

Stored Program Controlled Network:

Calling Card Service—Overall Description and Operational Characteristics

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Conventionally, operator assistance is required for most nonsent paid telephone calls (calls that are billed to a number other than the calling number). Examples of these calls include collect, credit card, and bill-to-third-number. These three types of calls currently represent about two-thirds of all operator-handled toll calls. To reduce the need for operator assistance, a new service, Calling Card Service, enables customers to make credit card calls by dialing in the billing information without the assistance of an operator; it also provides an alternative to operator-assisted collect and bill-to-third-number calls. This new capability is made possible through changes in the Traffic Service Position System (TSPS) No. 1, and uses the Stored Program Controlled (SPC) Network. By providing customers with an alternative to operator assistance, Calling Card Service is helping the Bell Operating Companies (BOCs) and independent telephone companies stabilize operator work force requirements. This paper gives a basic description of Calling Card Service and the customer interface. It also describes the implementation in TSPS, and other areas of the SPC network, and discusses some of the effects on telephone company operations.

I. INTRODUCTION

Telephone customers in the United States today may choose from a number of billing options. In addition to sent paid calls (calls for which the calling number is billed), several nonsent paid alternatives

exist. These include collect, credit card, and bill-to-third-number calls. Each of these billing operations requires operator assistance.

The widespread and efficient provision of these billing options has been made possible by the extensive use in the Bell System of the Traffic Service Position System (TSPS),^{1,2} a stored program system first introduced for service in 1969 and now providing service to over 90 percent of the Bell System lines and to almost 6 million independent telephone company lines. In the last decade, the volume of calls requesting these three types of alternate billing has continued to increase. On an average business day, operators handle over 4 million such messages in the Bell System. Requests for these services are expected to continue to grow.

Concern about the growing expense of handling these types of calls and the market need to provide customers with an alternative to operator assistance led AT&T to press for the rapid development and widespread introduction of Calling Card Service.^{3,4,5,6} This service permits a customer with a calling card (telephone credit card) to dial calls, including billing information, entirely without operator assistance. Calling Card Service capability will be available at stations using dual-tone multifrequency (DTMF) signaling. (This type of signaling is marketed in the Bell System as *Touch-Tone** service.) In addition to substantially reducing operator-assisted credit card calls, Calling Card Service provides an alternative to collect and bill-to-third-number calling. The development of Calling Card Service has been one of the major undertakings of the Bell System and the independent telephone industries.

Calling Card Service has been made possible through new capabilities of the Stored Program Controlled (SPC) Network.⁷ This paper is the first of a series, in this issue of *The Bell System Technical Journal*, that discusses Calling Card Service and describes how key elements of the SPC network, such as TSPS and common-channel interoffice signaling (CCIS),⁸ are being modified to provide the new service. This paper gives a general description of the service and discusses its operational characteristics. Implementation and plans for service introduction are also described. Subsequent papers in this issue consider the human factors and market aspects of the service and some of the more complex aspects of the implementation.

II. CREDIT CARD, COLLECT, AND BILL-TO-THIRD-NUMBER SERVICE PRIOR TO CALLING CARD SERVICE

Since its introduction, TSPS has provided an efficient method for handling credit card, collect, and bill-to-third-number calls. By allowing customers to dial these types of calls, TSPS provides faster service.

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To assist the operator in processing these calls, all administrative functions such as call timing, call supervision, and recording of the billing information are automatically handled by TSPS. Thus, with TSPS, the operator's interaction with the customer is more efficient and accurate and the operator is relieved of most of the routine manual operations required with cord boards.

In a typical TSPS, nearly two-thirds of all calls handled by operators are credit card, collect, or bill-to-third-number calls. Prior to Calling Card Service, the operator was required

- (i) to determine the number to be billed for the call,
- (ii) to enter it into the system (except on collect calls), and
- (iii) to ensure acceptance of the charges.

To illustrate how these functions are handled by an operator at a TSPS, the following describes the processing of these types of calls.

To place a credit card, collect, or bill-to-third-number call, the customer typically dials 0, plus the called customer's telephone number. The local office receives the digits and determines from the 0 prefix that the call is to be routed to a TSPS. The local office then forwards the called telephone number, followed by the calling telephone number, over a trunk to the associated TSPS. The TSPS uses this information to connect the call to an operator position. While the operator is responding to the call, the called number is forwarded to the toll office (see Fig. 1).

