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ACCESS CHARGE AND REVENUE ARCHITECTURE

Introduction

The Access Charge and Revenue architecture is a major new interdepartmental, integrated set of systems and data bases that has been specifically designed to address a business problem created by divestiture: the access charge process. This article describes the origin, nature, and solution of the business problem as well as the support the new architecture provides for bill processing and revenue management.

Origin of the Business Problem

The Modification of Final Judgment of January 8, 1982 required AT&T to divest itself of the 22 Bell operating companies. As of January 1, 1984:

- The Bell operating companies were to provide exchange and exchange-access services (Panel 1).
- AT&T was to provide interexchange services.
- The Bell operating companies were to provide all interexchange carriers with exchange access service equal in type, quality, and price to those they provide to AT&T (Figure 1).

Before divestiture, interstate revenues were distributed among the Bell operating companies, the various independent companies, and AT&T according to their interstate cost by means of the "division of revenue" and "settlements" processes. After divestiture, unbundled, tariffed *access charges* were required to compensate the local exchange companies for these exchange-access services. In addition, the local exchange companies were to be reimbursed for rendering billing and collection services to the customers of the new interexchange carriers.

Nature of the Business Problem

Just as the problem that confronted AT&T in managing its postdivestiture access charges and revenues was unique in both its novelty and complexity, so was the interdepartmental systems approach the company took in its solution.

Magnitude of Expenses and Revenues. The management of access and revenue is essential to the financial health of AT&T. Access charges and billing and collection expenses account for approximately two-thirds of AT&T's expenses. (Access charges and billing and collection expenses exceed $20 billion annually.) The local exchange companies bill and collect approximately 80 percent of the company's revenues through open billing contracts.

Shared Organizational Responsibility. After divestiture, because of the magnitude and relative novelty of these expenses, access and revenue management became the responsibility of numerous organizations within AT&T.

Panel 1: Kinds of Exchange Access

Exchange access may be *switched* or *special*. Switched-access service arrangements use switching facilities in a local exchange company's end office. Special access differs in that it uses a local exchange company's wire center, not its switching facilities, to provide line connections to interexchange carriers.

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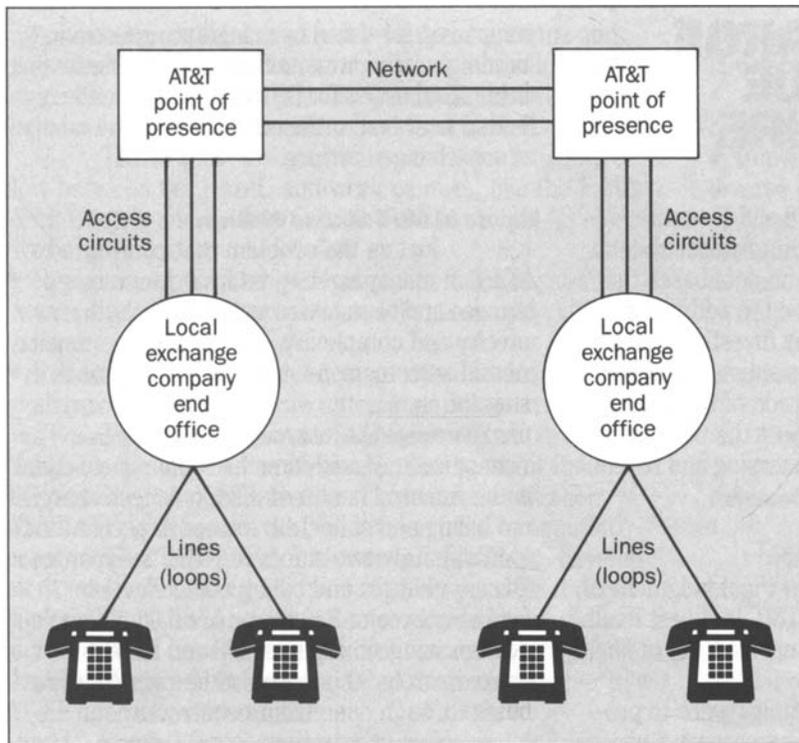
Figure 1. Exchange access services, provided by local exchange companies, give customers access to special and switched services provided by interexchange carriers like AT&T.

