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Thoughts on the future of finance

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## Introducing R3 Corda™: A Distributed Ledger Designed for Financial Services

As reported in Bloomberg (<http://www.bloomberg.com/news/articles/2016-04-05/protecting-trade-secrets-challenges-wall-street-blockchain-play>) this morning, I'm delighted to confirm that R3 and our member banks are working on a distributed ledger platform for financial services: **Corda™**. I explain it on our official R3 blog (<http://r3cev.com/blog/2016/4/4/introducing-r3-corda-a-distributed-ledger-designed-for-financial-services>) and reproduce it here.

For the last six months, my team and contributors from our membership have been building a distributed ledger platform prototype from the ground up, specifically designed to manage *financial agreements* between regulated financial institutions. I am massively excited by the progress our team,

led by James Carlyle, our Chief Engineer, and Mike Hearn, our Lead Platform Engineer, are making and I think the time is right to share some details.

# Corda: A Distributed Ledger for Recording and Managing Financial Agreements

Corda is a distributed ledger platform designed from the ground up to record, manage and synchronise financial agreements between regulated financial institutions. It is heavily inspired by and captures the benefits of blockchain systems, without the design choices that make blockchains inappropriate for many banking scenarios.

Corda's key features include:

- Corda has no unnecessary global sharing of data: only those parties with a legitimate need to know can see the data within an agreement
- Corda choreographs workflow between firms without a central controller
- Corda achieves consensus between firms at the level of individual deals, not the level of the system
- Corda's design directly enables regulatory and supervisory observer nodes
- Corda transactions are validated by parties to the transaction rather than a broader pool of unrelated validators
- Corda supports a variety of consensus mechanisms
- Corda records an explicit link between human-language legal prose documents and smart contract code
- Corda is built on industry-standard tools
- Corda has no native cryptocurrency

Corda's design is the result of detailed analysis and prototyping with our members and will be open sourced when the code has matured further.

In the remainder of this post, I want to share some insight into our thinking. Why are we building Corda? Why have we made some of the design decisions we have? When will the code be ready for others to examine and build upon? How does this relate to other platforms and projects?

## A thought experiment

When I joined R3 from IBM in September 2015, I forced myself to stop and think. The blockchain bandwagon was running at full speed, I'd just been appointed CTO of a project intended to bring blockchains to finance but there was a nagging worry at the back of my mind... how could I avoid falling into the trap of believing all the hype?!

I imagined myself sitting in front of the CIO of one of our member banks some time in the future. I imagined we had naively selected a “blockchain for finance” based on what was popular at the time and widely deployed a range of products and services on top of it. And I imagined we had believed the hype, had suspended our critical faculties and had omitted any engineering. In this imagined scenario, I now found myself facing an angry CIO, who wanted to know why the system I had built had just failed calamitously. *Why on earth did I build it the way I did?!*

I concluded that an entirely inappropriate answer to that question would be: “because blockchains were cool in 2015”! No. That simply won't do.

The reality is that solutions based on selecting the design first and then trying to apply it to arbitrary problems never work out well. Every successful project I've worked on started with the *requirements*, not some cool piece of technology, and I was determined to bring that discipline into our work at R3.

## Remind me again why a system designed to replace banks is also supposedly their saviour?

And there is a second reason for this caution: the technology and finance industries collectively “decided” some time in early 2015 that “blockchain technology” was somehow the future of financial services.

Indeed, I am one of the most active proponents of precisely that claim. But the *reason* for blockchain technology's importance is extremely subtle – and this subtlety is something that most people seem to have missed.

To understand this, we need to look at Bitcoin.

Bitcoin's architecture, as I have often written, is a marvel. Its interlocking components are one of those rare examples of something so elegant that they seem obvious in hindsight, yet which required a rare genius to create.

But what is often missed is that the cleverest part of Bitcoin isn't actually its architecture; I think the cleverest part was to articulate the *business problem*. We don't tend to think of Bitcoin as being the solution to a “business problem” but it can perhaps be thought of as a wonderfully neat solution to the problem of: “how do I create a system where nobody can stop me spending my own money?” Now, I can't claim to know the mind of Satoshi and he certainly didn't write the whitepaper in this way but it triggers a very useful thought-experiment.

In fact, once you write this ‘business problem’ down, the design drops out almost trivially! (Almost...) You want always to be able to spend your own money? Then you can’t have a central point of control. It could be shut down by the authorities. You can’t even have a collection of validators with known identities as they could also be shut down with concerted effort. Very quickly you realise you need a massively replicated consensus system and, if you don’t want to tie actions to real-world identities, you need something like Proof of Work to make the voting work. You work the logic through and pretty much the whole design (the blockchain, the need for mining, block rewards, maybe even the UTXO transaction model, etc., etc.) drops out. Of course, it does push a lot of work onto the users: confiscation of somebody’s bitcoins is easy if you know their private key... but let’s leave that to one side for now.

And this way of looking at it is important because it highlights how Bitcoin’s blockchain can be thought of as the *solution* to a business problem. Satoshi Nakamoto didn’t wake up one morning wanting to “apply Blockchain to finance”. Blockchain was the tool that was invented to solve a real problem.

So we have a conundrum, right? If that’s the case, then *what on earth* is the argument that says blockchain has *any* relevance at all to banking?!

Indeed, last time I checked, banks have the *inverse* of my Bitcoin problem statement!

## What is the defining characteristic of blockchain systems?

So I spent most of October sitting in a dark room (really! This was our first London office... a tiny four-person room in a shared working space in the City of London) questioning some of the most fundamental assumptions about blockchains. *What is it exactly that makes them interesting to banks?*

Most people had already made the mental leap that the “bitcoin package” was unacceptable as a take-it-or-leave-it deal: proof of work is unnecessary for private deployments, for example. But, as I looked around, all I could see was firms who had accepted everything else... It seemed strange to me that, as an industry, we could tease apart *one* part of the “blockchain bundle” but then stop there.

I spent several of my earlier, formative years at IBM in a role called “technical sales”. If you’ve ever bought technology from a large IT vendor, you’ll have met somebody like me. We’re the people who visit clients with the sales rep and act as the technical expert: we explain how the product works, make sure we’re proposing the right solution to the client and ensure there is no technical barrier to closing the deal.

A lesson I learned very early in that role was: it doesn’t matter how hard you wish or how many client meetings you schedule or how aggressive the sales rep gets, if you can’t show how your solution is going to solve the client’s business problem then the deal almost certainly won’t close.

And those that do are the ones you'll live to regret...

Fast forward a decade, and as I surveyed the blockchain landscape in October 2015, all I could see was excitable (and vocal!) firms touting solutions that made very little sense to me for the kinds of problems I was trying to solve. I will confess to many moments of self-doubt: maybe they were all sane and *I* was the mad one..?!

