

The Big Question

Alipay's Financial Revolution

A Weekend in Bitcoin City

Q&A with Stripe's Patrick Collison

Starbucks's Mobile Bet

M-Pesa Tries to Branch Out

The Future of Money

From Apple Pay to Bitcoin, payment technology is changing. Some of the big winners in this "revolution" may be the old guard.



DANIEL ZENDER

The Big Question

Technology Repaints the Payment Landscape

As technology-driven payment ideas give cash a run for its money, the big winners could be established banks and credit card companies.

● In developed economies, money has been digitizing for decades. Few Westerners touch a paycheck anymore. Through direct deposit, digital money is transferred electronically from our employer to our bank account every pay period. A similar process moves contributions into our 401(k) accounts or zaps money over to pay the rent, the utility bill, a student loan, or any other expense.

Yet it remains a cash-based world, with 85 percent of consumer transactions worldwide done with bills and coins. While some countries, like Singapore and the Netherlands, now use cash in a minority of payments, consumers in such diverse economies as India, Mexico, Italy, and Taiwan still execute more than 90 percent of transactions with cash, according to research by MasterCard Advisors. Even in the United States, they find, cash accounts for 55 percent of payments. New technologies, including digital wallets, cryptocurrencies, and mobile peer-to-peer payments, aim to tip that balance. They're accelerating the move away from cash in countries where alternatives to banks and credit cards are well established, and they're doing the same in developing economies.

Which technologies and companies are likely to lead this transformation is the big question for this Business Report.

One way to look at these new technologies is through their relationship with the long-established payment services. Some technologies, including the

mobile wallets Apple Pay and LoopPay, run on top of the existing payment networks owned and operated by banks and credit card companies. The new technologies are designed to make those established systems faster, more convenient, or more secure, and to convert transactions now being done in cash. A different group of technologies would replace the established systems with new ones, fundamentally challenging the vast industry that executes, guarantees, and tracks payments. Among them: Venmo, a person-to-person payment app and social network that processes \$3 billion of payments a year, and Dwolla, an upstart in Iowa looking to cut the payment-processing revenue enjoyed by Visa and other networks.

As technology drives a shift in how we buy things, the revenue that the payments industry extracts could grow to more than \$2 trillion a year by 2023, double the 2013 figure, the Boston Consulting Group predicts. Much of that increase will come from a reduction in cash payments in developing countries. But across the globe, BCG predicts a time of "disruption and opportunity" driven by digital technologies that will require the existing credit card system to prove that it's better than its new competition.

"The smartphone is the catalyst for a lot of change in this industry," says Dana Stalder, a venture capitalist with Matrix Partners and a former eBay and PayPal executive now on the board of Poynt, which recently introduced a smart credit

card terminal. Venture capitalists invested over \$2 billion in payment technology firms between January 2013 and June 2014, according to the data tracking firm CB Insights.

However, established players, especially the banks and credit card companies that handle most noncash payments today, have, if anything, seen their positions strengthened by recent developments. A good example is the high-profile launch of Apple Pay. Unlike earlier technologies like Google Wallet and PayPal, Apple Pay makes no attempt to supplant the Visas and Bank of Americas of the world. Look at your digital wallet in Apple Pay and you see a version of exactly the same card that's in the wallet in your pocket. The

\$2 billion

VC investment in payment tech

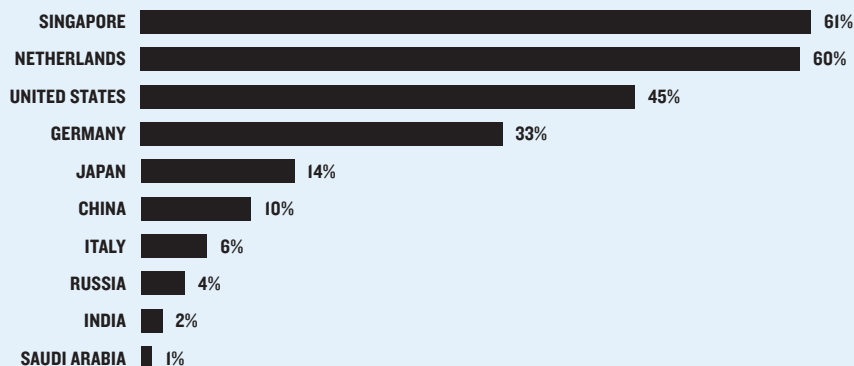
digital wallet LoopPay, which can be used in many more terminals than Apple Pay because it uses a simple, widely compatible copper loop technology to simulate the coding in your credit card's magnetic strip, similarly relies on the existing credit card system.

"Think about the infrastructure and how long it took to create that," says LoopPay CEO Will Wang Graylin. "It's very difficult to change merchant behavior."

Innovation in payments might be especially likely to take hold in the devel-

The Surprising Persistence of Cash

Estimated percentage of consumer payment transactions done with noncash methods, including credit cards, checks, and electronic payments.



oping world, where cash is still king. Leapfrogging ATMs and checks the same way they have skipped over landlines and cable, whole chunks of population are moving straight from cash to mobile money. M-Pesa, which has become a force in Kenya and Tanzania, has turned money into a cellular currency that can be converted into airtime or used to pay for things. Today, some 60 percent of Kenyan adults have used a mobile phone to receive or send payments.

What could derail the boom in payment technologies?

Security concerns. The consulting firm Accenture recently surveyed 4,000 consumers in North America and found that while more people expect to use mobile payments, 57 percent of respondents were concerned about the security of such transactions. That's up from 45 percent two years ago.

New approaches could help. Apple Pay, Google Wallet, and others utilize a system that creates a one-time digital token for each transaction and sends that, rather than a customer's credit card information, through the system.

Innovations like this show that mobile payments—even if they don't lead to a radical shake-up—are improving a global payment ecosystem that's long been due for an upgrade. —*Nanette Byrnes*

Case Study

Alipay Leads a Digital Finance Revolution in China

What started as a service to help customers buy goods from Alibaba retailers has grown into a serious finance business all its own.

● Not many years ago, Jane Yang, a 26-year-old civil servant in Beijing, paid her landlord in three-month installments

with a stack of 100-yuan notes. To pay her utilities—water, electricity, and home Internet—she went to three separate banks, where she handed cash to a teller. The process was “very time-consuming and irritating,” she remembers. Even as

“[Alibaba and Alipay] are integral to each other's success. But I wouldn't be surprised if, in the long term, Alipay turns out to be the more important business.”

—Ben Cavender, China Market Research Group

skyscrapers and gleaming shopping malls cropped up around China's capital, most middle-class residents had never seen or used a simple checkbook.

Today she uses the Alipay app, China's most popular online payment service, on her smartphone to transfer money directly to her landlord's account. She pays for her utilities and her mobile-phone account through Alipay as well. Yang even keeps savings in her Alipay Yu'e bao money market account, where money accrues higher interest than it does in a traditional bank account. Yang hadn't set out to deliberately overhaul her financial habits, but new mobile technology, she says, “made so it easy.”

As of October 2014, Alipay had more than 300 million registered users in China (and 17 million overseas), according to the most recent figures the company has made public. Many, like Yang, originally set up accounts in order to shop at parent company Alibaba's wildly popular retail sites Taobao.com and Tmall.com, where everything from designer clothes to pet food is for sale. The Alipay payment system works much like PayPal, except that funds are held in escrow and are released when the goods arrive in satisfactory fashion. In a society where consumers have learned to be wary of false advertising and fake products, Alipay's escrow system helped ease consumer fears—and gave Alibaba's retail sites a crucial early advantage over rival eBay.

Today Alibaba's sites sell \$300 billion worth of goods annually, dwarfing sales on eBay and Amazon combined. The

company, which unlike Amazon doesn't actually stock and sell the merchandise on its sites, held its initial public offering on the New York Stock Exchange in September, raising \$25 billion, the largest debut ever.

Alibaba and Alipay, which has been incorporated as a separate company since 2011, helped drive the very rapid expansion of online sales in China—now the world's second-largest “e-tail” market. McKinsey Global Institute estimates that by 2020, Chinese e-tailing could generate as much as \$650 billion in sales, and China's market “will equal that of the United States, Japan, the United Kingdom, Germany, and France combined today.”

As much as Alibaba has driven China's booming e-commerce market, it's possible that Alipay will ultimately have the bigger impact on the Chinese economy. Alibaba and Alipay “are integral to each other's success,” says Ben Cavender, principal at China Market Research Group in Shanghai. “But I wouldn't be surprised if, in the long term, Alipay turns out to be the more important business—it's so flexible and has so many potential uses.”

