AT&T Message Service

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AT&T Message Service (AMS) allows a caller to use an 800 number, or a four-digit service code, to deliver a one-minute recorded message to a specific telephone, or person. The message can be delivered immediately or at a scheduled time, via either menu prompts or a service attendant. The caller can opt for the recipient to record a reply for up to one minute. Delivery attempts are made at 15-minute intervals, for up to four hours, with delivery status available to the caller for up to 24 hours. The transaction can be billed to the caller's telephone, or to an AT&T, local exchange, or other commercial credit card. Architectural components include the AT&T Conversant Voice Information System (CVIS) and an AT&T Definity® G.2 private branch exchange (PBX) with Automatic Call Distributor (ACD) capabilities. Components communicate over a StarLAN local area network.

Introduction

Successful communication of a message must satisfy the needs of both the sender and the recipient. The sender should be able to:

- Have a message delivered at a specific time,
- Get confirmation that the message was both delivered to and understood by the recipient,
- Gain access to the recipient's reply, if one was made.

In turn, the recipient should be able to:

- Receive the message at a convenient time,
- Receive the message in the sender's own words, not paraphrased or condensed, and
- Confirm receipt and, if desired, respond.

Before the introduction of AT&T Message Service (AMS), a voice store-and-forward service, message recipients had the responsibility to make arrangements to store and retrieve telephone messages. For personal use, this usually meant purchasing and installing a telephone answering device. For business applications, the messaging function was provided by answering devices or services, secretaries and, more recently, premises-based messaging products, such as the AT&T Audix® system.

While very useful, none of these arrangements fully meet the needs of either the sender or recipient. Senders might encounter busy signals, or there might not be an answer. Leaving messages with a third party, such as a hotel clerk, doesn't ensure the message will be delivered accurately. Senders often have to rely on the recipient making an effort to receive the message, and have no way of knowing if and when the message is received. Recipients, on the other hand, have to take a specific action to receive the message, and have no simple way of responding, particularly if the sender is travelling.

AMS, marketed as AT&T True Messages, addresses the needs of both the sender and the recipient. In particular, a high priority was placed on *not* requiring either the sender or recipient to have special equipment, or *any* equipment other than a standard touchtone telephone set. In addition, the message delivery had to be simple and convenient for users, under the control of the sender, capable of confirming delivery, and priced so that it was available to all.

AT&T Message Service allows a sender using a standard telephone to record a message at any time, and to specify the telephone number (domestic or international) where the message is to be delivered, as well as the date and time of delivery. Either touchtone signals or an attendant can be used to

Panel 1. Acronyms Used in the Paper

ACD—Automatic Call Distributor
AP—Applications processor
AMA—Automatic message accounting
AMS—AT&T Message Service
ANI—Automatic number identification
Audix—Audio Information Exchange System
CAS— Customer account services
CCITT—International Telegraph and Telephone Consultative Committee, now called the International Telecommunications Union (ITU)
CVIS—Conversant Voice Information System
IDDD—International direct distance dialing
ISDN—Integrated services digital network
ITU—International Telecommunications Union, formerly CCITT
LAN—Local area network
LEC—Local exchange carrier
NANP—North American numbering plan
PBX—Private branch exchange
RBOCs—Regional Bell operating companies

specify the delivery schedule. The message is delivered to anyone answering the destination telephone or, at the sender's option, to a specific person with an attendant verifying receipt. The sender also can call AMS to verify if and when the message was delivered, and may retrieve any response that the recipient has made. Calls can be charged to any billing number acceptable for other AT&T calls, including commercial credit cards, which also provides the sender with a record of the transaction. No charge is made for messages not delivered.

This service overcomes many of the shortcomings of the various answering arrangements that the recipient can provide. Senders have found this service particularly advantageous if they are unable to call at a time when the recipient is available to answer the telephone. AMS also is useful when the sender is not at a telephone that can be easily reached by a return caller, when the recipient is en route to a location that doesn't support message answering and retrieval services, or when direct personal communication is not required.

A prototype AMS underwent successful market and technical trials at AT&T American Transtech in Jacksonville, Florida. The trials provided service to customers from the fourth quarter of 1989 to the first quarter of 1991, when the production platform came on-line.

This paper describes what AMS is and how it is provided. Specifically, it describes AMS's feature set, the service platform architecture, the service user interface, and what is necessary to provide service billing.