Briefly, some of the critical activities AT&T departments perform in managing access charges and revenues include the following:

- The Network department evaluates the accuracy of access bills to determine whether claims should be filed with a local exchange company for improper or erroneous billing.
- The Finance department collects the actual charges and revenue data, pays authorized bills, and books the expense and revenue.
- The Marketing department evaluates the quality of the local exchange company revenue remittances for billing rendered to the customers of AT&T.

- The Billing Information Management department (the Billing and Collection organization) evaluates the accuracy of billing and collection service bills rendered by the local exchange company to customers of AT&T.
- Finally, the External Affairs department interacts with the local exchange companies to negotiate claims settlements and other related matters.

Variety of Widely Dispersed Users. Personnel in a number of different types of departmental work centers process access bills and manage revenues. Some of the functions they perform are:

- Bill validation—essentially an editing and checking process that checks for the presence and validity of data both financial and nonfinancial (such as volumes, bill periods, company locations, etc.).
- Bill verification—a comparison of actual bill data with anticipated bill data to determine correct payment status and to identify any discrepancies.
- Claims management.
- Accounting procedures such as journalization and bookclose.
- Cash flow management.
- Billing and collection contract management.
- Coordination of local exchange company relations.
- Revenue verification.

These departmental work centers are regionally located; that is, they are geographically dispersed, including locations in New York City; Chicago; Atlanta; Kansas City, Missouri; and Pleasanton, California.

Complexity of Data. Approximately 1400 local exchange companies submit bills to AT&T. The average monthly volume is approximately

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30,000 bills. Some bills (those submitted by the Bell operating companies, for example) are mechanized, although the tapes may use three or more concurrent versions of a standard Carrier Access Billing System (CABS). Over 1000 local exchange companies, however, submit manual bills, some of which are hundreds of pages long, in a variety of formats, with varying levels of detail. On-line data entry and editing are needed to transcribe these paper bills into a standard AT&T format. Moreover, because of the lack of standardization, work center personnel can spend hours tracking down missing supporting detail to validate charges as well as arduous manual processing time to locate and summarize charges printed in a cumbersome format.

Special Data Requirements. Certain access-charge management functions, such as forecasting, claims management, accruals, and billing adjustments, require long-term retention of data, for example, from 13 to 24 months. In addition, the corporate and financial nature of the data place significant emphasis on data sharing, security, control, consistency, and auditability requirements.

Lack of Coordinated Mechanized Support. In January 1985, AT&T data system support for revenue and access management consisted of over 50 systems implemented in a wide variety of technologies. Each region and department had done its best to adjust to divestiture—each in its own way. The result was a series of independent systems. However, each system addressed only part of the overall business process and potentially could provide overlapping, inconsistent information that might hinder management decisions. In this uncoordinated system environment, key linkages, such as revenue for access expense, were difficult to make with any level of confidence. Payment of bills occurred with minimal interdepartmental, integrated mechanized support for validation, verification, and claims management.

Solution of the Business Problem

Soon after divestiture, it became apparent that a whole new set of interdepartmental, integrated systems and data bases would be required to manage this large, complex business problem. A new position, that of vice-president, Access Management, was created to provide a single focal point for access charge policy and management. An interdepartmental task force was established to define the required system and data base support and the appropriate technology. The task force adapted the Systematic Planning for Information Systems (SPIS) process to develop the Access Charge and Revenue (AC&R) business model and the AC&R data and system architecture.

The AC&R Business Model. The AC&R business model shown in Figure 2 provides a top-down functional perspective of how AT&T manages access charges and revenues. The model depicts how various functions are related and is developed in enough detail to design an information system architecture.

The AC&R Architecture. As originally defined, the fully integrated target AC&R architecture specifies the project functionality and basic data needed to support the business model. After the design of the architecture, the size and complexity of the development effort resulted in changes in definitions. The system developers defined an initial functionality—known as baseline architecture—and decided to implement it in phases, with quarterly deliverables starting early in 1987 and continuing through 1988.

