Saving Enterprise Data from the Client/Server Grinch

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Abstract
In the world of client/server technology, where enterprise databases are distributed, how do postsecondary institutions keep from losing control of their data sources? One university’s answer was to create an enterprise data infrastructure to ensure the integrity and integratability of enterprise data. The data infrastructure serves as the “hub” of a portfolio of distributed enterprise applications. This paper describes the implementation of the first subject area of the hub, the Affiliate Management System, which contains enterprise data on the organization’s customers.
SAVING ENTERPRISE DATA FROM THE CLIENT/SERVER GRINCH

In the world of client/server, where enterprise applications and databases are distributed, how do postsecondary institutions keep from losing control of enterprise data? This was the question asked by Arizona State University’s data administration and information technology managers as they observed the outward flow of enterprise data as business units pushed to implement client/server solutions.

ASU’s Computing Environment

Arizona State University is a Research I, multi-campus university consisting of three campuses in the Phoenix metropolitan area. Total enrollment exceeds 45,000. The administrative computing environment centers around IBM 3090 MVS architecture. The student information system, developed by ASU, is an on-line and batch application using a large integrated data base (IDMS). The human resources system is a purchased package running on DB2. The university’s financial system is also a purchased package running on IDMS, but migrating to DB2 this year. Another IBM product supports electronic mail and FOCUS applications. FOCUS, which was used for end-user reporting and departmental applications, is being replaced by client/server applications. The first client/server implementation was a data warehouse. ASU is exploring other client/server applications in a re-engineering project involving the student information system. Client/server applications use Sybase on a UNIX server.

ASU’s Difficulty in Implementing Client/Server Technology

Implementing client/server technology at ASU proved more difficult than promised by industry. Client/server technology is less reliable, secure, and timely than its mainframe predecessor. Networks add new layers of complexity, and monitoring performance and tuning of servers is imperfect. The result is that for complex organizations like ASU, quickly moving mainframe legacy systems to client/server on a major scale may be too difficult. ASU’s information and technology managers came to this conclusion re-engineering the organization’s student information system. Given the problems in piecing together the new and old technology, ASU realized that mainframe systems were going be around a long time, coexisting with client/server applications until the industry solves some of the problems inherent in distributed and shared computing. For ASU, slowing the pace of client/server development provided data administration and the information technology mangers the time to devise a solution to the critical data problems posed by client/server.

The Need for an Enterprise Data Infrastructure

ASU’s information managers view client/server as a desirable computing solution because of the potential for new and improved services for less cost (see anticipated client/server benefits in Table 1). However, client/server also raises many technical, data and security risks. One big risk is that distributed databases and systems will degrade the integrity of enterprise data and lessen the ability of the organization to integrate data between computing systems.
These concerns lead ASU's information managers to conclude that the organization needs a client/server enterprise data infrastructure (EDI). The vision of EDI is that ASU captures the critical enterprise data elements required by *multiple business processes* in a single data model and database. EDI functions as the hub of a portfolio of mainframe and distributed enterprise applications (see enterprise hub at Figure 1). Some of the applications interface with the hub via client/server over ASU’s network backbone. Independent systems interface with the hub via program bridges between the two applications.

![Figure 1. Enterprise Data Infrastructure is the Client/Server Hub.](image)

The advantages of the EDI are many. As ASU implements more and more client/server applications, EDI serves as a seamless data foundation, containing the enterprise data needed by distributed applications. Tremendous economies flow to ASU by managing enterprise data through a single model and updating these data in a single database. Distributed systems benefit by having the most recent occurrence of data, and information engineers benefit by having enterprise formats and standards to guide their work. Through EDI, ASU is banking on improved data integrity, lower...
costs in updating enterprise data, less data redundancy, and improved services to customers (see benefits listed at Table 2).