Service Description

Domestically, a person can access AMS in one of two ways, by:

- Dialing an 800 number (currently 800-562-6275), or
- Dialing a party directly, then pressing #123 upon reaching either a ringing or a busy signal.

Using the 800 Number. When dialing the 800 number, called *customer-initiated access*, the caller is connected to the AMS system, receives a greeting, and is asked to select "record a message" or "hear status information." If the record-a-message option is chosen, the caller is asked to:

- Enter a card number for billing,
- Enter a destination number,
- Record the message,
- Select immediate or custom delivery, and
- Choose whether an attendant should introduce the message.

For immediate delivery, AMS begins to place calls within 15 minutes, and retries every 15 minutes for up to four hours or until the message is delivered. For custom delivery, the caller specifies a start time within the next seven working days.

If the caller selects "hear status information," the system asks for a billing number. It then recites the status of calls awaiting delivery, or that have been delivered for that billing number in the past 24 hours.

Dialing the Caller First. When the caller places a phone call and receives either a ringing or a busy signal, the caller can press #123 to access the service and leave a message. In some circumstances, the caller may hear a network announcement suggesting that a message can be delivered to the called number by pressing #123. The network sends billing and called-number information to AMS, relieving the caller of re-entering these data. The caller is prompted, however, to provide the recorded message, to select immediate or custom delivery, and to choose whether an attendant should announce the message.

International Calling. Callers from an international location can access AMS by:

- Using USA Direct® Service and asking the operator to call the AMS customer-initiated 800 number, or
- Using the access number (#123) if, after dialing the number, the line is busy or no one answers.

Feature Description

This is a brief description of the AMS feature set:

Delivery Destination. A caller selects a domestic destination by specifying a 10-digit North American numbering plan (NANP) telephone number (excluding 700, 800, and 900 numbers), or an international direct distance dialing (IDDD) number.

Record Sender's Name. A caller can record a name to be used in the message introduction.

Record Message. A caller can record a one-minute message for domestic delivery, and a three-minute message for international delivery. The message length is a system-variable parameter that can be from one to three minutes, and is dependent on the delivery location.

Cancel Current Message. A caller can cancel a completed message recording and record another message without having to hang up and redial.

Multiple Messages. The service provides three multiple message features: *message copy* allows a caller to send the same message to different telephone numbers with different delivery options; *message broadcast* allows a caller to send the same message to different telephone numbers with identical delivery options; and *new message* allows a caller to send different messages to different numbers with different delivery options. All calls set up in a session are billed to the same billing number.

Delivery Mode. A caller can have the message delivered automatically or introduced by an attendant, who can also be instructed to play the message only to a specific person. Messages delivered domestically are played twice to the recipient, and those delivered internationally are played once, with a replay at the recipient's option.

Record Recipient's Name. If the attendant is to play the message to a specific person, the caller is prompted to record the recipient's name.

Foreign Language Selection on International Calls. A caller setting up a message for automatic delivery to an international location can choose English or one of 20 other languages for the message introduction.

Schedule Mode. A caller can choose immediate message delivery or scheduled delivery at a specific time and date within the next seven days.

Recipient Response. A caller can opt for the message recipient to record a one-minute response message, at no additional cost.

Quick Disconnect Call Back. If the recipient hangs up during an automatic delivery before the message can be played (called a "quick disconnect"), subsequent delivery attempts will include an attendant to introduce the message and to maximize chances of delivery.

Status. A caller can ascertain the delivery status of a recorded message for a period of 24 hours. The status of any message is: *delivered* (with a recorded recipient response, if any); currently *being delivered*; *scheduled* for future delivery; *not delivered* within the delivery window; and *canceled.*

System Architecture

This section describes the components of the AT&T Message Service system architecture, discusses the design considerations, and traces a sample message setup and delivery attempts through the system.

Architecture Components. The AT&T Message Service architecture (see Figure 1) is comprised of components that:

- Allow callers to provide information related to message delivery features;
- Record, store, and play messages;
- Permit access to attendants;
- Validate billing information; and
- Place calls to recipients.

The components communicate over a StarLAN local area network.

