HOW CARD PAYMENTS WORK

Inside the Systems Behind Issuing, Authorization, Clearing, and Settlement

CUSTOMER ONBOARDING → CARD CREATION → AUTHORIZATION → CLEARING → SETTLEMENT

ISSUERS → ISSUING PROCESSORS → CARD NETWORKS → BANKS → PROGRAM MANAGERS → FRAUD SYSTEMS → TOKENIZATION SERVICES → AND MORE

SCOTT D. PHILLIPS

How Card Payments Work

Inside the Systems Behind Issuing, Authorization, Clearing, and Settlement

Steve Publications

This book is available at https://leanpub.com/howcardpaymentswork

This version was published on 2026-09-10

This is a Leanpub book. Leanpub empowers authors and publishers with the Lean Publishing process. Lean Publishing is the act of publishing an in-progress ebook using lightweight tools and many iterations to get reader feedback, pivot until you have the right book and build traction once you do.

Contents

Inside the Systems Behind Issuing, Authorization, Clearing, and Settlement

This book explains the complete end-to-end architecture of modern card issuing. From customer onboarding through card creation, authorization, clearing, settlement, and eventual closure, you will learn what happens behind the scenes at every stage. The material covers the roles and interactions of issuers, issuing processors, card networks, banks, program managers, fraud systems, tokenization services, and every other component that makes a card transaction work in production. This is written for engineers, architects, product leaders, and operators who need to understand how card issuing actually functions under the hood.

Introduction: What Happens When You Swipe a Card

A person walks into a store, taps their card on a terminal, and within two seconds a green light confirms the transaction is approved. On the surface this is simple. Behind the scenes, dozens of specialized systems across multiple organizations have exchanged messages, performed security checks, updated balances, and prepared to move money that will actually change hands later.

Card issuing is one of the most complex distributed systems problems in modern finance. A single authorized purchase touches real-time authorization engines, fraud detection models, core banking ledgers, card network switches, cryptographic key managers, and batch processing pipelines, all of which must operate with millisecond precision and near-perfect reliability. A system designed for issuing a card must also handle the thousands of edge cases that occur when things go wrong: network timeouts, duplicate requests, failed clearings, chargeback disputes, expired credentials, and everything else that happens when humans use systems built on other systems built on other systems.

This book maps that terrain.

The goal is straightforward. After reading it, you should understand not just what each component in the card-issuing stack does, but how they interact, what data flows between them, what state changes occur at each step, what happens when something fails, and what trade-offs drive the architecture. You should be able to look at any card transaction, from authorization through settlement and dispute, and trace the path that data and money take from start to finish.

This is not a glossary of payments terminology or a marketing overview of card products. This is a technical reference focused on backend operations, system interactions, and the actual mechanics of running a card-issuing program in production.

Why This Book Exists

The card payments industry is enormous. In the United States alone, credit card transactions exceeded 56 billion annually by 2024 [1]. Visa processes roughly 276 billion transactions each year across more than 4 billion cards globally [2]. This scale is built on infrastructure that is largely opaque to most of the engineers and product leaders who depend on it.

The industry has become more accessible in recent years. Modern issuing processors like Marqeta, Lithic, and Stripe Issuing expose the entire card lifecycle through APIs. A fintech can launch a card program without understanding every layer beneath them. That is convenient and powerful, but it also creates fragility when things break. When authorization rates drop, when settlement files have exceptions, when token provisioning fails, when a chargeback dispute is won or lost, teams that do not understand the underlying mechanics spend days or weeks chasing issues they could diagnose in hours.

This book exists to close that gap. It is aimed at three audiences:

- Payments engineers and backend developers who build or maintain card-issuing systems and want to understand the infrastructure they are working with.
- Product managers and operations leaders at fintechs and banks who define card products and need to reason about trade-offs between features, risk, cost, and reliability.
- Technical founders and consultants who are evaluating whether to build, buy, or integrate card-issuing capabilities and want a realistic sense of the complexity involved.

The book assumes you understand basic software concepts: APIs, databases, message queues, microservices, and distributed systems. It does not assume prior knowledge of the payments industry.

How This Book Is Organized

The book is structured to build your understanding progressively, from ecosystem foundations through detailed backend architecture and then into complete end-to-end workflows.

The first section establishes the landscape: who the players are, how they relate to each other, and how a payment moves through the ecosystem at a high level. You cannot understand a specific system without understanding what it connects to.

The second section examines each major infrastructure layer: card networks and their rules, issuing processors and what they provide, core banking systems and ledgers, KYC and AML requirements, card product configuration, PAN generation, physical card manufacturing, digital tokenization, authorization engines, fraud and risk systems, and 3-D Secure authentication. Each chapter in this section focuses on one component or one group of closely related components and explains what it does, how it works, what data it handles, and what constraints it operates under.

The third section ties everything together into complete workflows: how holds and pre-authorizations work, how clearing and settlement are processed, how fees and interchange are calculated, how reconciliation is performed, how refunds and reversals are handled, how disputes and chargebacks are resolved, how card lifecycles are managed, how ATM and cash transactions differ from POS, how cross-border payments are processed.

The final section addresses the operational realities: system architecture patterns used by modern issuers, security and compliance requirements, and the failure modes and edge cases that every production system must handle.

Throughout, the book uses concrete examples to illustrate abstract concepts. You will see ISO 8583 messages, tokenization flows, authorization decision trees, reconciliation matching logic, and chargeback timelines, all of which are grounded in real-world implementations.

What This Book Does Not Cover

The book is focused on card issuing from the issuer-side perspective. It does not cover merchant acquiring in depth, though acquiring concepts appear where they are necessary to understand the full transaction lifecycle. It does not cover real-time payment rails like FedNow, RTP, or instant SEPA, though it notes where those systems interact with card-based flows. It does not cover cryptocurrency or blockchain-based payments, except where card networks have integrated with them.

The book is technically detailed but intentionally vendor-neutral. It describes industry-standard architectures and protocols rather than documenting the internal systems of any specific company. Where vendor examples are used, they illustrate patterns rather than endorse products.

How to Read This Book

Read the book in order. The early chapters establish terminology and mental models that are used throughout. If you already know the basics and want to jump to specific topics, the chapter and section headings will guide you. Each chapter is self-contained enough to be read independently, but together they form a cohesive picture of how card issuing works end to end.

The book is long because the subject is complex. It is not long because of padding. Every section is designed to help you understand something real about the systems behind card transactions. If you are here to learn how to build or operate those systems, this book will give you the mental model you need.

Chapter 1: The Landscape of Card Issuing

Before examining any specific system, you need to understand the ecosystem. Card issuing does not exist in a vacuum. It is a coordinated effort involving banks, technology providers, card networks, regulatory bodies, and merchants, all of whom have distinct roles, incentives, and constraints. This chapter maps that landscape and explains how a payment moves from swipe to settlement at a high level.

The Anatomy of a Payment Transaction

Consider a purchase at a retail store. A customer taps their Visa debit card on a payment terminal to buy $42.50 worth of groceries. The terminal displays approved within two seconds. The customer walks away. The merchant receives the money a day or two later.