But I ploughed on: even if they *are* right that a “take it or leave it” blockchain design is the saviour of the financial industry, I'll be doing our members a favour if I could explain *why*.

So we started picking away at what can perhaps be called the “blockchain bundle”: the collection of services that blockchains provide to those who use them.

We concluded that a blockchain such as the ones underlying Bitcoin or Ethereum or any of the private variations actually provide at least five interlocking, but distinct, services. And the right approach is to treat them as a *menu* from which to select and customise... different combinations, in different flavours, for different business problems.

## CONSENSUS

The first, and most important, feature of blockchains – and the thing that is probably genuinely new in terms of scale and scope – is that they create a world where *parties to a shared fact* know that the fact they see is the same as the fact that other stakeholders see:

*“I see what you see... and I know that what I see is what you see”*

And, critically:

*“I know that you know that I know”!*

And:

*“I know that you know that I know that you know...”*

And so on...

And it makes this promise across the Internet between mutually untrusting parties. Sure: consensus systems and replicated state machines have existed for years but consensus systems at Internet scale, between untrusting actors, that work in the face of powerful adversaries? That's a step forward.

In Bitcoin, the shared facts are things like: “What are all the bitcoin (outputs) that have not yet been spent and what needs to happen for them to be validly spent?”. And the facts are shared between all full node users.

In Ethereum, the shared fact is the state of an abstract virtual computer.

But notice something interesting: there isn't some law of nature that says the set of people who have to be in consensus is the whole world. Bitcoin just happens to work that way because of its unique business problem. If you don't have Bitcoin's business problem then be very wary of those trying to sell you something that looks like a Bitcoin solution.

## VALIDITY

The second feature in the “blockchain bundle” is *validity*. Tightly linked to consensus, this feature is the one that allows us to know whether a given proposed update to the system is valid. It is how we define the *rules* of the game. What does a valid “fact” look like in the system? What does a valid update to that fact look like?

## UNIQUENESS

The third feature in the blockchain bundle is its “uniqueness service”. I can quite easily create two perfectly *valid* updates to a shared fact but if they *conflict* with each other then we need everybody who cares about that fact to know which, if either, of those updates we should select as the one we all agree on. The “anti-double-spend” feature of blockchains gives us precisely this service and it's hugely important.

## IMMUTABILITY

The fourth feature in the “Blockchain Bundle” is often, if misleadingly, termed “immutability”: data, once committed, cannot be changed.

This isn't quite true: if I have a piece of data then *of course* I can change it. What we actually mean is that: once committed, nobody *else* will accept a transaction from me if it tries to build on a modified version of some data that has already been accepted by other stakeholders.

Blockchains achieve this by having transactions commit to the outputs of previous transactions and have blocks commit to the content of previous blocks. Each new step can only be valid if it really does build upon an unchangeable body of previous activity.

## AUTHENTICATION

The final critical feature in the “Blockchain Bundle” is authentication: every action in the system is almost always associated with a private key; there is no concept of a “master key” or “administrator password” that gives God-like powers. This is quite different to traditional enterprise systems where these super-user accounts are prevalent and petrifying from a security perspective.

## So what is the *financial services* business problem?

So why did I take us through this analysis? Because it gets us to the heart of the distributed ledger domain: the thing that is *genuinely new* is the emergence of platforms, shared across the Internet between mutually distrusting actors, that allow them to reach consensus about the existence and evolution of facts shared between them.

So if that’s what this is all about, then what are the “shared facts” that matter in finance? What business problem would we need to have for any of this work to be of any use at all?

And this is the light bulb moment *and the fundamental insight driving the entire Corda project*:

The important “shared facts” between financial institutions are *financial agreements*:

- Bank A and Bank B agree that Bank A owes 1M USD to Bank B, repayable via RTGS on demand.
- *This is a cash demand deposit*
- Bank A and Bank B agree that they are parties to a Credit Default Swap with the following characteristics
- *This is a derivative contract*
- Bank A and Bank B agree that Bank A is obliged to deliver 1000 units of BigCo Common Stock to Bank B in three days’ time in exchange for a cash payment of 150k USD
- *This is a delivery-versus-payment agreement*
- ... and so on...

The financial industry is pretty much *defined* by the agreements that exist between its firms and these firms share a common problem: the agreement is typically recorded by *both* parties, in *different* systems and *very large* amounts of cost are caused by the need to fix things when these different systems end up believing different things. Multiple research firms have postulated that tens of billions of dollars are spent each year on this problem.

In particular, these systems typically communicate by exchanging *messages*: I send an update to you and just *hope* you reach the same conclusion about the new state of the agreement that I did. It’s why we have to spend so much money on reconciliation to check that we did indeed reach the same conclusions and more money again to deal with all the problems we uncover.

Now imagine we had a system for recording and managing financial agreements that was *shared* across firms, that recorded the agreement consistently and identically, that was visible to the appropriate regulators and which was built on industry-standard tools, with a focus on

interoperability and incremental deployment and which didn't leak confidential information to third parties. A system where one firm could look at its set of agreements with a counterpart and know for sure that:

*"What I see is what you see and we both know that we see the same thing and we both know that this is what has been reported to the regulator"*

That's Corda.

## How does Corda choose from the "Blockchain Bundle" Menu?

So now we understand the financial services requirement, we can look again at the "Blockchain Bundle" menu from above and outline the choices we've made.

### CONSENSUS

A critical piece of the Corda philosophy is that our problem is to ensure that "I know that you see the same details about a shared fact that I see".

But this *does not* mean that a third party down the road also needs to see it: our consensus occurs between parties to deals, not between all participants.

### VALIDITY

Furthermore, in Corda, the only people who need to be in agreement about a fact are the stakeholders to that fact: if you and I agree about something that pertains only to us then why should we care what some completely unrelated third party thinks? And why would we even **think** of sending them a copy so they could opine on it? So, in Corda, we let users write their validation logic in time-tested industry-standard tools and we define who needs to be in agreement on a transaction's validity on a contract-by-contract basis.

### UNIQUENESS



Just like every other distributed ledger out there, we need to be sure that two valid, but conflicting, transactions cannot both be simultaneously active in the system. But we also recognise that different scenarios require different tradeoffs. So Corda's design allows for a range of "uniqueness service" implementations, one of which is a "traditional blockchain". But it doesn't need to be and, for our purposes, we also need implementations that make different tradeoffs under Brewer's CAP theorem ([https://en.wikipedia.org/wiki/CAP\\_theorem](https://en.wikipedia.org/wiki/CAP_theorem)): in particular, some financial services use-cases need to prioritise consistency at the expense of availability in the event of a network partition.

## IMMUTABILITY AND AUTHENTICATION

Here, Corda's design departs very little from existing systems: our data structures are immutable and our building block is the exchange of digitally-signed transactions.

