This comparison of three payment mechanisms—ACH, wire, and checks—is a first step toward understanding the potential of ACH as an efficient, low-cost alternative to paper-based transactions.

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The long-predicted electronic payments revolution has been thwarted for a variety of reasons, including relative cost, product requirements that have not been met, and organizational and structural barriers. Understanding the operational attributes and the comparative economics of payment alternatives is crucial to assessing whether electronic payment systems, particularly the automated clearinghouse (ACH), are likely to displace checks and drafts as the nation's primary noncurrency payment mechanisms.

Types of Payments

Payments commonly comprise two broad classes—paper and electronic. Paper-based payments include checks and drafts as well as credit card payments (credit drafts). Electronic payment is a generic term for any fund transfer or payment mechanism that relies primarily on computerized communication systems rather than paper instruments.

The two major categories of electronic payments—wires and ACH—differ markedly. In fact, the ACH has more in common with checks than with wires. The structural similarities between checks and ACH payments is no accident, for the latter was designed as a computer-based alternative to checks.[1] The ACH system was intended to make full use of the processing and communication efficiency ushered in by the computer revolution, and thus to provide a cheaper, more reliable payment mechanism than checks.

Despite the widespread view that wire payments and ACH payments are simply two electronic alternatives, their differences are more important than their similarities. Only the ACH pertains when electronic displacement of checks and drafts is discussed, since wires generally are not a substitute for checks. (See Exhibit 1 for the characteristics of wire, ACH, and check payments.)

Features of Wire Payments

While the major wire systems (Fedwire, CHIPS, SWIFT, and, until recently, Bankwire and CHESS) vary in structural and operational details, they share many key features.[2] The most important distinguishing attribute of wire-type payment services is their communication system. The virtually instantaneous transfer of payment data by a two-way, telephone-like communication network shapes the prominent economic and operational characteristics of wire payment systems (Exhibit 1).

Wire transfers are expensive compared with checks. For instance, the Federal Reserve charges the originating and receiving institutions 55 cents each for executing a wire transfer versus 3.5 to 5.3 cents for an interdistrict check. Banks

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Exhibit 1
Key Characteristics of Wire, ACH, and Check Payments

Characteristic	Wire	ACH	Check
Cost	Very high	Low; could be very low	Low
Notification	Yes	No	No
Confirmation	Yes	No	No
Transfer Execution Time	Within day	Next day	Generally next day or later
Transaction Type	Single or small group	Batch	Batch
Message	Limited	Limited (CCD) Extensive (CTP) Extensive (CTX)	Limited on check but extensive via attachment of remittance advice.
Economics	Very high fixed cost and peak-load limited.	High fixed cost but no peak-load problem; very low variable cost.	Moderate fixed cost but relatively high variable cost.
Security	Crucial	Important	Important

typically charge a company $10 to $15 to send and another $10 to $15 to receive and process a domestic wire transfer.[3] Hence, total sending and receiving charges for domestic wires typically range from $20 to $30 per wire. The charge for sending and receiving wires is analogous to the charge for check payment and deposit. Recent surveys of bank charges to their corporate customers for check services indicate a total charge ranging between 25 cents and 50 cents—much less than the $20 to $30 range typical for most wire charges for sending and receiving.

The reasons for the much greater cost for wires are their speed, single transaction focus, and the greater security problems involved. Wires are clearly not a substitute for most check payments. Corporations use wires only when they must have the payment services that wires uniquely provide, namely fast payment and possibly rapid confirmation or notification of the payment. The term "fast" denotes either virtually immediate (intraday) transfer or at least same day transfer.