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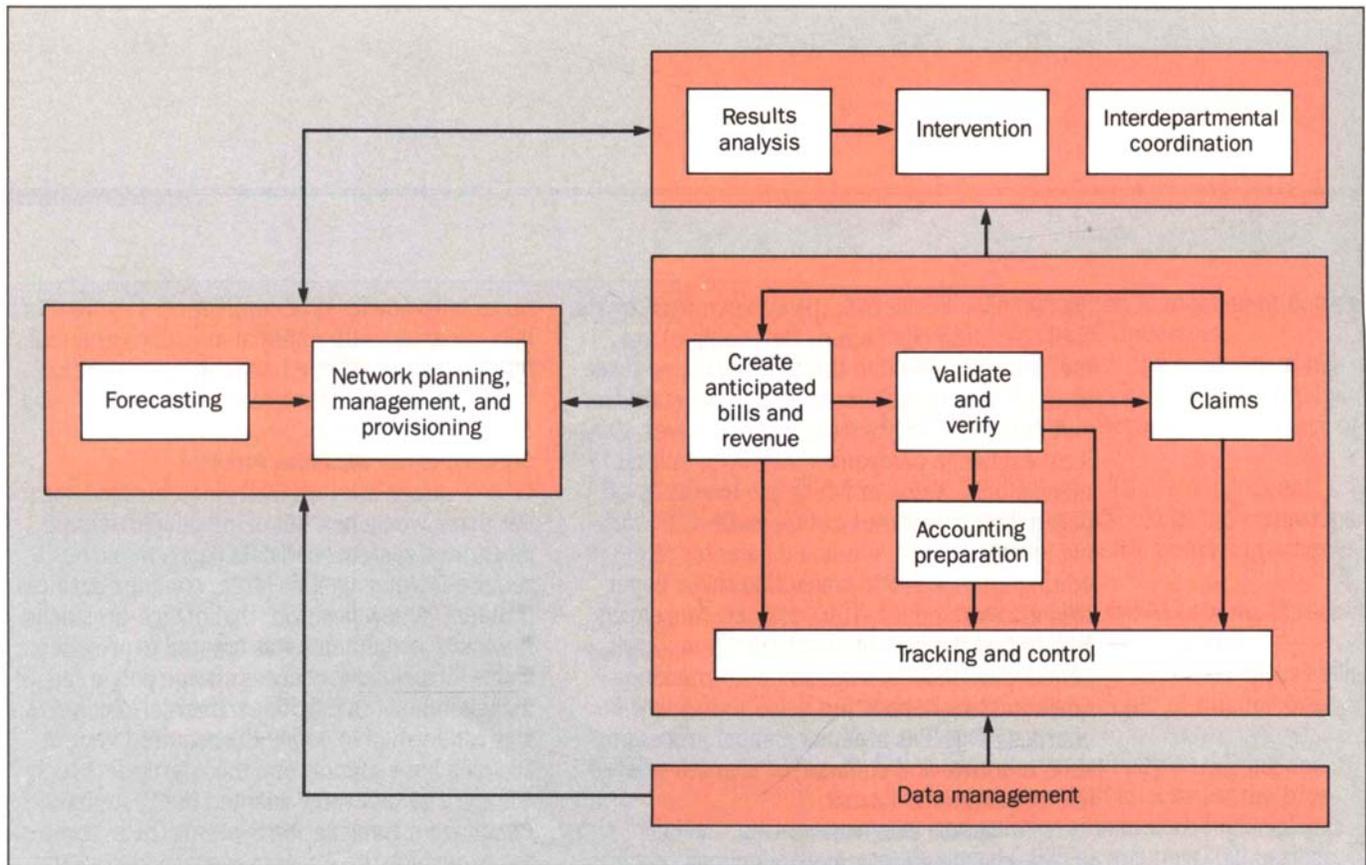
Figure 2. AC&R business model.

The baseline AC&R data and system architecture is to process inventory and usage data to generate expected charges and revenue. When the actual charge or revenue data are received, the architecture systems are to compare them with the expected data to identify discrepancies. The architecture is to support payment and booking preparation. Work center personnel in the various organizations are to interact with the architecture to determine if a discrepancy identified in the verification processes is an AT&T inventory or usage problem or if the discrepancy forms a basis for a claim or referral. In addition to these basic functions, the architecture is also to support AC&R bill tracking and control, system and data security, and management information functions.