What actually happened during those two seconds and the days that followed can be divided into four phases:

Authorization. The terminal reads the card and sends an authorization request containing the card number, transaction amount, merchant identifier, terminal location, and other data. This request travels through the merchant processor, then through the Visa network, and finally reaches the customer's issuing bank. The issuing bank checks whether the card is valid, whether the customer has sufficient funds or available credit, whether the transaction looks fraudulent, and whether any card controls or limits would block it. If everything checks out, the bank approves the transaction and places a temporary hold on $42.50 of the customer's funds. The approval response travels back through the same path to the terminal. No money has moved yet. The bank has simply reserved funds and agreed to move them if the merchant settles the transaction.

Capture. After the customer leaves, the merchant captures the authorized transaction. In many cases this happens automatically and immediately. In

other cases, like hotel stays or car rentals, the merchant captures funds later, potentially in multiple increments and potentially for a different amount than the original authorization. The capture signals to the system that the transaction is final and ready for settlement.

Clearing. Clearing is the exchange of detailed transaction information between the acquiring bank and the issuing bank. During clearing, the networks aggregate all authorized and captured transactions for a given day or batch window and produce files that describe each transaction: which card was used, which merchant accepted it, what amount was charged, what fees apply, and what the net obligation is. Clearing is typically batched and happens overnight or at regular intervals throughout the day. The issuing bank uses clearing data to post the final transaction to the cardholder's account and to reconcile its authorization records.

Settlement. Settlement is when money actually moves. The issuing bank transfers the net amount for all transactions it processed, minus interchange fees, through the card network to the acquiring bank. The acquiring bank then deposits the funds, minus its own fees, into the merchant's account. Settlement is a net process: the network calculates what each bank owes and is owed across millions of transactions and moves a single aggregated amount per bank. Settlement typically takes one to three business days depending on the network, the transaction type, and the region.

These four phases are distinct for a reason. Authorization is real-time and determines whether a transaction is allowed. Clearing is batched and determines what transactions are final. Settlement is scheduled and determines when funds change hands. Keeping them separate allows each phase to optimize for its own requirements: authorization for speed, clearing for accuracy, and settlement for efficiency.

Issuers, Acquirers, Networks, and Processors

The card payments ecosystem operates under what is commonly called the four-party model. The four parties are the cardholder, the merchant, the issuing bank, and the acquiring bank, with card networks like Visa and Mastercard routing messages between them. Let us define each role precisely.

The Issuer. The issuing bank is the financial institution that issues a payment card to a cardholder. The issuer extends credit for credit cards,

manages deposit accounts for debit cards, or holds prepaid funds for prepaid cards. The issuer is the entity that authorizes or declines every transaction on the card. The issuer assumes the risk for fraud on the card and the responsibility for complying with regulations like the Fair Credit Billing Act, Regulation Z, and anti-money laundering requirements.

The issuer is always a regulated financial institution. A fintech company cannot issue cards in its own name without a banking charter. Instead, fintechs partner with banks through BIN sponsorship arrangements, where the bank provides the regulatory license and network membership, and the fintech manages the customer experience. More on that in Chapter 3.

The Acquirer. The acquiring bank, often called the acquirer, is the financial institution that provides merchants with the ability to accept card payments. The acquirer holds the merchant's bank account and routes transaction authorizations through the appropriate card network to the issuing bank. The acquirer assumes responsibility for the merchant's compliance with card network rules and for managing merchant fraud risk.

Many merchants never interact directly with their acquirer. Instead, they use a payment service provider or payment facilitator that aggregates many merchants under a single acquiring relationship. Stripe, Square, and Adyen are examples of companies that act as payment facilitators and provide the technical interface for merchants to accept payments.

The Card Network. Card networks like Visa, Mastercard, American Express, and Discover operate the messaging infrastructure that connects issuers and acquirers. When a merchant's terminal sends an authorization request, the network routes it from the acquirer to the correct issuer. When a refund or chargeback occurs, the network provides the rules and channels through which it is processed.

Card networks do not issue cards to consumers or extend credit. Visa and Mastercard are pure routing and clearing networks that set the rules, fee structures, and technical standards for every transaction that passes through their systems. They make money from assessments (per-transaction fees charged to members) and from technology services they provide to banks and merchants.

American Express and Discover operate under a slightly different model called the three-party or closed-loop model. In that model, the network acts as both issuer and acquirer for its own cards, giving it tighter control over the

ecosystem but limiting the openness of the network.

The Processor. Processors are technology companies that build and operate the systems that handle authorization, clearing, and settlement for banks. Most issuing banks do not run their own authorization engines or clearing pipelines. Instead, they partner with issuing processors that provide these capabilities as a service.

The processor is the technical backbone of a card program. It receives authorization requests from the network, runs them through fraud checks and business rules, checks balances, and responds with an approval or decline. It generates clearing files, handles settlement reconciliation, and provides the APIs through which the issuing bank or fintech manages cards, customers, and transactions.

Major issuing processors include FIS, Fiserv, Marqeta, Galileo (now SoFi Tech Solutions), Lithic, and Stripe Issuing. They vary in architecture, target market, and capability, but they all perform the same fundamental role: running the real-time and batch systems that make card issuing work.

The Four-Party Model Explained

The four-party model is not just a naming convention. It defines the legal, financial, and technical relationships that govern every card transaction. Understanding these relationships is essential for understanding where responsibility lies when something goes wrong.

Here is how the model works in practice:

1. A cardholder and an issuing bank have a contractual relationship. The bank issues a card, the cardholder agrees to pay back what they spend, and the bank agrees to honor purchases at any merchant that accepts the card network.
2. A merchant and an acquiring bank have a contractual relationship. The acquirer enables the merchant to accept cards, the merchant agrees to pay processing fees, and the acquirer agrees to settle funds into the merchant's account.
3. The issuing bank and the acquiring bank are both members of the card network. They agree to the network's rules, fee schedules, and technical standards.

4. When the cardholder makes a purchase, the issuer and acquirer exchange transaction data and funds through the card network. The issuer pays the acquirer for the transaction, and the acquirer passes the money to the merchant after deducting its fees. The issuer charges the cardholder for the purchase.

The critical insight is that the cardholder and the merchant do not have a direct financial relationship with each other. They each have a relationship with a bank, and the two banks settle between themselves through a network. This structure is what enables a customer with a bank account in New York to buy from a merchant in Tokyo using a card network that neither bank owns.

The four-party model also defines liability. If a customer disputes a transaction, the claim is between the customer and their issuing bank, not between the customer and the merchant. The issuing bank initiates a chargeback against the merchant's acquiring bank, and the card network provides the rules for how the dispute is resolved. The issuer protects the cardholder first and figures out which party ultimately bears the loss later.

What Card Issuing Actually Means

When people say "card issuing," they can mean several different things. In regulatory terms, issuing means assuming the legal and financial responsibility for a card program. The issuing bank is on the hook for everything: fraud, compliance, customer disputes, network fees, and the credit risk if it is a credit card.

In technical terms, issuing means operating the systems that manage the card lifecycle. This includes:

- Creating and managing cardholder accounts
- Generating and assigning card numbers
- Authorizing and declining transactions in real time
- Posting transactions to cardholder accounts
- Managing clearing and settlement with the networks
- Handling disputes, chargebacks, and refunds
- Producing physical cards or provisioning virtual cards
- Running fraud detection and risk management

Most fintechs that talk about "issuing cards" are not actually issuing in the regulatory sense. They are operating a card program through a sponsor bank that holds the license and assumes the regulatory risk. The fintech provides the customer experience, sets the product terms, and runs whatever custom systems they need, but the sponsor bank remains the issuer of record with the card networks.