So Corda is very traditional in some respects – we directly apply the "authentication", "immutability" and "uniqueness service" features of blockchains but we depart radically when it comes to the scope of "consensus" (parties to individual deals rather than all participants) and "validation" (the legitimate stakeholders to a deal rather than the whole universe or some arbitrary set of 'validators').

## How is Corda Different?

Hang on? Isn't this the same pitch that every other blockchain firm is making? Not quite.

Notice some of the key things: firstly, we are *not* building a blockchain. Unlike other designs in this space, our starting point is individual agreements between firms ("state objects", governed by "contract code" and associated "legal prose"). We reject the notion that all data should be copied to all participants, even if it is encrypted.

Secondly, our focus is on agreements: the need to link to legal prose is considered from the start. We know there will still always be some disputes and we should specify right up front how they will be resolved.

Thirdly, we take into the account the reality of managing financial agreements; we need more than just a consensus system. We need to make it easy to write business logic and integrate with existing code; we need to focus on interoperability. And we need to support the *choreography* between firms as they build up their agreements.

# Different Solutions for Different Problems

But... we should be clear. We are not viewing Corda as a solution to all problems. This model is extremely powerful for some use-cases but likely to be less well suited to others. It's why we continue to engage extremely deeply with all our partners who are working on complementary platforms in this space; we are not omniscient. Moreover, there are still many significant design and research questions we have to resolve: there is still a great deal of work to do.

Furthermore, I have been deeply impressed by the quality engineering embodied in the many platforms that have passed through our labs and you will continue to hear about projects we are delivering on platforms *other* than Corda: different solutions for different problems is our mantra. Indeed, those who have attended panels or workshops in recent months will have heard me saying this for some time now.

Corda does not seek to compete with or overlap with what other firms are doing: indeed, we are building it because no other platform out there seeks to solve the problems we're addressing. That's what makes this space so endlessly exciting.

## What next?

In the coming weeks and months, you'll hear more about Corda, about our initial projects and about its design. We will also be gearing up to release the core platform as open source, possibly as a contribution to other endeavours. Watch this space.

And... we're still hiring (<https://jobs.lever.co/r3cev.com>): there is a great deal of work still to do!

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BLOCKCHAIN, CAREERS, DISTRIBUTED LEDGERS, R3, SHARED LEDGERS

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6 COMMENTS

It's New Year... Time to change the world

We're hiring! (<http://r3cev.com/careers>)

- Are you a talented developer?
  - ... who has experience of banking technology *and* a passion for blockchain technology?
- Can you tell your *nostro* from your *vostro*?
  - ... and do you have an intuitive understanding of why it's quite so hard to change *anything* in a bank?!
- Do you understand why Bitcoin works the way it does?
  - ... and can you explain the block size debate in a way that *all sides* would agree was fair?
- Can you explain why \$100 at Chase is different to \$100 at Wells Fargo?
  - ... and can you design a data model that reflects this reality?
- Do you have a passion to transform the world of finance by applying insights from the worlds of cryptography, blockchain technology and distributed systems?

**If so, we should speak.**

At R3 (<http://r3cev.com/careers>), we're working on what I think is the most interesting and exciting technology project in finance for years and we're hiring talented, motivated professionals to turn our vision into a reality.

If you think "a blockchain" is the answer to every question then you probably shouldn't apply. But if you think the application of modern cryptography, consensus techniques and modern internet-scale technologies to some of the thorniest problems in financial technology sounds exciting, please email me (<mailto:richard@r3cev.com>).

Before you do, however, some background. Because I'm convinced many people are thinking about the problems and opportunities completely back to front...

The reality is that banks were amongst the earliest adopters of information technology and, contrary to popular belief, they have done a good job in automating previously manual processes and in digitising previously physical processes.

But there *are*, of course, significant opportunities to improve the cost and efficiency of the architectures that have emerged – and today's developments in blockchain technology and distributed ledgers are showing us how.

**At core, this is all about moving from *firm-level* systems to *industry-level* systems.**

Today, each bank has its own ledgers, which record that firm's view of its agreements and positions with respect to its customer set and its counterparts – and its counterparts, in turn, maintain their views. This duplication, whilst robust, is expensive and can lead to inconsistencies, and it drives a need for costly matching, reconciliation and fixing of errors by and among the various parties to a transaction. To the extent that differences remain between two firms' views of the same transaction, this is also a source of risk, some of it potentially systemic.

The maturation of cryptographic techniques, exemplified in part by “blockchain technology”, provides a new opportunity: the possibility of authoritative systems of record that are securely *shared* between firms. This provides the opportunity to implement new shared platforms for the recording of financial events and processing of business logic: one where a single global logical ledger is authoritative for agreements between firms recorded on it, even though the relationships and obligations recorded remain between those firms.

I believe successful, transformational, large-scale deployments of shared ledger technologies in finance depend on the adoption of an architecture that is designed from the ground up to address the functional and non-functional requirements of banks. And the non-functional requirements are really, *really*, exacting.

It’s why I hired James Carlyle, Mike Hearn and Ian Grigg (<http://gandal.me/2015/11/19/introducing-the-r3-technical-leadership-team/>) to start building out our technical leadership team: I might be CTO but I’m not remotely clever or experienced enough even to *begin* to figure out the answers to these questions.

And it’s also why we’re hiring talented developers, designers and architects to join our team.

So, if you’re experienced, intelligent, curious and motivated by solving difficult problems in distributed systems in finance, I can think of no better places to be working right now.

*email me at [richard@r3cev.com](mailto:richard@r3cev.com) (<mailto:richard@r3cev.com>) if you want to talk.*

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## Introducing the R3 Technical Leadership Team

I joined R3 in September as our Chief Technology Officer. Regular readers may have noticed a drop-off in my blogging at precisely the same time. It turns out that joining a high-profile, fast-growing startup consumes a lot of time..!

In this post, I want to share some early thoughts and to introduce my senior leadership team (<http://static1.squarespace.com/static/55f73743e4b051cfcc0b02cf/t/564dd802e4b0dff76870e198/1447942146527/PRESS+RELEASE+R3+tech+management+team+%2811-19-15%29.pdf>). Regular readers of my blog will know that I have thought deeply and written often about the applications of blockchain and distributed ledger technology in finance. But as I set out on my journey at R3, I tried to imagine myself in a few years, sitting in front of the CIO of one of the world's largest banks, having a conversation about our project. What would we talk about? How would I describe what we had built? How would I explain why we built it one way rather than another?

I figured it would be an *extremely* difficult conversation if my opening line was: "well... you know.... I built the platform like this because blockchains were cool in 2015"... No. That simply won't do. The rules of engineering and architecture don't fly out of the window just because somebody pulls out the "shared ledger" trump card.

