The Statistical Analysis System (SAS) is perhaps the most appropriate vehicle for conducting capacity planning and computer performance evaluation studies because of its flexibility, ability to read different formats of data (e.g. binary, packed, zoned), RMF/SMF data functions (e.g. SMFSTAMP8., RMFSTAMP8., ETC.) and overall ease of use.

There are many ways to structure your SAS programs which are intended to reduce SMF/RMF data and produce capacity planning reports. In order to facilitate the processing of data, and improve the index of maintainability of your SAS/CPE programs, several architecture alternatives are available to optimize the many factors that will determine the structure and logic of your CPE modules.

For example, whether or not to have an extract phase in your system is an alternative that should be evaluated. In some environments, it may be beneficial to structure large SAS/CPE systems in such a manner that an extract phase is run before all other analysis programs.

The objective of this short discussion, is therefore, to explore some architecture alternatives and to enumerate the benefits and costs of such options.

**ALTERNATIVE NO 1 : NO EXTRACT PHASE :**

The simplest way to structure your program or set of programs (i.e., CPE system) is for each SAS program to read SMF independently, create its own dataset and call its own procedure.

This simple architecture offers several advantages and disadvantages. If the objective is to create a set of programs which run independently of each other, regardless of the system overhead, then this approach is valid. Certainly, in cases where each program runs as part of its own job stream or in cases where the user is not concerned with the sophistication of the job-streams, this is a valid architecture.

However, by using this approach, SMF/RMF datasets are read over and over, depending on how many modules your SAS/CPE system has. This is a costly architecture, specially in live production environments where you may be dealing with hundreds of thousands of SMF/RMF records.
ALTERNATIVE NO 2: Extract Phase and One Runstream

Since alternative No. 1 is too costly for many environments, then another approach to consider is to have the first program read the entire SMF dataset, split the records into several SAS/DB datasets and use this WORK.DATASETS in the subsequent SAS steps.

This approach is beneficial since it eliminates the overhead of reading SMF repeatedly.

For example, in a SAS/CPE system where reports are produced for job terminations and lines printed, MODULE A selects (e.g., via sub-setting IF statements) TYPE 5 SMF records and MODULE B selects TYPE 6 SMF records.

If alternative No. 1 is used, then SMF is scanned sequentially and all TYPE 5 records are extracted. SMF is then read again and all TYPE 6 SMF records are extracted in order to satisfy MODULE B.

If alternative No. 2 is used, then the SMF/RMF dataset is read only once and all relevant records are put to the same SAS/DATABASE under different database datasets names.

SAS EXAMPLE:

```
DATA TYPE5
   TYPE6;
INFILE SMF;
INPUT @3 REC_ID PIB1.
   .
   .
   .
IF REC_TYPE = 5 THEN OUTPUT TYPE5;
IF REC_TYPE = 6 THEN OUTPUT TYPE6;
DELETE;
```
EXTRACT PHASE AND EXTERNAL DATABASES

A third alternative is to extract SMF/RMF records previously read and to pass control to subsequent programs which call SAS procedures and build/update an external database -- IMS/VS-DB.

This IMS-DB database may then be used with other programs and/or products such as CICS/VS, IMS/DC, and/or SAS/GRAPH to graphically display systems performance and current capacity to management.

SAS/IMS provides the flexibility to accomplish this by providing the facilities to read and update the database using SAS as the database manipulation language as well as the performance measurement vehicle.

PERFORMANCE SYSTEMS AND SAS/DATABASES

When there is a daily performance system in production, the use can save the work databases or the relevant portions needed in order to:

(a). Use this extracted database for post-run online systems investigation

(b). 'feed' these daily databases into weekly and/or monthly performance measurement system streams.

Our daily OP2XXDOM CP/EMS performance measurement system creates tape SAS/DAB databases which are used in our performance measurement streams.

These databases contain the extracted records for:

- DALYEXCP -- DAILY TOTAL EXCP DATA
- DISKEXCP -- DISK EXCP DATA
- TAPEEXCP -- TAPE EXCP DATA
- TYPES -- JOB TERMINATION RECORDS
- TYPESE -- TYPE 5 RECORDS EXTENDED
- TYPE35 -- TYPE 35 -- TSO records
- TYPE35e -- TYPE 35 RECORDS EXTENDED
- TYPE70 -- RMF/CPU ACTIVITY RECORDS
- TYPE71 -- RMF/PAGING ACTIVITY
- TYPE73 -- RMF CHANNEL ACTIVITY
- STRING1 -- DASD ACTIVITY FOR STRING1
- STRING2 -- DASD ACTIVITY FOR STRING2
- STRING3 -- DASD ACTIVITY FOR STRING3
- STRING4 -- DASD ACTIVITY FOR STRING4
- STRING5 -- DASD ACTIVITY FOR STRING5
- STRING6 -- DASD ACTIVITY FOR STRING6
- STRING7 -- DASD ACTIVITY FOR STRING7
- STRING8 -- DASD ACTIVITY FOR STRING8
- NEWTYPE6 -- JES3 TERMINATION RECORDS
WEEKLY SYSTEMS ARCHITECTURE

Management often likes to see the systems performance statistics for the previous week. Among the variables needed for this analysis are:

(a). CPU activity for the previous week
(b). CHANNEL activity for the previous week
(c). EXCP activity
   -- TOTAL
   -- DASD
   -- TAPE
(d). PAGING activity
(e). TSO activity
(f). DASD systems performance
(g). Lines printed analysis

One way to achieve this analysis is by using the daily SAS/DAB databases produced by the daily system.

It is more efficient to use these extracted work databases and copy them using the SAS COPY procedures since weekly SMF datasets expand into several RAW data tapes.

A sample program flow is to:

(a). Copy the daily system databases into a weekly system database.
(b). Select only the information relevant for the weekly analysis.
(c). COPY/RENAME needed SAS work-database datasets in order to meet the requirements of the weekly system.
(d). execute the weekly performance reporting system using the extracted weekly performance database.

SUMMARY:

SAS has proved to be in our installation an effective tool to conduct capacity planning and performance evaluation studies.

We have found the extract approach to be extremely effective since the summarized SAS work databases are used in all subsequent analytical steps and are kept (on DASD OR TAPE) without any additional programming effort.

In addition, it is preferable for efficiency considerations to only make one pass at the database and select the information needed.

In a normal MVS environment, the cost of reading the raw SMF data repeatedly is un-acceptable.

There are many other ways to structure your SAS/CPE system by combining these architectures and create hybrid models.

The prospective SAS/CPE designer should examine the needs and peculiarities of the system (as well as the operating environment), and determine the architecture that is best suited for the design.