For the purposes of this book, "issuer" refers to the entity that assumes regulatory responsibility for the card program, whether that is a traditional bank or a fintech operating through a sponsor arrangement. "Issuing processor" refers to the technology provider that runs the backend systems on behalf of the issuer.

Physical vs Virtual Cards

Card issuing spans two fundamentally different delivery models: physical cards and virtual cards. Both follow the same authorization, clearing, and settlement mechanics, but they differ dramatically in provisioning, security, and use cases.

Physical cards are PVC or composite plastic cards with an embedded EMV chip, a magnetic stripe, and a printed card number. They are produced by card manufacturers, personalized at secure bureaus with cryptographic keys and cardholder data, and shipped to cardholders through postal or courier services. The provisioning timeline ranges from a few days for standard cards to several weeks for custom designs. Physical cards are used primarily for in-person purchases at POS terminals and ATM withdrawals.

The physical card supply chain introduces latency and operational complexity. Cards must be designed, ordered, manufactured, personalized, quality-checked, packaged, and shipped. Lost or stolen cards require replacement cards to be produced and delivered, which takes time. Fraud on physical cards typically involves card-not-present transactions where someone uses a stolen card number online rather than counterfeit physical cards.

Virtual cards are digital-only payment credentials that exist as card numbers in a database rather than on plastic. They can be generated and activated in seconds through an API. A virtual card number works exactly like a physical card number for online purchases, recurring billing, and digital wallet provisioning. Virtual cards can also be used at physical terminals through QR codes or mobile NFC when provisioned to a smartphone.

Virtual cards enable capabilities that physical cards cannot: instant issuance for gig workers receiving payments, single-use card numbers for online shopping, programmable spending limits that change dynamically, and automated reconciliation through metadata tagging. Many modern card programs are virtual-first or virtual-only, especially for B2B use cases like corporate spend management and embedded finance.

The backend systems for virtual and physical cards are largely the same. Both require account creation, PAN assignment, real-time authorization, clearing, and settlement. The differences appear in provisioning logistics, security controls, and product design rather than in the fundamental transaction processing mechanics.

Credit vs Debit vs Prepaid

Card issuing covers three distinct product types: credit cards, debit cards, and prepaid cards. They all use the same networks, the same message formats, and largely the same transaction processing systems. The differences are in the account structure, the source of funds, the regulatory requirements, and the risk profile.

Credit cards are linked to a revolving line of credit extended by the issuer. When a cardholder makes a purchase, the issuer pays the merchant immediately and bills the cardholder later. The issuer carries the credit risk: if the cardholder does not pay, the issuer absorbs the loss. Credit card issuing requires capital reserves, credit scoring, underwriting, and compliance with Regulation Z and Truth in Lending Act requirements. Credit cards typically have higher interchange rates because the issuer bears more risk.

Debit cards are linked to a deposit account at the issuing bank. When a cardholder makes a purchase, funds are withdrawn directly from the cardholder's account. The issuer does not extend credit and does not carry credit risk. Debit card transactions require available balance verification at authorization time. In the United States, debit card issuing is regulated by Regulation E, which governs electronic fund transfers and consumer protections. Debit cards typically have lower interchange rates than credit cards, and in the US, interchange for large bank debit cards is capped by the Durbin Amendment at $0.21 plus 5 basis points per transaction.

Prepaid cards are funded with money loaded onto the card in advance, similar to debit cards but without requiring a traditional bank deposit account.

A prepaid card can be a closed-loop card like a gift card that only works at a specific retailer, or an open-loop card like a Visa or Mastercard prepaid that works anywhere that brand is accepted. Prepaid cards are popular for payroll disbursement, government benefits, travel money, and controlled spending use cases. Prepaid card programs are regulated by the Economic Growth, Regulatory Relief, and Consumer Protection Act in the United States and have requirements for fee disclosure and account holder protections.

From a technical perspective, the issuing processor does not need different infrastructure to handle these three card types. The authorization engine checks different things for each: available credit for credit cards, available balance for debit and prepaid cards. The clearing and settlement mechanics are identical. The differences are in the account data model, the business rules, and the regulatory reporting.

Chapter 2: Card Networks: Visa, Mastercard, and Beyond

Card networks are the plumbing of the payments world. They are not banks, they do not issue cards directly, and they do not hold customer funds. They operate the messaging infrastructure, set the technical standards, define the business rules, and run the clearing and settlement systems that allow billions of transactions to flow between thousands of financial institutions worldwide.

Understanding what networks actually do, and what they do not do, is essential for understanding how the rest of the system works. This chapter examines the role of card networks in technical detail.

What Card Networks Actually Own and Operate

Visa and Mastercard are often conflated with the banks that issue their branded cards. They are not banks. They do not take deposits, extend credit, or underwrite loans. They operate two primary types of infrastructure:

Authorization networks. VisaNet is Visa's global authorization network. When an authorization request is sent from a merchant's acquirer, VisaNet routes it to the correct issuing bank based on the card number's issuer identification number. VisaNet processes these authorization messages in near-real-time with extremely low latency. The routing time from acquirer to issuer typically takes around 150 milliseconds [3]. VisaNet operates at massive scale, handling millions of authorization requests per hour with 99.99 percent or higher availability.

Mastercard operates Banknet, which performs the same function for Mastercard-branded cards. Banknet has similar latency profiles and throughput capabilities.

These authorization networks are not simple message routers. They perform message validation, format translation between different member implementations, fraud screening, and risk assessment before and after routing. They embed intelligence into the routing process itself.

Clearing and settlement systems. After transactions are authorized, networks run clearing systems that aggregate transaction data, calculate fees, determine net obligations between member banks, and generate settlement instructions. Visa and Mastercard each operate global clearing houses where billions of dollars change hands daily between member institutions. The networks calculate what each issuer owes to each acquirer across all transactions, net the mutual obligations, and produce settlement files that specify the final fund movements.

Rules and standards. Networks define the technical specifications that govern every aspect of card processing: message formats, security requirements, fraud standards, dispute resolution procedures, interchange rate tables, and compliance obligations. They require members to certify their systems against these specifications before being allowed to connect to the network.

Tokenization services. Both Visa and Mastercard operate their own token service providers. Visa Token Service (VTS) replaced primary account numbers with tokens for digital wallets and card-on-file transactions, with 16 billion tokens issued by Q4 FY2025 [4]. Mastercard's Mastercard Digital Enablement Service (MDES) serves the same purpose. These services are now central to how cards work in the digital world.

Network Rules and Compliance Requirements

Every bank or processor that connects to Visa or Mastercard must comply with a comprehensive set of rules. These rules are not guidelines; they are enforceable contractual obligations that can result in fines, penalties, or expulsion from the network.

The rulebooks run thousands of pages and cover:

Technical requirements. Members must implement specific message formats, security protocols, encryption standards, and response time requirements. Systems must be certified against network specifications before going live. This certification process can take months and requires extensive testing against the network's test environments.

Data requirements. Transactions must include specific data elements for fraud prevention, authorization optimization, and regulatory compliance. Networks require card-present transactions to include EMV chip data, card-not-present transactions to include 3-D Secure authentication data where

applicable, and all transactions to include merchant category codes, terminal locations, and other identifiers.

