Flexa Network Whitepaper

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flexa

At Flexa, we believe that the best way for global commerce to become more efficient and accessible is by making cryptocurrency spendable everywhere.

With cryptocurrency transactions exceeding 20 billion USD each day,[1] it's simply a matter of time before digital commodities become a central part of global commerce. And yet, cryptocurrency's collective value of 0.25–0.5 trillion USD[2] remains practically unusable in physical retail.

Considering that 90.9 percent of retail sales in the US still take place offline,[3] brick-and-mortar payments are the primary hurdle in realizing the true utility of cryptocurrencies. Furthermore, widespread retail acceptance of cryptocurrency is critical for its sustainable value.

The solution to blockchain payments

We have developed the Flexa network as an open standard that enables instant cryptocurrency payments in stores and online. This new network is designed to act as an intermediary between merchants and the blockchain, offering them inexpensive and fraud-resistant transactions without volatility exposure. Flexa enables consumers to pay with their preferred cryptocurrency while preserving their freedom, security, and data privacy. And, Flexa doesn't require any physical cards or merchant point-of-sale upgrades.

Flexa was developed from decades of experience in fintech, retail, and payments. Today, Flexa features many high-profile merchants on its platform, the launch of which marks the first real instance of a decentralized, global payment network with the power to make commerce more efficient and accessible for billions of people.
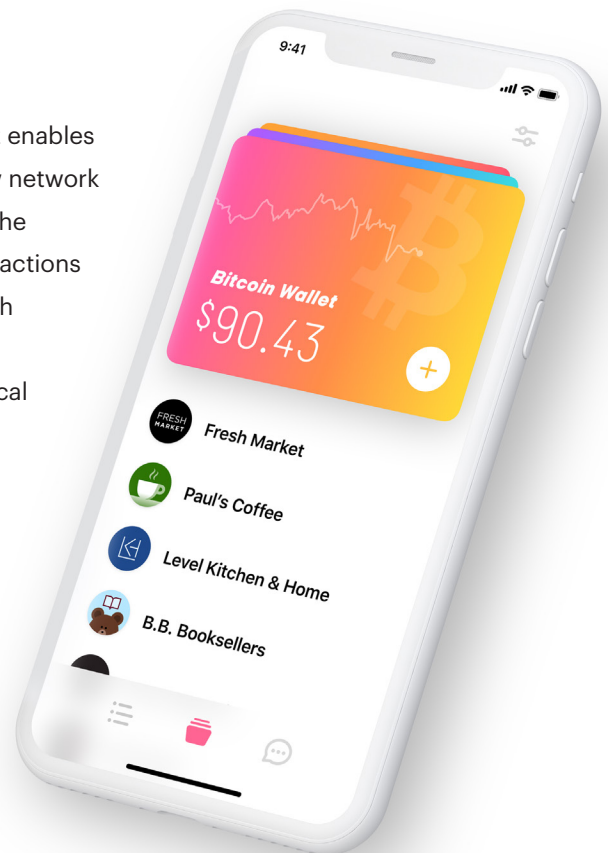
Vision

We're making cryptocurrency useful

In the original Bitcoin whitepaper, Satoshi Nakamoto outlined a perspective on the fallacies of modern-day commerce, which relies "almost exclusively on financial institutions... to process electronic payments."[4]

Digital payment instruments in the United States and around the world consist of complicated financial settlement processes—costing merchants *up to 4 percent in processing fees* for purchases and involving up to twelve different entities (each a discrete point of failure) to process a single exchange. Meanwhile, retail fraud losses in the US alone continue to reach all-time highs, claiming more than 48.9 billion USD in 2016.[5]

However, present-day payment instruments are extremely useful to consumers because they have widespread merchant acceptance. And in order for cryptocurrencies to realize similar real and sustainable value, it is critical that they become spendable everywhere.

Many companies have recently developed wallets and apps that enable retail blockchain payments, but they are *universally dependent on existing payment networks*. The promise of cryptocurrency is not being realized when it also requires physical debit cards, linked accounts, or centralized payment infrastructure to facilitate the purchase of a cup of coffee.

Flexa is the first network specifically designed to facilitate practical cryptocurrency payments by enabling instant, no-fee transactions at stores, restaurants, and online. Flexa represents a milestone in the utility of cryptocurrency—payments that are both consumer and merchant

friendly. With a simple SDK, Flexa allows developers to add retail payment features to any app, streamlining acceptance of cryptocurrencies for merchants and eliminating volatility exposure.

Flexacoin (FXC) is the new digital collateral token for facilitating retail cryptocurrency payments on the Flexa network. Flexacoin is staked to collateralize every payment on the Flexa network, enabling instant, fraud-free point-of-sale transactions at merchants worldwide—helping to achieve a long-term vision of making cryptocurrency spendable everywhere.

As a simple, neutral, fixed-supply ERC20 token, Flexacoin ensures that the network itself is blockchain-agnostic, and allows people to spend the cryptocurrencies that are meaningful to them. Anyone can use Flexacoin to stake wallets on the Flexa network. Stakers help to collateralize payments made by those wallets, and in return, they earn stake rewards based on transaction volume.

By connecting merchants, banks, and the blockchain with this open network, we're building a new, global payment system to challenge the status quo.

