

SAS as a "Gateway" to OLAP-Case Study

Michele R. Rushing

Ronald D. Hickman

Southern Illinois University at Carbondale

Introduction

Educational institutions face a number of issues that threaten their theatre of operations:

- Competition for scarce resources
- Declining monetary support
- Changing demographics
- Political accountability
- Global competition
- Capital asset deterioration
- Technological advancements and changes

As a result, administrators are investigating different ways of conducting business in an increasingly competitive environment. One such avenue is the decentralization of authority and responsibility—pushing it out to the areas where daily decision-making takes place and requiring accountability for revenues and expenditures. Several types of philosophies are emerging centered around the idea of "Responsibility Centered Management (RCM)." Southern Illinois University at Carbondale (SIUC) is developing its own version of RCM termed, "Planning and Resource Management."

Project Focus

This project focused on the first step required for the new planning and budgeting process—attributing tuition income earned to the appropriate revenue-generating academic budget unit (or college) based on teaching and enrolling dimensions. Tuition revenue is only one part of the revenue received by the University. Future steps will include the distribution of the remaining elements of revenue and expenditure.

For SIUC, tuition revenue accounts for an estimated 20% of the budget, or approximately \$56,317,800 for fiscal year 1998. (See Figure #1)

The Need for Information

Much of the information needed for attributing tuition revenue was not easily retrievable from existing

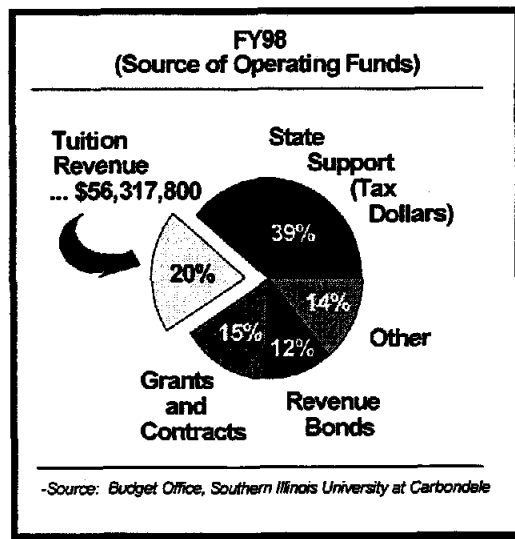


Figure 1

systems. The legacy systems currently in place are good for handling operational data, but hard to use in translating or creating the type of information needed for the new planning and budgeting scheme. The information residing in the Student Information System (SIS) needed to make the transition from data centrally held on a mainframe to "information" to be distributed and accessible throughout the campus. This quandary was causing a strain on budgeting and information system professionals.

The solution called for bringing together a team in order to develop a database to provide specific answers to questions relating to the distribution of tuition revenue.

Assembling the Team

The key to any successful project is assembling the right team. During the team assembly phase, the following activities contributed to the success of the project:

- Secured high level executive sponsorship of, support for, and participation in—the project
- Achieved "buy-in" from team members
- Included team members with functional backgrounds who could solve the problem
- Included a customer on the team
- Trained the team

The project was sponsored by C. Michael Williams, Executive Director for Budgeting, who reports directly to the Chancellor.

Team members were carefully selected by Williams after discussing the project and achieving “buy-in” from each participant.

The project required expertise in budgeting and technology. Budget professionals were selected from the Budget Office, and technology expertise was acquired through the hiring of consultants.

In addition to the budget and technology professionals, a customer was asked to join the team. The customer perspective became essential in determining the types of data that each of the academic budget units might require for making decisions regarding the distribution of tuition revenue.

Team members (including the customer representative) were provided training on the tools and concepts in order to better understand and prepare for project implementation. The training benefited the entire team by providing common knowledge, terminology, and general understanding.