When the call arrives at the position, the appropriate keys and lamps are lighted to indicate to the operator what type of call the customer dialed. The operator is then ready to help the customer.

If the customer wishes to make a credit card call, the card number

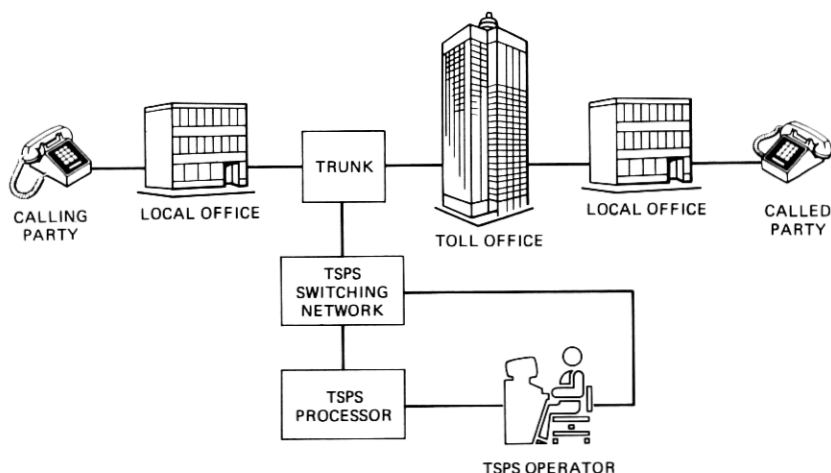


Fig. 1—Basic TSPS No. 1.

is given to the operator, who depresses a key to inform the system that this is a special billing call and enters the credit card number into the system. The system performs validity checks on the number entered by the operator, and if the card number is valid, the operator prepares the system for automatic billing of the call by indicating the type of billing requested and initiating the automatic timing of the call. The operator then allows the call to proceed. While this is taking place, the call is forwarded through the toll network. If the credit card number is invalid, the operator stops the progress of the call and asks the customer to make other billing arrangements.

If the customer desires to place a collect call, the operator indicates to TSPS that the call is to be billed to the number being called. When the called station answers, the operator obtains acceptance of the charges, initiates the timing of the call, and allows the call to proceed.

For bill-to-third-number calls, the customer gives the billing number to the operator, who informs the system that this is a special billing call and keys the third number into the system. The operator then contacts someone at the number being billed to obtain acceptance of the charges. If the charge is accepted, the operator indicates the appropriate type of billing, initiates the timing of the call, and allows the call to proceed.

III. CALLING CARD SERVICE OVERVIEW

Calling Card Service is based on the use of the calling card number, which is composed of a billing number and the customer's personal identification number (PIN). This number is assigned to a subscribing customer and is used to validate that a particular call can be billed to the associated billing number. The billing number usually corresponds to the customer's telephone number. However, in certain cases, a number that is not associated with an actual telephone number is assigned for special billing purposes; these numbers are often used for businesses.

With Calling Card Service, the customer has a number of options available for providing the billing information to TSPS. If the telephone is capable of DTMF signaling to a TSPS, the customer may directly dial the billing number for calling card calls without operator assistance. This is referred to as customer-dialed Calling Card Service.

A caller who has made a call and dialed the billing information may wish to place another call and bill it to the same calling card number. This may occur at the conclusion of a call or upon receiving a busy signal or no answer from a call. This new capability has been designed so that the customer does not need to reenter the billing information but may just signal TSPS that another call is to be billed to that same number. This is done by depressing the DTMF pushbutton with the

number sign (#) on it and then dialing the new call. This capability is referred to as sequence calling. There is no limit to the number of calls that may be dialed sequentially, but a request for a sequence call must be made within an appropriate interval following a call.

In those cases where the customer has dialed the called number but chooses not to dial the billing information, the billing information may be given orally to the operator. The customer can reach the operator by dialing 0, "flashing" (momentarily depressing) the switchhook, or waiting a few seconds. In addition, if the telephone is not equipped to send a DTMF signal to TSPS, the customer will be connected immediately to an operator. This is similar to the current credit card service and is referred to as operator-assisted Calling Card Service.