We envision that the Flexa network will ultimately come to represent open network infrastructure for any blockchain payment, similar to how card associations such as Visa, Mastercard, UnionPay, and American Express offer closed payment rails for credit cards. Beyond that, with digital global payments *in excess of 10 trillion USD each day*,[6] this retail platform will make cryptocurrency more valuable, meaningful, and useful.
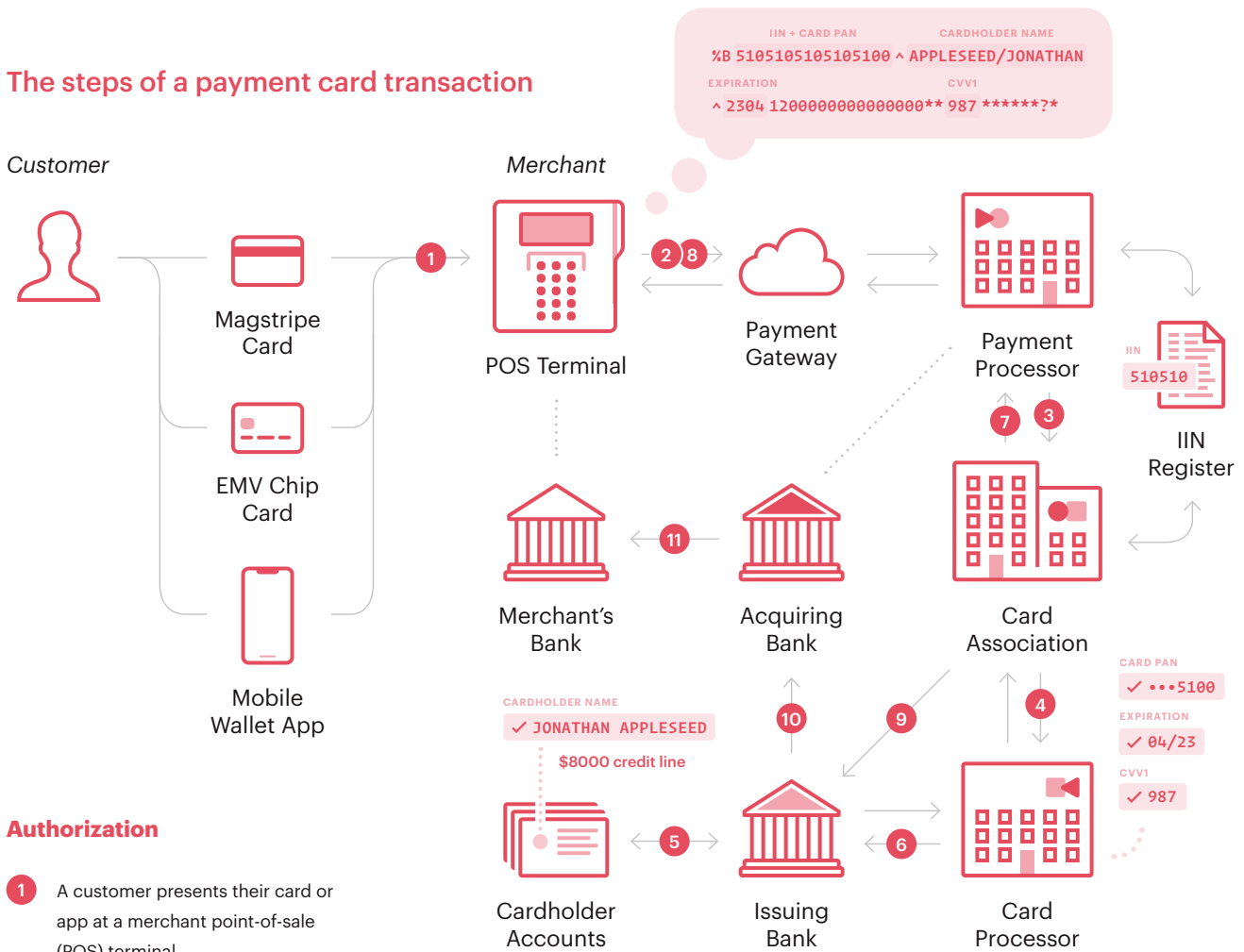
The blockchain as the future of commerce

The limitations of traditional payment instruments—fraud and cost—are solved by the primary strengths of blockchain technology. Accordingly, merchants and the greater blockchain community each stand to benefit from making cryptocurrency spendable everywhere.

For many merchants, payment card fraud and transaction expense are two of the most significant operating costs to manage and actively reduce (e.g., in 2017, losses due to payment card fraud amounted to an estimated 28 billion USD worldwide).[7] Payment card fraud today takes many forms, from stolen account numbers to abuse of marketing incentives. Even chargebacks, initially developed as a consumer protection over forty years ago, have become a vehicle for malicious activity. And smaller merchants ultimately share a disproportionate share of the damages, as they have fewer resources to counter sophisticated fraud or defend themselves in the case of a dispute.

In addition to the costs of fraud, the very act of processing a payment can be extremely expensive, due to the variety of fees and operating expenses involved in handling cash, payment cards, and other payment instruments. For instance, in 2016, the top twenty-five merchants by revenue worldwide spent a collective 19 billion USD to accept payments.[8] In general, these expenses are a result of complex settlement processes across a variety of network participants, including payment gateways, processors, card associations, and financial institutions. Due to this complexity, a standard payment card transaction in the United States involves more than ten discrete steps.

The steps of a payment card transaction

Customer

Merchant

IIN + CARD PAN   CARDHOLDER NAME
%B 5105105105105100 ^ APPLESEED/JONATHAN
EXPIRATION   CVV1
^ 2304 1200000000000000** 987 ******?*

Magstripe
Card

EMV Chip
Card

Mobile
Wallet App

POS Terminal

Payment
Gateway

Payment
Processor

IIN
510510

IIN
Register

Merchant's
Bank

Acquiring
Bank

Card
Association

CARD PAN
✓ •••5100

EXPIRATION
✓ 04/23

CVV1
✓ 987

CARDHOLDER NAME
✓ JONATHAN APPLESEED

$8000 credit line

Cardholder
Accounts

Issuing
Bank

Card
Processor

Authorization

1 A customer presents their card or app at a merchant point-of-sale (POS) terminal.

2 The terminal reads the magnetic stripe or embedded signature data from the card and transmits it through a payment gateway to a payment processor.

3 The processor uses a list of Issuer Identification Numbers (IINs) to route data through the appropriate card association, or network.

4 The card association sends the transaction to the bank that issued the card through a card processor.

5 The issuing bank reviews the transaction data, metadata, and internal risk models to determine whether the transaction should be authorized.