If we aspire to reduce cost, free up capital, improve controls and enable innovation in finance and beyond, we need to build our vision on more than hype and hope. So I've gone back to basics: what properties does a technology platform need to possess if it is going to enable the world's banks – and other firms – to deploy shared platforms to record, manage and report on their contractual agreements with each other and with their customers? What is the irreducible set of functional requirements we must provide? What are the non-negotiable non-functional requirements?

So I've spent my first few weeks building my leadership team, establishing an Architecture Working Group with our members and developing a detailed view on what a shared ledger for financial firms needs to look like if it's going to gain widespread adoption and solve real business problems.

In the coming weeks, I'll share thoughts on these questions. I'm probably wrong about huge portions of it (I usually am...). But my strong desire is to have this debate in the open: just as we're driving this discussion with our members, we also want to debate this with other practitioners, firms and projects. Not least, because it's *manifestly obvious* that a base "fabric" for the recording of financial events and execution of logic has to be open and if I can persuade you of my vision (or you can persuade me of yours...), perhaps we can work together to drive some standardisation too. Watch this space.

In the meantime, I'd like to introduce my senior leadership team.

First, I'm delighted to announce that James Carlyle (<https://twitter.com/jwgcarlyle>), formerly Chief Engineer at Barclays Personal and Corporate Bank, is joining R3 as our Chief Engineer. He is almost too-good-to-believe: he built hugely complex systems for a hugely complex bank, founded two startups *and* he happens to be one of the few people I know who can both *talk* about ethereum *and* develop for it.

Secondly, I am beyond excited that Mike Hearn (<https://github.com/mikehearn>) has joined us as our Lead Platform Engineer. He brings half a decade of experience of blockchain and cryptocurrency development and over seven years of experience helping run some of Google's most heavily-trafficked websites. The combination of deep understanding of blockchain technologies and real-life

experience of building rock-solid internet-scale production platforms is truly unmatched in the industry. And his involvement in the recent bitcoin blocksize debate gives me confidence he can hold his own against a group of *very* opinionated bank architects...

Thirdly, I would like to welcome Ian Grigg (<http://www.financialcryptography.com/>), our Architecture Consultant. Ian has been building cryptographic ledger platforms for *over two decades*. He invented the concept of the “Ricardian Contract” ([http://iang.org/papers/ricardian\\_contract.html](http://iang.org/papers/ricardian_contract.html)), co-invented the concept of triple-entry accounting ([http://iang.org/papers/triple\\_entry.html](http://iang.org/papers/triple_entry.html)) and astounds me every day with the experience and perspective he brings to the team. You would be amazed how many of the concepts in the shared ledger space today can be traced back to Ian’s work.

Fourthly, Tim Swanson (<https://twitter.com/ofnumbers>) joins as our Head of Research. I have to believe there are people in this space who Tim *doesn’t* know, but I’ve not met one yet. He teaches me every day that it’s OK to be opinionated, provided you can justify the opinions. And Tim can; his most recent report (<http://www.ofnumbers.com/2015/11/18/watermarked-tokens-and-pseudonymity-on-public-blockchains/>) is a fascinating demonstration. I lean on him heavily for advice and insight and am delighted to have him as a colleague.

They join a fast-growing team, which also includes Jo Lang (<http://www.femtechleaders.com/north-america/jo-lang/>) and Ayoub Naciri (<http://www.fifthmoment.com/author/ayoub-nacirigmail-com/>), amongst others.

... and what about you? **We’re hiring!**

We are working on the most interesting and exciting project I can imagine in technology today. We’ll be sharing details of our open roles and how to contact us shortly. In the interim, if you’re interested in working with us, I’d encourage you to think about a few questions that just might come up in interview...

- If you were building a system to enable multiple parties to come to consensus about the state of an agreement between them and maintain that in lockstep for the life of that agreement, what are some of the most important non-functional requirements you would want to explore to validate your design?
- If you were building a shared ledger system between large numbers of regulated financial entities with hugely sophisticated IT infrastructures, what would be your approach to co-existence and integration?
- What would be your answer to the CIO’s *follow-up question*? “Tell me... why *did* you build your shared ledger using a blockchain rather than another technology?”



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COMMENTS

17 COMMENTS

## Free advice can be valuable... but only if you take it

*If a client tells you your solution doesn't solve their problem, it may not be the problem that needs to change...*

I often argue for the importance of blockchain and distributed ledger technology by using the following chain of logic:

- Bitcoin's architecture solved the problem of censorship-resistant digital cash
- But few, if any, financial firms are interested in censorship-resistant digital cash
- So why are they looking at this technology?
- Because some principles underpinning Bitcoin's architecture – shared ledgers, for example – could be relevant to problems that banks face.

Sure, a blockchain or a replicated shared ledger *could* indeed be useful to banks. Perhaps it could reduce the need for reconciliation between firms if they all ran off a single ledger, for example. But this says nothing about whether blockchains are the *optimal* solution to any particular problem in banking. That still has to be argued, of course.

Recall: the bitcoin architecture was a solution to a very specific, very carefully framed problem – how to transmit value without the risk of censorship. Just because the underlying architecture *could* be used to solve some pressing problems in banking doesn't mean it's the best way to do so. Indeed, although the interlocking aspects of the Bitcoin solution are in some ways quite elegant, there are also some compromises. After all, it is an engineering solution to a set of very specific constraints and so it has to be demonstrated that it's the right solution when the constraints are different.

Lee Braine, of Barclays Investment Bank CTO Office, made an important contribution to this debate when he spoke at London Blockchain Conference 2015 recently. The video is now available and I urge anybody working in this space to watch it and to internalise its message.

[vimeo 137190236]

We all too often “talk past each other” in the distributed ledger world and we are quick to assume the other person just “doesn’t get it”. I can assure you that Lee *does* get it and it would be a brave startup in this space that chooses to disregard what he said. *He’s giving us free advice! Take it!*

Like I say, watch the video for yourselves.

I think another way to capture the chain of logic in the video is as follows:

- Assume the ongoing interest in the application of blockchain technology continues
- Assume further that some banks identify some compelling business opportunities in deploying a cryptographically-secure shared ledger between themselves.
- What is the probability that a derivative of Bitcoin or Ethereum or any other current platform will be the best solution to that specific problem?
- Given that none of them were invented to solve that problem, surely it’s quite low, right?

So we could find ourselves in the situation that bitcoin and blockchain technology have catalysed an orgy of activity, that this activity has identified countless high-quality business problems and yet none of those opportunities are best addressed with the technology that triggered the excitement in the first place!

The theme of this blog is “free advice” and the free advice I’m taking from Lee’s comments includes:

First, we shouldn’t get enamoured by a *particular* implementation of a technology. Sure: if you have an implementation then you may have bought a place at the table. But don’t make the mistake of assuming that if the business problem doesn’t fit the technology then it’s the business problem that needs to change!