Security requirements. Networks mandate PCI-DSS compliance for all members that handle cardholder data. They define requirements for tokenization, encryption, secure key management, and data retention. They operate their own security programs, such as Visa's Visa Security Program and Mastercard's SecureCode requirements.

Consumer protection requirements. Networks enforce rules about fee disclosure, dispute handling, billing rights, and unauthorized transaction protections. These rules often implement or exceed legal requirements. Visa and Mastercard each have detailed chargeback guides that define the evidence standards, timelines, and procedures for dispute resolution.

Interchange and fee compliance. Networks publish rate tables that define interchange fees for every combination of card type, transaction type, and merchant category. Members must apply the correct rates to every transaction. Networks audit members and assess penalties for incorrect fee application.

The enforcement mechanism is direct. Networks conduct regular audits and can levy fines ranging from thousands to millions of dollars for compliance violations. A processor that consistently fails to meet technical or security requirements can be disconnected from the network entirely.

This regulatory infrastructure is one of the reasons that card issuing is not as simple as building an API. Even if you have the technology to process transactions, you must navigate a complex rules ecosystem to connect to the networks and remain connected.

Transaction Message Flow Through the Network

Let us trace what happens when a transaction message enters a card network. Consider an authorization request for a purchase at a retail store.

The merchant's payment terminal or online payment gateway captures the transaction data and sends it to their acquirer or payment processor. The acquirer formats the request according to network specifications, typically using ISO 8583 or a network-specific variant, and transmits it to the card network's authorization system.

When VisaNet receives the authorization request, it performs several operations almost simultaneously:

1. **Message validation.** The network validates the message structure, checks that required fields are present, and verifies the format conforms to specifications. Invalid messages are rejected immediately with an error response.
2. **Routing.** The network extracts the issuer identification number from the card's primary account number and routes the request to the correct issuing bank. For Visa cards, the first six digits of the card number identify the BIN, which maps to a specific issuer member.
3. **Pre-routing processing.** Visa applies its Visa Advanced Authorization (VAA) service, which scores every transaction on more than 500 risk attributes in under a millisecond, producing a score from 1 to 99 that is sent to the issuer along with the authorization request. This score reflects the likelihood of fraud or decline based on global patterns across Visa's entire transaction history [5].
4. **Network-level fraud checks.** The network checks for known fraud patterns, blocked card numbers, and other risk indicators.
5. **Value-added services.** If applicable, the network applies services like Visa Risk Manager scoring, network tokenization de-tokenization, or other enhancements.

The request then reaches the issuing bank's processor, which runs its own authorization logic: balance checks, fraud detection, business rules, and card controls. The processor sends a response code back through the same path: issuer to network to acquirer to terminal.

The entire round trip, from terminal to issuer and back, typically takes one to two seconds. VisaNet's routing component of that latency is around 150 milliseconds [3]. The bulk of the remaining time is spent in the issuing processor's decision logic and in the acquirer's systems.

For Mastercard, the flow is similar. Mastercard has launched the Payment Optimization Platform (POP), which enriches authorization messages in real-time using Mastercard's global transaction data, providing issuers with additional context for authorization decisions [6].

BIN Ranges and Issuer Identification

The primary account number on every card contains a built-in routing address. The first six digits, known as the Bank Identification Number (BIN) or Issuer Identification Number (IIN), identify the issuing institution and the card network.

Here is how the PAN is structured:

- **Position 1:** Major Industry Identifier (MII). A 4 indicates Visa, 5 indicates Mastercard, 3 indicates American Express, 6 indicates Discover, and other digits indicate various regional networks.
- **Positions 2 through 6:** Issuer Identification Number (IIN). These five digits, combined with the first digit, identify the specific issuing institution. For example, all Visa cards issued by Chase start with a specific six-digit BIN range.
- **Positions 7 through 15:** Individual account identifier. These digits are assigned by the issuer to uniquely identify the cardholder's account.
- **Position 16:** Luhn check digit. This digit is calculated using the Luhn algorithm to detect transcription errors.

Card networks allocate BIN ranges to member institutions. A bank that wants to issue cards receives one or more BIN ranges from Visa or Mastercard. The bank then generates card numbers within those ranges and assigns them to cardholders. The network's routing systems use the BIN to direct authorization requests to the correct issuer.

BIN ranges can encode product information. An issuer might use one range for consumer credit cards, another for business credit cards, another for prepaid cards, and so on. This allows networks and processors to apply different rules, fees, and risk parameters based on the BIN.

Modern BIN ranges have expanded from six digits to eight or more digits due to exhaustion of available combinations. Visa and Mastercard have been transitioning to longer BIN formats to accommodate the growth in card issuance.

BIN ownership is a critical asset. In the BIN sponsorship model, the sponsor bank owns the BIN range and provides access to fintechs that want to issue cards. The sponsor remains the issuer of record with the network, while the fintech operates the card program under the sponsor's BIN.

Network Fee Structure and Interchange

Card networks make money from three primary sources:

Interchange fees. Interchange is the fee that the merchant's acquiring bank pays to the cardholder's issuing bank for each transaction. The network sets the interchange rate tables that define what the fee is for every transaction type. Interchange is not network revenue; it flows from acquirer to issuer. However, the network controls the rates and publishes the tables.

Interchange rates vary based on:

- Card type: Consumer credit, rewards credit, corporate credit, debit, prepaid
- Transaction method: Card-present, card-not-present (online), telephone
- Merchant category code
- Merchant size and processing volume
- Whether the transaction used EMV chip technology
- Whether 3-D Secure authentication was used

In the United States, typical interchange rates in 2026 range from approximately 1.15 percent to 2.70 percent plus a fixed per-transaction fee for credit cards, and significantly lower rates for debit cards [7]. US businesses paid roughly $187.2 billion in card fees in 2024, with interchange comprising 70 to 90 percent of that total [8].

Network assessments. Assessments are per-transaction fees that member banks pay to the card network for using its infrastructure. These are smaller than interchange fees but are pure network revenue. Visa's assessment is approximately 0.13 to 0.15 percent of transaction volume, and Mastercard's is similar.

Technology and services. Networks charge for access to their value-added services: fraud detection platforms, tokenization services, data analytics, decisioning tools, and technology APIs. Visa Token Service and Mastercard MDES are examples of services that generate additional revenue beyond basic routing.

The fee structure creates specific incentives. Issuers prefer high-interchange card products because interchange is revenue. Acquirers compete on the fees they charge merchants, which must cover interchange

plus network assessments plus their own margin. Networks benefit from transaction volume across all product types because they earn assessments on every transaction.

This economic structure is heavily regulated in some jurisdictions. The European Union caps interchange at 0.2 percent for debit cards and 0.3 percent for credit cards. The United States caps interchange for large bank debit cards through the Durbin Amendment but leaves credit card interchange largely unregulated. Australia caps credit card interchange at 0.50 percent. Different regulatory regimes create very different economics for card issuing in different markets.

Regional and Alternative Networks

Visa and Mastercard dominate global card payments, but they are not the only networks. Understanding the alternatives is important for understanding the full ecosystem.

American Express. Amex operates a three-party or closed-loop model where the company acts as both issuer and acquirer. Amex members are always Amex, and merchants that accept Amex deal directly with Amex, not with a separate issuing bank. This closed loop gives Amex tighter control over the experience and pricing but limits network openness. Amex cards typically carry higher interchange rates and are positioned as premium products.