In many cases, all that matters is that good funds be credited to an account the same day so that, for example, a firm can avoid an overdraft at the end of the processing day. In other transactions, however, companies—and financial institutions—are concerned with achieving instantaneous, or intraday, funds movement. Security transactions are an important instance, as are commercial transactions requiring good funds payment before wares are released to a buyer or buyer's agent. For instance, a petroleum company may be notified that a tanker of oil has arrived and is ready for unloading. To gain rapid access to the petroleum, the company asks that funds be wired to the owner. A check or ACH payment would cost the firm far less than a wire, but would entail next day or later payment and therefore next day or later access to the oil. Clearly, the petroleum company's cost of delay in getting the oil greatly exceeds the cost of the wire transfer. Thus, it pays a premium for speed.

Aside from their speed advantage, wires permit confirmation and notification. In some high value transactions, the sending company requires confirmation of the wire transfer, as when there is a contractual obligation like a lease payment. Notification to the receiver can

be important both to the receiver and to the sender. The good funds were received in a particular account before releasing purchases such as oil, gems or securities to the buyer. Hence, the sender benefits from the intraday fund transfer only when the receiver knows that payment has occurred. Additionally, the receiver's cash manager typically wants to learn of large dollar good funds payments as soon as possible so that these funds can be put to use rather than left idle in the receiving account.

Security is crucial in wire systems, since transferred funds are generally beyond the sender's control once the wire is executed. Companies must exercise meticulous control over those who have access to wire initiation. Likewise, banks and other financial institutions must be cautious to restrict access to their wire room and avoid errors, fraud, and theft. The need for such security contributes to the high cost of wire transfers.

The Automated Clearinghouse

The automated clearinghouse arose as a computer-based counterpart to the existing check system for facilitating the collection and settlement of check-like payments. Rather than sorting checks by financial institution and exchanging bundles of checks (cash letters), as is the method in a paper-based clearinghouse, the ACH sorts check-like electronic images and exchanges the electronic records.

As Pam Frisbee notes in "The ACH: An Elusive Dream," which leads off this issue, the original efforts to replace checks by electronic images were voluntarily initiated at the regional level. Banks in California first agreed to exchange electronic payment data and organized a California automated clearinghouse association. The second such association emerged in Georgia. Ultimately the National Automated Clearing House Association (NACHA), which was formed to coordinate the regional associations, led to a national settlement network built on these regional systems. Owing to this history, today's national settlement system handles two broad types of transactions—intraregional and interregional. In this article, the term "ACH transaction" is used as a catch-all term for any data transmission from one depository institution to another via the ACH system. It may be an electronic credit or debit, a return item or even a message not involving payment such as a prenotification message. (See the box, "ACH Terminology," for definitions of key terms.)

Processing Logic. The institution that initiates a transaction is called the originating depository institution (ODI, or originating bank); the institution to which the transaction is transmitted is called the receiving depository institution (RDI, or receiving bank). The basic logic for ACH transaction processing is set forth in Exhibits 2 and 3.

Intraregional transactions are transactions exchanged between institutions in the same geographic area and with the same regional ACH association. *Interregional transactions* are transactions involving financial institutions in two different regional ACH territories.[4]