Secondly, if you’re working in a financial institution, be careful to distinguish between the *principles* embodied in these technologies. Shared ledgers? Yes. That seems to be at the heart of this domain. Indiscriminate replication? Perhaps. Cryptographically-secured access down to the “row” level? Probably. And so on.

Thirdly, consider the complexity of banks’ existing IT environments. An idealised, “wouldn’t the world be perfect if...” solution is no use to anybody if it requires the whole world to move at once and/or if there is no credible migration path. This points to a need to listen to the incumbents when they object. Furthermore, consider the *non-functional requirements* which are simply a given in this space.

Fourthly, if we assume that today’s current hyperactivity will lead to a new understanding of the possibilities for banks but don’t assume that today’s blockchain platforms (permissioned or permissionless) are the (whole) answer, then surely we’re back in the land of engineering, architecture and hard work? Perhaps this means that the combination of persistence, data models, APIs, consensus, identity and other components that we need won’t all come from one firm. So a common language, some common vision and an ability to collaborate may become critical. Where is your distinct differentiation? Where would you fit in an overall stack?

POSTED BY

GENDAL

POSTED ON

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BITCOIN, BITCOIN XT, BLOCK SIZE, GOVERNANCE  
COMMENTS

33 COMMENTS

## Brief thoughts on the Bitcoin block size debate

I've kept well away from the block size debate but the launch of Bitcoin XT (<https://medium.com/@octskyward/why-is-bitcoin-forking-d647312d22c1>) is worth a quick mention.

My reasons for staying out of the debate are pretty obvious: I'm not a miner, I'm not a core developer, I don't run a wallet service, I have no particular insight into the engineering trade-offs and, perhaps most importantly, I'm *not mad*. If I wanted to argue with people on the internet, there are far more interesting topics than Bitcoin's block size...

But I've been asked by several people what I think. And, at core, I think it might come down to three issues: 1) fear of two different types of failure, 2) a clash of visions and 3) no process for reconciling the first two issues.

## **Fear of Two Different Types of Failure**

### *Fear of technical failure*

I don't contribute, but I do read the Bitcoin Development (<http://lists.linuxfoundation.org/pipermail/bitcoin-dev/>) mailing list. I find it immensely helpful in keeping up with much of the day-to-debate debate. What becomes clear when you read it is that there are (at least!) two distinct cultures at work.

First, there is a very strong security engineering (<http://www.cl.cam.ac.uk/~rja14/Papers/SEv2-c01.pdf>) culture. I sometimes think the trick to being a good security engineer is to think like a software tester (and vice versa): "How could I break this?"... "How could an attacker get round

this?"... "What could go wrong here?"... "How could I force the provider of this service to waste all their resources" And so on. Your job is to figure out all the ways something could fail, and fix it.

So, when presented with something like an increased block size, you obviously focus on all the things that could go wrong: miners on slow connections could get out-of-sync with those on the other side, the increased cost of running a node could create a centralisation pressure and so on. And when you compare this against the potential benefits, you might not think the change makes sense: there's an increased technical and security risk but you haven't fixed the underlying scalability issue at the heart of the system... you have, in some ways, just kicked the can down the road. So you might say that a driving issue here is "**fear of technical failure**": the change, which has uncertain benefits, could cause catastrophic harm. Better not do it just yet.

### *Fear of practical failure*

But, on the other side, is a somewhat different culture, one that comes from a world where there are problems everywhere you look and they all need fixing. So you pick the biggest one, fix it and move on. The engineering functions of large companies are often like this. You know your change might cause problems but if you believe "doing nothing" is not an option then it comes down to making the least-worst decision. There are, after all, usually no good solutions, just compromises.

So, if you're faced with a problem like blocks getting full in some foreseeable timeframe, it is natural to ask yourself: what is the risk of doing nothing? If your belief is that consumers mostly have *choices* and will simply abandon a system that can't guarantee transaction confirmation in a reasonable period then you'll likely see failure to increase the block size as something that will lead to a catastrophic exodus of users and your bias will likely be towards making the change. For you, the issue is "**fear of practical failure**": failing to increase the blocksize, a change which has uncertain risks in any case, will drive away users and make the system a failure in all practical cases.

I exaggerate for effect, of course and I've ignored many aspects of the argument (e.g. the fee market, etc). And I'm sure some of the details are simply wrong. But note: even under this simplistic model, it doesn't mean either side is "wrong" or "bad": it is possible to hold either view quite legitimately and to passionately believe the other side is wrong

## A Clash of Visions

Where it gets more complex is when it comes to vision: if there was common agreement on what outcome was desired (e.g. "x transactions per second across the blockchain by 2017" or "the system should support this number of consumer wallets") then the discussion would be a pure engineering discussion: "what is the best way to achieve this goal?" But it strikes me that there isn't agreement on this underlying vision.

And so, the engineering discussions get lost in the sound of people talking past each other or, worse, resorting to ad hominem arguments. If you're arguing from different premises, you never get anywhere, sadly. It's what makes political discussions on the internet so tedious..!

# Process

In most projects, these issues can be resolved, ultimately, through the “benevolent dictator” model. Linus just decides ([https://en.wikipedia.org/wiki/Benevolent\\_dictator\\_for\\_life](https://en.wikipedia.org/wiki/Benevolent_dictator_for_life)).

Unfortunately, that process just doesn’t work in a system like Bitcoin. It’s not enough to control which code goes into the “core” distribution: the prevailing network rules are a complex function of miner adoption, full node adoption, wallet adoption, major merchant/processor adoption, and more. It’s an inherently messy and political process. So the block size debate is likely to just be the first of many such controversies in this world. The launch of Bitcoin XT is an interesting way to force the debate towards a conclusion but it’s likely to be messy.

And I hope those looking at “private blockchains” aren’t feeling smug as they read this. Managing the maintenance and upgrades of shared ledger systems between firms won’t be a walk in the park, either.

I have no particular insight into where this will go or which vision of the future will prevail. But I hope (perhaps forlornly) that it will be resolved through the actions of professionals acting in good faith and that neither side will resort to “dirty tricks”.

POSTED BY

GENDAL

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BITCOIN, BLOCKCHAIN, LEDGERS, MODELS

COMMENTS

27 COMMENTS

## Bitcoin and Blockchain: two revolutions for the price of one?

*I gave a brief talk on Bitcoin and blockchain technology to an audience of non-specialists at a dinner last week. It covers many of the themes I’ve explored on this blog before. But the short, fifteen-minute, format forced me to be brief and clear. This is an edited version of the speech*

A £20 note has an obvious, yet extraordinary super-power. I can hand it to anybody in this room and £20 of value will be transferred instantly, directly, peer-to-peer, person-to-person. Settlement, with finality, in central bank money! And nobody else need know. And nobody can stop me.