Alipay debuted as a simple e-payment system, but it's now a destination app (and website) in its own right. In addition to easing consumers into online shopping, Alipay, with its huge built-in user base, has recently made a range of financial services available to people who previously lacked easy access to money market accounts, small business loans, and tools for making payments.

As the Chinese fast become accustomed to banking on their phones, Alipay faces new competition from alternatives like Tencent's Weixin Wallet function, which enables mobile payments.

“In China today, it's technology companies that are driving innovation in

mobile payments,” says Zennon Kapron, a financial technology and digital currency expert in Shanghai. Traditional banks and the government are not the main actors.

Between July 2013 and June 30, 2014, Alipay handled \$778 billion (4.8 trillion yuan) in transactions, according to the company. It is able to process more than 10 billion transactions per day. During the popular “Singles’ Day” annual sale—which is like Black Friday in the U.S. but on overdrive—Alipay handled up to 2.85 million transactions per minute, and 54 percent of its transactions are made via mobile device.

Alipay’s back-end technology is similar to that of PayPal, Kapron says, but on the front end the user’s experience is quite different. PayPal is best known as a payment option, a screen you may reach at the end of a transaction on a retail web-

site, but with Alipay, customers can go directly to its app and website to make payments, check their investments, or buy movie or plane tickets. The presentation, says Kapron, is suited “for people who have quickly gotten used to using their mobile phones for everything.”

With these new mobile payment technologies, China has leapfrogged both checkbooks and desktop banking. Jane Yang, for example, went straight from paying rent in cash to paying via Alipay. According to PricewaterhouseCoopers, 79 percent of Chinese consumers surveyed said they were happy to receive coupons via their mobile devices, versus just 53 percent globally. And 55 percent of Chinese consumers said they expected their phone to be the main way they made purchases in the future, versus 29 percent globally.

This is a remarkable turnaround for a country that for years seemed to be stuck in a far earlier, low-tech era of consumer financial services. “The banks did nothing to make customer service easy,” says Cavender, who notes that for many years paying a credit card bill required standing in line at a bank. It could not be done through the mail or online. Only those who had significant funds to invest and lived near large bank branches had easy access to wealth management options.

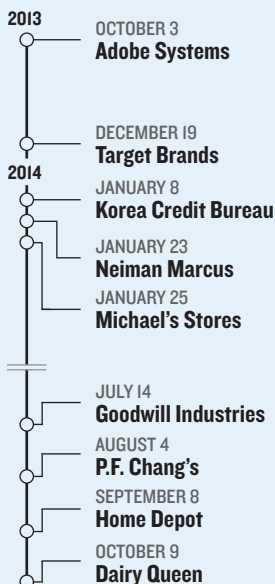
These changes coincide with rising overall incomes in China, and with the government’s desire to build a more consumer-based society, observes Tjun Tang, senior partner and managing director at Boston Consulting Group’s Hong Kong office. “In uptake of digital finance, China is probably leading the world right now,” he says. —Christina Larson

Hacking Payments

Attacks that come in many forms are yielding more records and doing real damage.

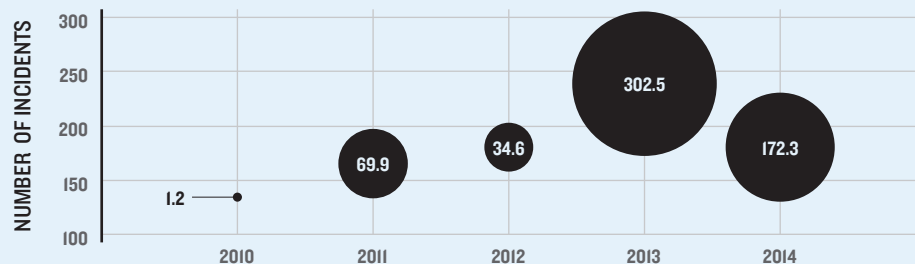
Incidents

Some of the most notable large-scale breaches of card information, by day of announcement.



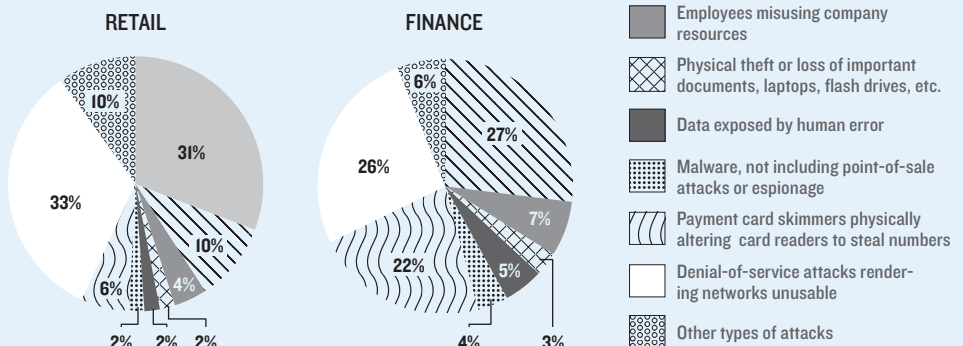
Impact

Records, in millions, exposed in incidents involving stolen payment card data in retail and finance. Includes breaches publicly disclosed in English-language media reports, government sources, and online forums.



Method

Types of major industry security incidents from 2011 to 2013. Incidents may include theft of non-payment information.



Technology

A Weekend in Bitcoin City: Arnhem, the Netherlands

Is it possible to live for 48 hours on nothing but Bitcoin?

● Propped up next to me on the red sofa in my room at the boutique Hotel Modez in Arnhem, the Netherlands, my iPad has its screen on the Bitcoin exchange Bitstamp.net, and the value of the cryptocurrency is dropping, moment by moment. At breakfast one bitcoin had been worth over \$400, but the value has been sinking for the past 30 minutes and has now hit \$383. I know I'm blowing it.

When the price of a bitcoin tumbles by another \$10, I am unwilling to risk any further losses. My stomach sinking, I head to reception to pay my bill. My exchange rate later turns out to have been near the day's low, and I feel like a sucker.

For the vast majority of Bitcoin holders—and the billions of people who have never even heard of the digital currency—such fluctuations may not seem like a big problem. But for me, sitting in the Hotel Modez, it was very real: I'd committed to paying for a room, priced in euros, with Bitcoin. As I waited, and the exchange worked against me, my bill had grown increasingly expensive.

Such is the state of affairs in the volatile world of cryptocurrencies—where regulation is a distant concept and large market swings are commonplace. Because it's hard to trace, Bitcoin has become common currency for criminals, but the list of legitimate companies accepting it as payment—or planning to—is growing to include the retailers Overstock and Newegg and the mainstream travel site Expedia, among others. Homes have been purchased with Bitcoin, which leans heavily on cryptography and a public led-

ger system called the blockchain. So has a hoped-for trip to space.

A rising number of people report or anticipate transacting in Bitcoin, and advocates see great potential in the currency for lowering the transaction cost of payments while increasing their security. But for Bitcoin to survive as a functional currency, it has to be widely accepted and useful in the way cash and credit cards are today. Retailers will need a reason to accept it—because of the lower costs, perhaps—and consumers will have to be convinced it's no more of a hassle than paying by conventional means. Can Bitcoin pass that test?

To find out, I had come to Arnhem, a place with one of the highest concentration of merchants accepting Bitcoin anywhere in the world. My experiment: Could a journalist plan a weekend escape paid for entirely with Bitcoin? Further, could he not only survive but perhaps even enjoy himself?

Arnhem's friendliness to Bitcoin has much to do with Patrick van der Meijde, a 36-year-old resident of this city of 150,000 located on the Rhine. Van der Meijde heard about Bitcoin a few years ago. Finding the concept intellectually interesting, and figuring that the traditional banking system could use competition, he decided to buy some. As his cache grew, he realized it wasn't so use-

any of the money. So eight days before I set out for Arnhem, I opened an account with a Boston-based startup called Circle that would let me buy bitcoins with a credit card.

Next, I logged onto CheapAir.com, one of a few companies that will let you book flights using Bitcoin, and bought a ticket flying KLM to Amsterdam from Munich. At the payment page I chose the option to display a Bitcoin address—a 25-to-34-character string of letters and numbers—to which I could send my payment. I then logged into Circle again to buy enough bitcoins to cover the ticket, but the transaction was immediately denied. After a call to my bank to explain that the charge indeed was not fraudulent, I tried again. This time I bought \$450 worth of bitcoins, safely within Circle's \$500-per-week credit card limit. The transaction went through instantly.

Proud of being a part of the future, I went to Circle's payments page, entered the Bitcoin address from CheapAir, and keyed in the \$450 listed as the cost of my ticket. Almost instantly CheapAir's website updated—to tell me I'd sent the wrong amount. What?