Discover. Discover operates in the United States under a model similar to Amex, though it also co-brands with other banks and networks internationally. Discover is often partnered with Pulse for domestic debit processing.

UnionPay. China UnionPay is the largest card network in the world by number of cards issued, though Visa and Mastercard have more transaction volume. UnionPay dominates the Chinese domestic market and is expanding internationally.

RuPay. RuPay is India's domestic card network, created to reduce dependence on Visa and Mastercard for Indian transactions. RuPay is now used for a significant share of Indian card transactions and is expanding to neighboring countries.

Regional debit networks. In the United States, debit cards may route through regional networks like Pulse, NYCE, STAR, or Interlink rather than

through Visa or Mastercard. These networks typically charge lower fees and are commonly used for PIN-based debit transactions.

Alternative payment methods. Networks like Bancontact in Belgium, iDEAL in the Netherlands, and local schemes across Latin America, Africa, and Asia provide regional alternatives to card-based payments. These are technically distinct from card networks but occupy the same role: enabling electronic payment authorization and settlement between merchants and financial institutions.

Each network has its own technical specifications, fee structures, and compliance requirements. A processor that supports multiple networks must implement and maintain separate integrations for each, or build abstraction layers that can normalize across network-specific behaviors.

Chapter 3: Issuing Processors and the Processor Model

This content is not available in the sample book. The book can be purchased on Leanpub at https://leanpub.com/howcardpaymentswork.

The Role of the Issuing Processor

This content is not available in the sample book. The book can be purchased on Leanpub at https://leanpub.com/howcardpaymentswork.

Major Issuing Processor Models

This content is not available in the sample book. The book can be purchased on Leanpub at https://leanpub.com/howcardpaymentswork.

What the Processor Provides vs What You Build

This content is not available in the sample book. The book can be purchased on Leanpub at https://leanpub.com/howcardpaymentswork.

SPI and Network Direct Integration Paths

This content is not available in the sample book. The book can be purchased on Leanpub at https://leanpub.com/howcardpaymentswork.

Sponsor Banks and Program Managers

This content is not available in the sample book. The book can be purchased on Leanpub at https://leanpub.com/howcardpaymentswork.

Cost Structures and Contract Considerations

This content is not available in the sample book. The book can be purchased on Leanpub at https://leanpub.com/howcardpaymentswork.

Chapter 4: Core Banking and Cardholder Account Management

This content is not available in the sample book. The book can be purchased on Leanpub at https://leanpub.com/howcardpaymentswork.

Core Banking System Responsibilities

This content is not available in the sample book. The book can be purchased on Leanpub at https://leanpub.com/howcardpaymentswork.

Account Structures: Primary, Sub, and Virtual Accounts

This content is not available in the sample book. The book can be purchased on Leanpub at https://leanpub.com/howcardpaymentswork.

Ledger Design for Card Accounts

This content is not available in the sample book. The book can be purchased on Leanpub at https://leanpub.com/howcardpaymentswork.

Balances, Available vs Posted Amounts

This content is not available in the sample book. The book can be purchased on Leanpub at https://leanpub.com/howcardpaymentswork.

Integration Between Core Banking and Card Systems

This content is not available in the sample book. The book can be purchased on Leanpub at https://leanpub.com/howcardpaymentswork.

Customer Onboarding and KYC Integration

Chapter 5: Card Product Design and Configuration

This content is not available in the sample book. The book can be purchased on Leanpub at https://leanpub.com/howcardpaymentswork.

Card Product Definition and Parameters

This content is not available in the sample book. The book can be purchased on Leanpub at https://leanpub.com/howcardpaymentswork.

Currency, Region, and Network Configuration

This content is not available in the sample book. The book can be purchased on Leanpub at https://leanpub.com/howcardpaymentswork.

Card Controls: Spending Limits, Blocks, and Rules

This content is not available in the sample book. The book can be purchased on Leanpub at https://leanpub.com/howcardpaymentswork.

Fee Structures: Interchange Pass-Through, Monthly Fees, FX

This content is not available in the sample book. The book can be purchased on Leanpub at https://leanpub.com/howcardpaymentswork.

Rewards, Cashback, and Points Program Architecture

This content is not available in the sample book. The book can be purchased on Leanpub at https://leanpub.com/howcardpaymentswork.

Launching a New Card Product

This content is not available in the sample book. The book can be purchased on Leanpub at https://leanpub.com/howcardpaymentswork.

Chapter 6: Identity Verification, KYC, and AML

This content is not available in the sample book. The book can be purchased on Leanpub at https://leanpub.com/howcardpaymentswork.

Regulatory Requirements for Issuers

This content is not available in the sample book. The book can be purchased on Leanpub at https://leanpub.com/howcardpaymentswork.

KYC Flows: Document Verification and Identity Proofing

This content is not available in the sample book. The book can be purchased on Leanpub at https://leanpub.com/howcardpaymentswork.

AML Screening and Watchlists

This content is not available in the sample book. The book can be purchased on Leanpub at https://leanpub.com/howcardpaymentswork.

PEP Screening and Risk Categorization

This content is not available in the sample book. The book can be purchased on Leanpub at https://leanpub.com/howcardpaymentswork.

Integration with Identity Providers

This content is not available in the sample book. The book can be purchased on Leanpub at https://leanpub.com/howcardpaymentswork.

Chapter 7: Card Number Generation and PAN Management

This content is not available in the sample book. The book can be purchased on Leanpub at https://leanpub.com/howcardpaymentswork.

How PANs Are Structured: IIN, Account, Check Digit

This content is not available in the sample book. The book can be purchased on Leanpub at https://leanpub.com/howcardpaymentswork.

The Luhn Algorithm and PAN Validation

This content is not available in the sample book. The book can be purchased on Leanpub at https://leanpub.com/howcardpaymentswork.

BIN Allocation and Management

This content is not available in the sample book. The book can be purchased on Leanpub at https://leanpub.com/howcardpaymentswork.

PAN Assignment and Account Mapping

This content is not available in the sample book. The book can be purchased on Leanpub at https://leanpub.com/howcardpaymentswork.

Virtual Card Number Generation Strategies

This content is not available in the sample book. The book can be purchased on Leanpub at https://leanpub.com/howcardpaymentswork.

PAN Tokenization at the Issuer Level

Chapter 8: Physical Card Production and Personalization

This content is not available in the sample book. The book can be purchased on Leanpub at https://leanpub.com/howcardpaymentswork.

The Card Manufacturing Supply Chain

This content is not available in the sample book. The book can be purchased on Leanpub at https://leanpub.com/howcardpaymentswork.

Personalization Bureaus and HSM Integration

This content is not available in the sample book. The book can be purchased on Leanpub at https://leanpub.com/howcardpaymentswork.

EMV Chip Personalization

This content is not available in the sample book. The book can be purchased on Leanpub at https://leanpub.com/howcardpaymentswork.

PIN Generation and Secure Delivery

This content is not available in the sample book. The book can be purchased on Leanpub at https://leanpub.com/howcardpaymentswork.

Card Packaging, Shipping, and Tracking

This content is not available in the sample book. The book can be purchased on Leanpub at https://leanpub.com/howcardpaymentswork.

Production Failures and Rework

Chapter 9: Digital Card Provisioning and Tokenization

This content is not available in the sample book. The book can be purchased on Leanpub at https://leanpub.com/howcardpaymentswork.