(<https://gandal.files.wordpress.com/2015/07/super20.png>).

*Super £20!! [I really hope there's no law against posting photos of money...]*

But this super-power only works at close distance. If I want to transfer £20 of value to somebody in a different town or in a different country, I need to trust other people. Sure: I could put the £20 in an envelope and post it. But even then I'd have to trust the postal service.

Or I could use a bank. But I'd be trusting them to be good for the money. And I'd have handed over control: if my name's on the wrong list, the bank would be obligated to seize my funds. And if *you're* on the wrong list, the bank will refuse to transfer the money to you...

"Digital" money is not the same as physical cash.

And the world's financial plumbing – payments systems, correspondent banking, SWIFT, ... – is a direct consequence of this observation: physical cash really is fundamentally different to every other form of money: only *physical* cash is a bearer instrument. And only *physical* cash can be transferred without permission – *censorship-resistant*.

Or so we thought.

Because a [curious email to an obscure cryptography mailing list](https://www.mail-archive.com/cryptography@metzdowd.com/msg09959.html) (<https://www.mail-archive.com/cryptography@metzdowd.com/msg09959.html>) at the end of 2008 said something quite audacious. The email, from the hitherto unknown Satoshi Nakamoto heralded the arrival of Bitcoin and the advent of "purely peer-to-peer electronic cash".

## Bitcoin P2P e-cash paper

Satoshi Nakamoto | Sat, 01 Nov 2008 16:16:33 -0700

I've been working on a new electronic cash system that's fully peer-to-peer, with no trusted third party.

The paper is available at:

<http://www.bitcoin.org/bitcoin.pdf>

The main properties:

Double-spending is prevented with a peer-to-peer network.

No mint or other trusted parties.

Participants can be anonymous.

New coins are made from Hashcash style proof-of-work.

The proof-of-work for new coin generation also powers the network to prevent double-spending.

Bitcoin: A Peer-to-Peer Electronic Cash System

Abstract. A purely peer-to-peer version of electronic cash would allow online payments to be sent directly from one party to another without the burdens of going through a financial institution. Digital signatures provide part of the solution, but the main benefits are lost if a trusted party is still required to prevent double-spending. We propose a solution to the double-spending problem using a peer-to-peer network. The network timestamps transactions by hashing them into an ongoing chain of hash-based proof-of-work, forming a record that cannot be changed without redoing the proof-of-work. The longest chain not only serves as proof of the sequence of events witnessed, but proof that it came

(<https://gandal.files.wordpress.com/2015/07/super202.png>).

*"A purely peer-to-peer version of electronic cash"*

We all know the story of what happened next.

Except... what many people have missed is that the choice of the word "cash" in that email was absolutely critical and absolutely deliberate. What this email announced was the arrival of a *digital* bearer asset that is censorship resistant. Digital cash. A digital asset that you can hold outright, with no risk of confiscation, and which you can transfer to anybody you choose with no permission from anybody else.

And the funny thing is: the architecture of Bitcoin flows almost trivially (*almost...!*) from this requirement. Proof-of-work, the peer-to-peer gossip network, mining, the mining reward, the *blockchain*. The lot. It's as if the genius of bitcoin was to *ask the question*.

But why am I saying this in the summer of 2015? This exact same thing could have been said at any point from 2009 until now. There's nothing new here.



Except...

Nobody asks the obvious question:

*Who actually wants a censorship resistant digital bearer asset?!*

Well... some people do, of course. But none of them are banks or corporates. At least, *I've* not yet met a bank that wants this.

*So why are so many banks, corporates, VCs and startups spending so much money in this space?!*

I think there are two completely distinct reasons and that that the world of “blockchain technology” is actually two completely different worlds, with different opportunities and different likely winners. And those who don’t realise this might be about to lose a great deal of money.

**First, let’s look at Bitcoin.**

We should probably be realistic here. Bitcoin is not the solution to Greece’s crisis and it won’t bring finance to the world’s poor. But it turns out that censorship resistance *is* extremely valuable, even for people who don’t think they need it.

Because censorship resistance implies *openness*.

Anybody or *anything* can connect to an open network like Bitcoin to own and transfer value. And anything that is open, standardised, owned by nobody and useful smells very much like a platform. And we’ve seen how those stories play out.

But notice something else: Bitcoin is *worse* than existing solutions for all the use-cases that banks care about. It’s expensive. It’s slow. And it’s “regulatorily difficult”. And this is *by design*.

So this makes it doubly interesting.

Because it means Bitcoin is probably worse than existing solutions for all the things *most* people and firms care about but *vastly* better for one single use-case (open access to value transfer) that could be very useful for *some* people.

Isn’t that pretty much the definition of a disruptive innovation? Something that’s worse for existing use-cases but solves a niche use-case very well?

So, if this is true, we should expect to see adoption of Bitcoin come from the margins, solving marginal problems for marginal users.

But disruptive innovations have a habit of learning fast and growing. They don’t stop at the margins and they work their way in and up.

So this is why I think so many of the big-name VCs are so excited about it.



So the incumbents should be keeping a very close eye on what's going on. If anything in this space is going to disrupt them, it will probably come from this world. But it's perfectly understandable that vanishingly few of them are actually *engaging* deeply in this world.

**So if Bitcoin isn't why banks are looking at this space, what *are* they looking at?**

How have so many people convinced themselves that there is something of interest here that is "separate" to Bitcoin or systems like it?

At this point, it's customary to observe sagely that "of course, the real genius of bitcoin was the blockchain; that's where the value is".

But I've discovered something rather amusing. If you push the people who say this, and ask them what they *actually* mean, most of them can't! And yet... whether they understand why or not, they are actually on to something.

It comes down to how bitcoin delivers on the design goal of "censorship resistant" cash.

Imagine Bitcoin didn't already exist and you were asked to design a system of censorship-resistant digital cash. How would you do it?

Well... you couldn't build it around a central database: the government could shut it down. That doesn't sound very censorship resistant.

And you couldn't rely on a network of trusted people around the globe since law enforcement could simply collaborate to shut them down too. And in any case, who would control the identity system that helped you be sure these people were who you thought they were in any case?

It turns out that the answer is quite unexpected... and it's something I'd bet almost *all* engineers would consider *completely mad*.

The answer is that you get everybody who fully participates in the system to maintain a full copy of the ledger. And every time somebody, anywhere in the world, spends some bitcoin, we're going to inform everybody who's maintaining this ledger and they're going to store a copy of that transaction too.

Bitcoin essentially runs on a MASSIVELY replicated, shared ledger. (The trick is in keeping it consistent, of course...)

It sounds insanely inefficient and expensive... and perhaps it is. But we also have to ask ourselves: inefficient and expensive as compared to *what*?