Was this a scam? I had taken screenshots at a few phases of paying, so I did a quick post-mortem and realized I'd made a beginner's mistake: CheapAir's price

Bitcoin has become common currency for criminals, but the list of legitimate companies accepting it for payment is growing.

ful if he couldn't use it to buy things. So, with two partners, he set up a payment system local vendors could run—on their phones or any other connected device, like a laptop or tablet—allowing the owners to accept Bitcoin but be paid in euros. Van der Meijde has now convinced 45 businesses to accept Bitcoin, including a hotel and a major franchise grocery store.

Step one: Buying the plane ticket

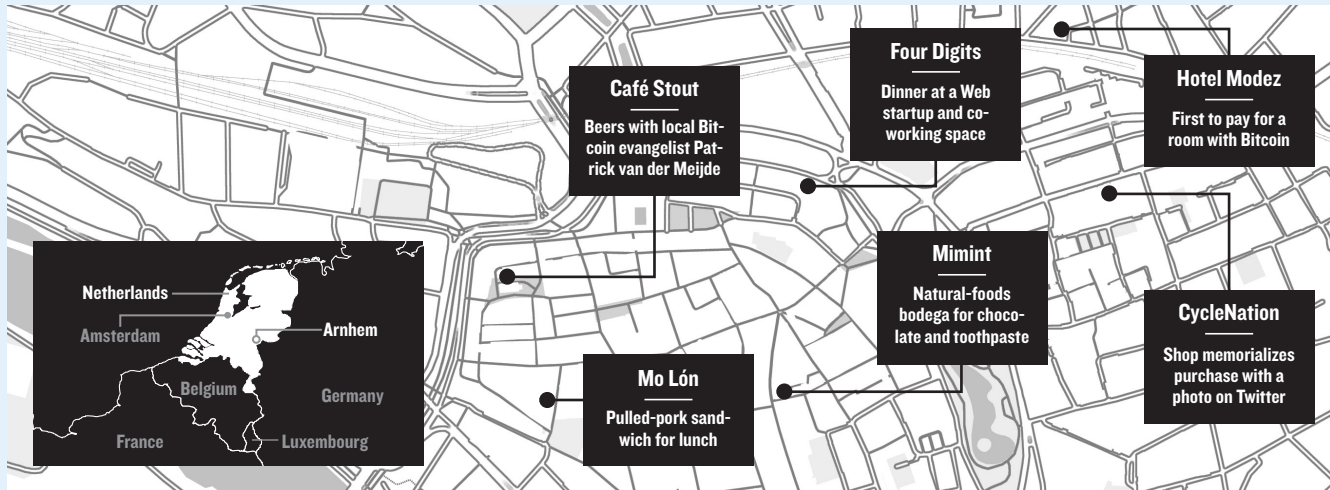
Though I was familiar with Bitcoin, its genesis, its technical underpinnings, and its controversies, I didn't actually own

was listed in dollars with the equivalent in Bitcoin, so I'd also entered my payment via Circle in dollars. It felt like the intuitive thing to do—but it was wrong. Whether because of the volatility of Bitcoin or the fact that there are multiple exchanges to price it and they rarely match up, the payment I had sent was roughly \$1.60 short.

I started making calls. Charlie at Circle, stumped, suggested a do-over. Gemma at CheapAir was sure we could resolve the problem but insisted, "Only our CEO has access to the Bitcoin stuff."

A Bitcoin Weekend

Highlights of 48 hours living on cryptocurrency



She told me to wait for CEO Jeff Klee to get in for the day—and he’d take care of it for me.

About an hour later, I received an e-mail confirmation for my flight. “Do I owe you five bucks or something?” I asked Gemma when I called her back. “Don’t worry about it,” she said. “It was easier to just issue the ticket.”

Using Bitcoin for everyday purchases was proving more difficult than paying with a credit card.

Step two: Bitshock

A part of me expected Arnhem, about an hour from Amsterdam by train, to feel like a high-tech hub. But instead it resembled any typical European city. It had a few churches, a central pedestrian area filled with shops, and a handful of antique Dutch windmills. After checking into Hotel Modez, where the bubbly owner said I would be the first customer to pay in Bitcoin (something I’d hear a few times over the weekend; at the CycleNation bike shop a bemused employee took a photo of me at the register and posted it to Twitter), I met up with van der Meijde at a bar named Stout to chat over a beer.

“With Bitcoin?” said the gray-haired bartender when it came time to pay. He knew van der Meijde’s face, as did others

in town: he is variously referred to as “this guy who is really into Bitcoin” or, more simply, “that Bitcoin guy.”

Payment itself was seamless: the bartender pulled up a QR code on his phone, van der Meijde scanned it using a Bitcoin wallet app called Mycelium on his phone, and the payment registered instantly. Later we repeated the process as I transferred Bitcoin directly to van der Meijde to cover my drinks.

A befuddled kid at the bar, of around university age, wanted to know what we were doing. “You mean I can buy drinks

Step three: Full Dutch crypto (mostly)

Over the next two days, guided by a map hosted on van der Meijde’s website, I did indeed spend nothing but Bitcoin—with fewer mishaps than early users of Apple Pay were reporting in the press at about the same time. At dinner I ate a massive pile of ribs and learned that tips in Bitcoin are handled much like tips using a credit card, with waiters paid out from the register. Another day, at a restaurant called Mo Lón, I ordered a heaping pulled-pork sandwich and scanned a QR code that the owner, a Bitcoin enthusiast, loaded on a

At Hotel Modez I was the first customer to pay in Bitcoin. At the CycleNation bike shop a bemused employee took a photo of me at the register and posted it to Twitter.

with this?” the kid asked. “Yes, of course,” said van der Meijde. Ever the evangelist, he helped the kid download a Bitcoin wallet—and then transferred five euros’ worth of bitcoins to him. The kid’s friend watched all this with a stunned look on his face. “Does Café ’t Huys take this?” the kid asked. When van der Meijde told him that the bar did, the kid bolted for the door with his phone, now a few milibits richer, clutched in his hand.

large LCD TV on the wall. At Mimint, a natural-foods bodega, I bought chocolate and toothpaste.

In only a few places did I encounter obstacles. At a souvenir shop I had to wait a few minutes for the owner to arrive, since he was the only one who knew how to accept Bitcoin. And at another shop I had some momentary Wi-Fi problems. I was turned away only once, at a small restaurant where the young woman work-

ing that day hadn't heard of Bitcoin. The cook, who was sitting at a table waiting for customers, said, "I've heard of Bitcoin, but I don't think we take it. Maybe the previous owners did?" (They were both surprised when I showed them the Bitcoin sticker affixed next to ones from MasterCard and Visa on the restaurant's window.)

One night, at van der Meijde's suggestion, I stopped by unannounced at a Web

45

Number of businesses in Arnhem that take bitcoins

startup and co-working space called Four Digits, where once a week around a dozen tech-minded folks in Arnhem get together informally to eat, drink, and geek out. A few of the people there were equal parts skeptical and excited by the idea of cryptocurrencies. Two of them discussed theoretical—but exceedingly unlikely—exploits that would let them rip off the point-of-sale application van der Meijde had helped design. The Indian delivery order they were eating had been paid for with Bitcoin, and as they split the bill, some were paying the purchaser back in Bitcoin, too.

"How much did dinner cost?" I asked.

"About half a bitcoin," someone said.

Step four: Ex post crypto

Though I mostly enjoyed the weekend, the getaway to Arnhem at times felt like a chore. I'd had to skip some cultural sites recommended by a friend from Amsterdam. The Hoge Veluwe National Park and its museum with works by van Gogh, Rodin, and Dubuffet don't accept Bitcoin, sadly.

Having exhausted most of the possible Bitcoin-ready diversions in town, I spent the last few hours of my visit, on a rainy Sunday, walking along the waterfront and through a park. I pined for a museum, or a bowling alley, or a film in a warm theater. Spending bitcoins had been easy, and ultimately—despite the snafu paying for the hotel—not that expensive. But the options had run out quickly.

And there was one exceedingly important thing I could not do: get out of town. The only way to travel between Arnhem and the airport using Bitcoin was to rent a car or hire a taxi—a multi-hundred-euro expense. By contrast, the train ticket to the same place, which was not payable by Bitcoin, cost only 17.10 euros. Even the very staunchest Bitcoin enthusiast would be unlikely to pay that kind of premium.

Knowing this, I had come to town with 18 euros in my pocket. I felt like I was betraying something or someone—perhaps Bitcoin's mysterious inventor, Satoshi Nakamoto—as I inserted coin after real-euro coin in the yellow ticket machine of the government-owned Dutch Railways. When the railroad accepts Bitcoin, I thought, we'll know that cryptocurrencies have truly arrived. —*Russ Juskalian*

Q&A

Increasing the GDP of the Internet

Improving payment technology is vital if Internet companies are to make an impact, says Stripe CEO Patrick Collison.

