



DISCUSSION PAPER

PAYMENT CARDS CENTER

Clearing and Settlement of Interbank Card Transactions: A MasterCard Tutorial for Federal Reserve Payments Analysts

Susan Herbst-Murphy*

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***Summary:** The Payment Cards Center organized a meeting at which senior officials from MasterCard shared information with Federal Reserve System payments analysts about the clearing and settlement functions that MasterCard performs for its client banks. These functions involve the transfer of information pertaining to card-based transactions (clearing) and the exchange of monetary value (settlement) that takes place between the banks whose customers are cardholders and those banks whose customers are card-accepting. This document summarizes some of the key points from that meeting.*

Keywords: Card network clearing and settlement, single-message transactions, dual-message transactions, settlement risk management

JEL Classification Numbers: G2, G28, L14

* Payment Cards Center, Federal Reserve Bank of Philadelphia, Ten Independence Mall, Philadelphia, PA 19106. E-mail: Susan.Herbst-Murphy@phil.frb.org. The views expressed here are those of the author and do not necessarily reflect the views of the Federal Reserve Bank of Philadelphia or the Federal Reserve System. No statements here should be treated as legal advice. This paper is available free of charge at www.philadelphiafed.org/payment-cards-center/publications/discussion-papers/.

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Ten Independence Mall, Philadelphia, PA 19106-1574 • (215) 574-7220 • www.philadelphiafed.org/payment-cards-center/

I. Introduction

It happens in seconds and it happens more than 74 billion times a year: The selling party to a transaction transmits a customer's payment card information electronically into an interconnected global architecture designed to communicate information for a specific transaction from the seller to the buyer's financial institution.¹ When a customer's payment card information is electronically exchanged between the selling party (referred to in a payment card transaction as a merchant) and the buyer's financial institution (referred to in a payment card transaction as the cardholder's issuer), a process of automated tests and decisions begins, starting with authentication of card validity. Another step in the process verifies that the account is open, is in good standing, and has the available buying power for the amount of the purchase. Anti-fraud controls are applied at various steps along the route. The results of all these tests and decisions are returned to the merchant. Electronic records of the exchange (called an authorization) are created within the merchant's system and also at the cardholder's bank.

All in less time than it takes to read this sentence.

MasterCard's 2012 annual report asserts that its network can handle more than 160 million transactions per hour with an average network response time of 130 milliseconds. Operating 24 hours a day every day, MasterCard reports that its processing systems have consistently maintained availability 99.9 percent of the time.²

MasterCard rival Visa reports similarly impressive statistics. Its website recounted the results of an August 2010 stress test during which it processed more than 24,000 transactions per second "with no degradation in quality or security." The site further claims that its VisaNet network was available 100 percent of the time for 18 consecutive peak seasons.³

¹ According to *The Nilson Report*, 74.14 billion transactions were conducted with payment cards in 2010. See *The Nilson Report*, Issue 985, page 10 (December 2011).

² See "A World Beyond Cash: Our Journey Continues," MasterCard Annual Report 2012, MasterCard Worldwide, available at <http://investorrelations.mastercardintl.com/phoenix.zhtml?c=148835&p=irol-reportsannual>.

³ See Visa.com. Peak season is the holiday spending period, which begins the day after Thanksgiving each year.

As impressive as these numbers are, they represent only the beginning of a series of electronic exchanges that culminated in the remittance of \$3.8 trillion from U.S. consumers to their trading partners in 2010.⁴ Another \$616 billion in commercial payments was settled through the payment card system that year.⁵ The series that commences with the payment authorization that results from the process described above is completed when the seller's bank account is credited with, and the buyer's account is debited for, the amount of the purchase.

To bring about this exchange of monies between buyer and seller, the payment card networks⁶ must first facilitate interbank clearing and settlement of card transactions each processing day.⁷ This exchange of information and related funds takes place between "acquiring" banks, the banks that provide services to network merchants (also referred to as "acquirers"), and "issuing" banks, the banks that service cardholder accounts (also referred to as "issuers").

To gain a more detailed understanding of interbank clearing and settlement in the United States, the Payment Cards Center held a meeting with representatives of MasterCard Worldwide and guests from the Federal Reserve Board of Governors and the Atlanta, Chicago, and Kansas City Federal Reserve Banks. The meeting provided an opportunity to raise the level of understanding of the card clearing and settlement operations, as well as related risks and the safeguards in place to mitigate those risks. The MasterCard Worldwide representatives who attended the July 17, 2012, meeting were Roger Griffith, senior vice president, Global Settlement and Customer Risk; Brenda Ellis, vice president, Global Settlement Strategy; and Randi Adelstein, vice president, Senior Managing Counsel, U.S. Regulatory and Public Policy. This document summarizes key information from that meeting and is organized as follows: a brief overview of the functions of a network; an explanation of the mechanics of interbank

⁴ The 74.14 billion total payment card transactions reported for 2010 represented \$3.811 trillion in payment volume. *The Nilson Report*, Issue 985, page 10 (December 2011).

⁵ *The Nilson Report*, Issue 979, page 12 (September 2011).