6 The issuing bank returns an approval or decline to the card association, along with any other verification data as requested by the merchant.

7 The card association relays the authorization to the processor, which sends a transaction success message back to the POS terminal.

8 Based on the merchant's decision to complete the transaction, the POS terminal sends the payment processor instructions to "settle" the prior authorization amount, which are then relayed to the card association.

Clearing & settlement

9 The card association directs the issuing bank to transfer a final purchase amount (minus interchange) to the processor's own bank, called the "acquiring bank." It returns a success message to the payment processor.

10 The acquiring bank receives funds within 2 business days. Meanwhile, the issuing bank resolves the customer's pending record of charge, and appends it to their statement.

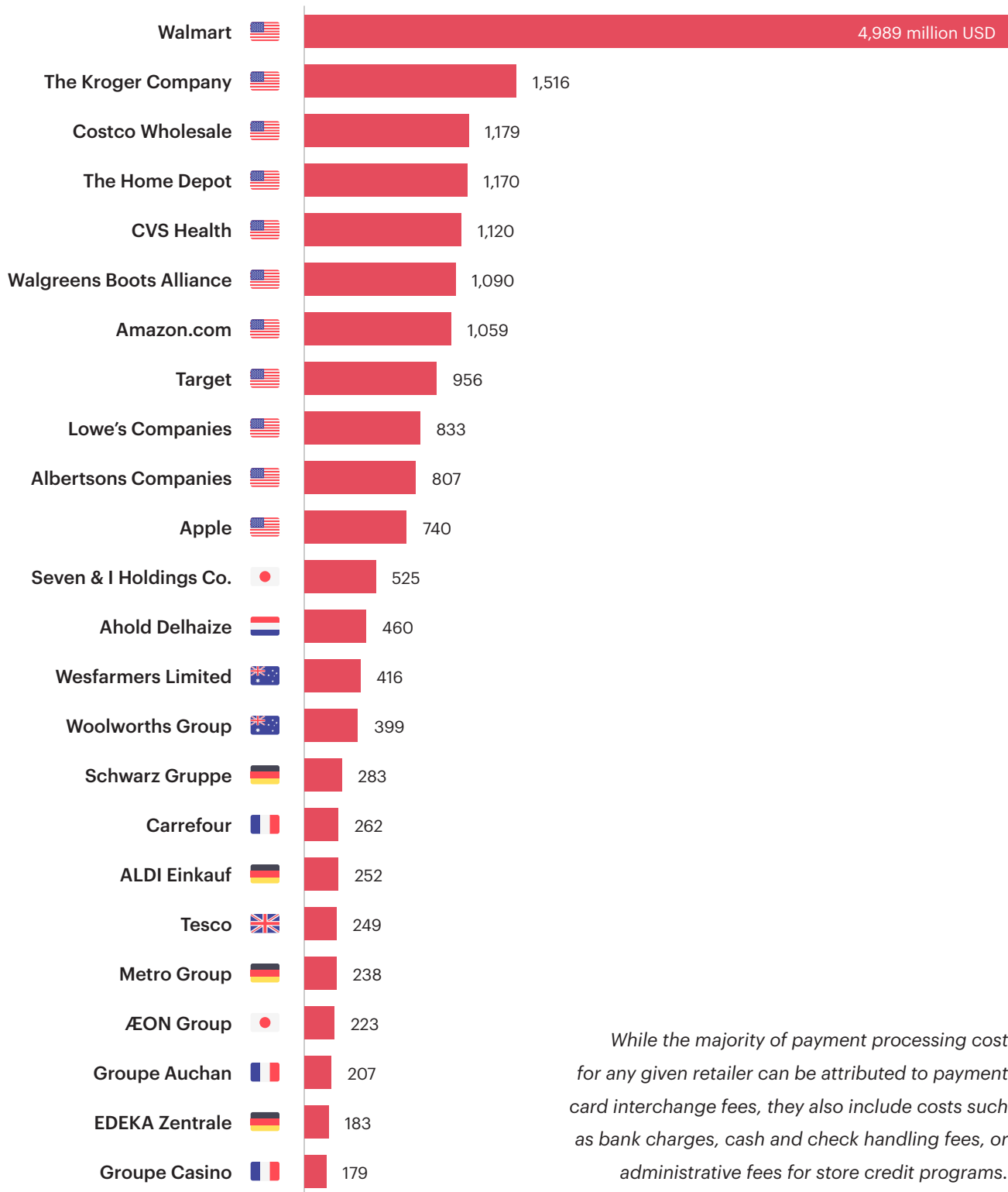**11** The acquiring bank initiates a daily transfer for funds collected minus any fees for processing.

Payment processing costs of the world's largest retailers by revenue in 2016[9]

Retailer	Cost
Walmart 🇺🇸	4,989 million USD
The Kroger Company 🇺🇸	1,516
Costco Wholesale 🇺🇸	1,179
The Home Depot 🇺🇸	1,170
CVS Health 🇺🇸	1,120
Walgreens Boots Alliance 🇺🇸	1,090
Amazon.com 🇺🇸	1,059
Target 🇺🇸	956
Lowe's Companies 🇺🇸	833
Albertsons Companies 🇺🇸	807
Apple 🇺🇸	740
Seven & I Holdings Co. 🇯🇵	525
Ahold Delhaize 🇳🇱	460
Wesfarmers Limited 🇦🇺	416
Woolworths Group 🇦🇺	399
Schwarz Gruppe 🇩🇪	283
Carrefour 🇫🇷	262
ALDI Einkauf 🇩🇪	252
Tesco 🇬🇧	249
Metro Group 🇩🇪	238
ÆON Group 🇯🇵	223
Groupe Auchan 🇫🇷	207
EDEKA Zentrale 🇩🇪	183
Groupe Casino 🇫🇷	179

While the majority of payment processing cost for any given retailer can be attributed to payment card interchange fees, they also include costs such as bank charges, cash and check handling fees, or administrative fees for store credit programs.