Two principles are fundamental to the AC&R architecture environment. First, all systems and work centers use the same data base with the same data definitions, implemented from an integrated, consistent standard data specification. Second, responsibility for architecture system development has been shared by all the organizations involved in revenue and access management. Thus Billing Information Management, External Affairs, Finance, Marketing, and Network have each been responsible for developing one or more of 23 major architecture projects.

To coordinate the system development effort, a centralized project management staff was organized. All departmental participants report on a "dotted line" relationship to the centralized staff as well as on a "solid line" to their home organizations, in a matrix reporting structure. In turn, the centralized staff reports to the vice president, Access Management. This matrix-reporting environment safeguards

both the corporate and departmental needs.

The integrated data base. The data base necessary to "drive" this complex and diverse AC&R architecture is unique in that its development is truly interdepartmental in nature. The logical design of the data base was the work of 23 data base administrators using data gathering, definition, normalization, cataloging, and usage methodologies. Transition from the logical design to the physical design involved the creation of a single data base using Cullinet Software's integrated data base management system (IDMS®).

AT&T's System Development organization recommended the IDMS software for its flexible and high-performance data base manager, active and integrated data dictionary, tools for prototyping, and high-level program development package.

IDMS provides a network data base manager for production applications. It is appropriate for operational support, management information, and reporting analysis. Its logical record facility also produces "relational" views of the data base, a capability especially desirable for AC&R applications. For example, embedded pointers can represent a relationship between data tables.

The integrated data dictionary is the "heart" of the integrated software architecture. It is the central repository for the definition and control of all application information (elements, records, programs, screens, security, system generation, etc.). Once an item is defined, it is accessible to all products. The precompilers automatically update the dictionary to maintain cross-references.

Prototyping capability is an important feature used in developing the AC&R system applications. A *prototype* is a working model of

an "on-line" system that contains screens, basic field and table edits, data-base-processing functions, and minimal error-handling and mimic algorithms. Prototyping defines requirements by extracting, presenting, and interactively refining user needs by quickly building and demonstrating a working model of the planned production system. Its benefits to AC&R development are that it:

- Avoids costly errors
- Improves quality
- Increases user commitment
- Provides better understanding of user needs
- Allows developers to try alternatives
- Reduces the amount of rework required in design, coding, and testing.

IDMS also provides a family of *program development packages*:

- An application development system combines an application generator, an application controller, and a high-level structured language (ADSO) for on-line programs. Needing up to 50 percent less procedural code than COBOL via its interaction with the data dictionary, the application development system also allows the linking of COBOL modules with ADSO programs.
- An on-line mapping feature is a tool for developing screens by "painting" the format at a display terminal. On-line mapping also displays and then generates field-level edits and table edits for any data entered on the screen.
- A nonprocedural report writer is a programmer's tool that generates production reports from data bases and sequential files. It can also be used to extract or summarize data from existing data bases or files and to load a separate file or data base. It requires fewer lines of code than COBOL.

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- An on-line query feature is a nonprocedural data base query and reporting language for end users. It has a menu facility for easier use and generation of its commands.
- A number of utilities are also available for program compilation, data base maintenance and recovery, and data dictionary reporting.

The technological architecture. The AC&R technological architecture must provide heavy computing power, large storage capacity, and interactive access by many geographically dispersed users. To achieve this, it uses about 80 percent of a multiprogramming virtual storage mainframe computer. At full potential, usage will require two-hundred-fifty 3380 disk storage devices and approximately 1400 AT&T 6500 terminals with the 6538 display (whose "windowing" capability can simultaneously display information from both AC&R and another software system).

The communications network. The data base and the system applications interact via a complex data communications network that uses existing internal dedicated and dial networks to support AC&R's large number of geographically dispersed users. The technology deployed in this area uses tools such as remote multiple access facility (for interactive terminals), dial net (for report distribution), and remote job entry and TTRAN (for file transfer).

An IDMS teleprocessing monitor handles the communications environment. It interfaces with TCAM (telecommunications access method), VTAM (virtual telecommunications access method), or BTAM (basic telecommunications access method) and contains controls to limit resources (such as CPU time and input-output ports) used by any task. IDMS passes the most critical benchmark

requirements with an average throughput of 39,000 transactions per hour (per CPU) and a peak volume of 90,000 transactions per hour (per CPU).