The major architecture components are AT&T Conversant Voice Information System (CVIS) units and an AT&T Definity® G.2 private branch exchange (PBX) with Automatic Call Distributor (ACD) capabilities. CVIS units provide two types of service:

- *Message servers* interact with callers for message recording and storage, and with recipients for message playing, and
- *Validation servers* perform billing number validation.

The Definity PBX distributes calls to attendants for handling, and interconnects the message servers for message response playbacks.

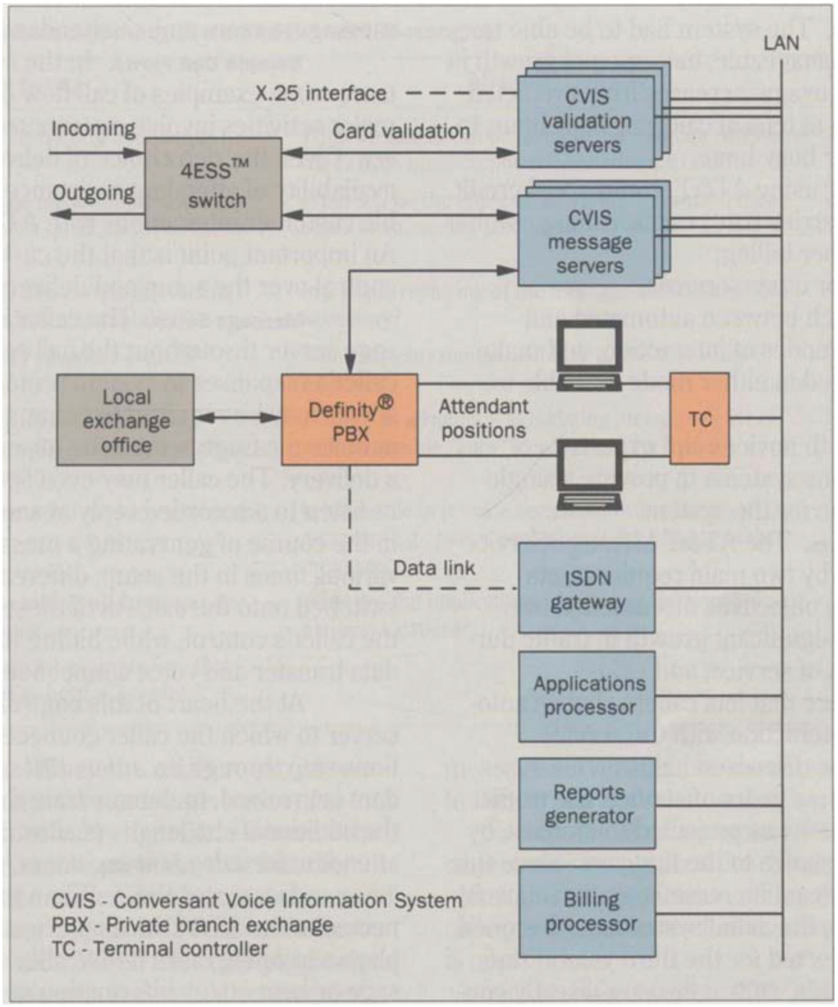

Figure 1. The AT&T Message Service architecture includes the Definity® PBX that connects to the attendant positions, the message servers, and the ISDN data link gateway to the local area network; the applications processor (AP), reports generator, and billing processor; the Conversant Voice Information System (CVIS) validation and message servers; and the 4ESS™ switch.

Other components include:

- *Attendant* servers that drive the terminal display at the attendant position,
- An *applications processor* (AP) that stores information related to the delivery status of all messages in the system,
- The *billing processor* that converts billing information received from the AP into the automatic message accounting (AMA) format, then transmits these data to a reports generator and to the AT&T billing system for subsequent billing, and
- An ISDN *gateway* that is the data interface, via the LAN, between the Definity PBX and the other architectural components. Data received from the Definity PBX allows for the transfer of the caller voice path, and the data associated with the call, to the correct attendant position.

The CVIS units are directly connected to the AT&T network via tariffed facilities. These facilities permit the message servers to receive incoming calls (for message recording), allow for the message servers to place outgoing calls (for message delivery), and permit the validation servers to validate billing information.

Design Considerations. The system design was shaped by the service objectives, highlighted below. The next subsection, "Architecture Impacts," addresses the impact these service objectives have had on the architecture design.