How merchants and the blockchain stand to benefit

The blockchain offers a practical solution to merchant concerns of fraud and cost. It dramatically reduces the number of possible fraud vectors by enforcing tamper-proof transactions on a ledger, and it decentralizes transaction verification—creating an open market for processing that more closely represents the actual computation cost. As an added benefit, the blockchain provides native support for borderless payments, which opens merchants to a global community of customers without requiring additional payment infrastructure or currency exchange.

Meanwhile, the blockchain needs merchant adoption in order to become a viable supplement to other payment methods. Additionally, with this increased utility comes more straightforward cryptocurrency valuation, reduced volatility, and market stabilization. Growing merchant acceptance will make cryptocurrencies substantially more valuable, and truly enable the globalizing effects of peer-to-peer electronic cash that Satoshi Nakamoto envisioned.

Blockchain adoption is inevitable

For these reasons, we believe that the blockchain complements the infrastructure of traditional payment instruments. However, due to the operational and technical complexity in managing native cryptocurrencies at scale, many merchants will require an intermediary service. This service must be designed so that it cannot compromise the core principles of data protection, decentralization, and choice that have bolstered the cryptocurrency community since its inception.

We believe that the Flexa network offers the first practical cryptocurrency payments service for retail, dining, groceries, fuel, travel, and more. We remove the complexities of acceptance to bring fraud resistance and low-fee processing to merchants, while still protecting consumer tenets of privacy, decentralized governance, and freedom of choice. By allowing merchants and their customers to engage directly as buyers and sellers, global commerce becomes vastly more efficient.

A framework for consumer adoption

The software that moves the vast majority of money around the world today still uses legacy standards created during the late 1970s,[10] but in the absence of a compelling alternative, consumers are trapped into maintaining the status quo.

Since the creation of Bitcoin in 2008, blockchain communities have attempted to make cryptocurrencies a useful complement to traditional payment instruments like credit cards, debit cards, and cash. However, fundamental user-experience challenges such as unintuitive QR code interfaces, complex address strings, new security protocols, and network capacity issues have hindered commercial adoption. Various scaling solutions such as multi-layer protocols and Proof of Stake consensus algorithms show considerable promise for improving the speed and utility of blockchain transactions, but create issues of complexity and compatibility for merchants.

A variety of mobile wallets are promoting cryptocurrency payment solutions, but unfortunately, they are completely reliant on existing legacy infrastructure. These wallets utilize high-fee virtual Visa and Mastercard debit cards—requiring bank accounts, physical cards, and multiple tiers of centralization. Digital payments on these platforms are subject to low transaction limits (in some cases, less than $100),[11] as well as Apple's restrictions for NFC access on iOS devices.[12] Justifiably, these systems have extremely low consumer adoption due to the increased friction compared to a typical payment card.

The solution to blockchain payments is not building cryptocurrency acceptance on top of the existing multi-layer networks, but creating a *new network* that solves merchant and consumer needs alike.

While decades of retail payments experience confirm the pain points of fraud and processing cost, we find that consumers' needs are distinctly different. Consumers evaluate payment instruments against an individual framework of five basic criteria:

Basic consumer criteria	Bank transfers	Payment cards	Mobile wallets	*Flexa*
Freedom of choice The need to avoid fees, and mechanisms of unwarranted control	✕	✕	✕	✔
Security The need to use a system without fear of loss by deception or failure	✔	✔	✕	✔
Speed The requisite convenience of instant confirmation, often lost to security	✕	✕	✔	✔
Usefulness The need for widespread acceptance of a particular payment instrument	✔	✔	✔	✔
Value Any incentive to use a payment instrument (e.g., rewards, no fees)	✕	✔	✕	✔

Speed, usefulness, and value are often the most critical factors in choosing a particular payment instrument at retail. Each of these features must be addressed for cryptocurrencies to see widespread adoption.

In order for a viable blockchain cryptocurrency payment network to achieve meaningful scale, the table stakes for consumers are the following:

(1) Real-time transactions

Merchants and their customers need to receive confirmation that a transaction was successful in less than one second.

(2) No consumer-facing fees

Consumers will not pay a premium to use blockchain cryptocurrencies, because such a cost represents negative value in their decision-making framework. The fee must be zero on the consumer side of the transaction, and ultimately provide competitive spending incentives.

(3) Broad acceptance

In order to see widespread consumer adoption, it must be possible to use cryptocurrencies for the majority of daily expenditures. Any less than that, and the mindshare required to maintain "front of wallet" utility will not be attainable.

Meeting and dramatically exceeding these expectations will be challenging, but any new payments network must comprehensively solve both consumer and merchant needs. We believe that Flexa satisfies all of the core consumer requirements necessary to break the legacy payments status quo.
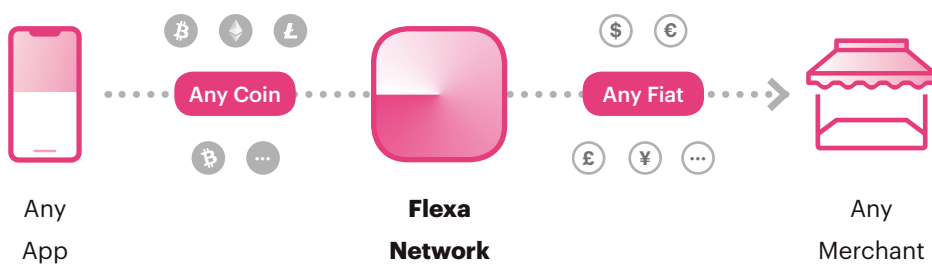
Product

Introducing Flexa

Flexa is an open network for enabling instant cryptocurrency payments in stores and online, allowing merchants to receive secure cash deposits via their existing points-of-sale.