IV. COMPONENTS OF CALLING CARD SERVICE

Many changes were made to the existing switching network and supporting systems to accommodate Calling Card Service. These changes were particularly significant in TSPS. Further detail is provided later in this paper. In addition, a variety of new components and features are being introduced to provide the service. These include:

- **Originating station treatment (OST)**—A feature to determine when the originating station can be given the capability for customer-dialed Calling Card Service.
- **Billing validation application (BVA)**⁹ and **Data Base Administration System (DBAS)**¹⁰—Two SPC components: the BVA is a processor-controlled data base that contains information about the calling and billing numbers and the DBAS is an associated administration system.
- **Inward validation**—An SPC capability that allows non-TSPS operators from both Bell System and non-Bell System companies to validate billing data through TSPS.
- **Billed number screening (BNS)**—An additional SPC network feature that enables the TSPS operator to determine if the collect or bill-to-third-number request is allowed for the particular billing number. The BNS data are stored in a BVA.

4.1 Originating station treatment

The OST determines the type of treatment to be given the calling station after a customer has dialed a 0+ call. The need for OST is based on the results of a human factors trial of this service described in a later paper in this issue.⁶

Basically, three treatments are provided:

- (i) A prompting tone followed by a prompt announcement
- (ii) A prompting tone only

(iii) Operator-assisted service (essentially the same service as before Calling Card Service).

The distinctive prompting tone indicates to the customer that the billing information may now be entered. The announcement provides an additional prompt for those not familiar with the service.

The first treatment, tone followed by announcement, is now being deployed for public and semipublic stations that have DTMF signaling capability. The second treatment, tone only, is now being deployed with most other DTMF phones. The third treatment, operator assistance, is provided for rotary-dial telephones. Provision has been made to allow changes in the above for cases where the recommended treatment is inappropriate.

4.2 Billing validation application and Data Base Administration System

The BVA is accessed by TSPS using a form of signaling called common-channel interoffice signaling/direct signaling (CCIS/DS). This signaling builds on the already available capability of the existing CCIS network.

The information in the BVA is used

(i) to determine the OST for the originating line so that the appropriate treatment can be given to the calling customer,

(ii) to provide security by validating the billing number and PIN combination provided by the customer, and

(iii) to alert the operators on collect and bill-to-third-number calls if the billing requested is not allowed for that particular billing number.

The computer-based DBAS, which currently administers the Automatic Intercept System¹¹ has been enhanced to administer the BVA. From the telephone company's viewpoint, the information in the BVA is stored primarily in an on-line data base at the DBAS.

In addition to initial data base loading and updating, the DBAS provides other base support functions. These include:

- Screening input data for possible errors
- Providing backup and recovery if a failure occurs at the BVA
- Providing user access restrictions for security
- Auditing the BVA for inconsistencies
- Transferring data from one BVA to another to balance the load over the SPC network
- Collecting measurements from the BVA
- Generating summary reports.

The interconnection of the various components of Calling Card Service is shown in Fig. 2.

4.3 Inward validation

Since most non-TSPS operators (for example, mobile, marine, and international operators) are unable to access the data base (the BVA),

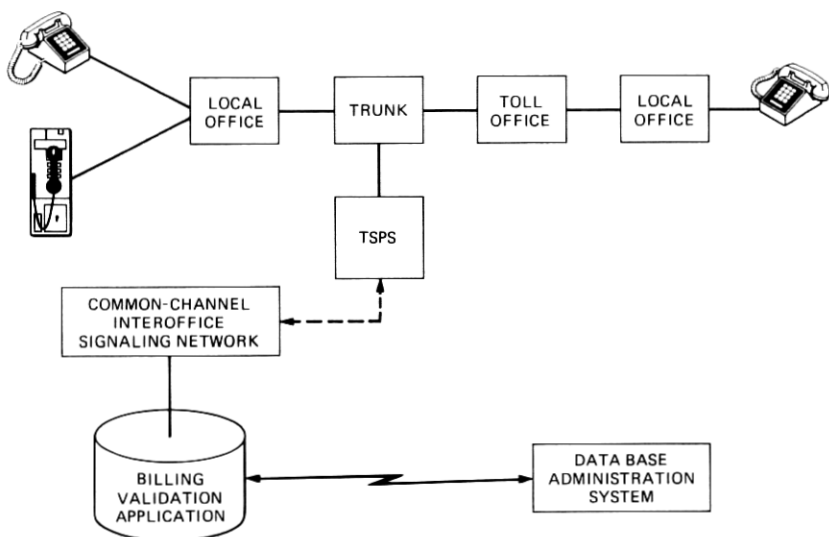


Fig. 2—Calling Card Service components.

other arrangements have been provided. The TSPS is capable of processing operator-requested calling card validations automatically if the operator has a DTMF or multifrequency key set. If not, the validation can be handled by TSPS on an operator-assisted basis.