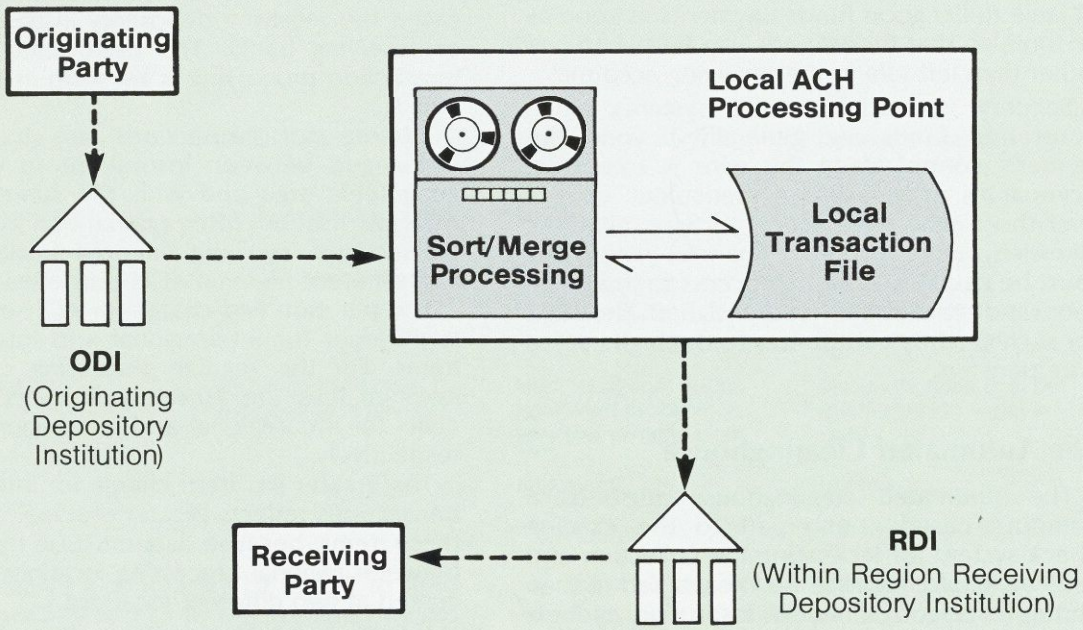
The per item Fed charge for ACH processing is different for intraregional and interregional items. For the regular processing cycle, per item charges are currently 2 cents and 3.6 cents for intraregional and interregional items, respectively.

The greater per item charge for interregional transactions reflects greater processing cost for these items, because data must be transmitted between regional processing locations and processed at two different locations.

Intraregional Transactions. The ODI prepares the transaction and delivers it to the RDI, which validates the data for completeness, conducts error checks, removes on-us transactions (those occurring within the same financial institutions), and delivers the data to its regional clearinghouse.[5] The clearinghouse sorts the data by depository institution and merges the transactions into a summary file for each institution. When all processing is complete, the clearinghouse sends each institution in its region the appropriate transaction data for posting to accounts (Exhibit 2).

Interregional Transactions. The processing of transactions for depository institutions outside the ODI's region is slightly more complex (Exhibit 3). The originating bank delivers its transactions to the regional clearinghouse processing point. There, transactions are sorted by depository institution within the region, as well as grouped by the other designated regions. These extraregional data are merged into a summary file for each of the other regional associations, and these files are transmitted to

Exhibit 2
Intraregional Transactions (The Basic Steps in ACH Processing)



Company Processing. Company prepares tape or other media acceptable to its originating depository institution.

Company Delivery to ODI. Company delivers or transports data to ODI.