Scalable retail payments for any app


| Any App | Flexa Network | Any Merchant |

Flexa is designed to facilitate payments from any wallet, in any coin, to any merchant, across the globe. Flexa's network is already integrated with many high-profile merchants, offering instant acceptance of potentially hundreds of cryptocurrencies to developers all over the world.

The vision for this new network is to become the open, seamless standard for cryptocurrency payments in physical retail.

Flexa will enable developers to integrate retail cryptocurrency payments within their own apps. By creating the most simple, direct network, Flexa enables broad cryptocurrency acceptance with the least complexity— no longer requiring the variety of payment gateways, processors, associations, and financial institutions.

Sample Flexa transaction flow
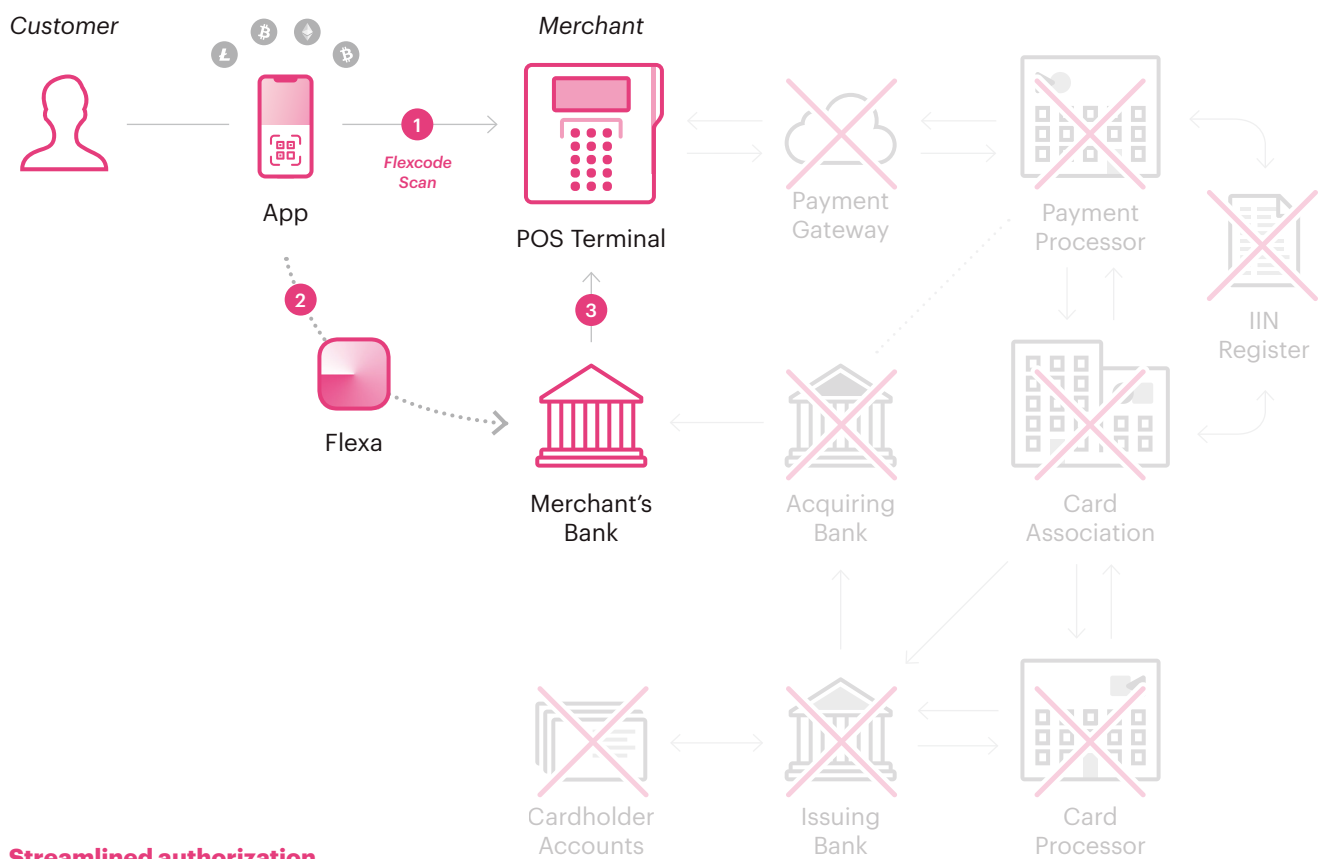
Streamlined authorization, clearing & settlement

1. A customer scans their app at merchant POS for payment in any cryptocurrency supported by Flexa.

2. The app requests the current conversion rate for the customer's desired cryptocurrency, and submits a blockchain transaction via Flexa.

3. The Flexa network transmits a one-time authorization code (FPAN) in real time to authorize the transaction on the merchant's POS terminal, then pushes fiat funds to the merchant's bank account. The customer's purchase is complete.

The Flexa payment experience

Flexa payments are designed to be as simple as possible. With just a single tap and scan, Flexa verifies your cryptocurrency balance against a public index rate and generates a proprietary flexcode for payment.

Because Flexa payments do not require NFC (like traditional payment cards), they are not restricted by Apple's requirements for payment cards to be loaded into the Wallet app, nor by tap-to-pay (contactless) implementation timelines or transaction limits. This greatly reduces the network's risk as compared to other cryptocurrency payment solutions.

A Flexa transaction has two primary components, which are delivered to client apps through the Flexa Wallet SDK:

- The first is called an **FPAN**, or flexible primary account number, which is a one-time authorization that allows a merchant to debit local fiat currency against the selected cryptocurrency wallet balance.

- The second is called a **flexcode**, which is a proprietary and backwards-compatible barcode format that is scannable by standard point-of-sale barcode readers. Each flexcode conveys the FPAN with any user-authorized metadata through the merchant's point-of-sale system.

Because all Flexa transactions use the same authentication process for payments, they represent the only interface that is just as secure—and just as usable—whether used in stores or online.