⁶ For a description of the fundamentals of payment card networks, see Robert M. Hunt, "An Introduction to the Economics of Payment Card Networks," Federal Reserve Bank of Philadelphia Working Paper No. 03-10 (June 2003).

⁷ In the United States, settlement processing generally occurs Monday through Friday.

clearing and settlement; and a discussion of certain related risks and the controls that are in place to mitigate those risks and safeguard the integrity of the payment card system.

II. MasterCard Networks: Roles and Responsibilities

MasterCard operates both kinds of networks on which general-purpose payment card transactions are conducted. The first is the dual-message system, which was originally designed for credit cards but is also used today for MasterCard debit card transactions. This system generally relies on a cardholder signature to authenticate transactions. The second is the single-message system designed for automated teller machines (ATMs) and point-of-sale (POS) Maestro transactions. This system requires personal identification number (PIN) entry by the cardholder in most situations to authenticate the transaction. There are some differences in clearing processes for these two network types (which will be discussed later in this document), but the governing role of MasterCard is identical in each. The MasterCard representatives explained that the network facilitates the simplicity of conducting transactions among the key stakeholders: cardholders (consumers, businesses, or public-sector entities), merchants, issuing banks, and acquiring banks. The network is responsible for collecting all transactions and operating a gateway. It exchanges information between issuers and acquirers, establishes rules and processes for participation in the network, creates formatting standards for information going across the network, and facilitates monetary settlement between and among its client banks.⁸

MasterCard does not directly contract with the merchants that accept MasterCard. While it legally could do so, MasterCard's Griffith explained that retailers historically are not as well capitalized as banks and are not subject to the same prudential oversight. To avert the risk associated with merchant failure, MasterCard prefers to have merchants sponsored into the network through an acquiring relationship with a regulated financial institution. These acquiring banks establish contractual agreements directly with merchants. Alternatively, they may sponsor merchants indirectly through a supply chain,

⁸ See www.mastercard.com/us/merchant/pdf/BM-Entire_Manual_public.pdf.

which may include transaction processors, independent sales organizations, or other financial institutions operating as agents.⁹

Likewise, MasterCard does not issue cards, extend credit, or service individual card accounts. Those activities are conducted by financial institutions that have contracted with MasterCard to issue cards carrying its brand and to authorize, clear, and settle those transactions on MasterCard's networks. Issuers may also extend their supply chain to reach cardholders through agent or correspondent relationships with other banks and through other partnerships.

Regardless of the nature of the supply chain or how extended it might be, a bank that directly contracts with MasterCard is ultimately responsible to the network for the financial obligations of itself and its agents. The bank is also responsible for ensuring that its agents comply with network rules and requirements, including those pertaining to fraud protection and information security standards. (These banks are also subject, of course, to all applicable legal and regulatory requirements and oversight.) MasterCard assumes certain responsibilities as guarantor for these banks, stating in its 2012 annual report that, as a result, it is "exposed to customer credit risk arising from the potential financial failure of any principal customer of MasterCard, Maestro, and Cirrus, and affiliate debit licensees."¹⁰

Significantly, more than 80 percent of total U.S. general-purpose debit, credit, and prepaid card dollar volume from mid-year 2011 to mid-year 2012 was transacted with cards of the two interbank networks — MasterCard and Visa.¹¹ In the United States, both of these networks currently restrict client status to only banks and other federal- or state-chartered financial institutions. This limitation means that these networks operate on the underpinnings of a highly regulated set of companies that are subject to routine supervision and examination for safety, soundness, and compliance with all other regulations,

⁹ Ann Kjos, "The Merchant-Acquiring Side of the Payment Card Industry: Structure, Operations, and Challenges," Federal Reserve Bank of Philadelphia Discussion Paper (October 2007).

¹⁰ See MasterCard Annual Report 2012, which can be downloaded from the MasterCard website: <http://investorrelations.mastercardintl.com/phoenix.zhtml?c=148835&p=irol-reportsannual>. Visa Inc. also indemnifies its client banks against settlement loss resulting from failure of another client to meet its settlement obligations and, like MasterCard, addresses this in its annual report, which can be downloaded from its website: <http://investor.visa.com/phoenix.zhtml?c=215693&p=proxy>.

¹¹ *The Nilson Report*, Issue 1000, page 7 (August 2012).

including those related to fairness and privacy. Therefore, every dollar exchanged between U.S. cardholders and merchants participating in those networks is settled among banks and financial institutions operating under the oversight of a state or federal governing body. So while these networks are private-sector initiatives, they operate within and benefit from the strength of a regulated and supervised U.S. banking system.

In addition to issuing and acquiring banks, the payment card system uses a number of third-party processors, information technology companies, and specialty technology firms. For example, there are solutions that enable prepaid cards to access funds in health savings accounts or flexible spending accounts. In these examples, additional authorization criteria are checked to verify that the purchase qualifies under the Internal Revenue Service rules established for these types of accounts. There are business systems designed for specific industries, e.g., restaurant, hospitality, and medical. The Payment Cards Industry (PCI) Security Standards Council is responsible for developing certification criteria for these specialized applications. Among other things, these criteria establish requirements for data security and standards of operability that must be encoded in these software packages in order for them to be integrated into the transaction processing supply chain.