● When Apple launched its new payment service last October, it boasted of support from major partners such as American Express, Chase, and Macy's. But Apple had also spent months ahead of the launch working with a relative minnow in the world of financial technology: a four-year-old San Francisco startup called Stripe.

Stripe got started in 2010 selling tools that make it easy for businesses to add credit card payment functionality to a website or mobile app. It quickly earned a reputation for being friendlier to coders than more traditional payment processors, making it popular with app makers and a natural choice for Apple when it began designing Apple Pay.

Today, Stripe's products have expanded to include subscription billing services and an online checkout system. Customers include Walmart, Twitter, and the ride-sharing app Lyft. The company has received \$190 million from venture funders including PayPal cofounders Peter Thiel, Elon Musk, and Max Levchin.

In an interview with *MIT Technology Review's* San Francisco bureau chief, Tom Simonite, at his company's headquarters in San Francisco, CEO and cofounder Patrick Collison explains how he is trying to increase the small fraction of spending that takes place through e-commerce.

Payments processing seems like a fairly simple function. What makes it important?

Today the most exciting technology companies are the mobile marketplaces, companies like Airbnb and Lyft. Software is suffusing every industry and sector and market. As technology companies expand into more markets that have been traditionally offline, it's natural that business models are more about payments. Stripe is providing the infrastructure for the next wave of these companies.

Only 2 percent of commerce worldwide is e-commerce today. Why is that share so small?

There are major infrastructural deficiencies. If you're in Latin America or China and go to a website, it's almost guaranteed that you can't buy from it. By only accepting credit cards, which is what the majority of websites do, they're essentially restricting themselves to selling to North American and Western European buyers.

Even in the U.S., e-commerce only accounts for just over 6 percent of all retail. Is that a business problem or a technology problem?

It's absolutely a technology problem. Think of the places where you're likely to discover something that you want to purchase. You no longer stumble across it when you're walking down the high street; you find it in your Facebook or Twitter feed, on your phone.

But think about what you're supposed to do on a mobile device: click on the link, get bounced to some random e-commerce website, click "add to cart," zoom in, peck in your address and credit card number, and click on checkout. It's a 10-step process, and it might not even work at the end of it all. I can hand a dollar to somebody really easily in the store; it's really difficult for me to digitally hand them a dollar.

Apple Pay, which you worked on, seems to work well, and there are a lot of partners. But it's not very radical, is it?

I think Apple was quite aggressive on a number of points. Giving merchants a "token" versus your credit card number is a very important shift. If that business is compromised, you're not liable to any-

There's the difficulty of obtaining bitcoins. With Stellar you can use real, normal currencies in addition to digital ones. Transactions clear instantly. We backed this because we're in favor of anything that seems it might help us build a more ubiquitous, useful commerce infrastructure for the Internet.

Can you really make as much money as other high-margin software startups by taking a small slice of transactions you handle?

The economics of the business generally work better than people think. Look at PayPal's income statement and margins—they're really good. We're a technology provider and happen to bill for that as a function of the transaction volume, but that's an implementation detail of the

Something from Visa, MasterCard, or one of the big banks, perhaps?

No doubt you've guessed it's none of the above. Starbucks has emerged as the runaway leader in mobile payments at retail stores. Twelve million active users now pay for their Frappuccino with a wave of a phone. Of the \$1.6 billion spent via smartphone in U.S. stores in 2013, the company claims, a full 90 percent went to Starbucks, and most payments experts don't doubt it.

Starbucks's mobile wallet is actually a digital stored-value card more akin to its popular gift card. Its success—the app now accounts for 16 percent of Starbucks's 47 million weekly transactions (up 50 percent from a year ago)—makes it both a model and a target for payment apps from other retailers and tech companies alike.

Starbucks CEO Howard Schultz has even bigger plans for mobile payments. In comments to investors in late 2014, Schultz made it clear that he views the mobile app as a linchpin of plans to keep growth perking. For one thing, the company says, it speeds payment and reduces waits in line. It also makes it easier to track rewards points, giving customers incentive to buy more at Starbucks so they can get perks such as a free drink after buying 12.

But the real attraction is in the data that the company can collect. Whoever last touches the customer at the point of sale owns a wealth of information about purchases and preferences that can be fed back into the business. Starbucks has started using purchase data to send personalized offers the way merchants do online—say, for food to complement a drink. It's beginning to result in additional purchases. "It's going to be the Amazon experience, inside the store," says Ken Morris, a principal with Boston Retail Partners, which helps retailers create systems like Starbucks's.

To get more people to use the app and join the rewards program, the company plans to add major new features in 2015. One is the ability to order and pay in advance, which launched in Portland, Oregon, in December and will expand to other cities later. And in a few markets

"A new, successful, behavior-altering payments product is a big deal and represents a crack in that frozen ice of the industry and the way things are done."

—Patrick Collison, CEO of Stripe

one in the world stealing from you. The privacy changes are not insignificant. It would have been very natural for Apple to try to aggregate all this data and use it for ad targeting, but they haven't.

There's no point proposing some utopian vision that doesn't come to pass. A new, successful, behavior-altering payments product is a big deal and represents a crack in that frozen ice of the industry and the way things are done.

Stripe is invested in some more radical ideas. You support payments made via Bitcoin, and you've invested \$3 million in a Bitcoin alternative called Stellar.

Bitcoin is kind of a financial Rorschach test; everyone projects their desired monetary future onto it. What we care about is making digital transactions and commerce more universal. There is the element to Bitcoin of just being a universal means to transport value.

Bitcoin has some user experience issues. Transactions take minutes to clear.

pricing. Do you price it as a percentage of the transaction or as a monthly fee or an annual fee? There's no reason why the margins should be that different.

Case Study

Starbucks Bets the Store on Mobile

The iconic coffee merchant built a payment app that quickly became the envy of retail. Can it recharge Starbucks's growth despite new competition?

● If pressed to name the leading smartphone app for paying for a purchase in a store, would you say Apple Pay? PayPal? Google Wallet?

starting in mid-2015, the app will enable customers to schedule regular delivery of individual drinks and food to offices—further expanding Starbucks’s brand beyond its own stores.

Schultz wants to push deeper into the digital realm. He’s talking to tech firms and other retailers about licensing its payment and rewards software, much the way Seattle neighbor Amazon sells its cloud computing services to other companies. Starbucks even aims to turn its stored-value cards, app, and rewards points into a broader currency usable at other retailers, creating a potential alternative to credit and debit cards.

Launched widely in January 2011, the app generates a bar code on the smartphone that can be scanned at checkout readers already installed in most stores. At the time, bar codes were pooh-pooed by tech firms already looking to a radio-based technology called near-field communication that Apple Pay now uses to send payment information. But Starbucks was looking for ease of use above all, says Chuck Davidson, who then worked for the company’s prepaid-card business (worth \$1.5 billion at the time) and is now head of customer engagement at the mobile-commerce firm CardFree.

The strategy worked. Just two months later, some three million people had paid with the app. Of course, Starbucks benefited from its brand name, customers who can afford smartphones, and a daily-habit product. But Davidson and other payment experts say other features were the real key to its success. Allowing easy tracking of card balances and rewards points encouraged customers to use the app more often.

New alternatives like Apple Pay and rival retailers’ apps present challenges for Starbucks. Dunkin’ Donuts, for instance, less than a year after relaunching its mobile app with a new rewards program in January 2014, said it reached two million rewards members and 10 million app downloads.

Starbucks created the iconic mobile payment app. Now its customers know how to use their phone to pay everywhere else, too. —Robert D. Hof

Case Study

Can Mobile Money Conquer New Markets?

After great success in East Africa, mobile-phone wallet M-Pesa hit some bumps in South Africa.

● Since its launch in 2007 by mobile-phone giant Vodafone and local partners, M-Pesa has taken East Africa by storm. Today more than 18 million users, most in Kenya and Tanzania, use the mobile-phone wallet to transfer billions of dollars a month. The technology has brought new financial options to places where banks and credit cards are scarce and cash has long been king, promising a faster, cheaper, more secure way to pay for things and send money.

The service enables cell-phone owners to essentially use their mobile device like a bank card. After registering as a user with

monthly M-Pesa transactions are valued at \$820 million.

But despite this remarkable record, M-Pesa has found that moving the technology into a different market can be a challenge. Though the service is now available in 10 countries, more than 100,000 of M-Pesa’s 186,000 authorized agents worldwide are still in Kenya.