Online Flexa transactions will make use of identical FPAN provisioning mechanisms and back-end integrations. In fact, online Flexa transactions will differ from physical Flexa transactions only in their form of approval. Instead of using a flexcode, virtual Flexa transactions will relay an FPAN via an account-linked device.

Principles for network development

Flexa has presented six principles for the network, representing our vision for its ongoing development and sustained platform growth.

In order to become a trusted, public cryptocurrency payment rail, we believe that Flexa must be:
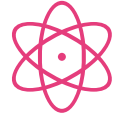
Compliant	Secure	Instant	Open	Simple	Useful

We present these principles to help guide the development of Flexa, and we hope to build trust and transparency with the blockchain community by articulating them as the ongoing intentions guiding the network:

Compliant

We designed Flexa to support local compliance requirements and data protection regulations. Notably, unlike alternative solutions for institutional cryptocurrency payments, the network does not require Flexa or third parties to act as custodian of funds; the technology functions as a direct payments processor without volatility exposure for merchants.

Secure

The Flexa network has been designed with open-source, end-to-end encryption for resilience from man-in-the-middle attacks and other forms of surveillance or tampering, and exposes only non-sensitive information in the course of completing a transaction.

⚡ Instant

Flexa is the only network to offer instantaneous conversion of cryptocurrency via direct bank deposits at merchant point-of-sale, regardless of block time. End users need only one tap to authorize payment, with transactions (confirmed by point-of-sale) currently measured at less than a second. Flexa transactions are designed to be the absolute fastest payment solution available in the world.

🌐 Open

Flexa is designed to enable the free and open use of cryptocurrency at retail. The network will be accessible to a wide variety of developers and merchants around the globe. To support this widespread acceptance, the network community need only stake Flexacoin. Therefore, Flexa requires no proprietary license or gateway in order for developers to integrate their wallet or transmit cryptocurrency transactions.

📎 Simple

From tap to transaction, Flexa supports simple, straightforward API methods for exchange and payment. Because the network is not reliant on existing payments infrastructure, payments are pre-authorized in a single message, enabling authorization signatures and settlement to be combined into one fraud-resistant transaction. Flexa's simplicity of integration, operation, and settlement makes cryptocurrency payments easy for merchants and their customers alike.

⚛️ Useful

Finally, Flexa is designed to be backwards-compatible with existing POS systems, and as interoperable with as many partners and platforms as possible. We have developed the Flexa network toward broad accessibility and widespread acceptance—starting with the very first apps on the network, which take advantage of existing POS integrations and require no new hardware or merchant upgrades.

People

Our team

The people behind Flexa combine more than twenty decades of experience in technology, retail and payments at American Express, Bloomberg, the MIT Media Lab, NASA, Starbucks, and Warby Parker.

Tyler Spalding
Co-Founder

Tyler has founded and invested in various blockchain projects since 2011. He was previously the CTO of Raise, Co-Founder and CTO of Tastebud Technologies, and an Engineering Lead with the United Space Alliance, US Air Force, and NASA's Space Shuttle Program. He holds two Masters degrees from MIT and UIUC.

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Trevor Filter
Co-Founder

Trevor began his career at the MIT Media Lab, and has been designing award-winning, customer-centric experiences for over a decade. He was previously Head of Product & Design at Raise, Head of Product at Slide Network, and a Senior Product Manager at American Express. He holds a Bachelors from MIT.

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Zachary Kilgore
Co-Founder

Zach has more than eight years of experience engineering front-end and back-end software platforms and infrastructures for payments and mobile. He was previously an Engineering Manager at Raise, Director of Engineering at Slide Network and a Front-End Engineer at Warby Parker. He holds a Bachelors from Duke University.

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Daniel C. McCabe

Co-Founder

Daniel has 20 years of experience across finance, technology, and private equity law. He was formerly a partner at Greensfelder and holds a JD from the Chicago Kent College of Law with a Bachelors from Northwestern University.

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Ryan Records

VP of Partnerships

Ryan led the creation, rollout, and consumer growth strategies for the Starbucks mobile app, one of the most successful mobile payment platforms in the world. He holds a Masters degree from Washington State University.

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Caitlin Skulley

Sr. Director of Merchant Dev.

Caitlin built and grew the merchant B2B program from the ground up for a leading payments distributor, and boasts nearly 20 years of experience in client services. She holds a Bachelors degree from Colby College.

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Alex Disney

Blockchain Engineer

Alex is a blockchain engineer with ten years of experience developing cryptocurrency mining and trading operations at DRW. He implemented EIP-758 for Parity and holds a Bachelors degree from UIUC.

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Chris Pick

Software Engineer

Chris is a financial software engineer with seven years of experience building distributed data storage and analysis systems and infrastructure at Bloomberg. He holds a Bachelors degree from UIUC.

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Advisors

To guide the growth and scale of our products, we have also assembled a group of talented individuals across blockchain development, consumer retail, hardware, machine learning, marketing, and payments. Our advisors bring the experience of leadership positions with some of the most notable companies in the world, including:

Amazon.com	**Google**	**Tesla**
American Express	**Mastercard**	**Venmo**
Apple	**Nike**	**Visa**
Capital One	**PayPal**	**Walmart / Store No. 8**
Citigroup	**Pinterest**	**Warby Parker**
ConsenSys	**Samsung**	

Payments, financial services, and blockchain

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Retail, hardware, and consumer partnerships

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Background

The present state of digital payments

Digital payments take many forms around the world and move a collective 10 trillion USD each day.[13] The majority of these transactions are conducted using one or any combination of three instruments:

Direct bank transfer	**Payment cards**	**Mobile wallets**
e.g., SWIFT, Fedwire, ACH	*e.g., Visa, American Express*	*e.g., Apple Pay, Google Pay, Alipay*
Global and domestic bank clearing networks that move 3.6 quadrillion USD in 102 million transactions per year[14]	Plastic cards leveraging credit and debit networks to move small purchases of 26 trillion USD in 257 billion transactions per year[15]	Mobile apps that proxy traditional payment instruments to move more than 8 billion USD in 300 million transactions per year[16]
Common throughout Europe for all transaction sizes, and in the US and Canada for large and commercial transactions	Common in most geographies throughout the world for small transactions, especially the US, Canada, Europe, and Asia-Pacific	Common in Asia-Pacific for all transactions (via bank transfers); gaining broad acceptance in the US, Canada, and Europe