Griffith stated that the U.S. card market is one of the more technologically advanced in the world, and there is a myriad of configurations of systems and applications. Some banks may do all their processing in-house. Some may outsource all of it to one processor. Others may use multiple processors along with a variety of specialized applications; this is often seen among banks that acquire transactions for merchants representing a variety of industries, each using customized platforms.

More layers of diversity and complexity are included when considering the network's operations outside of the United States. MasterCard's network operates globally, traversing multiple geographic, political, and cultural boundaries. One of its distinctive characteristics is that cards issued in any global

region are accepted at any MasterCard-accepting merchant anywhere in the world.¹² MasterCard settles transactions among more than 21,000 financial institutions in 150 currencies across more than 210 countries and territories.¹³ (Its interbank-card counterpart, Visa Inc., operates a similarly complex and expansive global network, incorporating 9 million-plus miles of wire and fiber optics and more than 20,000 business enhancements and capacity upgrades each year.¹⁴)

Because of the diversity, Griffith explained that flexibility is necessary to manage the operations and associated risks of its networks. MasterCard has the ability to exercise multivariate controls and mitigants, separately or in combination, on a routine or as-needed basis, allowing for flexibility while simultaneously ensuring system reliability and integrity.

III. Mechanics of Clearing and Settlement

One of the most critical functions performed by a payment card network is settlement of funds between and among the banks participating in the network. It is the assurance of reliable, accurate, and timely settlement of funds that induces participation in the network in the first place.

Settlement is the final process in the series of steps that begins with authorization,¹⁵ described at the beginning of this paper, and includes clearing, the nonmonetary exchange of transaction-related information.¹⁶ Data exchanged in the clearing process provide the verification for the dollars debited from issuing banks and credited to acquiring banks. The clearing data also provide the detail necessary

¹² This distinction exists in contrast to cash, which typically must be converted to a local currency before it can be used internationally, and the automated clearinghouse, which has very limited reciprocity across geographic boundaries. Even within the confines of the United States, checks encounter limitations to their acceptance.

¹³ MasterCard Annual Report 2012.

¹⁴ Adam B. Frisch, "Visa 101: Overview of a Payments Company," UBS Investment Research (June 2005).

¹⁵ Not all authorization requests are approved. Occasionally the cardholder's bank will send a *decline* to the merchant. A decline also creates a record at the issuing bank. The data from declined transactions are useful for, among other things, fraud detection and response to cardholder inquiries.

¹⁶ For glossaries with definitions of these and other related terms see "The IT Examination Handbook: Retail Payment Systems," Federal Financial Institutions Examination Council, March 2004, or "A Glossary of Terms Used in Payment and Settlement Systems," Bank for International Settlements, March 2003.

for the banks to make entries to their accounting and general ledger systems, to populate management and reporting systems, and to update all customer service channels. This detail is critically important to acquirers in making credits to merchant accounts and to issuers in matching authorization records to the clearing data and appropriately debiting cardholder accounts. In addition to these monetary entries, the banks also use the clearing data to update their customers' accounts with the information necessary to recognize the transactions and to conduct their own account management.

Figure 1 (included at the end of the paper) provides a graphic illustration of authorization, clearing, and settlement flow for dual-message transactions.

Managing the clearing of information of the magnitude and consequence of the payment card system, and doing so in a dependable, timely, and accurate manner, requires a sophisticated infrastructure that incorporates a fail-safe design. MasterCard's primary data center in St. Louis houses 595 miles of copper infrastructure, 508 miles of fiber-optic cable, three miles of cable trays, and enough backup power capacity to support a town with 10,000 homes. All this is within a structure built to withstand extreme hazards, including fires, floods, tornadoes, and earthquakes, according to MasterCard officials. MasterCard touts what it calls tri-dundancy, i.e., multiple routing alternatives at all three critical points in payment processing — the acquirer, the issuer, and the payment network — for triple-layer protection against network outages.

A. Clearing of Dual-Message Transactions

The dual-message protocol is used for MasterCard credit and signature-authenticated MasterCard debit transactions.¹⁷ Dual-message transactions traditionally require a physical or virtual signature.¹⁸

¹⁷ The Cirrus network links MasterCard, Maestro, and Diners Club credit, debit, and prepaid cards to a worldwide network of ATMs. In the United States, Maestro is a PIN-based debit card network.

¹⁸ In today's environment, many transactions occur that do not involve physical presentment of a card that allows the magnetic stripe to be read and the cardholder's signature to be obtained. Examples include purchases made over the Internet or recurring charges, such as those from insurers and mobile phone providers. For these types of transactions, additional pieces of authentication information, often the three-digit verification code from the back of the card, are required in lieu of the cardholder's signature.