Table 2

Benefits of Enterprise Data Infrastructure

- One-stop update
- Data foundation
- Contributes to data integration
- Ensures data integrity
- Distributed developers know enterprise formats and standards

Pieces of ASU’s Enterprise Data Puzzle

Advocates of data administration maintain that enterprise data need high-level or corporate management. However, ASU found that defining enterprise data is problematic because almost every data element is “enterprise” to someone or something! In creating ASU’s EDI paradigm, data administration and the information technology departments conceptualized not only the data but what the data were about. For example, improving customer service is a major goal at ASU; therefore, much of ASU’s enterprise data concerns customers.

Following this logic, ASU identified four major subject areas (“puzzle pieces”) to EDI: (1) persons or organizations that do business with ASU, (2) work units or departments that comprise the organizational structure, (3) facilities used by both ASU’s customers and work units, and (4) programs (academic, research, public service, etc.) that impact ASU’s customers (see EDI subject areas at Figure 2). These four high-level subject areas are the foundation of ASU’s enterprise data infrastructure. ASU re-designated the customer subject area as the “affiliate” after defining customers more broadly, e.g. students, employees, vendors, donors, constituents, etc. Affiliates are anyone with a business relationship (affiliation) with ASU.

ASU’s vision is that through a single model and database, ASU enforces the business rules for the data in each subject area. For example, if an affiliate updates their address, the business rules for address are enforced by the affiliate data model and the update is stored in one location. Distributed or mainframe databases may replicate the address in affiliate, but the update occurs once.
ASU decided that the first EDI subject area built should be the area impacting the organization the most. The data administration and information technology departments agreed that the subject area with the most pervasive impact concerns affiliates. This decision was made in part because of ASU’s student information re-engineering project. ASU wants to maximize the number of new client/server applications and plans to establish the interface with the Affiliate Data Model from the beginning for these applications. Also, ASU’s business units plan on implementing a “single” campus card for all business transactions. The single campus card requires affiliate data services, such as a single affiliate ID for both students and employees. By implementing the Affiliate, the campus card initiative has the ability to interface more broadly with other applications at ASU.

The Affiliate Management System and Its Implementation

The Affiliate Problem

Arizona State University has many business relationships with persons and organizations. Capturing information about the affiliations these persons and organizations have with ASU is an important factor in developing new and improved services. In many cases, ASU affiliates have multiple relationships with the organization which are not understood.

In the past, ASU’s business practices and computing systems processed information about affiliates based on the needs of the department and not the needs of the enterprise. Information about affiliate characteristics such as address, name, ethnicity, etc., is captured and stored in different formats using different definitions. When the same data are carried on multiple databases, the data are frequently out of sync with no way to know which occurrence of the data are correct. As client/server technology advances, it is likely that the resulting distributed databases and applications will make this problem worse, unless enterprise data models and policies are implemented.
The end result is reduced levels of service, more expensive systems maintenance, a loss of data integrity, and redundant storage of the same or similar data. However, the most strategic loss is the failure to fully understand the myriad of relationships that a single affiliate may have with the organization. Understanding such relationships could result in a totally new view of ASU and how it serves its customers. ASU hopes another big benefit will be significantly reduced computing and information costs.

**The Affiliate Solution**

The Affiliate Management System is an enterprise application and data model which solves these problems by defining and capturing in a single data base the attributes and relationships of affiliates that are important to more than one ASU departments. Since affiliate data is stored in a single data base, in a single format, and based on a single definition, the data are more easily managed for the benefit of the organization. When affiliate data are updated, all distributed applications interfacing with the Affiliate System immediately have the benefit of the new information.

The Affiliate System has the advantages common to all EDI subject areas, i.e., reduced maintenance, update and storage costs, and increased data integrity and integratability (review benefits at Table 2). However, Affiliate brings unique benefits by providing ASU a single customer ID that can be linked to other IDs, giving an ASU affiliate the capability of maintaining their “personal” data, making it less complicated for ASU to build applications to support sophisticated customer services (e.g., single-campus ID card) or affiliate to affiliate relationships (e.g., advisor/advisee), and making it easier for ASU to strategically comprehend the full extent of the relationships it’s customers have with the organization (see unique affiliate benefits at Table 3).