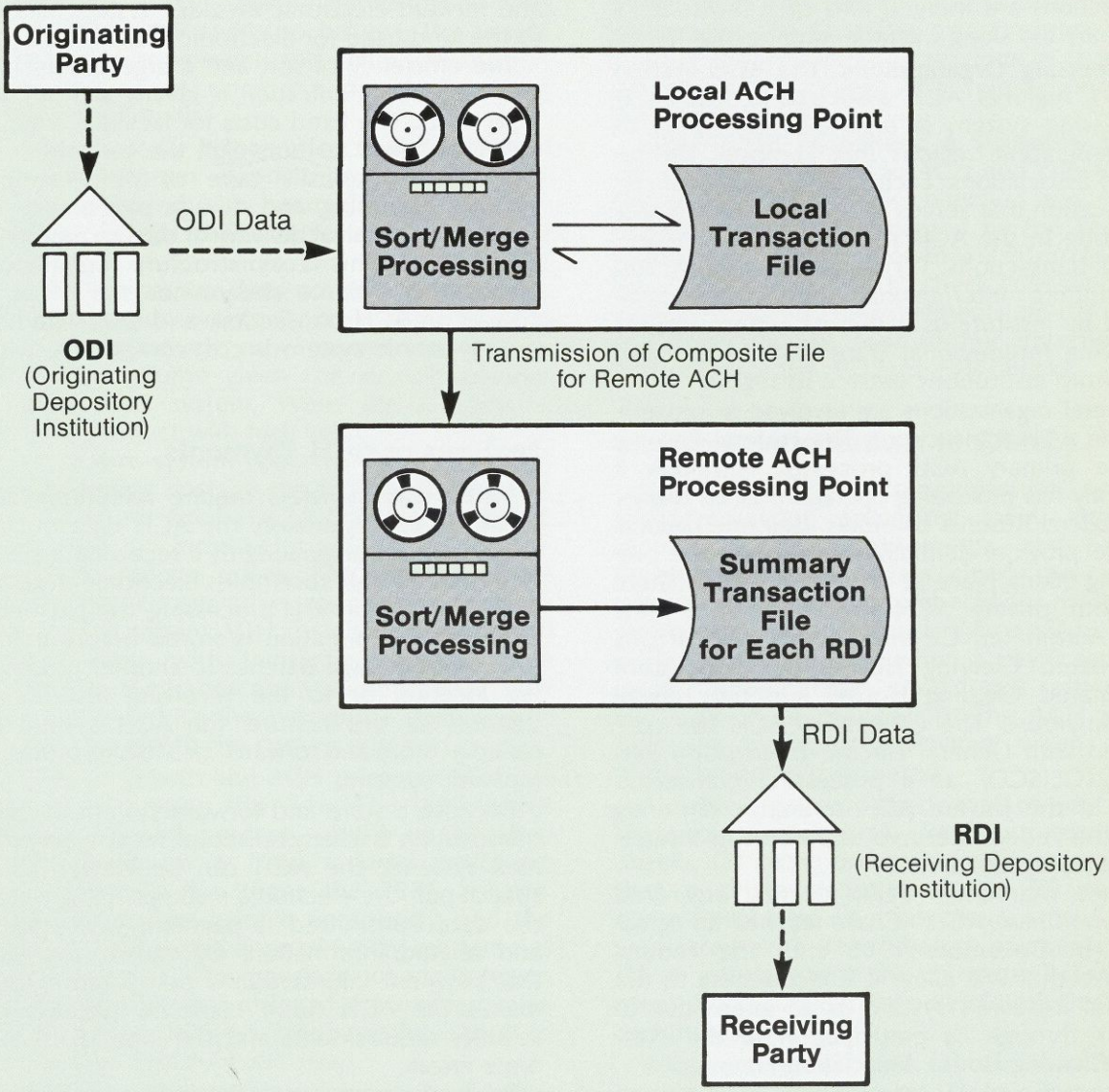
The ODI. The ODI: (1) validates the data, (2) removes any on-us items for posting to its accounts, and (3) merges the company's data with validated transactions provided by other companies into a composite file of all originated transactions.

ODI Delivery to Regional ACH. The ODI delivers or transmits composite data (merged, validated data) to its ACH processor, generally the processing location for its region.

The Regional Processing Point. The regional processing point: (1) sorts transactions contained on these tapes by ACH region, (2) merges this region-sorted data with region-sorted data provided by other depository institutions within the region, (3) retains the items for depository institutions within its region, (4) transmits the items for each of the other 30 regional ACHs to the appropriate regional processor, (5) receives transmissions from each of the other 30 regional ACH centers, (6) merges these 30 sets of transmissions into institution-sorted files, and (7) delivers or transmits to each institution within its region the summary file containing all the transactions for that institution.

RDI Processing. Each RDI: (1) sorts the data by account, (2) posts the transactions to the accounts, and (3) provides appropriate notice to the account owner of the transaction, possibly including daily reports for active ACH receivers.