For clues to how M-Pesa can find broader acceptance, many are watching its 2014 relaunch in South Africa, where an initial introduction in 2010 fell far below expectations, signing up 100,000 users instead of the 10 million anticipated.

The 2010 version was a “carbon clone” of its Kenyan counterpart, not well suited to South African customers, says Herman Singh, the managing executive for mobile commerce at Vodacom, who is responsible for the South Africa relaunch. (Vodacom is 65 percent owned by Vodafone.) The rollout also suffered because there weren’t enough agents to help customers upload and download.

Now M-Pesa has simplified the registration process for agents and increased their numbers in South Africa from 800 to 8,000. Users can use their mobile

Vodacom is betting on M-Pesa’s low cost. Users aren’t charged the monthly account fees they would have to pay a bank, and most services, like cash deposits and electronic transfers from bank accounts, are free.

an M-Pesa agent, a customer can upload money onto the phone. Those funds can then be used for many transactions, from grocery purchases to paying utility bills.

186,000

Number of M-Pesa agents worldwide

According to the Central Bank of Kenya, the value of M-Pesa transactions in Kenya jumped 30 percent, to \$12 billion, in the first six months of 2014 compared with the same period in 2013. In Tanzania, a country half as populous,

wallet at all retailers. And there is now a voucher system similar to the prepaid mobile-phone credit system most South Africans use to pay for cell time.

Vodacom is betting that M-Pesa’s low cost will win over consumers. There are no monthly account fees, and most services, like cash deposits and electronic transfers from bank accounts, are free of charge.

Early results are encouraging. In the first four months following the relaunch, the number of users grew from 100,000 to 650,000, and more transactions have been processed than in M-Pesa’s first four years in the country combined, Singh says.

—Miriam Mannak

Review

Modern Money Compared

Payment apps are all the rage. But how well do they work?

● Picture this: You're at a restaurant table surrounded by friends and acquaintances, and the end of the night approaches. The waiter picks up his check holder to find three different credit cards, accompanied by detailed instructions about which ones should be charged how much. He informs you that the restaurant does not accept cards. Since you are the one person who always has cash, you reluctantly pay the entire bill. You doubt anyone will pay you back in a timely fashion, if at all.

This is the type of scenario mobile payment apps, which allow you to send money digitally to a friend's account, were made for. Apps from Venmo, PayPal, and Square have spread quickly through word of mouth to become a staple in many Americans' lives. Venmo, a free peer-to-peer payment app attached to a social-media stream, is now processing \$700 million in transactions per quarter.

But are these apps any more useful than cash, checks, and the old-fashioned IOU? The short answer is yes.

Though some of apps offer a variety of services, I focused on the central tasks of sending and receiving money. I downloaded and tested the apps in November and December 2014, linking each one to a debit card and, when necessary, my bank account and routing number. I tested each app by exchanging funds with people I already knew. All seemed secure, either requiring you to unlock the app with a PIN or giving you the option to add that layer of security.

App: Square Cash

Payment methods: U.S.-based MasterCard and Visa debit cards. No credit cards.

Fees and limits: Free. The first time you surpass the initial spending limit of \$250

per week, the transfers become more complicated, requiring personal information like your birth date or the last four digits of your Social Security number. After you enter that information, the weekly spending limit is \$2,500. You can also receive up to \$1,000 per month simply by signing up for the app, but if you want to receive more than that, you must give more personal details.

Currencies accepted: U.S. dollars

Strong suit: Getting paid quickly with minimal hassle

I found Square Cash to be the easiest app for sending money to the bank account of someone who needs it right away. It has a sparse, utilitarian design. After typing in my debit card details, I could immediately send money to, or receive money from, anyone whose phone had the app installed. The screen looks like a calculator. There's a big field that flashes "\$0" at the top until you punch in the amount you want to send. After that, you have two options. You can hit "Request," which scours your phone's contact list for the person you want to tell that you need that amount. Or you can press "Send," which sends that amount almost immediately to the desired recipient's bank account. You can add a memo, and the app notifies you when the money is deposited into your bank account or your friend's account. Unlike other apps tested, Square Cash does not require you to add your bank account number to receive money, something that can be a hassle when you're on the go. You can find other users in the area via Bluetooth, making it easier to pay back people who are not yet on your contact list.

There's also Snapcash, a version connected to the popular photo-sharing app Snapchat. The interface is different, and I found it harder to use.

Many of Square Cash's security features are behind the scenes, which allows for an easy payment experience. An optional feature requires users to enter their card's CVV number each time they send money, which can prevent unauthorized use by a thief who gets hold of a user's phone. Information is encrypted and stored on Square servers using tokenization, adding to the system's security.

Would I use it again?

Yes. I probably would not use the Snapcash version again, though.

App: Venmo

Payment methods: Major debit and credit cards

Fees and limits: Free to send money from your Venmo balance, made up of the money people send you through the app. There's a fee of 3 percent for payment from a credit card or lesser-known debit card. Receiving money is always free. The sending limit is \$2,999.99 per week, but identifying information like your zip code, or Facebook account details, is required after \$300.

Currencies accepted: U.S. dollars

Strong suit: Fun

Since launching more than two years ago, Venmo has become popular with young people as a social network that tells the world when people pay each other and why. One friend accurately divulged that she sent me a dollar for "using technology," but the public feed shows memos running from the tame—"Kanye West fan club enrollment fee"—to the unprintable. Venmo defaults to making these updates completely public, but one can adjust the settings to make transactions private or visible only to friends. Like Square, Venmo has a function that allows you to discover other people using the app nearby.

The thought of telling other people what I was spending money on was uncomfortable for me at first. It seemed crass. I put this judgment on hold for a while, however, to see how the app worked. I found it slightly slower to set up than Square Cash but relatively easy to use after that initial housekeeping.

You can send and receive payments about as quickly with Venmo as you can with Square. However, the money is immediately available only as a balance on your app: you can use that to pay other Venmo users, but not for much else.

With Square, by contrast, that money shows up in your bank account. To get money into my bank account with Venmo, I had to dig up and enter the account and routing information, and then wait a day

Mobile Payment Apps

The lowdown on three of the most popular options

NAME	Venmo	Square Cash	PayPal
WHAT IT DOES	Social-media network built on peer-to-peer payments	Send and receive money from phone contacts with just a debit card	Peer-to-peer payments, digital wallet, mobile payments at some stores
MILESTONE	Processed \$700 million in payments during Q3 2014	U.S. users send millions in payments daily	Processed \$27 billion in mobile payments during 2013
BEST FEATURE	In-app commenting feature	Simple interface	Sends money in 26 currencies

for Venmo to post two small sums to my debit card.

I didn't realize at first that you could leave a balance on Venmo to pay other people without linking your bank account. I found that process inconvenient because I was set on getting money into my account. People who use Venmo often may not see this as an issue. Customers of Chase, Wells Fargo, Bank of America, and Citibank can link their accounts more simply.

Venmo gives users the option of requiring authentication, such as a PIN, to open the app on their phone. Other than that, the main security feature I encountered when testing the app was the process to verify my bank account. Behind the scenes, Venmo encrypts and stores users' information on secure servers, which are protected by a firewall and not directly connected to the Internet.

Would I use it again?

Probably. You can easily comment on transactions to thank a person for the money sent or share an inside joke about the event where the transfer took place. With Square, I found myself texting people separately to thank them for sending me money. Honestly, though, I am less likely to keep using Venmo. While the app works great for sending a few bucks quickly, the time one could waste digesting the status updates could easily eat up the time saved not going to the ATM.

And the rest

Google Wallet and PayPal also have mobile apps, but I didn't find them as useful. Though PayPal has strong security and was the only app that could move money between 26 different currencies (for a fee of 0.5 percent to 2 percent with a U.S. bank account or PayPal balance), others were better at domestic transfers. Unlike Venmo or Square, PayPal offers no way to use a debit card to send people money without incurring a fee.

Balances on Google Wallet can be used at some stores, a plus, but overall I found the app less useful. To claim even a small transfer, you must enter extensive personal verifying information. —*Kristin Majcher*

Technology

Who Are You?

Banks are using mobile technology to build better profiles of credit card customers that will be harder to fake—or shake off.

● I often travel to different countries chasing stories. It's hard for me, let alone my credit card issuers, to predict where I'll be at any given time. This summer, for

example, I moved from Madrid, Spain, to Oaxaca, Mexico, and in November I made quick trips to both California and Nicaragua. Confused by my unpredictable spending patterns, my credit card companies often block my legitimate transactions.

In this mobile, data-driven era, there must be some better way. After all, California friends may have heard about my trip ahead of time via Facebook, and my U.S. mobile operator might have noticed my new location when I plugged its SIM card into my phone at the border. But still, "your bank is the last to know," says Loc Nguyen, chief marketing officer of Feedzai, a mobile payments firm in San Mateo, California. Sure enough, when I tried to buy a bunch of hiking gear on arrival in California, my card froze and I had to call the issuer to verify my identity.