In the case of operator-assisted validation, the non-TSPS operator quotes the calling card number to the TSPS operator. The TSPS operator keys in the information and a data base check is made. The TSPS operator is then given a display describing the results of the query, and this information is quoted to the non-TSPS operator.

In the case of automated validation, TSPS is reached by special codes that indicate either DTMF or multifrequency signaling. The non-TSPS operator receives a tone when the TSPS is ready to receive the billing information. The operator then dials the information, a data base query is made, and results announced automatically to the operator. No TSPS operator is required in this process. If a dialing error was made, the operator can redial the information.

4.4 Billed number screening

Another SPC feature, called billed number screening (BNS), is being added to TSPS along with Calling Card Service. The BNS feature applies to collect and bill-to-third-number calls placed through a TSPS operator. With this capability, the TSPS will perform a data base check whenever a customer attempts to place a collect or bill-to-third-number call. The data base query will be used to determine if the type of billing requested is allowed for the particular billing number. If the

requested form is not allowed, the operator will be alerted so that the customer can be asked to bill the call in an alternate manner.

The BNS feature is expected to save operator work time and eliminate network time spent processing calls for which third-number and collect calls are not allowed; it is also expected to reduce fraud.

The BNS feature will be automatically invoked by TSPS whenever an operator attempts to complete a collect or a bill-to-third-number call for a customer. After its activation, BNS will function as follows: On a collect call, the TSPS launches a data base query as soon as the called number is known and it has been determined to be a collect call. In most cases, the operator will be notified by a display that the call is allowed, and TSPS then completes the call. Upon answer, the operator announces the call and determines whether the customer will accept the call.

The BNS feature provides for two cases of denial for collect calls. In the first case, the operator is informed that collect calls are denied and requests alternate billing information from the calling party. The operator is also informed in the case where the called number is a public or semipublic telephone. Collect is not a valid billing alternative for these calls; therefore, the operator will attempt to obtain proper billing information.

For bill-to-third-number calls, the operator is either instructed that this form of billing is allowed or denied. For example, bill-to-third-number calls are denied when an attempt is made to bill to a public or semipublic telephone. When this type of billing is denied, the operator announces that different billing must be used and helps the customer with an alternate form.

V. CUSTOMER USE OF CALLING CARD SERVICE

The basic flow of a call placed through Calling Card Service is depicted in Fig. 3. To place a calling card call, the customer dials 0 plus the called number. The TSPS then determines whether the station should receive the treatment for customer-dialed service by launching an OST query to the BVA via CCIS/DS. Depending on the outcome of this data base check, the customer is either prompted to dial the calling card number, or an operator is connected to obtain the billing information. After TSPS has received the calling card number, a second data base query is made to check that the billing number is authorized for this service and that the PIN is correct for that billing number. The TSPS processing of the call is suspended until the results of the query are obtained. Based on a successful response, the call is then processed in normal fashion. The sections that follow explain the details of the various types of calling card calls:

- Customer-dialed

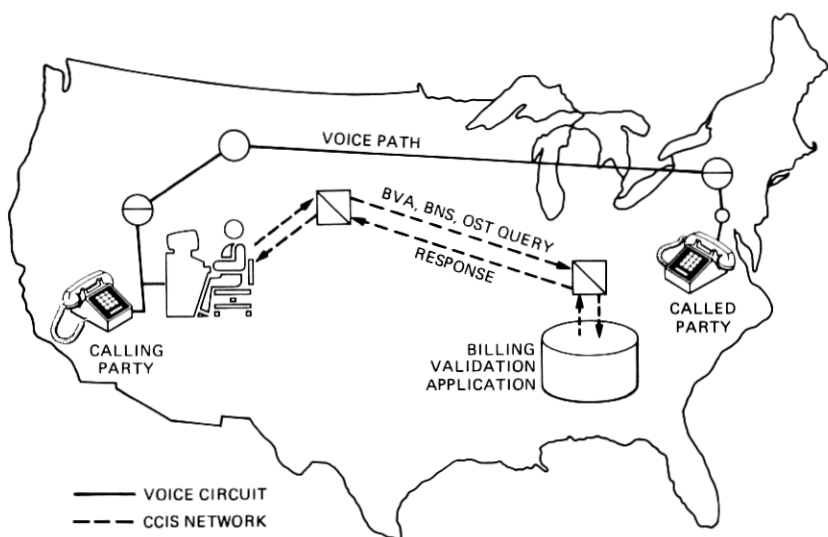


Fig. 3—Calling Card Service with ccis direct signaling.