Technology Considerations

Several technological considerations were identified:

- Ability to interface with SIS (legacy system) as well as future university systems
- Ability to personalize (or customize) data
- Ability to create meaningful reports to answer specific questions
- Ability to perform analysis, or “what-if” scenarios
- Ability to scale campus-wide
- Ability to calculate equations for analysis and reporting purposes
- Ability to distribute common reports to campus users for information, data entry, and/or re-submission
- Ability to offer different security levels
- Easy to use

The team examined on-line analytical processing (OLAP) tools which allowed multidimensional viewing and calculation of data elements. The OLAP applications chosen were Oracle Express and Oracle Financial Analyzer.

Analysis Software

Because there was no direct pathway across which information could flow from the SIS system into Oracle Express and Oracle Financial Analyzer, some type of statistical software was needed. Besides being compatible with the SIS system and Oracle products, the software chosen would need to have:

- Ability to handle unusual data structures
- Ability to interact with multiple operating systems

The SAS® System is an “integrated system of software providing complete control over data access, management, analysis, and presentation.”¹ It was determined that SAS® had the necessary characteristics needed for data extraction, manipulation, analysis and entry into an Oracle OLAP database. And since team members had previous experience using SAS® software to interact with the existing SIS legacy system, it became the statistical package of choice for this project.

In addition, team members may receive future benefit from skills developed from this project. Because SAS® is positioned to interact with Oracle products, the software can be used by staff when working with the Oracle Financial Accounting and Human Resource Systems scheduled to come on-line at the University over the next few years.

Working with Consultants

As mentioned earlier, the required “technology expertise” needed for the project was accomplished through the hiring of consultants. We defined the term “consultant” as:

“An individual with specialized skill and knowledge who is contracted to assist in accomplishing an assignment in an unprejudiced manner and independent of other responsibilities.”

Two consultants were brought in from the Oracle Data Warehousing Practice Group to assist with project implementation over a two week period.

During project implementation, we noted a few items which enhanced the engagement:

¹ As defined by SAS Institute, Inc.

- Demand consultants with industry experience
- Go as far as possible without them
- Be prepared when they get on site
- Strive for/demand knowledge transfer
- Treat the consultant as a member of the team, and include them before they get on site

Consultants with experience in higher education were requested in order to avoid wasting time (and money) overcoming language and culture barriers.

Using the knowledge gleaned from training, the team completed a preliminary plan. A project briefing was prepared and shared with the consultants. The briefing detailed thought processes and theories on the project path and described the steps taken to prepare—such as the methods used for identifying, extracting, and scrubbing data.

Because consultants are often focused on meeting deadlines, documentation and knowledge transfer do not take place. We allowed additional time in the contract for hands-on experience, inclusion in project decision making, and detailed documentation for each step of the way.

Finally, we contacted the consultants early in the planning stages and received valuable insights into the implementation process. It was the consultants that recommended a three-course training program for team participants.

“Proof of Concept” Engagement

The consultants also recommended a “Proof of Concept” engagement designed to test-drive equipment and successfully complete a small-scale data mart project in order to prove the concept viable. The prototype served as ground-breaking activity in the area of OLAP technology, organizing and populating a multi-dimensional database.

This engagement was contracted separately from the implementation project, and lasted over a two week period.

Mission

After successfully completing the “Proof of Concept” engagement, the mission was defined for the tuition revenue attribution project:

“Create a process that integrates classes taught with tuition paid and allocates that tuition revenue to the respective Colleges based on several attribution scenarios.”

Project Plan

The project implementation plan included four phases:

- Prerequisite activity
- Project definition
- Database design
- Build database

Members of the SIUC team worked in tandem with the consultants to design, document, and complete the project.

Prerequisite Activity

Preparatory activities took place prior to the consultants’ arrival and included:

- Designating a workstation/workspace for the consultants
- Installing software
- Preparing the project briefing
- Deciding on goals, objectives, and variables for project focus
- Providing the necessary cleansed data files

Data identification and transformation were the most time-consuming of the activities. Locating, extracting, and converting the data was a long and tedious process—estimated at approximately 80% of the project time investment. The lightly summarized data sets were stored to be converted later for transfer into the OLAP database.

Figure 2 represents an overview of the data mart process. *Figure 3* provides a look at the data transformation process used in this project.