Service Objectives. The system had to be able to:
- Allow for modular, manageable, incremental growth in capacity and costs as usage increases from predicted call volumes, starting at tens of calls per busy hour, to thousands of calls per busy hour;
- Provide robust billing using AT&T, commercial credit, and local exchange carrier (LEC) cards; calling number (ANI); and third-number billing;
- Serve as a platform for other services;
- Permit callers to switch between automated and attendant-supported modes of interaction, and make the information entered in either mode available to the other mode;
- Be easy to use, for both novices and experts;
- Use existing operations systems to provide a single point of administration for the system.

Architecture Impacts. The AT&T Message Service architecture was driven by two main requirements derived from the service objectives discussed above:
- The ability to handle significant growth in traffic during the first few years of service, and
- A flexible user interface that lets callers choose automated or attendant interaction with the service.

Each requirement will be discussed below.

Over the first three years of service, the traffic (call and message volume) was projected to increase by an order of magnitude relative to the first year. Since this growth required a significant increase in system capacity in a relatively short time, the initial system was designed to handle the traffic projected for the third year of the service. To accomplish this, CVIS units were directly connected to the AT&T network. Any increase in traffic could be handled by adding CVIS units, installing additional connections to the AT&T network, and modifying system parameters. No additional development is required for expansion, and existing AT&T network capabilities allow for balancing the traffic load among the CVIS units.

The second requirement of AT&T Message Service is a caller's ability—at any point in the call—to speak with an attendant for assistance, or to have the attendant complete the transaction. Also, for attendant-delivered messages, the system must connect an attendant to the outbound call and present the attendant with the information required to introduce the message successfully. This information may include the name of the message sender and the recipient. These attendant capabilities require close coupling of the voice and data associated with an individual call as it is switched between the message servers and an attendant, via the Definity PBX.

Sample Call Flows. In the subsections below, we trace some examples of call-flow interactions. The two major activities involve *message setup* and *message delivery.* Given the rich choice of delivery options and the availability of attendant-assistance, there are many possible customer interactions with AT&T Message Service. An important point is that the customer has complete control over the setup and delivery scenarios.

Message Setup. The caller is connected to a message server throughout the call setup. Based on the caller's responses to system prompts, this message server may be required to communicate with the PBX, another message server, the AP, or an attendant to set up a delivery. The caller may even speak with an attendant or listen to a recorded reply at another CVIS, via the PBX, in the course of generating a message. Additionally, at various times in the setup, different attendants may be switched onto the call. All of these steps must be under the caller's control, while hiding the complexities of the data transfer and voice connections to the caller.

At the heart of this control is the initial message server to which the caller connects. The following sections step through an *automated setup*, in which no attendant is involved, to demonstrate the basic functions and the additional challenges of allowing a caller to access an attendant for *attendant assistance.*

Automated Setup: When the caller is first connected to the AT&T Message Service, a message server plays a greeting, asks if the caller wants to set up a message or hear status information on previously recorded messages, and collects billing information. The message server communicates the billing information over the LAN to other components for billing validation. If the billing number is invalid, the caller is prompted for a valid billing number. To expedite the message setup and provide a smooth flow to the user interface, the message server continues to collect the delivery request parameters while the billing number is validated.

If the caller choses to hear the status of previous messages, the message server checks with the AP, via the LAN, for any status information on previous messages associated with the billing number. Any existing status information, such as the time of recording, delivery status, and recorded replies, is given to the caller. Since there are several message servers, and incoming calls are assigned to message servers using a load-balancing algorithm, these replies will probably be stored on a

Table I. Human Factors Issues Affecting Store-and-Forward Messaging

Message Setup	Message Delivery
What are the implications of restricting user inputs to touchtone keys?	What measures can be taken to differentiate AMS messages from more common telemarketing ones?
How can the caller interface be made simple and intuitive for inexperienced users, yet quick and efficient for expert users?	What will be the effect of delivering automated messages to answering machines?
Is uneasiness experienced by users when interacting with recorded prompts a hindrance to usability?	Is a single replaying of the message sufficient, or even necessary?
Is user entry feedback to every response critical?	Will recipients understand how to use the "reply" feature?
How can the overall time to complete the message setup transaction be limited, while retaining complete instructions and full functionality?	Is there an advantage to initiating message delivery with an audible "logo" identifying AT&T AMS?
What quality of speech for recorded messages is necessary to meet users' needs?	Is it feasible to provide recipients with a basic set of controls (e.g., pause, replay) over the playing of the message?
What are the implications for setting up messages destined for international locations?	What are the implications of message delivery to international locations?
What are the optimal wordings for prompts; i.e., that are clear and informative, yet as brief as possible?	