- Customer-dialed sequence
- Operated-assisted.

5.1 Customer-dialed Calling Card Service

A customer initiates a customer-dialed calling card call by dialing 0 plus the called number, just as is done today for a credit card, collect, or bill-to-third-number call. If the telephone is served by a TSPS equipped for this service, the TSPS will initiate an OST check to determine the proper station treatment for the call. If the results indicate that the line is equipped to provide customer-dialed Calling Card Service, TSPS prompts the customer with the proper treatment. In the case of public or semipublic telephones, a distinctive tone, which may be followed by an optional announcement, is used to provide the prompt. The announcement given by TSPS is

“Please dial your card number or zero for an operator now.”

For most other telephones where the service can be provided, only the tone is given. As noted earlier, should the customer not wish to dial a card number, an operator can still be reached by flashing the switchhook, dialing 0, or waiting a few seconds. If the OST check indicates that the telephone is not capable of customer-dialed Calling Card Service, the call is handled in the conventional manner.

The customer may begin dialing the 14-digit calling card number

following the prompt. If the customer begins to dial before the announcement starts, the announcement will not be given. This will allow customers familiar with the service to dial as soon as they hear the tone. If the announcement has started, it will be truncated as soon as the customer initiates dialing. The number sign (#) pushbutton may be depressed at the end of dialing to indicate that the customer has completed dialing the call.

After receiving the dialed billing information, TSPS will check its validity. If the billing information is valid, TSPS provides a "Thank You" announcement to the customer and proceeds to complete the call. If the information dialed is incorrect or the customer exceeds the timing threshold between digits, the following announcement is given:

"Please dial your card number again now. (Pause) The card number you have dialed is invalid."

If no dialing occurs within 3 seconds following this announcement, an alerting tone is given, followed by a prompt announcement. The customer has 5 seconds to begin dialing. If dialing is not started, a terminating announcement is given requesting that the customer reoriginate the call.

If a customer has twice dialed an invalid calling card number, the following announcement is provided:

"Please hang up and dial zero plus the number you are calling. (Pause) The card number you have dialed is not valid."

At this point, the customer must reoriginate the call.

5.2 Customer-dialed sequence call

The customer-dialed sequence calling feature allows a customer who has dialed a valid calling card call to originate additional calls to be billed to the same calling card number without redialing the billing information. The customer indicates the desire for a sequence call to TSPS by depressing the # pushbutton prior to dialing the new number.

A sequence call can be made at the conclusion of a call or upon receiving a busy signal or no answer from a call. To place a sequence call following a completed call, the calling party must wait until the called party hangs up. The # pushbutton must then be depressed. If there is a busy signal or no answer, another call can be attempted at this point by depressing the # pushbutton.

After the TSPS recognizes a sequence call attempt, the customer receives this announcement:

"You may dial another number now."

The customer can then dial the new called number, and if valid, TSPS replies with a "Thank You" announcement. If the number is invalid, the customer is requested to hang up and reoriginate the call. Any number of successful sequence calls can be made and charged to the calling card number.

5.3 Operator-assisted Calling Card Service

For customers dialing from rotary dial stations or for those who are unsure of how the service works, operator assistance is available to place calling card calls. Essentially, this service functions much like the current credit card service. The customer dials 0, plus the called number. If this telephone is not to be given the station treatment for customer-dialed Calling Card Service, the customer will be connected immediately to an operator. If the station is given the customer-dialed Calling Card Service treatment, the customer must either flash the switchhook, dial 0, or wait a few seconds for the operator. The customer then quotes the number to the operator, who enters it into the system. The TSPS performs a check on the number and allows the call to proceed if valid. If the number information is rejected as invalid, the operator informs the customers and requests new billing information. The operator is given an indication on those calls in which the OST check indicates that customer-dialed service was available. This permits the operator to provide dialing instructions to the customer.

Other types of calls can be billed to the calling card number. For example, a customer may dial a 1+ toll call from a coin station and, upon receiving the charge, wish to bill the call to a calling card number. The customer can reach the operator by either timing out or flashing the switchhook; the operator then keys in the new billing data. Operators will continue to handle noncalling card calls in the same manner as they do today.

VI. IMPLEMENTATION OF CALLING CARD SERVICE

The implementation of Calling Card Service requires changes to many parts of the switching network and supporting systems. Many new TSPS capabilities had to be instituted, including:

- Reception of DTMF and multifrequency signals
- New call types and announcements
- Signaling to the data base
- Provision of an interim OST data base
- Modified coin signaling to allow DTMF signaling.