This category includes credit card transactions (with the exception of ATM cash advances) and signature-authenticated debit transactions. When a merchant's credit card system receives an authorization message, it creates a record of that authorization through a function known as "electronic draft capture" (EDC).¹⁹ These electronic drafts are stored in a "batch" until the merchant conducts "batch processing." This typically occurs at least once a day. High-volume merchants may conduct batch processing multiple times in a day; very low-volume merchants may conduct batch processing on less than a daily basis. Whatever the frequency, merchants submit their authorized transactions to their acquirer in batch mode, not as individual transactions.

MasterCard rules provide time frames for submission of transaction information. Merchants must generally submit records of valid transactions to their acquiring banks within a specified time period, and those acquiring banks, in turn, have an additional time period to enter that electronically recorded information into network clearing. If those time periods are met, issuers are obliged to honor the transaction. In addition, pursuant to MasterCard's rules, issuers are obligated to honor transactions cleared outside of the required time period if the cardholder's account is still open and in good standing.

MasterCard provides multiple windows for dual-message batch processes; however, the network receives most of its clearing traffic in the earlier of these windows.

From among the thousands of banks representing millions of merchants throughout the world, the networks receive scores of millions of electronic drafts for clearing each processing day. Applying high-speed computing to an automated sorting and reconciliation scheme, the networks identify the issuing banks for these multimillions of drafts. These data are then organized into electronic reports to be transmitted to the respective issuers. Those reports contain all the detail that the issuer needs to conduct its activities, including posting transactions to cardholder accounts and facilitating disputes on behalf of its cardholders.

¹⁹ Electronic draft capture is sometimes referred to as electronic ticket capture.

The organization of each bank's activity also enables the network to calculate the total dollar value owed by each issuer and owed to each acquirer. This function of the clearing process is critical to the final settlement step, which will be discussed in a later section.

B. Clearing of Single-Message Transactions

According to MasterCard's Griffith, in the United States and in the rest of the world except for Europe, all card transactions for which a PIN is entered are single-message transactions. (Europe uses dual messaging for all card transactions, whether authenticated with a signature or with a PIN.) With single messaging, authorization and clearing are done in one dispatch, and all the information necessary to post the transaction to the cardholder's account is communicated at the time of each transaction. There is no need to batch a set of transactions and enter them into clearing; only monetary settlement is required.

Single-message transactions have only one cutoff time each day. This cutoff time has been changed over the years, although very infrequently — no more than two or three times in the past 15 years, according to Griffith. When it changes, it does so for all network participants so that at any point in time, the cutoff time is the same for all participants and is nonnegotiable.

At the cutoff time, the network calculates the total monetary positions for all its client banks for the day's single-message transactions. These include both PIN purchase transactions and ATM transactions that take place at "foreign" ATMs, i.e., those that are not operated by the bank that has issued the card. The ATM category includes ATM withdrawals made with debit cards or ATM cash advances made with credit cards.

C. Settlement

There is only one settlement window, which is used for both dual-message and single-message transactions. When settlement is performed, it is done on an aggregate net basis. This means that all the

customer activity, both credits and debits,²² of a client bank is summed up and that the net amount is transferred in a lump sum to the client bank's account, in the case of an acquirer, or from the client bank's account, in the case of an issuer.

For issuing banks, most of their cardholders' activity is in the debit category; they are making purchases for which their bank will pay into settlement on the cardholders' behalf. But some cardholder transactions, most prominently merchandise returns, fall into the credit category. The bank may also have made cash disbursements through its lobbies or ATMs to cardholders from other banks, and these transactions would be accounted for as credits to an issuer's daily settlement amount. The network calculates the total of the debits and offsets the total value of the credits, and the net remaining amount will be collected from the issuer through settlement.

For acquiring banks, most of their merchants' activity will be credit transactions; i.e., they will generate an incoming flow of funds through the settlement process. But merchants will also conduct transactions, such as refunds and returns, which create debits to the merchant (but credits to the cardholder, as explained in the previous paragraph). These debits will be deducted from the total of funds owed to the acquirer, and the net amount will be deposited to the acquiring bank's account through settlement.

Another activity that creates a debit position for the acquirer (merchant) and a credit for the issuer (cardholder) is a chargeback. Chargebacks occur when a cardholder exercises his or her rights to a payment reversal under certain conditions, after efforts to achieve resolution directly with the merchant have failed. There are time limits for exercising these rights, and not every cause of dissatisfaction is an allowable reason for entering a dispute. Some of the permissible reasons include duplicate processing, i.e., the merchant processed the same transaction more than once; the merchandise was defective or not as described; the goods or services were not received; or a biller continues to submit drafts for a canceled recurring payment.²⁰

²⁰ For a fuller understanding of the chargeback and dispute rights afforded to consumers by regulation and by card network bylaws, see Mark Furletti and Stephen Smith, "The Laws, Regulations, and Industry Practices that Protect

The network plays an intermediary role in chargeback processing. Disputes are submitted to the network by the cardholder's issuing bank and routed to the merchant's acquiring bank. There are rules and time frames established for both parties to the dispute, which are mediated by the network. The merchant may have the ability to re-present the chargeback to the network through its acquiring bank. If the chargeback is resolved in the merchant's favor, no settlement activity is required. However, if the chargeback is resolved in the cardholder's favor, the network will debit the amount of the transaction from the acquirer's net settlement and process a credit of the same amount to the issuer's net settlement.²¹

It is also during the settlement process that interchange fees²² are collected from acquiring banks and credited to issuing banks for sales transactions. For cash advances, cash withdrawals, credits, and returns, interchange flows in the opposite direction and the issuing bank pays interchange fees to the acquiring bank.