Virtual Card Issuance and Instant Activation

This content is not available in the sample book. The book can be purchased on Leanpub at https://leanpub.com/howcardpaymentswork.

Apple Pay, Google Pay, and Samsung Pay Tokenization

This content is not available in the sample book. The book can be purchased on Leanpub at https://leanpub.com/howcardpaymentswork.

Token Service Providers and Network Tokenization

This content is not available in the sample book. The book can be purchased on Leanpub at https://leanpub.com/howcardpaymentswork.

Device Binding and Provisioning Flows

This content is not available in the sample book. The book can be purchased on Leanpub at https://leanpub.com/howcardpaymentswork.

Ephemeral and Single-Use Virtual Cards

This content is not available in the sample book. The book can be purchased on Leanpub at https://leanpub.com/howcardpaymentswork.

Tokenization Technical Deep Dive: How Network Tokens Work

This content is not available in the sample book. The book can be purchased on Leanpub at https://leanpub.com/howcardpaymentswork.

Push Provisioning and Remote Token Enrollment

This content is not available in the sample book. The book can be purchased on Leanpub at https://leanpub.com/howcardpaymentswork.

Tokenization and Authorization Rate Improvement

This content is not available in the sample book. The book can be purchased on Leanpub at https://leanpub.com/howcardpaymentswork.

Chapter 10: The Authorization System

This content is not available in the sample book. The book can be purchased on Leanpub at https://leanpub.com/howcardpaymentswork.

The Authorization Request: From Terminal to Issuer

This content is not available in the sample book. The book can be purchased on Leanpub at https://leanpub.com/howcardpaymentswork.

ISO 8583 and Modern API Protocols

This content is not available in the sample book. The book can be purchased on Leanpub at https://leanpub.com/howcardpaymentswork.

The Authorization Decision Engine

This content is not available in the sample book. The book can be purchased on Leanpub at https://leanpub.com/howcardpaymentswork.

Real-Time Balance and Limit Checking

This content is not available in the sample book. The book can be purchased on Leanpub at https://leanpub.com/howcardpaymentswork.

Velocity Checks and Pattern Analysis

This content is not available in the sample book. The book can be purchased on Leanpub at https://leanpub.com/howcardpaymentswork.

Response Codes and Decline Reasons

This content is not available in the sample book. The book can be purchased on Leanpub at https://leanpub.com/howcardpaymentswork.

Decision Engine Architecture

This content is not available in the sample book. The book can be purchased on Leanpub at https://leanpub.com/howcardpaymentswork.

Pre-Checks and Post-Checks in Authorization

This content is not available in the sample book. The book can be purchased on Leanpub at https://leanpub.com/howcardpaymentswork.

Handling Edge Cases and Partial Failures

This content is not available in the sample book. The book can be purchased on Leanpub at https://leanpub.com/howcardpaymentswork.

Authorization Analytics and Continuous Optimization

This content is not available in the sample book. The book can be purchased on Leanpub at https://leanpub.com/howcardpaymentswork.

Chapter 11: Fraud Detection and Risk Systems

This content is not available in the sample book. The book can be purchased on Leanpub at https://leanpub.com/howcardpaymentswork.

Rule-Based Fraud Detection

This content is not available in the sample book. The book can be purchased on Leanpub at https://leanpub.com/howcardpaymentswork.

Machine Learning Models in Fraud Scoring

This content is not available in the sample book. The book can be purchased on Leanpub at https://leanpub.com/howcardpaymentswork.

Device Fingerprinting and Behavioral Biometrics

This content is not available in the sample book. The book can be purchased on Leanpub at https://leanpub.com/howcardpaymentswork.

Real-Time Decisioning and Latency Constraints

This content is not available in the sample book. The book can be purchased on Leanpub at https://leanpub.com/howcardpaymentswork.

Advanced Fraud Patterns and Detection Strategies

This content is not available in the sample book. The book can be purchased on Leanpub at https://leanpub.com/howcardpaymentswork.

Feature Engineering for Fraud Detection

This content is not available in the sample book. The book can be purchased on Leanpub at https://leanpub.com/howcardpaymentswork.

Fraud Feedback Loops and Model Retraining

This content is not available in the sample book. The book can be purchased on Leanpub at https://leanpub.com/howcardpaymentswork.

Managing False Positives and Cardholder Experience

This content is not available in the sample book. The book can be purchased on Leanpub at https://leanpub.com/howcardpaymentswork.

Chapter 12: 3-D Secure and Authentication Flows

This content is not available in the sample book. The book can be purchased on Leanpub at https://leanpub.com/howcardpaymentswork.

What 3-D Secure Is and Why It Exists

This content is not available in the sample book. The book can be purchased on Leanpub at https://leanpub.com/howcardpaymentswork.

3DS 1.0 vs 2.0 Architecture

This content is not available in the sample book. The book can be purchased on Leanpub at https://leanpub.com/howcardpaymentswork.

The Authentication Flow: DS, ACS, and Interoperability Server

This content is not available in the sample book. The book can be purchased on Leanpub at https://leanpub.com/howcardpaymentswork.

Liability Shift and Exemption Criteria

This content is not available in the sample book. The book can be purchased on Leanpub at https://leanpub.com/howcardpaymentswork.

Frictionless vs Challenge Flows

This content is not available in the sample book. The book can be purchased on Leanpub at https://leanpub.com/howcardpaymentswork.

3DS and Digital Wallets

This content is not available in the sample book. The book can be purchased on Leanpub at https://leanpub.com/howcardpaymentswork.

Technical Deep Dive: 3DS 2.0 Protocol Messages and Cryptography

This content is not available in the sample book. The book can be purchased on Leanpub at https://leanpub.com/howcardpaymentswork.

Operational Considerations for Issuers

This content is not available in the sample book. The book can be purchased on Leanpub at https://leanpub.com/howcardpaymentswork.

Chapter 13: Holds, Authorizations, and Pre-Authorizations

This content is not available in the sample book. The book can be purchased on Leanpub at https://leanpub.com/howcardpaymentswork.

Authorization Holds and Pending Balances

This content is not available in the sample book. The book can be purchased on Leanpub at https://leanpub.com/howcardpaymentswork.

Capture and Settlement Timing

This content is not available in the sample book. The book can be purchased on Leanpub at https://leanpub.com/howcardpaymentswork.

Partial Authorizations and Partial Captures

This content is not available in the sample book. The book can be purchased on Leanpub at https://leanpub.com/howcardpaymentswork.

Authorization Reversals and Voids

This content is not available in the sample book. The book can be purchased on Leanpub at https://leanpub.com/howcardpaymentswork.

Extended Holds: Hotels, Rental Cars, Gas Stations

This content is not available in the sample book. The book can be purchased on Leanpub at https://leanpub.com/howcardpaymentswork.

Hold Expiration and Balance Recovery

This content is not available in the sample book. The book can be purchased on Leanpub at https://leanpub.com/howcardpaymentswork.

Chapter 14: Clearing: The Batch That Moves Transaction Details

This content is not available in the sample book. The book can be purchased on Leanpub at https://leanpub.com/howcardpaymentswork.

Authorization vs Clearing: Why Two Steps

This content is not available in the sample book. The book can be purchased on Leanpub at https://leanpub.com/howcardpaymentswork.

Clearing File Formats and Schedules

This content is not available in the sample book. The book can be purchased on Leanpub at https://leanpub.com/howcardpaymentswork.