In addition, local office and coin station changes are required to allow DTMF signaling to TSPS.

Calling Card Service also requires the deployment of the BVA data bases in the CCIS network. The DBAS was modified to provide telephone

companies with the ability to create and modify new distributed data bases, the BVAs, as well as the interim data bases at the TSPS. Modifications are also required in the customer record information and service order processing systems of the telephone companies to provide the data for initially loading and subsequently updating the information in a form suitable for DBAS.

6.1 Traffic Service Position System implementation

The TSPS software and hardware changes required to provide Calling Card Service and BNS build on capabilities previously provided in TSPS. One of the major building blocks is the Station Signaling and Announcement Subsystem (SSAS)¹² used to provide Automated Coin Toll Service.

6.1.1 Dual-tone multifrequency signal detection and announcement capability

The SSAS was previously added to TSPS to provide the capability to prompt coin customers with announcements and to record coin deposits. This system uses a programmable controller to control the coin detection and announcement circuits and the announcement store, which stores the announcement phrases.

To provide Calling Card Service, the SSAS was extensively modified. Additional speech phrases were added for the Calling Card Service announcements. The SSAS capability to detect both DTMF and multifrequency signals was also developed. These modifications required major changes to microcode in the programmable controller to provide the new capabilities and to maintain the new hardware.

6.1.2 Common-channel interoffice signaling/direct signaling

The CCIS/DS feature was introduced to query the data base for OST, calling card number validation, and BNS checks. Hardware and software developed for the No. 4A toll crossbar application of CCIS and adapted for the TSPS CCIS/DS environment were used in the design of CCIS/DS.¹³

6.1.3 Interim data base for originating station treatment

Within TSPS, a limited interim data base for OST data was provided, thereby allowing telephone companies to offer Calling Card Service before the BVA was fully deployed. With this data base, telephone companies could provide an appropriate OST treatment to all public and a limited number of nonpublic stations.

6.1.4 Other changes

Several other changes were also introduced in TSPS for Calling Card

Service. As described in detail in Section 6.4, changes were required to allow the DTMF dial at coin stations to be activated when a customer enters the billing information. To achieve this, a new signaling arrangement between TSPS and certain local offices, known as expanded inband signaling, was introduced.

Major changes in the TSPS operational and maintenance software were also required to provide Calling Card Service. For example, software was needed to handle the new automated service and provide operator assistance if needed. A complete description of these changes is presented in Ref. 14.

6.2 Data bases

The BVA data bases were designed to store customer- and station-related information and are located at signal transfer point nodes on the SPC network.¹⁵ These distributed data bases contain information about the calling and billing numbers and are accessible to TSPS by means of CCIS/DS during the processing of calls.

The routing of messages between a TSPS and BVA is done by the CCIS network. The CCIS signal transfer points contain information required to ensure that query messages launched by TSPS are routed to the proper BVA and that reply messages are routed to the TSPS that sent the query.

The SPC network is arranged to allow this nationwide distributed data base to be evolutionary in nature. As use of Calling Card Service increases, new BVAs can be introduced in the network and data can readily be moved from one location to another to balance the load over the network.

6.3 Data base administration

Since BVAS contain customer- and station-related information, which changes frequently with customer movement, a high volume of updates is expected. Moreover, as the service attracts new customers, these data bases are expected to expand. For these reasons, a mechanized means of keeping these data bases current is essential. The support system that provides mechanized administration of the BVA is the DBAS.

The computer-based DBAS provides a secure interface between the telephone company service order systems and the BVAS (see Fig. 4). The DBAS is connected to each BVA that it administers by a pair of data links (primary and standby). Although a DBAS can administer up to four BVAS, each BVA is administered by only one DBAS for data integrity purposes.