Exhibit 3
Interregional ACH
(Data Flow in a Store, Forward, and Process System)



Some Variations in Processing

- About 20% of ACH participants send and receive transaction data via direct, computer to computer transmissions rather than physically delivering a tape or diskette.
- Some institutions exchange ACH transactions directly (similar to direct check exchanges) and bypass their regional processor completely.
- In some areas such as New York and California, there are competing processors so that an ODI may choose among the competing alternatives.
- RDI processing can vary. In many cases, the RDI merely posts the transaction to the receiver account and reports it in the monthly statement. In other cases, such as CTP or CTX transactions, the RDI typically provides daily reports of not only the payment transaction but also the addenda data, which may be teleprocessed to the receiving company.

"Volume determines the average cost of an ACH transaction, and thus whether the electronic system is cost-competitive with checks."

each of the other regions for further processing. In this way, each regional processing center receives those items originating from institutions outside its region and destined for those within its boundaries. After being sorted by depository institution, these between-region transactions are merged into each institution's summary file along with the intraregional items.

Processing Organizations. The ACH system has 31 regional ACH associations. The ACH processing system is organized according to the geographic regions that comprise the regional associations. Each region has a processing location that serves as the primary processing node in the ACH for (1) handling intraregional transactions, (2) receiving, sorting, and transmitting interregional transactions originated by institutions within its region, and (3) receiving interregional transactions that originate from institutions outside its region.

Several organizations are involved in processing the ACH transactions. The Federal Reserve is the primary ACH processor. Although it currently has processing operations at 28 offices, the Federal Reserve considers itself one national service provider centrally coordinating the processing taking place at its various offices. There are four private ACH processors—the New York Automated Clearing House, the Arizona Automated Clearing House, the Calwestern Automated Clearing House, and the Hawaii Clearinghouse. The Calwestern ACH has contracted with General Electric Information Services (GEISCO) as a processing contractor. Each of the private ACH operators currently uses the Federal Reserve to process its interregional transactions.

Chase Manhattan Bank recently organized its own "Chase ACH." Chase reached an agreement in December 1985 with the Federal Reserve that will allow it direct access to the Federal Reserve's system as an alternative to access through its participation in the New York Clearing House Association.

Processing Points. The ACH system can be viewed as both a network consisting of at least 32 processing nodes (processing points) that serve as electronic clearinghouses; and, as a communication system linking these 32 processing nodes.[6] Financial institutions send transactions to and receive them from this network. Communication between the regional processing clearinghouse nodes takes place through batched payment transactions. The Federal Reserve uses the same communication system for ACH transactions that it uses for Fedwire. However, the ACH does not require a telephone-type communication system like the one used for wires. Instead, it can use a one-way, store and forward electronic message system similar to the kind used for electronic mail.

The efficiency of sort and merge processing and data communication is clearly the key to ACH costs. The fixed costs for facilities, equipment, and staff far outweigh the variable cost component—basically tape or disk receipt, labeling, mounting, and storage, plus any costs involved in physical delivery of data to receiving institutions. This cost structure imbalance means that volume determines the average cost of an ACH transaction, and thus whether the electronic system is cost-competitive with checks.

Features of ACH Payments

While wire transfers require telephone-like quick data transmission, the ACH data movement from an originating to a receiving institution more closely resembles electronic mail. At various stages of ACH processing, the payment transaction information is stored before being forwarded in large batches to another processing location or to the receiving institution. Because of this feature, the ACH system is called a "store and forward" or a "store-process-forward" system.

Because a store and forward system of data transmission is characteristic of most electronic mail systems, the ACH can be viewed as a special-purpose electronic mail system in which the data transmitted is payment transactions and related information. Of course, the fact that payment information is being transmitted makes the ACH more complex, because of security requirements and the inability to tolerate errors.

Exhibit 1 summarizes ACH features compared with both wires and checks, showing that the ACH has many of the features of checks.