Interchange fee rates are established by the network²³ and vary depending on a number of factors, including the type of card used, the category of merchant, the type of transaction, the merchant's sales channel, and fraud rates associated with merchant and channel categories. All these permutations of card type, merchant type, transaction type, and channel type are denoted within the data captured as a transaction is authorized, captured, and sent forward for clearing. MasterCard analyzes these data points

Consumers Who Use Electronic Payment Systems: Credit and Debit Cards," Federal Reserve Bank of Philadelphia (January 2005) ; "Chargeback Guide," MasterCard Worldwide, http://www.mastercard.com/us/merchant/pdf/TB_CB_Manual.pdf; and "Chargeback Management Guidelines for Visa Merchants," Visa Inc. (2011).

²¹ As a percentage of total payment card system volume, chargebacks are a minute fraction, but the total dollar volume is still substantial. TSYS, the number one third-party processor of issuer transactions, estimated that chargebacks were one-half of 1 percent of total U.S. card volume in 2008, or an estimated \$15 billion on that year's total volume of \$3 trillion. See Tom Cain, "Risky Business: Best Practices for Managing Cardholder Dispute and Chargeback Processes in Challenging Times," TSYS White Paper (2010).

²² Section 9 of the MasterCard rules cited in footnote 8 explains that interchange fees are paid by the acquirer to the issuer with respect to the interchange of a transaction conducted by a merchant. A service fee is an amount paid by the issuer to the acquirer with respect to the interchange of a cash disbursement transaction. A transaction cleared and settled between MasterCard customers (issuers and acquirers) gives rise to the payment of the appropriate interchange or service fee.

²³ Pursuant to the Durbin Amendment to the Dodd-Frank Wall Street Reform and Consumer Protection Act, the interchange fee amount paid to debit card issuers for electronic debit transactions is subject to Regulation II.

during the clearing process and from them assesses the appropriate interchange for each transaction.

These amounts are then added to or deducted from MasterCard's client banks' net settlement amounts.

All this activity is conducted prior to the settlement cutoff time, at which time MasterCard sends advice of these amounts to each client bank. Banks with a net debit position are advised of the amount they need to remit to MasterCard's clearing account to be distributed to other clients. Banks with a net credit position are advised of the amounts that will be deposited to their settlement accounts.²⁴

MasterCard has pre-authorized arrangements with many issuing clients to do an automatic drawdown via Fedwire for daily settlement.²⁵ This is accomplished through a Fedwire 1031 drawdown, which is a nonmonetary request for the receiver of funds to send a funds transfer. This is followed up by a Fedwire 1032 response, which is a transfer of value honoring the 1031 request.²⁶

Griffith said MasterCard pays most credits within an hour after the settlement cutoff, and the bulk of debits come in that quickly as well. Once banks get their clearing files, they want to validate before they release funds. Most sophisticated banks have systems that conduct reconciliation very quickly, so they are able to act on settlement advice promptly. Griffith also noted that years of accuracy at MasterCard have created institutionalized trust in the system, and this underlying confidence reinforces expedient payment.

While the majority of funds are transferred within the first few hours after settlement cutoff, MasterCard monitors settlement constantly throughout the day to see who has paid and who hasn't. If

²⁴ Even using an aggregate net settlement method, some banks, especially larger ones that operate many different card-related businesses, may do separate settlement for these different categories. For example, a bank that is both an issuer and an acquirer may not want the settlement for those separate business lines to be netted against each other. Banks may want to keep their debit settlement separate from credit or their consumer card funds settlement separate from their commercial portfolios. There is more than one way to aggregate card transactions, but however they are aggregated, settlement is done in large-dollar increments for the net total of that transaction grouping.

²⁵ Fedwire is the wire transfer service of the Federal Reserve Banks. MasterCard's Griffith said that the bulk of dollar volume settlement through MasterCard is done via Fedwire, but the automated clearinghouse (ACH) is also used, depending on how the client bank is connected to MasterCard. If the only connection is through MDS (MasterCard Debit Switch, single-message only), it is likely that settlement will occur via ACH. If the client is connecting through the dual-message Global Clearing Management System (GCMS) and settling in U.S. dollars, wire transfer is then more likely. Some debit issuers and acquirers will consolidate their MDS and GCMS business and settle both by wire.

²⁶ See Fedwire Funds Service Format Reference Guide effective November 19, 2011, available at http://www.frbservices.org/campaigns/remittance/files/fedwire_funds_format_reference_guide.pdf.

MasterCard sees a position, especially one of \$1 million or more, that isn't settling promptly, that situation is prioritized for action and review.