**And this leads us to the *other* world**

Just look at the state of banking IT today... Payments, Securities, Derivatives... Pick any one. They all follow the same pattern: every bank has built or bought at least one, usually several, systems to track positions and manage the lifecycle of trades: core banking systems, securities settlement systems, multiple derivatives systems and so on.

Each of these systems cost money to build and each of them costs even more to maintain.

And each bank uses these systems to build and maintain its view of the world. And they have to be connected to each other and kept in sync, usually through reconciliation.

Take even the simplest OTC derivative contract: it is recorded by both sides of the deal and those two systems have to agree on everything for years. Very costly to operate.

But what if... what if these firms – that don't quite trust each other – used a *shared* system to record and manage their positions? Now we'd only need *one* system for an entire industry... not one per firm. It would be more expensive and complicated to run than any given bank-specific systems but the *industry-level* cost and complexity would be at least an order of magnitude less. One might argue that this is why industry utilities have been so successful.

But a centralised utility also brings issues: who owns it? Who controls it How do the users ensure it stays responsive to their needs and remains cost-effective?

The tantalising prospect of the blockchain revolution is that perhaps it offers a third way: a system with the benefits of a centralised, shared infrastructure but without the centralised point of control: if the data and business logic is shared and replicated, no one firm can assert control, or so the argument goes.

Now, there are lots of unsolved problems: privacy, performance, scalability, does the technology actually work, might we be walking away from a redundant (antifragile (<https://en.wikipedia.org/wiki/Antifragile>)?) existing model? Who will build these platforms if they can't easily charge a fee because of their mutualised nature? Difficult questions.

But see: this has nothing to do with funny internet money, bitcoin or censorship-resistant digital cash. It's a completely different world

## Two revolutions for the price of one

So... the blockchain revolution is so fascinating because it could actually be TWO completely different revolutions... both profound in their implications:

- Censorship-resistant digital cash providing a new platform for open, permissionless innovation driven from the margins
- And industry-level systems of record driving efficiencies for incumbents.

Neither of these are “sure things”... they are both high risk speculative bets... but they're also very DIFFERENT bets...

[EDIT 2015-07-23 Gideon Greenspan has written a great piece that comes at this argument from a very different angle (<https://www.linkedin.com/pulse/ending-bitcoin-vs-blockchain-debate-gideon-greenspan?trk=prof-post>)]

*As ever, the thoughts and comment on this blog are mine alone and don't represent the view of my employer....*

POSTED BY

GENDAL

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BALANCE SHEETS, BANKING, BLOCKCHAIN, DISTRIBUTED LEDGERS, SHARED LEDGERS  
COMMENTS

16 COMMENTS

## A Simple Explanation of Balance Sheets (Don't run away... it's interesting, really!)

*Shared ledgers could be revolutionary but do we need to share a mental model for banking to make sense of it all?*

What would be your first instinct if your friend were to tell you they had £1m in the bank? To congratulate them on their good fortune? To suppress a pang of jealousy?

Wrong, wrong, a million times WRONG!

The *only* acceptable first instinct is to shout loudly at them: “No! You fool! You don’t ‘have’ a million in the bank. You have *lent* a million to the bank. They *owe* it to you. How could you reveal so casually that your mental model of banking is so wrong?!”

If your first instinct was the correct one then you need read no further; there is nothing for you here. But, for everybody else, you could be missing something really important. And this could matter: as I’ve written (<http://gendal.me/2015/06/08/towards-a-unified-model-for-replicated-shared-ledgers/>) repeatedly (<http://gendal.me/2015/04/27/how-to-explain-the-value-of-replicated-shared-ledgers-from-first-principles/>), we could be witnessing the emergence of shared ledger systems in finance – blockchains, if you prefer. And they will be used to record obligations of – and agreements between – firms and people of all sorts. A more complex (and larger) example of this, if you like:

# DistributedLedger

Issuer	Holder	Asset	Value
GendalBank	Charlie	GBP	2m
GendalBank	Debbie	GBP	3m
OtherBank	Elsbeth	GBP	1m
Freddie	OtherBank	GBP-1yr-Loan	500k

(<https://gendal.files.wordpress.com/2015/07/balancesheet11.png>)

*The four-column model of shared ledgers*

To make this work, we're going to have to get a lot more precise about how we think about financial relationships. And I'm pretty sure it all comes down to having a clear mental model for balance sheets.

## What is a balance sheet?

Imagine you were starting a bank. You'd want to put a system in place to keep track of the finances: how much cash do you have in the vault? To whom do you owe money? How much have you lent out? And so on.

The basics are not rocket science and there are only two key reports at the heart of this: the balance sheet and the income statement (aka the P+L).

They exist to answer two important questions:

- What do I own and how much do I owe? This is what the balance sheet tells you. Think of it as a point-in-time snapshot.
- How did I do in the last period? That is what the income statement tells you. Think of it as the story for how you got from last year to this year.

In this piece, we'll look at the balance sheet, because I think it's the one you need to understand to make sense of where shared ledger technology could be going.

And the good news is: a balance sheet is simple... it's just a two column table:

- You write all the things you *own* – your assets – in one column
- You write all the things you *owe* – your liabilities – in the other column.
- If you own more than you owe, the difference belongs to your shareholders: their “equity” is what makes it “balance”.
- If you owe more than you own, then you're bankrupt (“insolvent”):

Assets	Liabilities

(<https://gendal.files.wordpress.com/2015/07/balancesheet1.png>).

*A balance sheet only has two important columns: what you own and what you owe.*

## Let's open a bank!

So now let's imagine you're ready to start your small bank, "GendalBank". Your friends think it looks like a good bet so they've agreed to contribute towards the £1m you need to get it up and running in return for shares.

*£1m to start a bank?! As you can tell, my example is going to be very unrealistic indeed...*

It may be obvious but I'll say it anyway: they have no right to ask for this money back... it's not a loan. *But* if you closed the company down, anything that was left after you'd paid off all your employees, suppliers and lenders, etc., would be returned to the shareholders.

So what they really have is a *residual claim* on the company. That's what equity is. And when you look at it this way, it's obvious that equity is a *liability* of the company: GendalBank has an *obligation* to return what's left over to the shareholders if it ever closes down.

So GendalBank has been set-up and the shareholders have handed over their £1m. How would we draw up a balance sheet to reflect all this?

Assets	Liabilities
Cash: £1m	
	Shareholders funds: £1m

(<https://gendal.files.wordpress.com/2015/07/balancesheet2.png>)

*GendalBank's balance sheet after the shareholders have paid for their shares. (Pedants: please forgive me... I omitted the trailing apostrophe on "Shareholders' funds". I don't have time to update ten diagrams... but I can assure you the mistake pains me more than you)*

It's as exactly as we'd expect. Your new bank has £1m in cash – maybe you're holding it in a vault or perhaps you're holding it at the Bank of England. But, either way, this cash is now *GendalBank's*... it doesn't belong to the shareholders any more; it belongs to the company. It's the *bank's* asset now. It can use that cash for whatever it likes. So we note it down in the assets column.