The Cost of ACH Processing

Electronic mail is generally a less costly way to transmit information electronically than a telephone-like system. One reason is that the

"Significant improvements in delivery cost are technically possible. Achieving these improvements, however, will require a substantial investment."

virtually instantaneous two-way transmission of a phone-type data transmission is more expensive than the time-delayed electronic mail. Another reason is that with electronic mail, transactions can be batched together and processed as a group rather than as a single transaction. Another cost saving feature is "load smoothing," the ability to balance the use of processing equipment and data transmission lines over time since the message can be stored or queued.[7]

The markedly higher price that the Federal Reserve charges depository institutions for wires compared with interregional ACH transactions reflects the economic differences in delivery cost for wires and ACH; and, the current comparison does not reflect the savings the ACH could eventually offer. First, the ACH is a comparatively new payment alternative with low volume given the capacity of the current ACH system. Wires are a relatively mature product with high volume in relation to current wire system capacity. Since almost all the operating costs to the Federal Reserve for the ACH are fixed (i.e., facilities, equipment, and staff), an increase in volume would dramatically reduce prices. For instance, if we make the conservative assumption that 80 percent of current ACH costs are fixed and will not increase with transaction volume, then increasing the transaction volume by a factor of ten would reduce the average per item cost to about one-eighth the current cost.[8]

Volume growth and ACH price over the last five years support this view. The 1981 prices reflected an 80 percent subsidy in that they were based on a 1986 volume projection approximately five times the 1981 volume. The 1986 prices involve no subsidy, and the interregional cost is approximately the same as the 1981 prices. The growth in volume between 1981 and 1986 has reduced the average value of the actual per item cost over this period to about one-fifth the 1981 level.

Besides volume relative to capacity, another factor in the economics of ACH vis-a-vis wires and checks is the efficiency of the current ACH processing system. It benefits from using Fed facilities and the already existing Federal Reserve communication system developed for wires and other Fed messages. However, the use of 32 processing locations can be questioned since fixed costs could be significantly reduced with fewer locations, as could direct processing costs and data receipt and delivery expenses.[9] The crucial point here is that significant improvements in delivery cost are technically possible. Achieving these improvements, however, will require a substantial investment in new systems and software, major changes in the ACH organization, and initial costs to many financial institutions in changing the way they exchange ACH transactions with their processor(s).

Comparative Economics: A Synthesis. Wires are expensive relative to ACH and check payments. ACH and check collection and settlement costs currently charged by the Fed are comparable. Volume growth will improve ACH per item costs relative to check collection and settlement costs. Improvements in the ACH processing system may further improve the economics of the ACH vis-a-vis checks.

Electronic Alternatives to Checks

Given their costly communication system, single-transaction processing focus, stringent security control requirements, and limited message capability, wires clearly are not a reasonable alternative to checks for most payments now made by check. Wires will be used in lieu of checks only when a payor requires same day or intraday good funds settlement, confirmation or notification. The ACH is the pertinent electronic alternative when check displacement is considered.

A viable electronic check replacement must have four features: (1) low cost relative to checks; (2) batch processing orientation rather than a single-transaction focus; (3) security control problems no more onerous than those associated with check-based payments; and (4) an interface with the computer-based payment processing frameworks of both the payor and the payee.

Requirements (2) and (3) are met by the current ACH. Requirement (1), low cost relative to checks, is attainable through volume growth and possibly through improvements in the ACH system. The interface to payor and payee is the last and most difficult requirement that the ACH must meet to displace checks. Various check uses call for more than just the transmission of an electronic check image. Many payment transactions involve information exchange

between payor and payee and provide controls such as stop payment. Much of the infrastructure for information exchange and control over payment amount and timing has not been incorporated in either ACH system capabilities or products. A flexible message feature, confirmation, notification, value dating, and various types of advance messages and conditional transactions to give a payor control over payee initiated debits are system capabilities that could be developed to meet these requirements. (See "Desiderata for a Viable ACH," this issue.)