All settlement funds are processed through MasterCard's settlement account. MasterCard considers a variety of factors in its selection of a primary settlement bank. Among those factors are operational excellence and multinational operations.

IV. Post-Settlement Activity

Once payment-related funds have settled between issuing and acquiring banks, those banks can proceed to post appropriate debits and credits to their cardholder and merchant customer accounts. The electronic reports prepared by the network during the clearing process are instrumental in facilitating the detailed accounting entries that are made to these millions of individual accounts each processing day, along with the necessary entries to their internal general ledgers and accounting systems.

The electronic files of transaction detail that MasterCard creates for each of its client banks allow issuers to do automated match-and-drop comparisons against their internal authorization files. Once the cleared draft comes through, the authorization hold that retains the funds pledged by the cardholder to the merchant is dropped and the amount of the transaction is posted to the cardholder's account. If a reversal is initiated as required under MasterCard's rules, an issuer must release an authorization hold against the cardholder's credit line or funds on deposit within a specified time period. (Remember that authorization and clearing are part of the same exchange of information in a single-message transaction. The match-and-drop process, therefore, applies only to dual-message transactions, for which the clearing information follows, by some hours, the authorization message.)

Issuers also use cleared item details from the network reports to provide the descriptive information on cardholder statements that accompanies the monetary entry. Additional information from the authorization and clearing cycles is also used to populate the systems used within issuing banks. The uses of this information include responding to customer inquiries, conducting fraud investigations, doing

chargeback research, preparing management reports, and populating Internet and telephone banking platforms.

Clearing data are used by acquiring banks in much the same way. The timing of when a merchant's account is credited for settled funds is determined by contractual arrangement with the acquirer. Each merchant negotiates an agreement, either directly with an acquiring bank or with a sales agent of an acquiring bank. With today's high-speed communications and processing capabilities, most merchants' accounts are automatically credited within 24 hours of entering their drafts into settlement. For some merchants, their daily settlement funds are retained at their acquiring bank. For many others, however, there is an additional step.

Merchants, particularly larger ones, use multiple financial institutions. They may choose an acquirer for its expertise in payments processing, but they may choose other banks to manage their deposit accounts. When this is the case, settled funds make an additional journey. Under directions from the merchant, the acquiring bank will initiate a transfer of funds from the merchant's account at the acquiring bank to the merchant's account at its primary depository institution.

V. Settlement Risk and Its Management

Settlement risk is "the risk that the completion of individual transfers does not take place as expected."²⁷ Settlement risk can come in the form of:

- Credit Risk – the risk that a party to a trade does not meet an obligation when due or at any time thereafter.
- Liquidity Risk – the risk that a party to a trade will not settle its obligation for full value when due but at some unspecified time thereafter, creating the potential for the counterparty to be unable to meet its financial obligations.

²⁷ This definition of settlement risk and the description of risk categories are taken from a presentation by the Payments Systems Studies Staff at a Federal Reserve Bank of New York Payment Systems Seminar held on October 13, 2000. The entire presentation is available at http://app.ny.frb.org/CfCBSWEB/Payments_Presentation.pdf.

- Operational Risk – the risk of problems associated with operational factors in the settlement process coming from computer or infrastructure failure, human error, disruption from natural disaster, or fraudulent activity.
- Systemic Risk – the risk that the failure of one participant to meet its obligations could create a chain reaction among other participants that could have broader economic effects.

During the meeting with Federal Reserve staff, the representatives from MasterCard explained that most credit risk is dealt with in advance through screening and approval processes. MasterCard manages risks with its issuing and acquiring clients and, by extension, protects merchants, cardholders, and system integrity.

The risks that exist on the cardholder and issuing side are obvious. Merchants must have confidence that they will be made whole for the goods and services delivered for which they have received nothing but a payment card authorization. In addition to the underwriting issuers do before extending credit to cardholders, cardholder risk is distributed across millions of accounts, with no single one having sufficient exposure that would represent significant risk to the system. If an issuing bank fails and does not cover settlement (which has happened), MasterCard pays acquirers and retains reserves for such an eventuality.²⁸ One factor in determining the amount to set aside is a calculation of exposure to the network at any point in time. The rudiments of that formula multiply the average daily volume (in U.S. dollars) times the average number of days that drafts are in the pipeline between authorization and settlement. According to MasterCard's 2012 annual report, the product of that calculation was approximately \$38 billion at the time the report was published.²⁹

MasterCard reinforces this position through its bylaws and agreements with client banks that, should a failure ever occur that creates a settlement amount too large for MasterCard to cover from its

²⁸ Arrangements for the disposition of settlement funds from acquirers to their merchants are covered by contract law, not by network rules.

²⁹ MasterCard Annual Report 2012.

reserves, the cost could be allocated across other client banks.³⁰ MasterCard has never had to implement this safeguard but reserves the right to do so.