Project Definition

Time was allotted in the implementation plan for project definition activities:

- Present project briefing
- Discuss goals and objectives
- Review and revise project plan

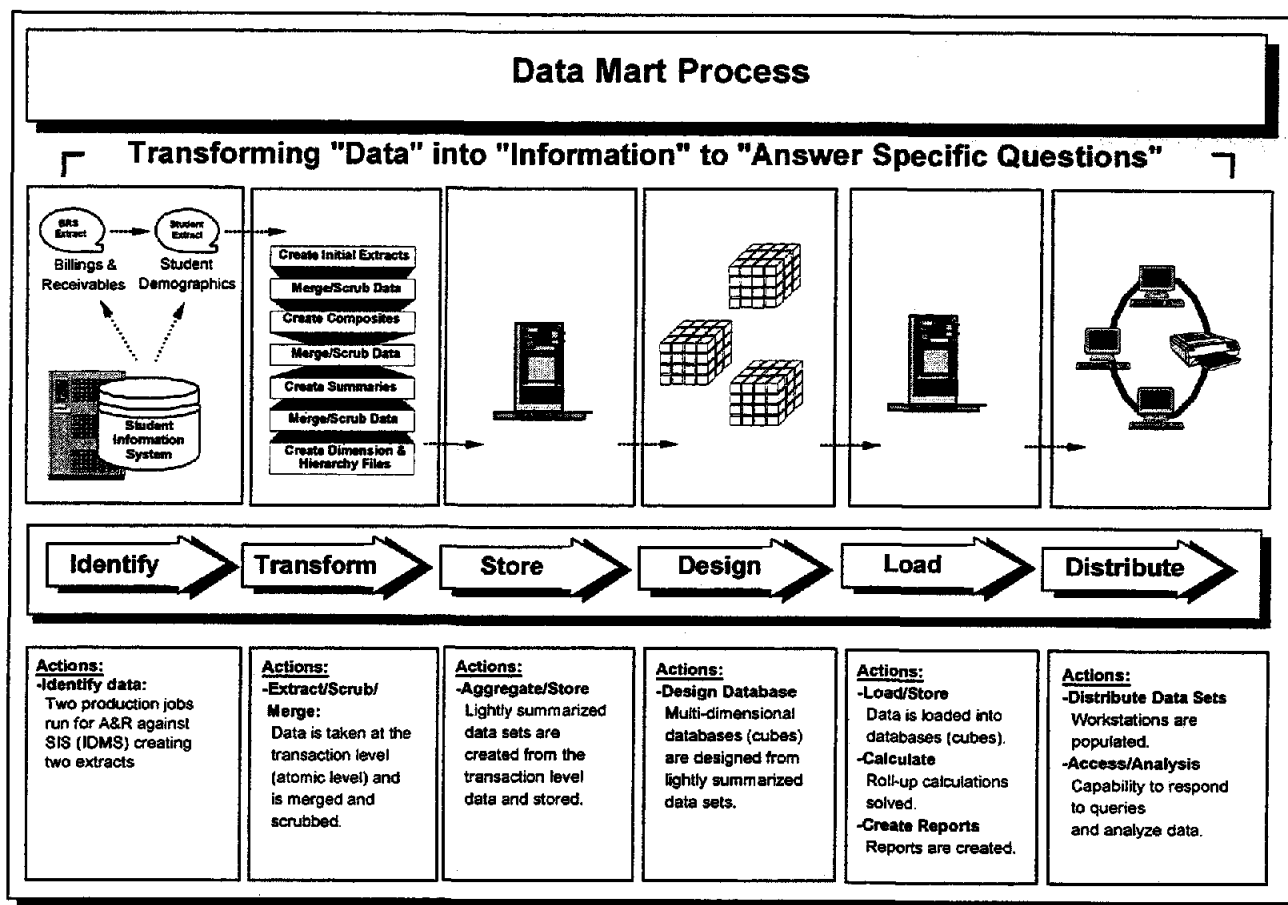


Figure 2

Database Design

This step included design of the several interrelated databases needed for the project. Some databases house specific data. Others pull data to perform calculations and display results.