different message server. When the caller requests to hear a reply resident on another message server, the original message server instructs the PBX to connect the caller's voice path to the message server that has the stored reply. The message server then sends a command over the LAN to the appropriate message server to have the reply played to the caller. When the reply playback is completed, the second message server is disconnected from the call, and the caller communicates with the original message server.

The remainder of an automated setup, including message recording, is performed by the caller's interaction with the original message server.

When the automated setup has been completed, the pertinent information is sent, via the LAN, to the AP. This information is stored and used for future status retrieval, as well as for service billing.

Attendant Assistance: At any time during message setup, the caller may request a connection to an attendant for assistance. If the message server detects a threshold number of inappropriate responses to a prompt, this connection takes place automatically. The message server instructs the PBX to connect the caller to the next available attendant. The PBX sends, as a message over the LAN, the attached attendant position identification. The message server then sends all pertinent call-related data to the screen at that attendant's position.

Should a caller or an attendant hang up, the message server recognizes the disconnect, and then completes the administration of the call setup, or returns the caller to the automated interaction, whichever response is appropriate.

Message Delivery. After message setup, the server that stores the recorded message calls the destination number at the appropriate time, based on whether the setup parameters specify automated or attendant-assisted delivery.

If the delivery is automated, the message server plays the message after recognizing the network's "call answer" signal. If there is no call answer, the message server either tries the delivery later, or assigns a final status of "not delivered," as appropriate, based on the time "window" originally requested for message delivery.

If the delivery is attendant-assisted, the message server instructs the PBX to connect an attendant during the delivery attempt. The message server then interacts with the attendant position, as discussed above, for the attendant-assisted call setup. Status updates that result from the delivery attempt, whether successful or not, are communicated with the AP via the LAN.

Caller Interface

The extensive functionality of AMS presented a challenge to design a caller interface that would be easy for people to learn, use, and understand, while not constraining experienced users. The AMS caller interface permits callers either to request an attendant or press touchtone digits in response to a set of prompts. This section focuses on human factors issues related to touchtone input, since these prompts provide access to a variety of features of differing complexity, and ease of use is vital to maximize acceptance by customers.

Human Factors Issues in Messaging. A variety of human factors issues relate to the design of both the message setup and message delivery aspects of any voice store-and-forward service, such as AMS. A sample set of these issues is shown in Table 1.

During the design of AMS, laboratory studies were conducted to:

- Identify announcement sequences that maximized usability,
- Test alternative sequences, and
- Further clarify human factors issues.

User interaction was studied using a voice store-and-forward simulation system. With this simulation, data were collected on the usability of a wide variety of message setup and delivery procedures. The following sections describe a subset of the studies performed, during the design phase of AMS, to improve the caller interfaces (see Benimoff et al.[1] for details on the simulation system and some of these studies).

Message Setup: Message Recorder Behavior. Basic AMS offers several options, each of which requires the user to specify a preference. In response to user requests for a fast and simple protocol, a "fast track" procedure was designed that allows a caller to complete the interaction for an automatic delivery after providing only the minimum billing and recipient information. After the message is recorded, a caller can simply hang up if message delivery is desired in the next four hours. Alternatively, the caller can remain on the line to customize the message delivery.

A study was done to determine whether the new fast-track protocol would lead to any serious errors or confusion. Subjects were familiarized with AMS, then asked to record six pre-specified messages. Some of the messages required custom-delivery features, while others did not and could be set up most efficiently using the fast track. A recorded prompt informed the message recorder that custom delivery features could be requested after completion of the message recording.

Of most interest in this study was the subjects' behavior when they finished recording their messages and heard the prompt stating that customized delivery could be requested. Of the six messages that each subject was asked to set up, two could be completed using the fast track. While there were 24 opportunities (two for each of the 12 subjects) to use the fast track, it was used a total of only eight times. That is, when subjects heard the first prompt—for customizing—after recording their message, they were likely to remain on the line to interact with the customized message delivery prompts, even if their responses to these prompts produced a basic, automated message delivery. In the post-trial interview, 11 subjects indicated that they *thought* they could hang up immediately after recording, but were not sure. Consequently, they remained on the line to respond to subsequent prompts.