Direct bank transfer

In general, non-cash payment instruments are underpinned by a traditional account held at an insured financial institution, such as a commercial bank or credit union. Whenever money is exchanged via one of these payment instruments, whether electronically or by an offline ledger, it is ultimately transmitted between financial institutions. To reconcile these payments, a variety of domestic and international standards are used for direct bank transfer between businesses and consumers (also sometimes called "electronic funds transfer"), such as ACH/IAT, CHIPS, SWIFT, RTGS, Fedwire, BEPS, NEFT, and KFTC.

Despite their ubiquity, each of these systems rely on legacy infrastructure that remains vulnerable to fraud and transaction inefficiencies.

Legacy infrastructure

The underlying technology of the global financial network is difficult to navigate, consisting of a variety of incompatible legacy protocols and standards; many of the current electronic settlement systems have remained relatively unchanged for 40 years. For instance, Automated Clearing House (ACH) transactions in the United States are still conducted via fixed-width text files (with precisely 94 characters per line), uploaded to various FTP servers and downloaded at specific times of day for settlement. Until 2016, these transactions cleared the following business day, when NACHA announced an update allowing for same-

Daily processing volume

SWIFT
5 trillion USD[17]
30.7 million transactions[18]

Fedwire
2.1 trillion USD[21]
528,000 transactions

CHIPS
1.4 trillion USD[21]
430,000 transactions

ACH
120 billion USD[19]
70.1 million transactions

day payments.[20] This "upgrade" involved no changes to the underlying specification; rather, banks were required to process transactions twice instead of once daily.

Other clearing systems include the Society for Worldwide Interbank Financial Telecommunication (SWIFT); the New York Clearing House Association's CHIPS network; and the Federal Reserve's Fedwire network. Each involve substantially more robust checks and balances than ACH and benefit from greater speed, increasing the complexity of the global financial system. Together, these systems transmit a staggering 3.6 quadrillion USD in global volume.[21]

Fraud vulnerability

Despite the additional supervision involved in these ledger systems, their protocols and networks are vulnerable to fraud. In a 2016 survey of the largest financial institutions, "cybersecurity concerns" was the most-responded challenge that bank executives said they faced in their day-to-day role,[22] and many such instances of theft have recently become public.

In 2016, thieves made off with 81 million USD by impersonating Central Bank SWIFT operators.[23] Throughout a single weekend, they routed four transactions through the New York Fed's mostly automated system, moving 101 million USD from Bangladesh to the Philippines. It was only when a New York Fed official caught a thief's misspelling of the beneficiary name that they were able to alert Bangladesh Bank officials and prevent the transit of an additional 920 million USD.

In 2018, a larger heist was discovered involving the Punjab National Bank and promissory "letters of understanding" issued through SWIFT, where funds were laundered by using a password provided by bank officials for direct access to the SWIFT network.[24] Letters of understanding were issued for the equivalent of nearly 1.77 billion USD, and they were not correlated with the lesser amount that was registered via SWIFT in the bank's holdings. Despite repeated warnings against fraudulent SWIFT messaging from the deputy governor of the Reserve Bank of India, the scam went undetected for nearly seven years.[25]

Transaction inefficiency

Despite the underlying fraud vectors, funds transmitted over SWIFT, Fedwire, CHIPS, and ACH incur costs of approximately 18 billion USD every day.[26] Additionally, transfers require three to five days for settlement, and up to 4 percent of payments fail due to technical reasons.[27]

The blockchain could potentially offer several enhancements in these systems, namely cryptographically secure transactions, immutability, and data redundancy. For instance, Ripple, a prominent US startup, allows financial institutions to quickly settle cross-border payments using its xCurrent network, claiming a 60 percent reduction in net cost.[28] Remittance providers such as Western Union and Moneygram have also piloted using native Ripple blockchain tokens (XRP) for settlement.[29] Using products such as these, we believe that blockchains have the potential to influence well beyond the primary layer of the global financial network.

Payment cards

Direct bank transfers are just one of the several steps involved in conducting a standard transaction with a payment card (e.g. a credit or debit card). In practice, the payment card authorization and settlement framework implemented throughout the United States and Europe involves the coordination of no fewer than six parties in order to transmit and guarantee funds.

Although payment cards offer universal acceptance and consumer benefits, they are prone to many single points of failure as well as the rising costs of fraud and incentive fees.

Many single points of failure

The companies involved in payment card processing serve mutually exclusive roles and extract a share of the transaction fee. This fee is called "interchange," and has been variously regulated by the European Union (Interchange Fee Regulation, April 2015), and the Federal Reserve (Durbin Amendment, July 2010).

Payment cards also mandate a secondary network provided by entities called "card associations." Card associations work with payment processors to conduct the three broad stages of a payment card transaction: authorization (verifying funds in accounts on either side of a transaction), clearing (transferring funds between banks after the exchange of goods or services) and settlement (paying a merchant).

Daily processing volume

Union Pay
41 billion USD[30]
105 million transactions[31]

Visa
20 billion USD[32]
305 million transactions

Mastercard
12 billion USD[33]
184 million transactions

American Express
3.2 billion USD[37]
19.8 million transactions

JCB
731 million USD[37]
8.1 million transactions

Discover
466 million USD[37]
6.4 million transactions

In order to accept payment cards, merchants incur disproportionately high processing fees which are often one of their largest operational costs.