For this project, a maximum database size of two billion records could be supported. This project operates well below that limit, with an estimated number of records (after significant scrubbing and merging) slightly above three million. Expedient use of the number of unique dimensions has resulted in extremely good database recalculation and display performance.

Build Databases

Upon completing the design phase, the following steps were taken to build the databases:

- Write data reader programs to load the dimension, hierarchy and data files into databases
- Solve roll-up calculations for dimensions and hierarchies
- Create reports
- Populate workstations and test ad hoc access and capability

Data reader programs were written to funnel the data from the lightly summarized data sets into the OLAP database.

Once the data was loaded, the roll-up process was executed to calculate data within each of the hierarchies.

Reports were built (with input from the customer) to provide answers to specific questions regarding tuition revenue.

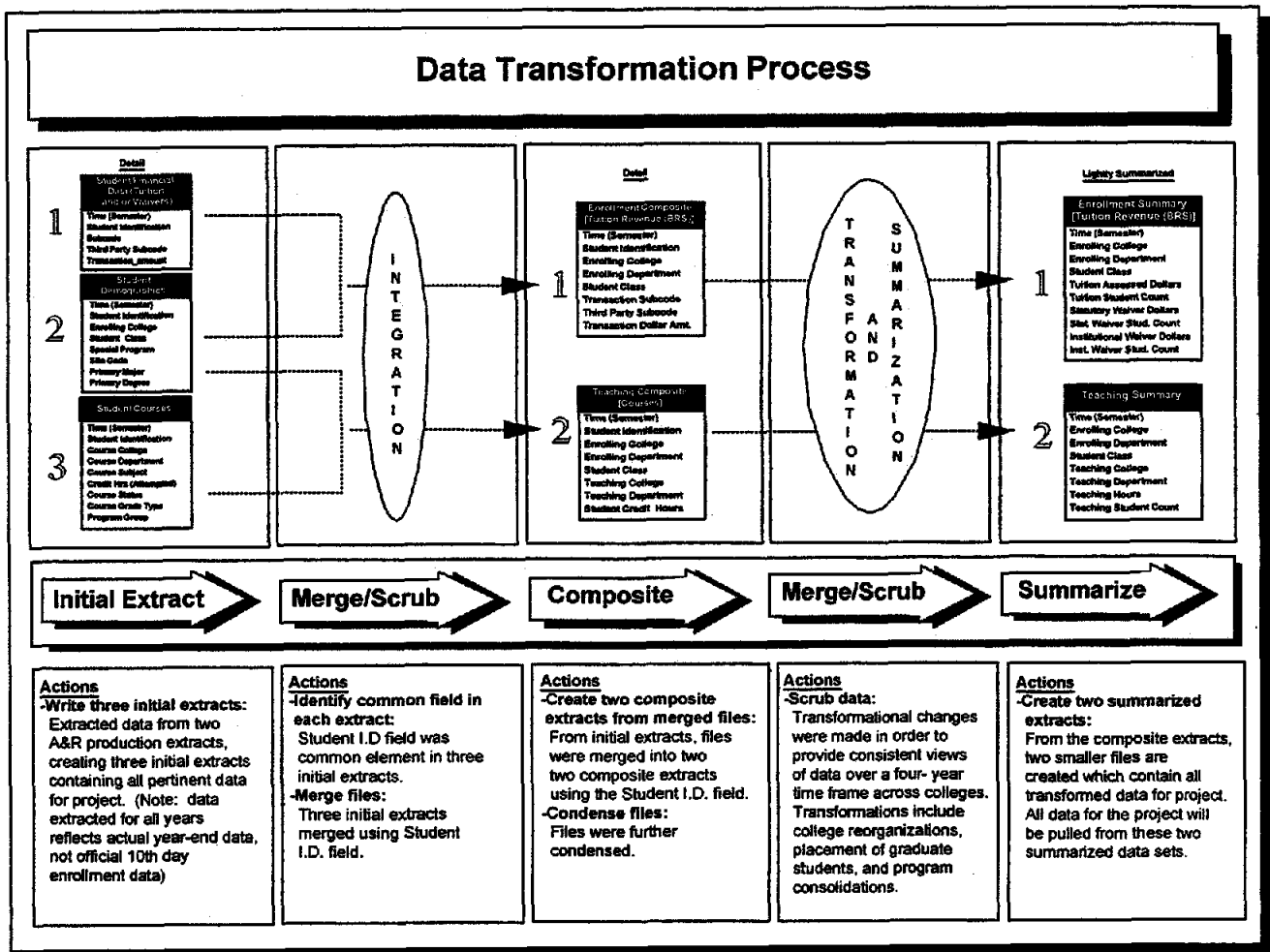


Figure 3

All workstations were populated, and access was tested. It is important to note that extreme care was taken after each of the steps outlined above to verify data in order to address concerns over data validity and reliability.

Post-Implementation Considerations

Post-implementation considerations remaining to be addressed include:

- Communication and change management
- Data quality
- Competition with existing data
- Data maintenance (including meta data)
- Program maintenance
- Disaster Recovery
- Technical support and maintenance

- End-user training
- Web enablement
- Project expansion (enterprise-wide architecture)
- Continuing investment

The first two considerations (communication and data quality) go hand-in-hand. We are currently taking the time to communicate the project campus-wide. Assumptions made for the data mart process are openly communicated, and as a result, perceived data quality has been high. Users have been able to examine for themselves the steps taken throughout the process. We feel this has been absolutely essential to project acceptance and believe it will help ease users through the change process. In addition, communicating the process adds understanding and lessens competition between the data mart and existing information on campus.

Data maintenance and program maintenance are two interrelated activities. Data maintenance includes regular refreshing of the database and updating meta data, while program maintenance requires reprogramming activities in order to capture and re-map such things as organizational changes across fiscal years. Disaster recovery requires back-up of data on a routine basis.

Technical support and maintenance require a recurring yearly payment to ensure vendor support for application software problems.