Banks and merchants want to know who is wielding a given credit card because they, not the cardholder, are on the hook for fraudulent transactions. And such fraud is rising, according to the 2014 Lexis Nexis annual fraud study. Worldwide, fraudulent card transactions have reached around \$11 billion a year, and the U.S. may account for about half of that. Europe's share was 1.33 billion euros (\$1.7 billion), according to a European Central Bank report.

New technologies try to address this problem by merging a broader range of financial data, mobile-phone data, and even social-networking data to better establish the likelihood it's actually you behind the transactions racking up on your cards or mobile device. Nguyen says that Feedzai's system can improve fraud detection rates from 47 percent to almost 80 percent. Chirag Bakshi, founder and CEO of Zumigo, a company in San Jose, California, that provides location-based mobile services, says his company's data algorithms reduce fraud losses by at least 50 percent.

"When fraudsters steal your identity, what they can't do is steal your behavior," Nguyen says. That, in fact, has long been the principle behind credit card fraud alerts. But a conventional credit card company is relying on information from your past to guess whether each attempted transaction is genuine. Today's new technologies tap into your mobile phone and its

more up-to-date information to see if your current behavior matches your purchase.

“[We can use] a SIM card as a proxy for a person,” says Rodger Desai, CEO of Payfone, which works with banks, mobile operators, and fraud detection companies to assess the legitimacy of a given payment. Payfone builds a profile of a user and tracks more than 400 types of data to create what it calls a persistent identity. Change phone company? Noted. Someone steal your phone or clone it? The company will catch that, too. Even if you’ve canceled your cellular data plan, it has ways of flagging the activity of someone who then tries to use the phone’s Wi-Fi connection.

Zumigo adds location information gleaned from partnerships with mobile network operators. It checks the name and address attached to the mobile device in a given transaction against Equifax’s credit records to confirm the buyer’s identity. Feedzai’s software combines that kind of information with current and historical location data to draw inferences such as whether it would be possible to travel from the site of an already approved purchase at, say, the airport to a shop in town in the amount of time between the transactions. The use of this method, Nguyen says, is what allows Feedzai to detect 80 percent of fraudulent transactions, rather than the 47 percent achieved by conventional methods, without adding more of the sort of false alarms to which I am growing accustomed.

Some companies are trying to build deeper identity profiles for mobile payments based on social-network data. It’s a tempting target. If I ask my friends for advice on rain jackets and I’m a member of a mountaineering club, it would lower the odds I might trigger a fraud alert at a shop selling outdoor gear. But that kind of information requires permission from users, and experts say it can be a source of false signals as well as reliable information.

Mobile-data-based identity systems have their limits. After my November trip to Southern California, I flew to Nicaragua. At the airport, I called my card providers to alert them to my travel. But in Managua, I paid cash for a local SIM card at the bus station, to avoid the roaming charges from

my home mobile operator. It required no registration forms, and I hopped on the bus to read the news and handle e-mail. Without trying, I might have outpaced the futuristic systems designed by Feedzai, Zumigo, and Payfone. Could I have then booked a hotel for the night on my phone with the new SIM card while riding the bus? Probably not. —*Lucas Laursen*

Q&A

New Technologies Can Change Payments and the Economy

Economist Simon Johnson examines how a “revolution in payments” could affect companies and communities.

● Formerly the chief economist at the International Monetary Fund and now a professor at MIT’s Sloan School of Management, Simon Johnson has studied and written widely about payments, credit, banking, and monetary policy. He is now watching a variety of “big ideas” that could influence the future of payments and have broad implications for the economy. New methods of transferring money quickly and at low cost could especially benefit the “unbanked” in emerging economies and poor people in the developed world. Johnson spoke to Business Reports editor Nanette Byrnes in his campus office in Cambridge, Massachusetts.

Is the system we use to pay for things today working?

The clearing of a check is very efficient, is done on a massive scale, and has very low costs. That part of making a payment works well. The other part obviously is the question “Is this check going to bounce?” We have become persuaded since the 1950s that it was better to use a credit

card, a system in which the transaction is guaranteed by a third party. But that is a very expensive way to make payments. It is run by a cartel with a lot of pricing power. The difference between what it really costs to make a payment and what you are being charged for that is a large amount of money. It’s a huge target for new payment technologies. And some set of technologies is going to find a way to reduce that difference.

There is a payment revolution under way—though maybe we’re not fully aware of it—and the incumbents [such as Visa and MasterCard] are not without some power or ability to respond. It’s difficult because they make so much money on the existing system; why would they cut their prices by too much? But there’s a big opportunity here.

If new technologies and other changes make paying for things less expensive, could that encourage more transactions and boost the economy?

I think the biggest issue is for lower-income people and lower-income countries. These are countries that typically have less well-developed banking systems, where credit cards are typically not as available. Now they can bypass [credit cards]. The financial services offered to relatively poor people in the U.S. are very expensive—including cashing your paycheck, or getting a payday loan, or even cashing a government check, which is crazy. I think change can help people across a range of activities and help less-well-off people more.

But the most discussed new technology in payments, Apple Pay, is not a threat to the existing payment business model. In fact, it runs on the rails of the existing system. Will it help overall costs drop?

I suspect not. They’re divvying up the pie.

Others are too. Starbucks reports that 16 percent of its sales are made through its phone payment app.

What Starbucks cares about is selling coffee. This money thing is just a side issue for them. They’re not going to screw me on that because then I’m not going to go

buy cups of coffee from them. Someone who has that kind of consumer trust I think can do well at this.

Consumers need to trust someone who is this kind of payments intermediary. You are giving them money. And maybe letting them draw more money from your account when necessary. They have a lot of data on you. We have to believe they can't be hacked into, to steal that data or money. So it does suggest you should think about a technology company or a company for whom data security is really key.

I'm surprised the technology companies haven't made more inroads [in payments] yet. There are some regulatory restrictions in the United States, which I think are going to come under some scrutiny. Regulators like to restrict who can run a bank. They like to keep it to this group of people who've run banks before. It's a very, very old-fashioned idea to think that bankers are somehow more honest or trusted. Who would you trust more? A big brand-name bank, or Google or Apple?

What role will cryptocurrencies play in the future of payments?

There is clearly something about the backbone of those systems that should work, but whether the consumer interface with bitcoins and wallets, whether that wins, I'm not sure. People want to steal your stuff all the time—that's just a common theme of human history. How much anonymity do you want to have, given that you want some protection against theft? The other issue is, do I want to work through this separate currency that has the fluctuating value of Bitcoin, or would I rather just have a lower-cost way of making payments in dollars? Ultimately money's going from my bank account to your bank account. I'm not sure I need it to go through an alternative currency. There are people who want to take Bitcoin [valuation] risk, but you're selling me a cup of coffee. Why do you want to take Bitcoin risk? You don't. You just want to be paid, and it's in both our interests to make that payment at very low cost.

Case Study

Can Apple Pay Do for Money What iTunes Did for Music?

With added security, better design, and improved convenience, Apple Pay hopes to finally make mobile payments commonplace at the register.

● The terminal at this CVS drugstore in Palo Alto, California, can accept payment through a quick tap from a smartphone. The clerk isn't sure how it works, though he knows it does because "a few kids" have used it. But one shopper tries it by taking out his Android phone and clicking on Google's Wallet app, which is intended to allow instant payment, and taps the terminal. Nothing happens. Then he tries PayPal's payment app. Nothing. Out comes the wallet.

Over the past decade, tech companies including Google, PayPal, and upstart Square, along with mobile carriers, credit card companies, and various retailers, have all proclaimed the "death of the wallet." The promise: their digital wallet equivalents would make paying for things in physical stores much easier. Instead, they ran into technical glitches, consumer indifference, and resistance from merchants, banks, and phone carriers.

Though mobile payments at U.S. retail stores will nearly double in 2014, to \$3.5 billion, according to market researcher eMarketer, they remain a rounding error on the more than \$4 trillion worth of in-store credit card and cash transactions. Cash and cards are simply good enough, says payments expert Bill Maurer, dean of the School of Social Sciences at the University of California, Irvine. "All of these mobile wallets are looking for a problem to solve," he says.

But in September 2014, Apple jumped into the market with Apple Pay in a bid

to take mobile payments mainstream. Standing in front of a photo of an overstuffed billfold, Apple CEO Tim Cook unveiled the mobile wallet at an event where he also debuted new iPhones and the Apple Watch. With iPhone 6 models, all it takes to buy a sandwich at Subway or chicken at Whole Foods Market is to hold your iPhone near a wireless reader and press your thumb on the Home button.