To understand this confusion over the use of the fast track, subjects were shown a videotape of a person recording a message from the beginning of the protocol through completion of the message recording. When queried, 10 out of 11 subjects correctly believed the message *would* be sent if the sender hung up at this point.

While callers during the study seemed to understand how to use the fast track, they were nonetheless wary of doing so. Since the fast track option is important to AMS customers, and its use could substantially reduce network holding time, it is quite important that customers use it for automated messages. Therefore, it was recommended that after callers completed recording their messages, they were specifically told that they could either *hang up* or proceed to customize message delivery. This prompt is expected to allay caller uneasiness and increase the correct use of the fast track.

Message Delivery: Message Recipient Behavior. The successful delivery of messages is obviously a critical aspect of AMS. When the service was new, most recipients had never received a recorded message when answering the telephone except, perhaps, from an automated telemarketing service. If AMS messages are incorrectly perceived as recorded advertisements, many recipients may not listen to the complete message.

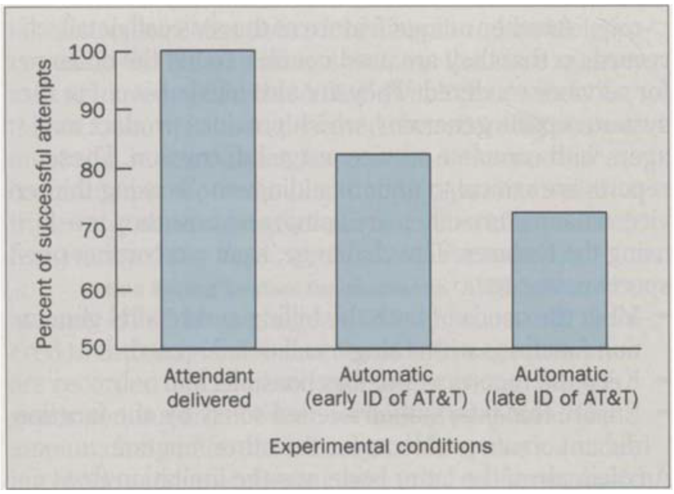

Figure 2. A major concern was the behavior of the message recipient when an AT&T Message Service (AMS) delivery attempt was made. Message delivery introduced by an attendant was successful 100% of the time, but automated delivery was successful about 78% of the time. Automated delivery was optimized, however, to about 85% by constructing an introductory prompt that mentioned "AT&T" at the very beginning of the prompt.

In a series of studies designed to examine recipient behavior and related aspects of the message delivery process, we attempted to deliver messages to 227 people, none of whom expected the message delivery call. A total of 211 people received automated messages, and 16 received messages introduced by an AT&T attendant. A variety of different methods and prompts was used in introducing the recorded messages.

Figure 2 summarizes the message delivery data from several studies. A total of 100% of the recipients who received messages introduced by an AT&T attendant remained on the line throughout the entire message. With automated delivery, however, about 78% of the messages were successfully delivered; that is, through at least one complete playing of the message. This difference in delivery rates should not be surprising, since it is directly related to the tendency of telephone answerers to hang up on taped presentations, and may also reflect the recipients' disinterest with the message content itself.

Another finding of interest was that when the prompt that introduced the recorded message mentioned AT&T and the service name early (such as, "Hello, this is AT&T Message Service with the following message..."), the successful delivery rate increased to 85%. An examination of the data revealed that the difference could be explained by the number of callers who hung up during the playing of the prompt. Some recipients, during a later interview, mentioned that these words suggested that the call was not "just another telemarketing call," and assigned it greater importance.

If recipients are confused by the message delivery procedure, or interpret the message as an unwanted solicitation, they may hang up prior to a successful message delivery. In these studies, we examined the effects of a variety of factors—automated delivery versus delivery via an attendant, the methods and prompts used in introducing the recorded messages, and the use of both the sender's name and the recipient's name—as they tended to influence a recipient's behavior. Factors that had the largest positive influence on the successful delivery of messages were adopted in the service.