It is difficult to decide what, if any, additional capabilities should be added to the ACH. The attempt to provide a message capability illustrates this difficulty. Developing an appropriate message capability is an active area of concern for NACHA. The message feature has been a problem for the ACH because the standard ACH payment transaction has at best a limited message capability and no system for ensuring timely electronic delivery to the transaction recipient. NACHA introduced special purpose transactions called corporate trade payments (CTP) to provide a message capability that would be the electronic equivalent of the remittance advice normally accompanying a trade payment to a vendor. The CTP service has not generated significant volume and has been criticized for a variety of reasons. NACHA has now announced another message-focused service—corporate trade exchange (CTX). It will have a variable length message and support an ANSI X12 data content standard. (See the box "ACH Terminology" for more details on CTP.)

Summary

Payments can be placed in three broad classes—wires, check and check-like instruments, and the ACH. Wires use expensive telephone-like communication systems, involve stringent security requirements, and are used primarily when fast transfer, confirmation or notification pertain. Wires will not displace checks to any great extent.

The ACH is an electronic payment alternative to checks and check-like payments. It is batch-oriented, uses store and forward communication systems, and looks much like an electronic check image.

Current ACH costs are comparable to check costs. However, with significant volume growth, and possibly an alternative network processing organization, ACH costs can be dramatically reduced relative to check costs. The issue of significant check displacement is, however, much more than a question of comparative economics. The basic ACH fund transfer capability must be translated into products and services that replace check-based activities.

Achieving a cost-effective ACH with product-service attributes requires considerable research, market analysis, and product development. An infrastructure for selling, distributing, and supporting ACH-based products comparable to the elaborate check product infrastructure must be created. Only a small part of the necessary infrastructure is currently in place. However, the organizational infrastructure is beginning to change. Additional capabilities are being debated. Many banks and vendors are looking at business opportunities inherent in ACH-based payment servicing. While volume growth will probably be slower than many popular forecasts, the ACH should be an exciting area of payment service innovation and competition as efforts are made to realize the potential benefits of batch-oriented, store and forward electronic payments.

ACH Terminology

Types of Services

Standard payment transaction. Most ACH volume is accounted for by this kind of funds movement. The transaction involves a single 94-character record in which the key transaction data are encoded: type of transaction (standard or corporate trade payment), payor institution and account number, and transaction amount. Because these data are similar to those contained in a check, the ACH payment transaction data can be thought of as an electronic image of a check or draft.

The standard transaction has a data field that can be used for messages to provide additional information (for example, payor name or payee name). However, because no ACH-wide data code standards or message translation procedures have been developed, the standard ACH payment transaction has limited message capacity and lacks a formal message support system.

Corporate Trade Payments (CTP). In 1983, NACHA announced the pilot test of a new ACH transaction designed for use in corporate trade payments. Besides providing for the standard 94-character payment record, the transaction offered from one to 4,999 addenda records of 94 characters each. These addenda are appended to the standard transaction record. Pricing of the CTP is fixed to include a service charge for 15 addenda records even if fewer than 15 records are used. The addenda records can convey information about the payment transaction such as invoices paid, discounts taken, trade and freight allowances, and a variety of other possible adjustments that occur in making trade payments. This message capability permits the transmission of remittance advice information that routinely accompanies check payments for items purchased via trade credit. In essence, the new service provides fixed-field electronic mail, in that the message addenda records are a series of fixed length message records that are routed from the originating institution to the receiving institution along with the payment but without any other processing.

Corporate Trade Exchange (CTX). This special trade payment transaction has a variable length message addendum format and will support the ANSI X12.4 data content standard.

ANSI X12. This standard, established by the American National Standards Institute, pertains to business-to-business electronic data interchange for buyer and seller transactions including order inquiries, ordering, credit terms, delivery instructions, invoicing, remittance, payment, cash application, and related information exchange. ANSI X12.4 is the part of the ANSI X12 standard that applies to remittance data.

Credits and Debits

Credit transactions. Credit transactions move funds from the account of the transaction originator to the transaction receiver's account. They are analogous to check payments drawn on the account of the transaction originator and deposited into the account of the transaction receiver. An example is direct deposit of payroll.