In 2012, responding to these rising processing fees, some of the largest merchants in the US—including Walmart, Target, Best Buy, CVS and 7-Eleven—created a cooperative organization called Merchant Customer Exchange (MCX), with the charter of developing an ACH-backed payment instrument to avoid interchange fees.[34] After three years of continuous merchant investment and delayed development, the MCX mobile app never exited a pilot phase. Although it was successful at reducing merchant costs of processing, MCX was never able to deliver a compelling consumer value proposition. In 2017, JP Morgan Chase acquired the MCX technology to integrate with its existing Chase Pay system.

In the past decade, payment card processing fees have skyrocketed for two main reasons: first, because of an increase in fraud, including losses that are paid by issuing banks when they reimburse their customers for unauthorized charges; and second, because of the consumer demand for better card benefits and rewards on high-end credit card products.

Rising costs of fraud

EMV (Europay Mastercard Visa) chip cards have found mainstream adoption in Europe, Asia and the US, but payment card fraud in aggregate has continued to rise. Despite broad acceptance of the card-based technology, 2.8 million fraudulent accounts were created in 2018,[35] and account takeovers cost merchants 5.1 billion USD.[36] Additionally, transactions made online (i.e., "card-not-present") have seen fraud losses increase more than 100 percent since the introduction of the EMV standard.[37] Chip-enabled cards have subsequently increased payment security, but are still vulnerable to man-in-the-middle attacks, especially when merchants don't upgrade their systems to support encrypted transaction data from EMV-capable terminals. Cards can also be cloned from unsophisticated account enumeration, physical card skimmers, RFID readers, or simply a restaurant waiter with a cell phone camera.

In 2016, the total fraud losses for payment cards worldwide was estimated at 22.80 billion USD,[38] with 46 percent of all US citizens reporting card fraud within the past five years.[39]

Recently, the rate of identity theft has soared, with more than 1,500 corporate data breaches,[40] including the theft of 143 million credit reports from Equifax[41] and 40 million credit card numbers from Target.[42]

Yahoo—now part of Verizon—also revealed that hackers obtained the personal information of its entire database of 3 billion worldwide users during an attack in 2013.[43]

Incentive fees

Credit card rewards points also contribute to the high fees incurred by merchants to accept these payment instruments. Originally introduced by American Express in 1991,[44] these points have since become a cornerstone of consumer marketing for major credit card products. Today, travel and dining bonuses have become extremely competitive for the major credit card issuers: Chase, Capital One, and American Express are each vying for coveted "front of wallet" placement by offering up to 5× points or five percent cash back on various purchase categories.

As a result, many industries have developed to help the affluent consumer "optimize" their spend for maximum returns, perhaps without realizing that the true cost of these rewards is subsidized either by the small merchant businesses (which lack the required leverage to negotiate more affordable interchange rates), or the other payment card consumers who finance debt through high monthly APR interest. Many small businesses ultimately choose to avoid payment cards altogether and revert to cash-only transactions, putting them at a significant consumer disadvantage.
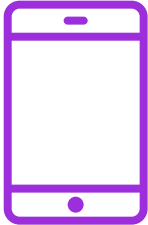
Mobile wallets

More and more, third-party mobile wallets are becoming mainstream payment instruments, capitalizing on their ability to aggregate various aspects of bank accounts and payment cards and offer even more consumer choice and convenience. While some (like Apple Pay, Google Pay, and Samsung Pay) simply serve as vehicles for virtual cards by proxying existing payment cards' primary account numbers, or PANs; others (such as Alipay, WeChat Pay, PayPal, Venmo, Square Cash, and Apple Pay Cash) have built a suite of value-added services and integrations on top of what is essentially a stored value account.

Many of these mobile wallets have seen substantial growth in recent years—especially in China—but their traditional payment instrument underpinnings present limitations on the ability to provide meaningful incentives, grow internationally, and manage fraud vulnerabilities.

Limited incentives

Today, even the largest and most successful mobile wallet apps and services enable the vast majority of their transactions by proxying an underlying insured or regulated payment instrument, such as a bank account or payment card. By functioning as this abstraction layer, services like Apple Pay and PayPal are able to offer value-added features like enhanced security or purchase protection, but are limited in their ability to provide unique incentives or sustainable bonus structures beyond what the underlying instruments already support natively.

Daily processing volume

Alipay
4.7 billion USD[45]
175 million transactions

WeChat Pay
3.3 billion USD[46]
130 million transactions[47]

PayPal (incl. Venmo)
425 million USD[48]
8.3 million transactions[49]

Paytm
55 million USD[50]
11 million transactions

International incompatibility

Moreover, mobile wallets have seen substantial growth in markets without entrenched financial institutions. For example, in the absence of traditional, credit-based payment infrastructure throughout China, companies like Alipay and WeChat Pay have built a direct system that facilitates mobile transactions on a private payment network over the internet. The rapid growth of these platforms—in terms of both scale and versatility—is impressive. But because the underlying financial infrastructure is still provided by domestic financial institutions, international growth is encumbered by the overhead of adapting these systems to foreign banks and exchanging currencies.

Outside of payments, the major value in third-party mobile wallets is their usefulness for internal or peer-to-peer transactions via network effects. Many people join Alipay, WeChat, Venmo or Square Cash because their friends are there, or because it's easier to send money to a phone number or username than it is to share account numbers. These features build community, but ultimately limit platform growth to these regional groups because users have limited incentive to interact internationally.

Fraud vulnerability

Mobile wallets are essentially an interface to existing payment instruments, which can make them vulnerable to certain types of fraud. By storing many payment instruments behind a single online account and password, these apps create an opportunity for account takeovers, which in 2018 amounted to 5.1 billion USD in losses.[51] Many apps also distinguish between peer-to-peer payments and payments for goods and services because of their inability to mitigate buyer fraud, such as chargebacks and ACH returns.

For example, due to its ACH underpinnings, Venmo's terms and conditions explicitly warn against using the app for retail payments. When a fraudster reverses an ACH transaction used to load a Venmo account, the company is forced to reverse the transaction within its own ecosystem, sometimes by directly debiting beneficiaries' bank accounts.

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