Table 3

**Benefits of Affiliate Management System**

- Single ID (could be linked to other IDs)
- One stop update to personal info
- Supports sophisticated services (i.e., mailings, e-mail, fax, etc.)
- Ability to study affiliate relationships with ASU
- Supports affiliate relations with each other

**The Affiliate Model**

The high-level Affiliate Data Model contains nine entities (see model at Figure 3). The most important entity in the model is the Affiliate. To be an affiliate, a person or organization must have a name and a location (a way for ASU to communicate with the affiliate, i.e., address, phone, or e-mail, etc.). Affiliates are randomly assigned a
unique ID which is a permanent identification number. Business units decide when to create an affiliate record. For example, the student recruiting office could decide to create an affiliate record for prospective students or wait until the “recruit” submits an application for admission.

In the Affiliate Model, there are two mandatory relationships between the affiliate and other entities. One mandatory relationship is between the affiliate and an entity called “Affiliation”. Affiliations are the “first-order” relationships affiliates have with ASU, e.g., student, employee, donor, vendor, etc. Second-order relationships (relationships which are not mission critical, e.g., a dorm student) are not included in the Model. ASU’s data administration and information technology managers believe relationships which exist because of previous relationships are best captured in departmental applications.

Figure 3. High Level Affiliate Data Model.

A second mandatory relationship exists between the Affiliate entity and Address. In order to become an affiliate, a person or organization must have a way of being contacted by ASU. This may be a mailing, phone call, or e-mail message, but the organization must have a way of communicating with the affiliate. This information is captured in the Address entity, where an affiliate can have multiple addresses, phone numbers, and e-mail locations with differing formats and differing uses.

Alias (other affiliate names), Demographics (ethnicity, birth day, gender, etc.), and Other IDs are entities which may or may not exist for an affiliate. These contain data which describe or identify the affiliate to ASU. The entity “Contact” contains information about persons who represent the affiliate. For example, a corporation may have multiple contacts that represent the organization with ASU. In this capacity, these persons are not directly affiliated with ASU, except through their relationship with the affiliate. This is also true of a student’s emergency contact. The Contact entity contains the contact’s name, address and phone number, and nature of the contact’s relationship with the affiliate.

Affiliate to Affiliate relationships is an entity which provides for non-mandatory relationships between affiliates, some of which may be important for ASU to capture.
For example, if a group of donors are related in some way, that relationship may be strategically important for ASU to capture. More probable examples are faculty with similar research interests, or advisor/advisee relationships. By capturing this information in the Affiliate Model, it is easier for ASU to build distributed applications which support the business needs that emerge from these relationships.

Only one entity in the Model is related to an entity other than Affiliate: Institution. At ASU, there are three campuses (Main, East and West) which comprise ASU as an Institution. Affiliates can be affiliated with one or more campus, but this relationship only has meaning when the nature of the affiliation is known. This relationship is mandatory so that it is clear what relationship an affiliate has and where (i.e., campus) that relationship exists.

Creating the Affiliate Management System meant that ASU developed new business rules to govern the Model and the data captured by the System. These rules (see list at Appendix A) are still in the process of developing, but do indicate a significant shift in ASU’s computing culture.

**Data Trustee Program**

Building the Affiliate Management Systems resulted in many data issues which are not completely resolved (see list of issues at Appendix B). ASU is creating a data trustee program to manage enterprise data and resolve the data issues posed by client/server. This policy states that a data trustee is assigned to each enterprise data element in the Affiliate Model. The data trustee is responsible for managing these data according to University data policies, including facilitating access and insuring data security. This program is administered by the Data Administration Office. Data Administration selects the data trustee, coordinates communication between data trustees, and facilitates all activities related to managing Affiliate data. Data Administration is the ultimate authority over the use and management of all enterprise data at ASU.