The DBAS receives initial load data via magnetic tapes from telephone company customer-record information systems. Update data

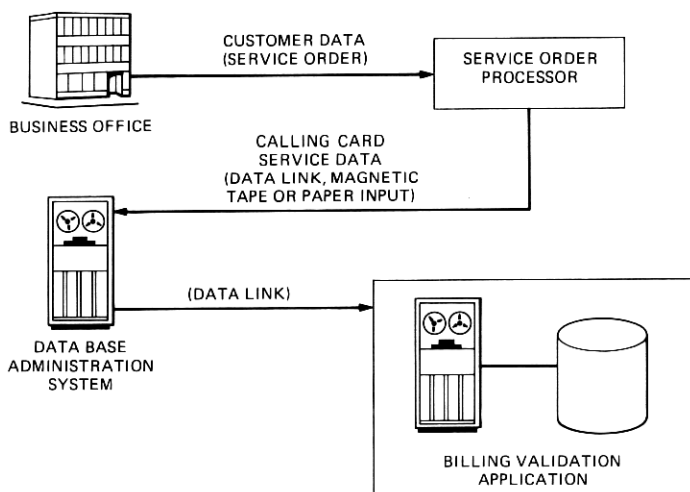


Fig. 4—Data Base Administration System.

are received from telephone company service order systems via data link, magnetic tape, or direct input from a terminal. The DBAS checks input data for logic and syntax errors prior to updating its own data base. Normally, updates are batched and transmitted to the BVA at a specified time of the day via data link. However, critical updates can be sent immediately if required.

6.4 Coin station enablement

Prior to the introduction of automated coin toll service,¹² it was necessary for local offices to disable the DTMF signaling dial on coin stations before a call was connected to TSPS. This was to prevent fraud, and was true for both dial-tone-first and coin-first coin lines. With Calling Card Service, the coin station dial must be enabled for the customer to enter the billing information.

The implementation of this capability requires substantial effort not only in TSPS but also in local offices and the public station area. Where economical, changes are provided in the local offices to implement this capability for all coin stations served by that office. Otherwise, per-station changes are required. In the case of local office changes, two methods of enablement are available: multiwink signaling and expanded inband signaling.

6.4.1 Multiwink

Multiwink signaling is currently available for use by many electro-mechanical and some ESS local offices to perform coin signaling with

TSPS. A series of one to five short-duration on-hook winks are used by the TSPS to signal the local office.

For a dial-tone-first call, the local office disables the DTMF signaling dial on the coin station immediately before making the connection to TSPS. If TSPS determines that this is a 0+ call and that the customer can dial a calling card number, TSPS sends a signal to the local office, which enables the dial. If the customer is subsequently connected to an operator, another signal is sent to notify the local office to disable the dial and allow coin signals to be transmitted.

In the case of coin-first stations, the dial is disabled as soon as the initial deposit is collected or returned. Before the introduction of Calling Card Service, the local office returned the coins prior to connecting the call to TSPS. To enable the dial, a limited form of coin retention has been developed. On calls connected to TSPS, the function of coin return has been moved to TSPS. On 0+ coin calls, TSPS retains the initial deposit until it is determined whether this is to be a customer-dialed Calling Card Service call. If it is, the deposit is retained until the end of the call, thus enabling the dial. If it is not, the initial deposit is returned before an operator is connected. In some electro-mechanical offices, coin retention will require minor hardware changes.

6.4.2 Expanded inband signaling

Prior to the need for DTMF signaling dial enablement, inband signaling has been used between TSPS and many types of ESS local offices. This form of signaling employs on-hook winks from TSPS to alert the local office that multifrequency tones will be transmitted. With inband signaling, three combinations of multifrequency tones are used to perform normal coin signaling (such as coin collect or coin return). Expanded inband signaling (EIS) provides three additional signals to provide DTMF signaling dial enablement. In addition, certain timing changes are incorporated in the signaling arrangement for enhanced reliability.

With EIS, the local office now enables the dial for calls dialed 0- or 0+; no EIS signal is required to perform this function. However, as soon as the call goes to an operator, TSPS must send one of the new signals to disable the dial and allow coin signals to be transmitted. A second signal is sent as soon as the operator disconnects so that the dial is again enabled. Enablement of coin-first coin stations with EIS uses coin retention in the same manner as multiwink signaling.

The implementation of EIS requires hardware and software changes in TSPS. Software changes are required for EIS in all ESS offices; in some cases, trunk designs must be modified. The activation of EIS requires a coordinated retrofit procedure between TSPS and the local office.

6.4.3 Coin station change

In some cases, it is not economical or practical to make local office changes for dial enablement, especially in areas where there are few coin stations. Three alternative methods are available for these cases: a complete new coin station with a new totalizer can be used, a new totalizer can be added to the existing set, or a newly designed polarity guard kit can be added to the station. These modifications make the station insensitive to battery polarity and, thus, allow the dial to be enabled at all times.

These station change techniques are applicable to only dial-tone-first coin lines; no station change procedures are available for coin-first lines.