Debit transactions. Debit transactions move funds into the account of the transaction originator; they are initiated by the payee with the payor's advance authorization. ACH debit transactions correspond to preauthorized checks or drafts. Insurance payments, initiated by the insurance company and drawn on a client's account, are an example of such ACH transactions. Insurance and mortgage payments are the major uses of ACH debits, as they both involve recurring payments of a fixed amount.

Processing Cycles

Regular processing cycle. This is the cycle used for most ACH transactions. It has a cutoff time early in the day for presenting transactions to a regional ACH processing point for settlement on the next business day.

Late night processing cycle. This cycle has a cutoff time late in the day for presenting transactions to a regional ACH processing point for next day settlement. It was introduced in 1979, primarily for cash concentration (the movement of company funds from deposit banks into a central cash pool in the company's concentration bank). Late night processing originally was limited to debit transactions, but this restriction no longer applies. The night cycle can now be used for any ACH transaction, but involves a premium price because of the fast processing.

NOTES

[1]See Pam Frisbee, "The ACH: An Elusive Dream," this issue, for a review of the history and evolution of the ACH.

[2]Bankwire and CHESS discontinued operations in March 1986.

[3]A limited number of banks offer wire transfer initiation from a Treasury workstation. For standing wires that conform to the number of control guidelines, charges range from $3.50 to $8. This lower cost reflects a shifting of data entry burden to the initiator and the automation of the interface to the various wire systems. However, this lower variable cost also involves a fixed cost for subscribing to the "automated wire system" and the user must assume the cost of hardware and sometimes long distance communication.

[4]When the ACH was first formed, only banks were members of the regional ACH associations. Intraregional transactions were between banks belonging to the same regional ACH; interregional were for different ACH associations. By the late 1970s, regional associations permitted all types of depository institutions (banks, savings and loan associations, mutual savings banks, and credit unions) to be members of a regional clearinghouse association. Since August 1981, the Federal Reserve has provided ACH processing to all depository institutions and not just its member banks and participants in regional ACH associations.

[5]Readers interested in more detail, especially the transaction validation, error checks, and controls are referred to Carey and Carr, "ACH Transaction Processing: An Overview of the Information Flows and Controls," *Journal of Cash Management*, vol. 2, no. 3 (September, 1982), pp. 32-47.

[6]The references to at least 32 "processing locations" may puzzle the reader. This does not refer either to the 31 regional associations per se or to processing organizations (Fed, New York Clearing House, Arizona ACH, Calwestern ACH, and Hawaii) but rather to physical locations where processing takes place. There are 28 Fed offices with processing facilities plus at least one non-Fed processing location each in New York, California, Arizona, and Hawaii. Hence, there are at least 32 physical processing locations.

[7]To understand load-smoothing and its benefit, imagine you are making a phone call; you are the message originator, the person who will answer is the message receiver, and your message is the data. If the line is constantly busy, as it could well be during afternoon business hours, your message—data—does not get through. The expensive solution is to add more telephone wires—more capacity for handling calls (data). In the case of the electronic mail, you can call, and if the line is busy, your message—data—is queued. When the receiver's line is free, the queued data is distributed—load smoothing. This type of communication is most useful for overnight purposes, when telephone activity drops, because data still moves after the message originator has gone home to sleep and does not require that the message receiver be physically present to answer the phone. It is just stored on his/her system and made available at a convenient time for the message receiver.

[8]This analysis assumes that current facilities and communication systems can handle up to 10 times current volume without significant additions of equipment or communication capacity. This assumption is probably conservative. There is clearly no problem with communication capacity. Likewise, existing computer equipment for sort-merge processing has capacity to handle many times the current volume. If there are limits, it is in input-output processing and tape handling—a minor part of the total fixed cost for ACH processing.

[9]See note 6, above.

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