The Clearing Cycle: Cut-off Times and Deadlines

This content is not available in the sample book. The book can be purchased on Leanpub at https://leanpub.com/howcardpaymentswork.

Merchant Clearing and Acquirer Roles

This content is not available in the sample book. The book can be purchased on Leanpub at https://leanpub.com/howcardpaymentswork.

Network Clearing Rules and Validation

This content is not available in the sample book. The book can be purchased on Leanpub at https://leanpub.com/howcardpaymentswork.

Clearing Exceptions and Rejections

This content is not available in the sample book. The book can be purchased on Leanpub at https://leanpub.com/howcardpaymentswork.

Clearing File Formats and Standards

This content is not available in the sample book. The book can be purchased on Leanpub at https://leanpub.com/howcardpaymentswork.

The Clearing Pipeline: Step-by-Step Processing

This content is not available in the sample book. The book can be purchased on Leanpub at https://leanpub.com/howcardpaymentswork.

Clearing Reconciliation and Discrepancy Resolution

This content is not available in the sample book. The book can be purchased on Leanpub at https://leanpub.com/howcardpaymentswork.

Chapter 15: Settlement: When Money Actually Moves

This content is not available in the sample book. The book can be purchased on Leanpub at https://leanpub.com/howcardpaymentswork.

Settlement vs Clearing: The Critical Distinction

This content is not available in the sample book. The book can be purchased on Leanpub at https://leanpub.com/howcardpaymentswork.

Net Settlement and Offset Calculations

This content is not available in the sample book. The book can be purchased on Leanpub at https://leanpub.com/howcardpaymentswork.

Reserve Accounts and Liquidity Management

This content is not available in the sample book. The book can be purchased on Leanpub at https://leanpub.com/howcardpaymentswork.

Settlement Timing: T+1, T+2, and Beyond

This content is not available in the sample book. The book can be purchased on Leanpub at https://leanpub.com/howcardpaymentswork.

FX Settlement and Multi-Currency Clearing

This content is not available in the sample book. The book can be purchased on Leanpub at https://leanpub.com/howcardpaymentswork.

Settlement Failures and Reconciliation

This content is not available in the sample book. The book can be purchased on Leanpub at https://leanpub.com/howcardpaymentswork.

Float Management and Settlement Economics

This content is not available in the sample book. The book can be purchased on Leanpub at https://leanpub.com/howcardpaymentswork.

Settlement Banks and Fund Transfer Mechanisms

This content is not available in the sample book. The book can be purchased on Leanpub at https://leanpub.com/howcardpaymentswork.

Settlement Accounting and Ledger Updates

This content is not available in the sample book. The book can be purchased on Leanpub at https://leanpub.com/howcardpaymentswork.

Chapter 16: Fees, Interchange, and Revenue

This content is not available in the sample book. The book can be purchased on Leanpub at https://leanpub.com/howcardpaymentswork.

Interchange Fee Structure and Rate Tables

This content is not available in the sample book. The book can be purchased on Leanpub at https://leanpub.com/howcardpaymentswork.

Assessments and Network Fees

This content is not available in the sample book. The book can be purchased on Leanpub at https://leanpub.com/howcardpaymentswork.

Scheme vs Member Fees

This content is not available in the sample book. The book can be purchased on Leanpub at https://leanpub.com/howcardpaymentswork.

Processor Pricing Models

This content is not available in the sample book. The book can be purchased on Leanpub at https://leanpub.com/howcardpaymentswork.

Revenue Attribution and Allocation

This content is not available in the sample book. The book can be purchased on Leanpub at https://leanpub.com/howcardpaymentswork.

Fee Pass-Through and Merchant Incentives

Chapter 17: Reconciliation and Operations

This content is not available in the sample book. The book can be purchased on Leanpub at https://leanpub.com/howcardpaymentswork.

What Reconciliation Means in Card Issuing

This content is not available in the sample book. The book can be purchased on Leanpub at https://leanpub.com/howcardpaymentswork.

Three-Way Reconciliation: Authorization, Clearing, Settlement

This content is not available in the sample book. The book can be purchased on Leanpub at https://leanpub.com/howcardpaymentswork.

Exception Handling and Unreconciled Items

This content is not available in the sample book. The book can be purchased on Leanpub at https://leanpub.com/howcardpaymentswork.

Batch Reconciliation Jobs and Scheduling

This content is not available in the sample book. The book can be purchased on Leanpub at https://leanpub.com/howcardpaymentswork.

Operational Controls and Auditing

This content is not available in the sample book. The book can be purchased on Leanpub at https://leanpub.com/howcardpaymentswork.

Common Reconciliation Pain Points

Chapter 18: Refunds, Reversals, and Returns

This content is not available in the sample book. The book can be purchased on Leanpub at https://leanpub.com/howcardpaymentswork.

Refunds vs Voids vs Reversals vs Credits

This content is not available in the sample book. The book can be purchased on Leanpub at https://leanpub.com/howcardpaymentswork.

The Refund Transaction Flow

This content is not available in the sample book. The book can be purchased on Leanpub at https://leanpub.com/howcardpaymentswork.

Partial Refunds and Timing

This content is not available in the sample book. The book can be purchased on Leanpub at https://leanpub.com/howcardpaymentswork.

Refunds After Expiration

This content is not available in the sample book. The book can be purchased on Leanpub at https://leanpub.com/howcardpaymentswork.

Network Recall and Recall-For-Payment

This content is not available in the sample book. The book can be purchased on Leanpub at https://leanpub.com/howcardpaymentswork.

Accounting Treatment of Reversals

Chapter 19: Disputes and Chargebacks

What a Chargeback Is and When It Happens

Chargeback Reasons and Representment

The Dispute Lifecycle: Filing, Response, Arbitration

Evidence Gathering and Compelling Evidence Standards

Chargeback Fees and Financial Impact

Representment Automation and Strategy

This content is not available in the sample book. The book can be purchased on Leanpub at https://leanpub.com/howcardpaymentswork.

The Chargeback Lifecycle: End-to-End Workflow

This content is not available in the sample book. The book can be purchased on Leanpub at https://leanpub.com/howcardpaymentswork.

Evidence Gathering and Compelling Evidence Standards

This content is not available in the sample book. The book can be purchased on Leanpub at https://leanpub.com/howcardpaymentswork.

Backend Dispute Management Systems

This content is not available in the sample book. The book can be purchased on Leanpub at https://leanpub.com/howcardpaymentswork.

Chargeback Fees and Financial Impact

This content is not available in the sample book. The book can be purchased on Leanpub at https://leanpub.com/howcardpaymentswork.

Representment Automation and Strategy

This content is not available in the sample book. The book can be purchased on Leanpub at https://leanpub.com/howcardpaymentswork.

Liability Shift Scenarios and 3-D Secure Impact on Disputes

This content is not available in the sample book. The book can be purchased on Leanpub at https://leanpub.com/howcardpaymentswork.

Chapter 20: Card Lifecycle Management

This content is not available in the sample book. The book can be purchased on Leanpub at https://leanpub.com/howcardpaymentswork.

Card Expiration and Renewal Cycles

This content is not available in the sample book. The book can be purchased on Leanpub at https://leanpub.com/howcardpaymentswork.

Lost and Stolen Card Blocking

This content is not available in the sample book. The book can be purchased on Leanpub at https://leanpub.com/howcardpaymentswork.

