder location.

Q3. Are there any other options besides SAS Views for non-programming oriented environment?
A3. Yes. If you have licensed SAS Information Map, same functionality can also be achieved without coding.

CONCLUSION

Using SAS views as the data source of dynamic prompts is capable of making the prompts truly ‘dynamic’.

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