End-user training will be provided to personnel of academic units that decide to purchase and use the OLAP tool to receive the reports generated from this project. Because of the expense involved with acquiring the OLAP tools, it is anticipated that the team will be asked to web enable the reports. This feat will require additional time and training of team members.

As is almost inevitable when providing useful information, project expansion into related areas has been mentioned. The challenge will be to build on the existing data mart, integrating its elements into future projects to ensure proper design of an enterprise wide data mart architecture.

Aside from the required activities mentioned above, probably the hardest recurring investment will be the human resources left behind to perform maintenance activities for the data mart.

Results

Upon successful completion of the project mission in November 1997, the process continues to be communicated across the campus to administrators, constituency groups and college deans. The easy-to-use tool allows creation of custom reports to answer questions relating to the specific topic of tuition revenue. As the process is unfolded in group meetings, participants have been amazed with the information in the reports and the ease with which it can be retrieved.

For the first time, administrators can get answers to such questions as:

- Which colleges and departments generate the most credit hours (enrolling and teaching)?
- What amount of tuition revenue can be tied to enrolling and teaching credit hours?

- How many institutional and statutory waivers do each college and department receive?
- How many credit hours do students enrolled in the College of Business take from the College of Liberal Arts?

Conclusions

In conclusion, educational institutions operate in an increasingly competitive environment, forcing administrators to operate differently. Southern Illinois University at Carbondale is striving to develop a new budgeting philosophy which decentralizes authority and responsibility.

The first step in developing SIUC's "Planning and Resource Management" process involves the distribution of tuition revenue to the appropriate revenue-generating college based on teaching and enrolling dimensions.

A project team was strategically assembled to build a multi-dimensional database using OLAP tools to assist in answering specific questions regarding the attribution of tuition revenue. SAS® software served as the vehicle for extracting and funneling data from the SIS legacy system into the Oracle database.

Consultants were used to supplement the budget professionals with technical expertise. A "Proof of Concept" engagement was undertaken in order to prove the project viable. After which, a plan was implemented to complete the project. Several post-implementation issues have been identified for continuing care and consideration.

The database allows users to examine data in ways never before possible—slicing, dicing, and transforming data into useful information to answer specific questions. This capability allows administrators the latitude for better planning and decision-making in the area of tuition revenue distribution.