Human Factors Summary. The studies described in this section are but a small subset of studies conducted over a four-year period to optimize and fine-tune the caller interfaces. Results obtained in each study were incorporated into succeeding studies, taking advantage of rapid prototyping and iterative design methodologies. The resulting caller interfaces attempt to address the essential challenge raised in this section's opening paragraph; that is, they must be efficient interfaces to the system's extensive functionality, while being easy to learn and use—for both experts and novices.

AMS Service Billing

Prior to divestiture, all recording of the customer calling information, bill calculation, rendering of the bill, and collection of revenue were the responsibility of what were then called the operating companies of AT&T. After divestiture, AT&T began contracting these services from the local exchange carriers. Since 1984, AT&T has been moving towards recording 100% of its calls, and has been preparing to perform billing for many of its long distance calls. Since AMS was one of the first enhanced services offered by AT&T after divestiture, providing customer billing from the AMS platform presented several call detail recording and billing challenges.

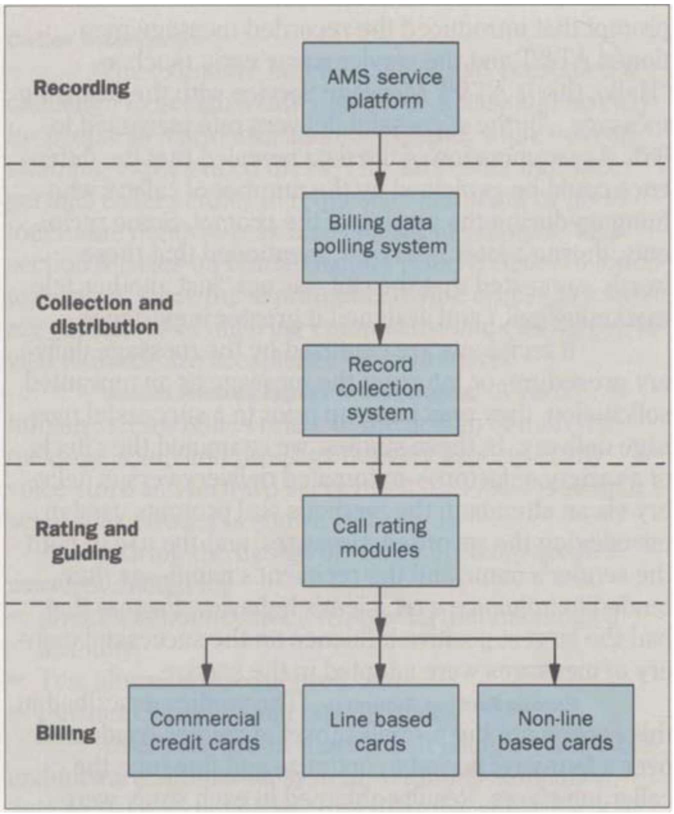

Figure 3. The billing architecture for AT&T Message Service includes four tiers: recording, collection and distribution, rating and guiding, and billing.

Call Detail Recording. While AT&T was in the process of establishing the recording of its long distance calls in the 4ESS™ and 5ESS® networks, AMS was under development using a network adjunct connected to a 4ESS switch. From a call detail recording perspective, this was one of the first cases in which recording would be done outside the umbrella of the AT&T switched network. The major challenges associated with this type of recording arrangement were in the areas of reliability, security, accuracy, and teleprocessing to the AT&T billing system. The AMS system had to ensure that no more than 3 in 1,000,000 messages were recorded and billed incorrectly, while guaranteeing not to lose more than 10,000 records during a system failure. The teleprocessing to the AT&T billing system required the AMS system to support a modified version of the BX.25, Issue 3 protocol via dedicated and dial-up links.

Another unique feature of the AMS call detail records is that they are used not only to bill the customer for services rendered. They are also used as input to the system reports generator, which provides product managers with complete service usage information. These reports are critical to understanding who is using the service, what features they are using, and how they are using the features. The challenge, from a recording perspective, was to:

- Meet the needs of both the billing and reports generation functions with a single call detail record,
- Keep the record as small as possible, and
- Ensure that information needed solely by one function did not create problems for the other function.

An example of the latter issue was the limitation that automatic message accounting records could not record alphabetic characters in the data fields without prior arrangements within the billing systems. Therefore, all information recorded, even for the reports generator's sole use, was recorded in numerical format.