**Developing the Affiliate Management System**

**Phase One (March to June 1994)**

The initial development phase occurred as part of a three month pilot project. The purpose of the pilot was to test a new development methodology (Information Engineering), a new development tool (Composer by Texas Instruments), and a new computing environment (client/server). The pilot consisted of developing the Affiliate Model and an application that processed a specific type of affiliate called constituents. During this phase, an overall affiliate model was developed but detailed implementation only included those pieces of the model that were needed for the constituent application. Business analysts from human resources, the registrar’s office, institutional research, and data administration participated in the project as well as information technology analysts.

**Second Phase (November 1994 to January 1995)**

The second development phase included a larger and more diverse group of business analysts with representatives from admissions, financial aid, the graduate college, the registrar’s office, sponsored projects, data administration, and the law college. Their charter was to review the “pilot” Affiliate Model, business rules, entities, and attributes and make any modifications needed to implement the model.
Third Phase (May 1995 to May 1996)

The third development phase is to implement the model validated in phase two. This involves completing all entity and attribute definitions, and building windows to maintain what was determined to be “core” affiliate information. The idea is to create a generic application to add and maintain affiliate information, knowing that additional windows will be needed later to enter affiliate information pertinent to a specific affiliation type.

Conclusion

ASU believes that building an EDI is essential if client/server is to produce the benefits promised by industry. The technologists will eventually solve all of the implementation problems of client/server. Interfaces will be smooth and system performance not a problem. What will be a problem is the loss of data integrity and ability to integrate data strategically as distributed applications capture and store enterprise data based on departmental definitions and standards. In building the Affiliate Management System, ASU is hoping to avoid this problem for critical segments of its business. At this point, the jury is still out on whether this approach will work. But be sure to stay tuned for future announcements!
APPENDIX A

Affiliate Business Rules

1. Who is an affiliate?
   An affiliate is a person or organization doing business with ASU
2. What entities and attributes of objects belong in the Affiliate Data Model?
   Entities and attributes of objects belong in the affiliate data model if they are
   enterprise, common to more than one “business process”, and a “characteristic of
   an affiliate”.
3. What is required information to create an affiliate record?
   To create an affiliate record, an affiliate must be separately identifiable, and have a
   means to be contacted.
4. What are valid affiliation types?
   Affiliation types are fundamental business relationships with ASU that are not
   concurrently dependent on other relationships. Examples of affiliation types are
   student, constituent, vendor, employee, and donor.
5. How will ASU format address?
   Affiliate addresses conform to the U.S. Postal Service’s format. The affiliate
   address structure is extremely complex. It allows for multiple address types and
   multiple addresses for each type. It provides the capability to designate an address
   as confidential or to be used for a specific purpose, such as mailing grades.
6. What data is excluded from the Affiliate Model?
   Highly sensitive relationships are excluded from the affiliate model to insure the
   privacy of those relationships. Examples are HIV status, disability, etc.
APPENDIX B

Ongoing Affiliate Data Issues

1. ASU’s data administration function and data trustee policies play an integral role in the new client/server environment. These functions and policies are evolving and represent a cultural shift in how ASU’s computing community views enterprise data.

2. ASU needs new policies and protocols to insure fair information practices. Since the integration capabilities of the Affiliate Management System make enterprise data more powerful, it is paramount that employees understand the appropriate and ethical uses of the new capabilities.

3. In order to successfully implement the affiliate concept, business units need to agree on data definitions and usage. The user community must abandon the “ownership of data” mentality that characterized past development practices.

4. ASU needs a way to secure certain sensitive or private data in the affiliate database. Due to the nature of the information or the position of the affiliate, some data should not be accessible by the campus community. The client/server environment opens a new set of security issues that were partially resolved in the mainframe world and need resolving in the client/server world.

5. ASU has several large purchased applications that need to interface with the Affiliate Management System. These applications carry name and address information about employees and vendors that must be incorporated into the Affiliate Database. ASU has yet to build the bridges linking these applications with the Affiliate, but is considering data replication.

6. Affiliate information needs to be updated by programs created with different application development tools. ASU needs to maintain the integrity of the data by enforcing business rules about how data is updated. This becomes more difficult when multiple application development tools are involved. The client/server industry needs to address this problem.