AC&R Bill Processing and Revenue Management Support

By the fourth quarter of 1988, when fully implemented, the AC&R baseline architecture will provide mechanized support for the processing of three types of bills: special-access, switched-access, and billing and collection bills. In addition, it will provide initial support for revenue management.

Processing Special-Access Bills. Special-access bills contain charges from local exchange companies for access circuits that connect a customer's premises to AT&T's special-service circuits. *Ordinary services* include residence, basic individual-line business, public telephone, and mobile telephone services. Examples of *special services* are foreign exchange service, wide area telecommunications services (WATS), and various private-line and private-network services.

Special-access bills contain recurring and nonrecurring charges and customer service record information for access circuits provided by the local exchange companies. *Recurring charges* represent the monthly amounts the local exchange company charges AT&T for each circuit. *Nonrecurring charges* are the amounts the local exchange company charges AT&T for one-time activities such as adding, changing, disconnecting, or testing an access circuit. Customer service records contain local exchange company inventory information on the special-service access circuits AT&T orders. Special-access bills contain primarily non-usage sensitive, or flat-rate, charges. These charges are
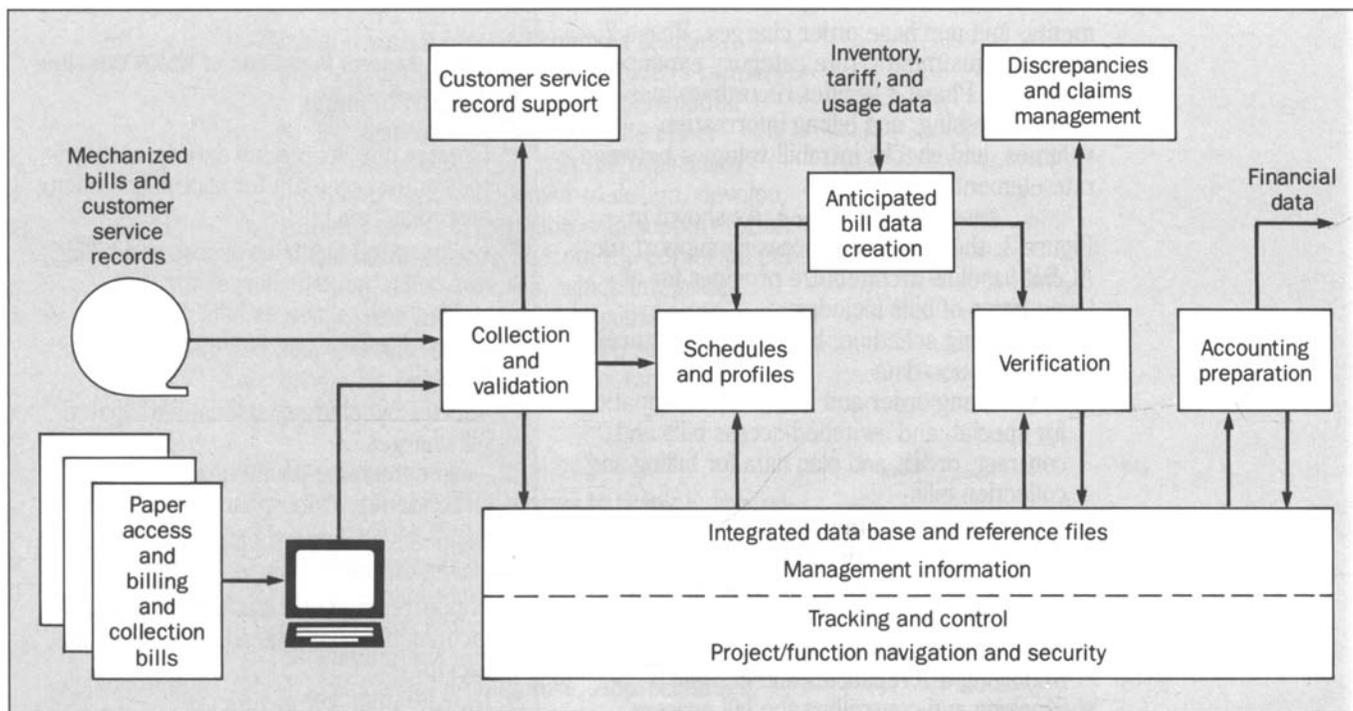
Figure 3. Basic bill-processing support provided by the AC&R baseline architecture.