The risks presented from the acquirer and merchant side of this two-sided platform may be less intuitive, but consider situations like chargebacks, in which funds flow back to the cardholder/issuer. Or consider merchants that take payment in advance of delivering goods or services, such as Internet and catalog merchants, or airlines and event ticket sellers. If such a business should fail prior to fulfilling transactions already paid for, cardholders are entitled to refunds. Certain types of merchant fraud, such as “bustout” or merchant collusion, also present risks to the system.³¹

Therefore, merchant and acquirer integrity and financial viability are critical to the strength and sustainability of the payment card networks. Because of the potential for risks presented by merchants, there is considerable onus on acquiring banks to be scrupulous about the merchants they sponsor into the network. Acquirers conduct due diligence and credit underwriting on companies wishing to accept payment cards. The extent of review and evaluation will depend on factors such as the size and type of merchant and number of years in business. Should a merchant go out of business or otherwise fail to meet its obligations, pecuniary responsibility resides with the acquirer.

VI. Nonsettlement Risks

Settlement risks are just one set of risks that the global interbank payment card system must anticipate and manage. Other broad categories of risk include litigation, business, currency conversion,

³⁰ This is similar to the model used for FDIC insurance. When the deposit insurance system is hard hit, as it was during the recent financial crisis, the FDIC raises (sometimes substantially) its premiums to insured banks to compensate for the expenditures from the insurance funds. In the case of MasterCard, if reserves are insufficient to cover the obligations of a failed bank, its agreements with its remaining client banks allow MasterCard to make assessments to cover the obligations related to the specific event. In both scenarios, the collective strength of the broader banking system can be marshaled in the case of a rare, catastrophic event.

³¹ Arrests were made earlier this year in one of the largest cases of fraud of this type. A sophisticated network using sham merchants, black-market businesses, and bogus identities perpetrated a \$200 million fraud scheme that was under investigation for 18 months by law enforcement in cooperation with the payment card industry and the postal service. The case is *U.S. v. Qureshi*, 13-mj-8013, U.S. District Court, District of New Jersey (Newark). See “18 Accused by U.S. of \$200 Million Credit Card Fraud” by David Voreacos, Bloomberg.com, February 5, 2013.

regulatory, financial market, geopolitical, and reputational risk. A significant section of MasterCard's annual report is dedicated to explaining potential risks and how the network has assessed the impact if certain situations or conditions should occur. Readers interested in learning more about these risks are referred to that document.³²

The networks study both settlement and nonsettlement risks and develop and employ strategies to avoid and manage these risks, thus minimizing negative effects when an untoward situation does occur. The networks do not do all this in a vacuum. In addition to self-adopted risk management strategies, other complementary and reinforcing controls come in various forms and involve other systems and entities, including, but not limited to:

- The underwriting, fraud control, and other risk management done by client banks;
- Compliance of issuers, processors, acquirers, and merchants with respect to standards, regulations, and best practices; for example, Payment Card Industry Data Security Standards (PCI-DSS) and SAS 70;
- Regulatory environment instrumental to the foundation of a safe and sound banking system;
- Reputable, established ratings agencies such as Fitch, Moody's, and Standard & Poor's; and
- Secure, reliable, and regulated telecommunications infrastructure upon which electronic payment authorization, clearing, and settlement messages are transmitted.

The list of interdependencies is not exhaustive, but it is sufficient to suggest that the payment card system illustrates the overlapping and intertwining attributes consistent with general system theory (GST), which at least one author has applied to the evolution of interbank cards. David Stearns writes

³² The link to the annual report can be found in footnote 2; the discussion of identified risks is found in Item 1A *Risk Factors*, pp. 28-46. The other major interbank network, Visa, likewise includes an extensive discussion of risk in its annual report. Visa's 2012 annual report can be downloaded from its website. The risk factors section is found on pages 19-36 and is available at <http://investor.visa.com/phoenix.zhtml?c=215693&p=proxy>.

that GST defines a system “as a dynamic combination of various elements in relation, each of which can be another, nested system.”³³

The interbank payment card clearing and settlement system is an example of the synergies created by interconnecting one state-of-the-art system with another. Using high-speed computing technology connected to sophisticated telecommunications systems, the card networks authorize, capture, and clear information related to millions of transactions each day then settle the related payments through other systems, for example, through the ACH and wire transfer apparatus operated by the Federal Reserve System. Each system is designed and developed with different expertise and specialization to deliver a whole, which Stearns characterizes as “more than just the sum of these parts; the interacting elements of a system often produce new emergent properties that cannot be said to originate solely from any one element.”

VII. Conclusion

The interbank card networks have operated for nearly five decades. Over that period, the U.S. economy has experienced seven recessions in addition to the many other economic, political, and social tribulations that have occurred in the last half-century. During that time, these networks have never failed to settle transactions. This dependability has no doubt been of significance in the growth of this payment system to include debit and prepaid cards, along with the original credit card product, and the expansion of the cardholder base from consumers to large corporations, small businesses, and government entities. The acceptance market has also surged. The original travel and entertainment merchant base now includes grocery stores, dry cleaners, post offices, doctor and dentist offices, large department store chains, and mom-and-pop operations.