The recording of AMS service information was made possible by AMA recording within the AMS adjunct. Bell Communications Research administers the AMA standard, which is adhered to by the regional Bell operating companies (RBOCs) and AT&T, to record call or statistical data for network usage and billing purposes. The standard consists of requirements for AMA generation, reliability, security, outputting, and accountability within the local and long distance switching systems.

Each AMA record consists of a set of common data fields, plus additional fields used to record specific usage information or statistical data associated with the event(s) to be recorded. Depending on the characteristics that must be recorded, AMA records can be of various lengths and will contain different types of data fields. To accommodate the robust feature set and several potential access methods for reaching AMS, five new AMA records were designed containing 50 unique data fields. In addition to the traditional data captured to bill a customer (i.e., originating number, terminating number, date, time, elapsed time, and billing number), AMS required the recording of the following events: message status; international or domestic delivery destination; automatic or attendant delivery; custom or standard message setup; date and time of message delivery; type of billing arrangement; and service access method.

Once the AMA record is recorded, great care is taken to ensure that the records are stored and teleprocessed to the AT&T billing system in the same manner as is achieved within the AT&T switched network. To this end, the AMS team designed the recording system to meet and, in some cases, exceed the AMA standard requirements. For example, the AMS system more than tripled the mass storage requirement to retain at least five average busy days' worth of AMA records.

AMS Billing System Development. AMS customers are only billed for messages that are successfully delivered to the recipient. Unsuccessful message deliveries are recorded and used as input to the system reports generator, but are not used for billing purposes. The amount charged for the message delivery varies according to the service access method (e.g., customer-dialed 800 #, USA Direct, etc.) message destination (domestic or international), delivery type (automatic, attendant-introduced, or person-to- person), use of an attendant for set up, and any service discounts that may apply. Because the rates for access to or from international locations vary, AMS uses a zoning system to price calls to or from international locations. Countries in a given zone will have the same access and delivery charges. Billing options allow the message delivery to be paid via an AT&T or LEC calling card, customer account services (CAS) card, non-domestic International Telecommunications Union (ITU, formerly CCITT) card, commercial credit cards, calling number ANI, or third-number billing.

The development of the AMS billing system was another of the challenging aspects of the AMS project. Figure 3 presents an overview of the many systems involved in the billing process. Dealing with separate billing development groups, both internal and external to AT&T, required the coordination of their individual schedules to ensure the complete system would be functional and validated to meet the service date. As stated earlier, from a call detail recording and billing perspective, AMS was not a traditional AT&T service. Recording calls in a network adjunct, connecting to a host collector (billing system), and negotiating to secure message rating and billing services for this enhanced service were new to the AMS team. Many experts within AT&T are skilled in these areas, and without them we would have not succeeded, but experience in this new environment—at that time—was limited.

AMS was one of the first AT&T services that allowed billing to commercial credit cards. To enable this feature, the AMS team secured the services of a banking institution to perform card validation and bill rendering. The biggest obstacle, however, was in the area of LEC negotiations. To allow billing to the AT&T and LEC calling cards, the AMS team secured the billing services of the seven RBOCs and many of the large independent operating companies that bill to these cards. This created the need to introduce the service, area by area, which complicated marketing the service.

The experience gained in successfully developing the recording and billing system for AMS has not only been critical to the introduction of the messaging service, but has assisted in the introduction of other AT&T services that followed. Today, the AMS adjunct not only generates the call detail records and billing system interface for its service, but also provides these capabilities for AT&T's Air-To-Ground and Telecommunications Relay Services.

Summary

When deployed, AMS was one of the first enhanced services that AT&T offered. As an enhanced service, AMS must use only tariffed facilities and services. AMS has a rich feature set that has continued to expand. It offers billing to telephone calling cards and commercial credit cards, and it generates standard AMA records that flow directly into the AT&T billing stream. AMS does not require any special customer premises equipment or subscriptions. It was designed with customer ease of use in mind. A great deal of work was done to understand how callers and recipients would interact with the service. It is built on a flexible platform that was deployed in a non-central office environment and supports other services today.

The service and platform demonstrate that, with careful planning and implementation, new technology can be incorporated into platforms to take advantage of improved capabilities, upgrade existing services, and provide new services—as opposed to deploying new platforms for each new service being developed.

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