VII. SERVICE INTRODUCTION

The introduction of Calling Card Service is affecting many areas of telephone company business, and a large coordinated effort is being applied to implement it throughout the industry. Because of the magnitude of such an undertaking, the service is being implemented in phases.

The initial phase began in July 1980. During this phase, BVAs were not deployed to provide billing validation and OST capabilities. Instead, TSPS performed internal validation checks in place of BVA queries.

In addition, since the OST capability (which relates to the customer's capability to dial the billing information) is essential to providing this service in an acceptable manner, an interim OST feature was provided in TSPS for use prior to BVA availability. The interim OST feature determined which public stations were equipped with DTMF signaling so that these stations could be given tone and announcement treatment. It also allowed a specified treatment (tone, tone and announcement, operator assistance) to be given to selected nonpublic stations. All rotary-dial public stations and other nonpublic stations for which tone or tone and announcement treatments were not specified received operator-assisted treatment.

The interim OST data were loaded and updated in TSPS by standard input messages. The DBAS administered and transmitted the data in the proper format to the TSPS administration center for subsequent input into TSPS.

Through the use of this interim OST feature, Calling Card Service was selectively introduced prior to BVA deployment. During this introductory phase, customers who were at public and selected nonpublic stations equipped with DTMF signaling could dial their billing information without operator assistance. The remaining customers gave their billing information to the operator, as with conventional credit card service.

Subsequently, the BVAs are being deployed nationwide, and Calling Card Service is being introduced into all TSPSS. Customer-dialed service can be extended to customers at all nonpublic and public stations equipped with DTMF signaling. As the service capability is introduced to TSPS offices, they will launch billing validation and OST queries to BVAs in lieu of local processing.

Billed number screening is being introduced for public telephones. The TSPSS in which the feature has been introduced will launch BNS queries to BVAs prior to the completion of collect and bill-to-third-number calls to ensure that the billing number is not a public telephone.

VIII. SYSTEM BENEFITS

The introduction of Calling Card Service benefits both the customer and telephone companies. For example, the service reduces operator involvement on calls, improves service, and increases customer billing protection.

Moreover, Calling Card Service calls for significant effort on the part of telephone companies and the Long Lines Division at AT&T to accommodate the modifications and additions to the network that it requires (refer to Section VI). Although these changes in the network are significant, the benefits of Calling Card Service are substantial and lie largely in the following areas:

(i) Decreased operating expenses resulting from the reduced need for operator services as customers more frequently dial their own billing numbers.

(ii) Reduced losses because of fraudulent calling and customer or operator error with billing information.

Economic analysis has shown that the reduction in operating expenses resulting from the use of Calling Card Service is particularly significant. This results from the rapidly rising operating expense and the high labor intensity of today's alternate billing arrangement. It has been estimated that at the anticipated growth rates in collect, credit card, and bill-to-third-number calls, the demand for operators could, without Calling Card Service, have increased by more than 50 percent within the next 20 years. It is expected that the new service will assist in stabilizing the operator force.

Another important area to consider when evaluating the benefits of Calling Card Service is customer reaction. Considerable data exist on customer acceptance of and performance with Calling Card Service. The first evaluation of customer experience with the new service was obtained in a Human Factors and Marketing Trial conducted between November 1977 and June 1978 in Milwaukee, Wisconsin.⁶ In that study, a variety of tests were conducted on ways of providing the

service. Further information has also been obtained from initial experience with the service both in Buffalo, New York, and in Jacksonville, Florida, since cutover in 1980.

The basic measures of success on Calling Card Service are customer acceptance and performance. Most customers with calling cards (or their predecessor, the credit card) who make calls from stations equipped to receive the customer-dialed protocol, have attempted to dial their billing numbers and have done so with considerable success. The high acceptance rate has been essentially unaffected by the successive addition of new user population and can be taken as an indication of the overall success of the new service.

IX. CONCLUSIONS

We have given an overview of the Calling Card Service. Subsequent papers in this issue examine in more detail the changes required for the new service. The introduction of Calling Card Service is having a significant and positive impact on the telephone industry. Moreover, the service is one aspect of a new dimension in customer control of network telephone services; the key to this dimension is the capability of the customer to dial billing information in addition to the destination number. This, coupled with real-time access to distributed data bases, results in security and service improvements that are appealing to the customer and to the telephone companies. With Calling Card Service, customers are provided an alternative to operator assistance, while the telephone company is offered relief from the rapid increase in demand for operators.

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