Integrating Legacy Systems: The Information Broker

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NEW TECHNOLOGY is introducing the possibility of process, procedure, and cost-effective improvements in the way we do business. However, along with these possibilities lie great dangers. There have been many instances of large-scale and costly failures, particularly when wholesale replacement of existing systems has been advocated. One large commercial airline, for example, had to scrap a large system development after some $50 million had been spent, in favor of returning to their original system with a strategy of slowly introducing incremental change. This presentation discusses an approach to integration pioneered by the Volpe Center and US Air Mobility Command (AMC). The Broker System is based on the concept of "brokering" data between existing systems. The Broker does not create new data, but relies on the impact that bringing together data that exist on disparate systems can have on the way that an organization does business. Broker is about reuse, incremental change, and the concept that in today's world there is no shortage of data, but often a scarcity of information resulting from the data.

BACKGROUND

From a user perspective, integration of legacy systems can be viewed as an effort to provide homogeneous access to data from heterogeneous sources. The user is interested in having a single, local point of access to data, without having to be concerned about how this "data store" is created or maintained. A range of solutions is possible to achieve this. As Fig 1 illustrates, at one extreme, all current systems can be replaced with a new system that relies on an integrated database. At the other extreme, all current systems can be linked through a series of interfaces.

However, both extremes hold danger. The integrated solution carries with it the risk of a long, difficult development project that may not succeed in meeting the disparate needs across an organization. The interfaced solution can lead to an explosion of interfaces that need to be maintained ($n \cdot [n - 1]$), or 210 interfaces for just 15 systems if each system is to interface to the other). The Broker solution, however, relies on building only two interfaces (2n or 30 interfaces for 15 systems) between each system (one to read data and the other to write it).

THE BROKER SOLUTION

The solution that was adopted by the Volpe Center to resolve the AMC's system integration challenge is called Broker, since it provides a function similar to that of a financial Broker: being the intermediary between two or more parties. It can be classified as a "loosely coupled federated database system." It facilitates the seamless exchange of management data transactions. Broker enables autonomous and heterogeneous databases, whether they are client-server mainframe-based, to agree (federate) to share information while, at the same time, maintaining autonomous control over the data and applications within their system. The Broker allows customers to dynamically define and implement new interfaces between systems regardless of the communications protocols and equipment and databases being used.

The following items are key components of the Broker concept:

- Each system only interfaces to the Broker and does not exchange data directly with other systems.
- Each system interfaces to the Broker in whatever format is most easily implemented.
- Multiple interface formats are manageable within the Broker concept because of the low number of formats involved—at most "n" formats for "n" systems.
- Data received by the Broker are examined, translated into a neutral format, and forwarded to the appropriate systems(s).
- The Broker will attempt to resolve any errors and problems (eg, retransmission). If a problem cannot be resolved by the Broker, the Broker will determine what action to take, depending on which system was the source of

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the data, eg, return the data to the source system with an appropriate message.

- Each legacy system still maintains control over its own database; no changes are made to the existing application code, in order to remove budgetary and political obstacles to sharing information.
- The Broker uses an internal database to perform message translation, message storage and error logging.

Using the Broker concept, about 10 systems have been connected at AMC and can share information. The Broker therefore provides a "force multiplier" for AMC, a means by which the "sum" of all legacy systems connected to the Broker, is greater than the individual systems operating by themselves.

Since its initial implementation at AMC, Broker has undergone many enhancements from the addition of other legacy systems to its use to mine key management data to make timely and accurate management decisions. These data can be displayed for use by management levels using web-based technologies. Data being forwarded by the Broker are kept in a separate database in its neutral extended data format (the format used by the Broker). Standard web-based technologies (specifically secure web servers and browsers) can then provide direct access to the aggregate data to anyone with a need to know and a secure internet connection. For example, the latter capability has enabled AMC to gather key resource information from their legacy systems, while processing and disseminating an uninterrupted flow of accurate focused and timely information needed to make decisions regarding the use, cost, and readiness of their worldwide forces. Today, AMC can use Brokered information to help manage it fleet of tanker and cargo aircraft and associated resources such as personnel, support equipment, vehicles, and material no mater where they are located (on ground or flying) in the world. It permits instantaneous decisions to be made concerning force readiness, deployment options, aircraft supportability, and mission scheduling.

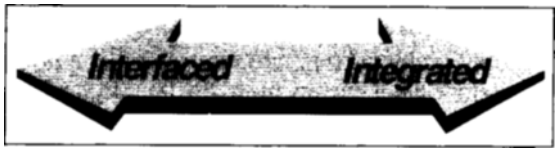

Fig 1. Information integration.

CONCLUSIONS

Broker is not an integrated database, but rather a "forward and store" system. It does not in any way guarantee data integrity, as it relies upon the original source system for data. Instead, it manages the transfer of data between several databases. Nevertheless, Broker is a practical and realistic way forward for many of the data interchange challenges currently being faced in government. Additionally, it provides an approach to handle the data and system disparity of today to meet the mission management challenges of tomorrow. Basically, the Broker offers the user the following advantages:

- eliminates multiple data entries and queries, data is entered one time at the source
- integrates disparate systems without altering legacy system structures or applications and data,
- builds upon existing desk-top applications,
- data access is immediate using available and commercially supported web-based technologies,
- dramatic annual support cost savings are possible without new system builds,
- provides a positive return-on-investment (ROI),
- the ability to link system and data in days, rather than weeks or months, and
- fully "extendable, portable, and customizable to meet customers" functional, data and system needs.