³³ David L. Stearns, “‘Think of it as Money’: A History of the VISA Payment System, 1970-1984,” dissertation submission, University of Edinburgh, August 2007.

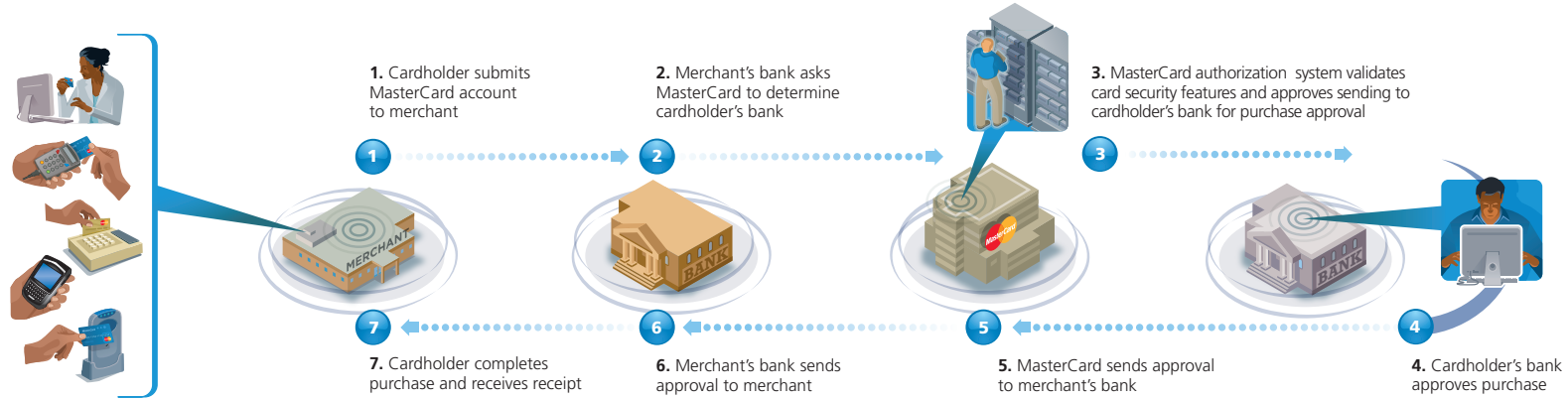
Commenting on this sustained record of performance through the challenges of explosive growth and economic turmoil, MasterCard's Griffith explained, "We have recently lived through challenges in Iceland, Ireland, and Greece, amongst others." On the occasions when adversity has confronted the network, it has used the tools at its disposal, applying them surgically and flexibly, as appropriate to the situation being dealt with. "While blunt force methods are available and could be used if a situation required it," concluded Griffith, "the preferred approach is to take efforts that do not intensify the problem and that cause no unnecessary disruption to the broader network."

Figure 1

THE ANATOMY OF A TRANSACTION

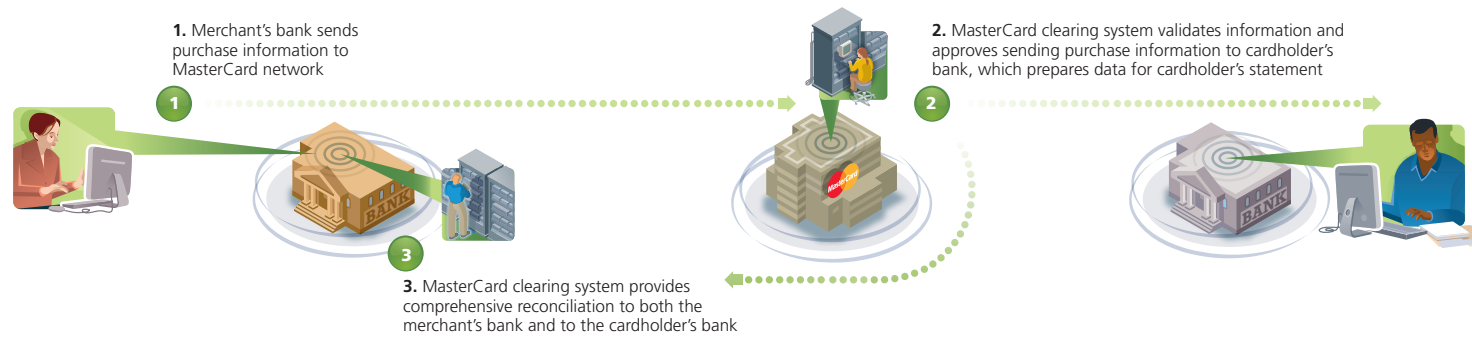
AUTHORIZATION

TIME OF PURCHASE FOR DUAL AND SINGLE MESSAGE TRANSACTIONS



CLEARING

USUALLY WITHIN ONE DAY FOR DUAL MESSAGE TRANSACTIONS; TIME OF PURCHASE FOR SINGLE MESSAGE TRANSACTIONS



SETTLEMENT

USUALLY WITHIN TWO DAYS FOR DUAL MESSAGE TRANSACTIONS; TIME OF PURCHASE FOR SINGLE MESSAGE TRANSACTIONS