Diagram labels:
- Customer service record support
- Mechanized bills and customer service records
- Paper access and billing and collection bills
- Collection and validation
- Schedules and profiles
- Inventory, tariff, and usage data
- Anticipated bill data creation
- Discrepancies and claims management
- Verification
- Accounting preparation
- Financial data
- Integrated data base and reference files
- Management information
- Tracking and control
- Project/function navigation and security

collected, validated, and verified prior to payment.

Processing Switched-Access Bills. Like special-access bills, switched-access bills contain both recurring and nonrecurring charges, and mechanized bills also contain customer service records. Unlike special-access bills, switched-access bill charges are primarily usage-sensitive. Two common rates used are *minutes of use*, a usage-sensitive rate that measures the time a circuit is actually in use, and *minimum monthly usage charge*, a flat rate that guarantees the local exchange company a return on its investment. All switched-access charges are collected and validated prior to payment. The mechanized local exchange company data are then verified twice, both before and after payment.

Processing Billing and Collection Bills. Billing and collection bills contain charges from local exchange companies for billing AT&T's customers and collecting AT&T's revenues. The charges include elements such as number of bills rendered, number of messages processed, and programming hours needed to modify local exchange company programs to meet AT&T's needs.

Because some local exchange companies submit a single billing and collection bill for a calendar month, while others submit multiple bills, billing and collection bills are verified in three phases. Phase 1 verifies rates, rate ele-

ments, and purchase order charges. Phase 2 verifies adjustments, rate category expenses, and taxes. Phase 3 verifies recording, message-processing, and billing information volumes, and checks intrabill volumes between rate elements.

Bill-Processing Support. As shown in Figure 3, the basic bill-processing support the AC&R baseline architecture provides for all three types of bills includes:
- Generating schedule, bill profile, and threshold deviation data
- Maintaining order and inventory information for special- and switched-access bills and contract, order, and plan data for billing and collection bills
- Generating anticipated bill data
- Collecting, validating, and verifying actual bill data received from the local exchange companies
- Preparing accounting data
- Managing discrepancies and claims
- Tracking and controlling the bill process
- Providing management information.

The baseline architecture also provides support for specific processing needs for each type of bill.

Revenue Management Support. The baseline architecture provides revenue data and limited validation support consisting of:
- Storing and updating purchase of accounts receivable, journal, nonfinancial revenue (e.g., minutes of use), revenue verification results, and revenue financial entries data
- Calculating interest penalties for delayed revenue
- Managing discrepancies and claims
- Providing management information.

The Revenue Quality Architecture under development by the Marketing Department, which

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Panel 2: General Functions of AC&R Baseline Architecture

- Creates anticipated bill data from inventory and usage data for access and billing and collection bills
- Collects and validates access and billing and collection bill charges for
  —Mechanized access bills
  —Paper access and billing and collection bills
- Verifies bill charges against anticipated bill charges
  —To determine payment status
  —To identify discrepancies
- Supports analysis of bill and revenue statement discrepancies
- Supports filing and tracking of claims for incorrect bill charges and late revenue receipt
- Prepares bill charges for
  —Payment
  —Booking of expenses
- Provides management information on charges and revenue

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will be "folded" into the baseline architecture, will provide additional support for the management of revenue.

Panel 2 summarizes the system and data support the AC&R baseline architecture provides for both bill processing and revenue management.

Conclusion

Following divestiture, AT&T was con-

fronted with a new and complex business problem of considerable magnitude, a primary solution to which is the interdepartmental AC&R systems architecture. The effort described in this paper was the first major *interdepartmental* endeavor to design, develop, and implement system and data support for an AT&T business process from the corporate perspective. This approach, which integrates system design and shared organizational responsibility, may in the future serve as a prototype for solving similar corporate business problems.