The iPhone's Touch ID fingerprint sensor, already used to unlock the phone, confirms it's really you. Behind the scenes, a payment processor such as Visa recognizes an encrypted version of your credit card such as the one in an iTunes account, along with a one-time security code for that particular transaction, and approves the sale—all in less than 10 seconds.

That is indeed easier than using most other digital wallets, which require unlocking the phone, opening an app, checking into a store, typing in a code, or other steps that can take much longer than swiping a credit card. Apple's ability to create elegant, user-friendly products helped it popularize and seize commanding positions in music players and smartphones. If Apple Pay works as promised, it could do something similar for payments: make mobile wallets appeal to the masses, starting with its influential army of iPhone users. "Mobile payment is finally hitting that pivotal moment when all the pieces are coming together," says Matthew de Ganan, senior vice president of product and commerce for Softcard, a joint venture of T-Mobile, AT&T, and Verizon that's working on a rival mobile wallet.

In the United States there are only about 220,000 merchant point-of-sale terminals featuring the wireless payment communications system known as near-field communication (NFC). That represents a small fraction of the more than six million U.S. retail outlets. They are used so rarely that, wags joke, "NFC" might as well stand for "not for commerce" or "nobody freaking cares."

But Apple's often adroit timing may prove spot-on once again, because a new development could bring NFC to many more stores. In a bid to force adoption of more secure credit cards that use a chip

and a PIN instead of a magnetic strip for payment authentication, Visa and other payment networks will, starting in October 2015, make merchants liable for fraudulent charges unless they use readers compatible with the new cards. That's expected to speed installation of new readers, most of which will include NFC capability.

Although credit cards are used in Apple Pay, it's more secure because card numbers aren't stored directly on the phone or on Apple's servers. Instead, digital tokens, encrypted numbers that look like card numbers, are assigned by a payment network such as Visa to each card and stored on a secure chip in the phone. During a purchase, that token and a one-time code are sent to process the payment, so even if hackers intercept the numbers, they can't do anything with them. Though Google Wallet and others have used tokens, Apple Pay will be the first to deploy them more widely.

"It is probably the most secure mobile payment solution to date," says David Brudnicki, chief technology officer for Sequent Software, which provides mobile wallet services to banks, retailers, and mobile operators.

Improved security is even more important to banks and retailers than it is to consumers, who have limited liability for fraudulent charges on stolen cards. Apple Pay has already signed up the three big payment networks—Visa, MasterCard, and American Express—as well as banks handling 90 percent of credit card transactions in the United States, including Bank of America, Capital One, Chase, and Citibank. Better security seems to have made up for any reservations that banks may have about Apple's role as a powerful new middleman on transactions, or the small cut of transaction revenues they'll be paying the company. Another potential bonus: Apple Pay could help the card networks capture transactions currently completed with cash.

For all that, Apple's impact will be small at first. For one, only iPhone 6 and eventually iPhone 5 owners with an Apple Watch can use Apple Pay. Large retail chains including Walmart and Best Buy, which are part of the Merchant Cus-

tomers Exchange consortium pushing its own wallet app, say they won't accept Apple Pay. The Softcard mobile wallet of T-Mobile, AT&T, and Verizon is touting its support of more than 80 Android phones and the ability to pay at retailers including McDonald's, Subway, and Walgreens. PayPal (soon to split off from eBay) and Google are pushing their wallet apps too.

Individual retailers that have persuaded customers to use their own apps have no intention of replacing them with Apple Pay. Starbucks, for instance, lets customers pay by launching an app and holding up the phone screen with a QR code to a reader on its cash registers.

Apple will have to offer a lot more to merchants than it currently does if it hopes to gain support from more of them. In particular, Apple Pay will need to incorporate loyalty programs and discount offers. Payments experts think the company will allow outside software developers to create apps that can add such features to Apple Pay.

By all accounts, it's going to take years for mobile payment to catch on widely. Apple Pay's success will ultimately come down to persuading consumers they should depart from payment methods that, after all, work pretty well.

—Robert D. Hof

Case Study

A Payment Upstart Still Trying to Catch On

Five years in, Dwolla's trying to make a dent in the payment processing business dominated by big names like Visa and MasterCard.

● "You could call it stupidity. Or naïveté."

Ben Milne is looking for the word to describe what made him think he could take on the multi-trillion-dollar payment

industry back in 2009, when he launched his company, Dwolla. At the time, he had been running a successful business selling audio speakers, but he was annoyed at spending tens of thousands of dollars a year to process payments. So he started looking for, and then building, an alternative.

"I didn't know we were taking on a system as big as we were when we started," he says, shrugging. "I was trying to solve my own problem."

The solution Dwolla came up with uses the Internet to move funds digitally and nearly instantaneously. But while the resulting system saves money and time, Dwolla is becoming something of a case study in how hard it is to do anything new in payments.

Dwolla's system bypasses decades-old payment arrangements. One of those arrangements relies on credit cards and carries 2 to 3 percent fees to execute a payment instantly; the other is far less expensive but processes payments in batches, meaning it can take two or three days for money to reach the recipient.

The new technology primarily serves as an alternative to the slower system, commonly called ACH, for "automated clearing house." A network run by banks and credit card consortiums, ACH processes bank-to-bank transactions like direct deposits or bill payments from an online checking account.

Any consumer who has an account with a bank using Dwolla's payment platform can directly pay a merchant in real time. It's also possible to store value on a Dwolla account, just as you might with PayPal or Venmo, and pay a merchant from that balance. Dwolla charges 25 cents per transaction of \$10 or more. Transactions under \$10 are free.

Milne still doesn't look much like a banker. In Las Vegas for a payment industry trade show last November, he wore a sports jacket and tie for a panel discussion with executives from Bank of America, the Federal Reserve Bank of Chicago, and other industry heavyweights. But his large-rimmed glasses and long beard set him apart from his fellow panelists, as did his frank message: Not every transaction

requires real-time execution, but the biggest winners in the expanding payment business will be the companies meeting customers' increasing expectation of rapid execution.

Dwolla has had the benefit of building its network in the modern era. Its open

alternative to traditional networks, Milne needs to rack up bigger partners and customers. His home state of Iowa—the company is based in Des Moines—now allows citizens to pay taxes using Dwolla. And in early 2015, Dwolla will launch a real-time payment system with BBVA Compass, a

Its system saves money and time, but Dwolla is becoming something of a case study in how hard it is to do anything new in payments.

system is accessible to developers for free. The company supports the network and its connections to financial institutions, but it does not hold customer deposits, allowing it to sidestep a host of regulatory requirements. Milne describes building the network as “reverse-engineering a mountain of payment spaghetti” bank by bank, trying to work with bank staffs that were not always anxious to help Dwolla decode each unique system.

The problem is that banks have not been quick to sign up, in part because revamping their existing systems is an expensive proposition. And one or two days to process a payment is in many cases fast enough, explains Kuba Zielinski, a partner at Boston Consulting Group who specializes in the payments industry. Also, most banks issue credit cards, a lucrative business they'd undercut if they embraced Dwolla's approach and moved away from the networks of Visa, MasterCard, and others.

New digital payment systems have taken off in some countries, including the United Kingdom and Switzerland, but only after regulatory mandate. In the U.S., Dwolla's home market, there has not yet been such a requirement.

As of late 2013, the last time the company disclosed numbers, Dwolla had 500,000 customers. But the list of merchants accepting the firm's virtual payment app remains dominated by niche firms selling things like small-batch perfume and heritage-bred pork.

To establish his rapid and inexpensive way of moving funds as a legitimate

bank with nearly 700 branches across the southern United States. That's an important expansion because customers can't do real-time transactions unless their bank or credit union accepts Dwolla's network.

Dwolla has raised \$32 million from investors such as Bain Capital Ventures, Andreessen Horowitz, and Union Square Ventures. But a recent investor, CME Group, could also become the kind of landmark customer Dwolla needs. CME Group operates derivatives markets where millions of trades are executed each day. It operates on a scale that could really benefit from—and demonstrate the value of—Dwolla's speed and low cost.

—Nanette Byrnes

Technology

Your Mobile Phone Is More Secure Than Your Visa Card

As mobile payments become more common, thieves will be more likely to target them.

● Is waving your smartphone over a store-counter gadget really a secure way to buy something?

Right now, such mobile payments—via Apple Pay and similar systems—are

extremely safe and secure, thanks to layers of protections including PINs, fingerprint identification, cryptography, and the logging of transaction data.