Card Replacement Workflows

This content is not available in the sample book. The book can be purchased on Leanpub at https://leanpub.com/howcardpaymentswork.

Card Controls: Freezing, Unfreezing, Temporary Limits

This content is not available in the sample book. The book can be purchased on Leanpub at https://leanpub.com/howcardpaymentswork.

Account Closure and Fund Return

This content is not available in the sample book. The book can be purchased on Leanpub at https://leanpub.com/howcardpaymentswork.

Card Status Transitions and State Machine

Chapter 21: ATM and Cash Transactions

This content is not available in the sample book. The book can be purchased on Leanpub at https://leanpub.com/howcardpaymentswork.

ATM Network Processing vs POS Networks

This content is not available in the sample book. The book can be purchased on Leanpub at https://leanpub.com/howcardpaymentswork.

PIN Verification and PIN Blocks

This content is not available in the sample book. The book can be purchased on Leanpub at https://leanpub.com/howcardpaymentswork.

Cash Advance Authorization and Fees

This content is not available in the sample book. The book can be purchased on Leanpub at https://leanpub.com/howcardpaymentswork.

ATM Settlement and Cash Loading

This content is not available in the sample book. The book can be purchased on Leanpub at https://leanpub.com/howcardpaymentswork.

International ATM Fees and Networks

This content is not available in the sample book. The book can be purchased on Leanpub at https://leanpub.com/howcardpaymentswork.

Cashback at POS

This content is not available in the sample book. The book can be purchased on Leanpub at https://leanpub.com/howcardpaymentswork.

Chapter 22: Cross-Border and Multi-Currency Processing

This content is not available in the sample book. The book can be purchased on Leanpub at https://leanpub.com/howcardpaymentswork.

Currency Identification and FX Rates

This content is not available in the sample book. The book can be purchased on Leanpub at https://leanpub.com/howcardpaymentswork.

Dynamic Currency Conversion

This content is not available in the sample book. The book can be purchased on Leanpub at https://leanpub.com/howcardpaymentswork.

Issuer FX Markup and Conversion Logic

This content is not available in the sample book. The book can be purchased on Leanpub at https://leanpub.com/howcardpaymentswork.

Cross-Border Interchange and Regulations

This content is not available in the sample book. The book can be purchased on Leanpub at https://leanpub.com/howcardpaymentswork.

Multi-Currency Cards and Accounts

This content is not available in the sample book. The book can be purchased on Leanpub at https://leanpub.com/howcardpaymentswork.

Sanctions and Geopolitical Constraints

Chapter 23: System Architecture for Modern Card Issuing

This content is not available in the sample book. The book can be purchased on Leanpub at https://leanpub.com/howcardpaymentswork.

Event-Driven Architecture for Card Issuing

This content is not available in the sample book. The book can be purchased on Leanpub at https://leanpub.com/howcardpaymentswork.

Microservices: Which Services Split, Which Stay Monolithic

This content is not available in the sample book. The book can be purchased on Leanpub at https://leanpub.com/howcardpaymentswork.

Real-Time Data Stores and Ledger Design

This content is not available in the sample book. The book can be purchased on Leanpub at https://leanpub.com/howcardpaymentswork.

Idempotency, Consistency, and Transaction Safety

This content is not available in the sample book. The book can be purchased on Leanpub at https://leanpub.com/howcardpaymentswork.

API Design: Internal vs External

This content is not available in the sample book. The book can be purchased on Leanpub at https://leanpub.com/howcardpaymentswork.

Observability: Logging, Tracing, and Monitoring

This content is not available in the sample book. The book can be purchased on Leanpub at https://leanpub.com/howcardpaymentswork.

Infrastructure Patterns for Card Issuing

This content is not available in the sample book. The book can be purchased on Leanpub at https://leanpub.com/howcardpaymentswork.

Scalability Patterns and Throughput Management

This content is not available in the sample book. The book can be purchased on Leanpub at https://leanpub.com/howcardpaymentswork.

Development Practices and Release Management

This content is not available in the sample book. The book can be purchased on Leanpub at https://leanpub.com/howcardpaymentswork.

Processor Architecture: Monolith vs Microservices

This content is not available in the sample book. The book can be purchased on Leanpub at https://leanpub.com/howcardpaymentswork.

Edge Services and Global Authorization Routing

This content is not available in the sample book. The book can be purchased on Leanpub at https://leanpub.com/howcardpaymentswork.

Chapter 24: Security, Compliance, and Resilience

This content is not available in the sample book. The book can be purchased on Leanpub at https://leanpub.com/howcardpaymentswork.

PCI-DSS for Issuers and Processors

This content is not available in the sample book. The book can be purchased on Leanpub at https://leanpub.com/howcardpaymentswork.

HSMs and Cryptographic Key Management

This content is not available in the sample book. The book can be purchased on Leanpub at https://leanpub.com/howcardpaymentswork.

Data Privacy: GDPR, CCPA, and Beyond

This content is not available in the sample book. The book can be purchased on Leanpub at https://leanpub.com/howcardpaymentswork.

Network Security and Threat Protection

This content is not available in the sample book. The book can be purchased on Leanpub at https://leanpub.com/howcardpaymentswork.

Disaster Recovery and High Availability

This content is not available in the sample book. The book can be purchased on Leanpub at https://leanpub.com/howcardpaymentswork.

Regulatory Auditing and Examination

Chapter 25: Failure Modes and Edge Cases

This content is not available in the sample book. The book can be purchased on Leanpub at https://leanpub.com/howcardpaymentswork.

Network Outages and Fallback Processing

This content is not available in the sample book. The book can be purchased on Leanpub at https://leanpub.com/howcardpaymentswork.

Duplicate Transaction Handling

This content is not available in the sample book. The book can be purchased on Leanpub at https://leanpub.com/howcardpaymentswork.

Race Conditions in Authorization and Balance Updates

This content is not available in the sample book. The book can be purchased on Leanpub at https://leanpub.com/howcardpaymentswork.

Reconciliation Discrepancies and Recovery

This content is not available in the sample book. The book can be purchased on Leanpub at https://leanpub.com/howcardpaymentswork.

Mass Failure Scenarios and Incident Response

This content is not available in the sample book. The book can be purchased on Leanpub at https://leanpub.com/howcardpaymentswork.

Operational Runbooks and Escalation

Conclusion: The Future of Card Issuing

This content is not available in the sample book. The book can be purchased on Leanpub at https://leanpub.com/howcardpaymentswork.

Real-Time Issuing and Instant Card Activation

This content is not available in the sample book. The book can be purchased on Leanpub at https://leanpub.com/howcardpaymentswork.

Embedded Finance and B2B2C Issuing

This content is not available in the sample book. The book can be purchased on Leanpub at https://leanpub.com/howcardpaymentswork.

Account-Based Payments and Card Competition

This content is not available in the sample book. The book can be purchased on Leanpub at https://leanpub.com/howcardpaymentswork.

Tokenization and the Death of the PAN

This content is not available in the sample book. The book can be purchased on Leanpub at https://leanpub.com/howcardpaymentswork.

Regulatory Trajectory

This content is not available in the sample book. The book can be purchased on Leanpub at https://leanpub.com/howcardpaymentswork.

What This Means for Practitioners

References

This content is not available in the sample book. The book can be purchased on Leanpub at https://leanpub.com/howcardpaymentswork.