Mobile payment systems use near-field communication, or NFC, to transfer payment information from the phone to a store terminal within a few centimeters. Whereas information stored on magnetic-stripe credit cards can be read by anyone with access to the card, mobile payment systems generally store the data in encrypted form on a special NFC chip and require the user to enter a PIN or even a fingerprint.

While newer credit cards also include a chip and require users to enter a PIN, mobile phones could still hold an advantage because they can log location and other data that could be used later to help prove whether a transaction was fraudulent or not.

57%

Proportion of respondents who worry about mobile payment security

To avoid major damage if retailers' databases are hacked, Apple Pay and some others also give stores “tokens,” or encrypted strings of data about the purchase, without passing along the actual credit card numbers.

For now, attackers have easier targets than mobile payments, including magnetic-swipe systems and department store servers housing millions of card numbers. However, as credit cards become harder to hack and more payments are made on smartphone, mobile payments will increasingly attract thieves.

One route in might be malicious software that steals your phone's payment credentials by getting beyond barriers imposed by Android and Apple's IOS. An essential defense: partitioning off payment functions with software or, better yet, more secure chips. Chipmakers are already broadening their products to emphasize “walling-off” functions, with one example being ARM's TrustZone.

—David Talbot

Industry Guide

A Closer Look at the Future of Money

A Bitcoin update, worthwhile further reading, and a list of upcoming events focused on payments, commerce, and banking

Bitcoin 2.0

Cryptocurrencies are still in their early days. Though a growing number of online and real-world businesses accept bitcoins, writer Russ Juskalian found while reporting “A Weekend in Bitcoin City” that they are not yet accepted widely enough to be a reliable substitute for cash.

Neither are bitcoins reliably functioning as a store of value, a second key function of any currency. Bitcoin has proved volatile recently, dropping from a value of over \$1,200 in November 2013 to \$310 in December 2014.

That fall-off, along with the fact that Bitcoin is still being used to move only about as much cash as it was a year

Free and open, the blockchain is maintained by computers around the world and shares some of the design features that laid the foundation for the success of the World Wide Web and Linux, among other technologies. Increasingly, investors believe that the future of Bitcoin lies in the idea of extending or building on the blockchain to create something called sidechains. Sidechains would build on top of the blockchain code—which currently records every Bitcoin transaction as an open, public ledger—to create systems that secure other kinds of assets beyond payments, such as contracts or ownership of stock.

Gavin Andresen, the driving force behind Bitcoin, foresees a future in which

Despite a steep drop in the bitcoin's value in 2014, advocates continue to see merit in a peer-to-peer digital currency that's independent of middlemen and governments.

ago, prompted senior editor Antonio Regalado to nominate the currency as one of the “top technology failures of 2014.” “The idea of Bitcoin remains intriguing,” he writes. “But in practice, it is more like a Ponzi scheme that attracts speculators, and it's become the payment form of choice among professional cybercriminals.” In November, the U.S. Marshals Service auctioned off 50,000 bitcoins seized from drug dealers, worth about \$19 million.

Still, advocates continue to see real value in a peer-to-peer digital currency that's independent of middlemen and government affiliation—and, lately, in the core computer code that makes Bitcoin what it is: the blockchain.

the currency might come to cheaply power a diverse collection of services focused on trust and security.

To use Bitcoin today, you must install a special wallet, like Coinbase, on your computer or mobile phone. You can trade U.S. dollars or other currency for bitcoins at exchanges like Bitstamp. Both of these sites explain how their systems work, and the nonprofit Bitcoin Foundation has published an explanation of the technology behind the payment system.

For insight into how Bitcoin solves some of the special challenges of digital currencies, a good starting place is “Explain Bitcoin Like I'm Five,” an essay published on Medium by financial consultant Nik Custodio.

Outside Reading

The End of Money: Counterfeiters, Preachers, Techies, Dreamers—and the Coming Cashless Society

by David Wolman

Da Capo Press, 2012

Wired contributing editor David Wolman exposes the unsavory side of cash as he seeks to measure its place in the modern world, talking to counterfeiters, coin collectors, and everyone in between. Even so, the book's takeaway that cash may be on its way out has proved controversial, explained the author in a 2012 interview with *MIT Technology Review's* senior editor Antonio Regalado (“The Slow Death of Cash,” March 2012).

Breaking Banks: The Innovators, Rogues, and Strategists Rebooting Banking

by Brett King

Wiley, 2014

In his latest book, best-selling author Brett King compiles interviews with executives at Google, Citibank, Zopa, Simple, and other firms that are disrupting banking with peer-to-peer lending, cryptocurrencies, and social media. The financial industry, he argues, will change more in the next decade than it has in the past 100 years.

Bitcoin and the Future of Money

by Jose Pagliery

Triumph Books, 2014

CNNMoney reporter Jose Pagliery details how Bitcoin came into the public eye and why it is prone to unique risks, as seen in February 2014 when nearly \$400 million vanished with the sudden shutdown of the online exchange Mt. Gox. The author talks to advocates like Ron Paul about how the digital currency could shape the world's economy and learns about the illicit side of Bitcoin through interviews with FBI officials and a Bitcoin entrepreneur behind bars.

The Age of Cryptocurrency

by Paul Vigna and Michael J. Casey
St. Martin's Press, 2015

A pair of *Wall Street Journal* writers team up to produce a sympathetic overview of cryptocurrencies. The book ends with the prediction that encryption-based, decentralized digital currencies “do have a future,” even though it’s a major task to convince people of their benefits. Those benefits include potentially making the financial system far more efficient and offering an affordable alternative to the many people without access to banks today.

Money, Real Quick: Kenya's Disruptive Mobile Money Innovation

by Nicholas P. Sullivan
and Tonny K. Omwansa
Balloon View, 2012

Tools to send money via mobile phone are gaining popularity in the United States, but this book reveals that 70 percent of Kenyans were already sending money that way when it was published more than two years ago. The book’s authors explain how M-Pesa, the country’s most widely used mobile money service, rapidly rose to popularity when not even 20 percent of Kenyans used traditional banks a year before its launch.

Mobile Banking: Financial Services Meet the Electronic Wallet

Ernst & Young, *Knowledge@Wharton* (the online business journal of the University of Pennsylvania’s Wharton School), 2013

This e-book provides an overview of the firms battling it out to provide mobile payment and banking services. In a series of accompanying videos, scholars from the University of Pennsylvania’s Wharton School discuss business opportunities, data security, and mobile wallet technologies with Ernst & Young analysts.

Calendar

Financial Cryptography and Data Security 2015
19th International Conference
January 26–30, 2015
San Juan, Puerto Rico
fc15.ifca.ai

First International Workshop on P2P Financial Systems
January 29–30, 2015
Frankfurt, Germany
www.ecurex.com/p2pfisy

8th Annual Smart Card Alliance Payments Summit
February 3–5, 2015
Salt Lake City
www.scapayments.com

Apex All Payments Expo
February 23–25, 2015
Las Vegas
www.iirusa.com/allpaymentsexpo/home.xml

BAI Payments Connect 2015
March 2–4, 2015
Phoenix
www.bai.org/paymentsconnect

GSMA Mobile World Congress
March 2–5, 2015
Barcelona, Spain
www.mobileworldcongress.com

Transact 15
March 31–April 2, 2015
San Francisco
electran.org/events/transact15/

Payments 2015
April 19–22, 2015
New Orleans
payments.nacha.org/2015CFP

Open Mobile Media's Mobile Commerce and Banking 2015
April 20–21, 2015
London
www.openmobilemedia.com/mobile-payments-europe

Virtual Currency Today Summit
April 29, 2015
Boston
summit.virtualcurrencytoday.com

Cards and Payments Middle East
May 12–13, 2015
Dubai
www.terrapinn.com/exhibition/cards-and-payments-middle-east/index.stm

Connect Mobile Innovation Summit
August 18–20, 2015
Chicago
mobileinnovationsummit.com

Money20/20
October 25–29, 2015
Las Vegas
money2020.com

CARTES Secure Connexions
November 17–29, 2015
Paris
www.cartes.com

Mobile Influence: The New Power of the Consumer

by Chuck Martin
Palgrave Macmillan Trade, 2013

It’s no secret that people use their mobile phones to buy goods online, but this book explains how brick-and-mortar stores can adopt new mobile payment technologies to better reach their smartphone-toting customers. The author describes different payment systems within the context of a bigger strategy for influencing consumers’ shopping habits through their mobile phones.

Designing Mobile Payment Experiences: Principles and Best Practices for Mobile Commerce

by Skip Allums
O’Reilly Media, 2014

The inner workings of mobile payment frameworks are the subject of this guide for app developers, designers, and project managers. The book gives a history of payment technologies and compares apps like Google Wallet, LevelUp, Square, and PayPal. It also explains how to integrate security features like PINs and passwords into payment apps.