And remember what the shareholders have paid for: a residual claim on the company. Well, there *are* no other claims on the company right now, so we record a liability to the shareholders of £1m. If we closed down right now, they'd be entitled to be paid £1m.

It bears repeating: bank capital is a *liability*. And this turns out to be a really useful thing to know. Because it allows you to spot charlatans at a thousand paces... any time you hear somebody talking about capital as if it were an asset of the bank ("holding more capital" is a great giveaway) then you know *they don't know what they're talking about...*

*(I can't help thinking making statements like that opens me up for all kinds of ridicule when the faults of this piece are identified...)*

Great... so now we buy some IT equipment and an office with some of that cash. So perhaps the balance sheet looks like this at the end of the first week:

Assets		Liabilities	
Cash:	£500k		
Equipment, etc	£500k		
		Shareholders funds:	£1m

(<https://gendal.files.wordpress.com/2015/07/balancesheet3.png>)

*We use some of the cash to buy some equipment and an office, etc*

*To keep things really simple, I'm going to assume the bank has no expenses. I did say this was a very unrealistic example! So we'll assume we own the office and that there are no employees to pay. This is just to avoid having to look at the income statement for now.*

**And now we're open for business... time to make some loans...**

Bob walks in off the street and asks to borrow £100k because he's planning on buying a very nice car at the weekend. He looks a trustworthy sort so we make the loan.

And now *another* really interesting happens: we create money out of thin air...

Assets		Liabilities	
Cash:	£500k		
Equipment, etc	£500k		
Loan to Bob:	£100k	Bob's account:	£100k
		Shareholders funds:	£1m

(<https://gendal.files.wordpress.com/2015/07/balancesheet4.png>)

*Our loan to Bob has created money out of thin air!*



Now Bob hasn't withdrawn any money yet – he's not buying the car until the weekend, remember. But look at how counterintuitive the balance sheet has become.

Look first at the asset side: we still have £500k cash, of course: he's not drawn anything out yet. And we see the £100k loan to Bob. That's *our* asset since Bob is obliged to pay us back £100k in the coming months and years. That's a valuable promise to hold – it's an asset of the bank, for sure.

*Aside: just as above, I'm making some massive simplifications here, not least that I'm completely ignoring interest rates and discount rates, etc. Humour me 😊*

And now look at the liability side: it records that we owe £100k to Bob. That's fair enough. If he looks at his account, he'll see £100k there that he can withdraw whenever he likes. As far as he's concerned he thinks "has £100k in the bank".

So we have £500k of our own cash – either in the vault or at the Bank of England. And Bob thinks he has £100k "in the bank" as well.

Hang on... what's going on? Did we just turn £500k into £600k by updating a spreadsheet?! Or does this mean that £100k of the £500k is now Bob's? Or what?

The way to understand this of course is to observe that the £500k is *our* asset, whereas the £100k is *Bob's* asset – and our *liability*. They're not the same thing at all and it makes no sense to compare them in this way.

And so here's another way to spot a charlatan: if you ever hear somebody talking about bank deposits as if they're *assets* of the bank, you know you can safely ignore anything that person says... As this example makes clear, bank deposits are *liabilities*... and you have to be careful around them... because customers have the annoying habit of asking you to *give* them the money so they can spend it on something. And, to do that, you'd better have enough cash (on the *asset* side of your balance sheet, remember) to be able to honour that request.

This is what people mean in this context when they discuss "liquidity" – do you have enough cash *or stuff you can quickly turn into cash* to meet withdrawal requests from your customers?

*Aside: in many ways, this conundrum is the absolute heart of banking: how to manage the problem of issuing short-dated liabilities (e.g. demand deposits) whilst holding longer-dated assets (e.g. one-year car loans). There's even a name for it: maturity transformation ([https://en.wikipedia.org/wiki/Maturity\\_transformation](https://en.wikipedia.org/wiki/Maturity_transformation)). It obviously relies on not all "depositors" wanting "their" money back at the same time and so is inherently unstable.*

But it turns out we do have enough cash on hand. So we get to live another day.

And this could go much further.... We could make *lots* of loans. As long as not everybody wants to take out money at once, maybe we'll be OK. Let's imagine lots of *other* customers plan to make some big purchases in the future and borrow some money from us. This is what the balance sheet would look like immediately after we'd made those loans but before any of them had withdrawn any of the cash:



Assets		Liabilities	
Cash:	£500k		
Equipment, etc	£500k		
Loan to Bob:	£100k	Bob's account:	£100k
Lots of loans:	£10m	Lots of "deposits"	£10m
		Shareholders funds:	£1m

(<https://gandal.files.wordpress.com/2015/07/balancesheet5.png>)

*We make lots of loans and make the balance sheet bigger and bigger...*

What happens if the people who borrowed the money from us want to draw out the cash? They presumably borrowed the money for a reason, after all...

Well, that's probably OK too, at least in "good times". Let's say they ask to withdraw £5m between them. There's the minor problem that we don't actually *have* £5m in cash... we only have £500k. But that's OK... provided we're not bust – that we're *solvent* – and people *believe* we're solvent, perhaps we can *borrow* the cash temporarily from somebody else – maybe the central bank.

So that's what we could do:

Assets		Liabilities	
Cash:	£500k		
Equipment, etc	£500k	Loan from other bank:	£5m
Loan to Bob:	£100k	Bob's account:	£100k
Lots of loans:	£10m	Lots of "deposits"	£5m
		Shareholders funds:	£1m

(<https://gandal.files.wordpress.com/2015/07/balancesheet6.png>)

*We borrow £5m cash from somewhere else and use it to pay the depositors who want cash. Notice "deposits" have reduced by £5m and loans from other banks have increased by the same amount. The asset-side of the balance sheet is unchanged in this example.*

Of course, another thing we could have done was *sell* some of the loans to somebody else for cash. And that would have also reduced the size of the balance sheet... since we'd only have £5m loans remaining on the asset side.

But it's counterintuitive, isn't it? We set up a bank that is making lots of loans and we've *not yet taken a single deposit!*

Indeed, it's even weirder... we've *created deposits* seemingly out of thin air by the very act of making these loans. Where else did Bob's "deposit" come from except from the fact that we made a loan to him? And it turns out this is a really important point. The Bank of England, no less, argues that this mechanism is the primary way money is created in the modern economy (<http://www.bankofengland.co.uk/publications/Documents/quarterlybulletin/2014/qb14q1prerelease/moneycreation.pdf>). Everything you were taught at school about how banks need to take in deposits in order to make loans *isn't actually true*... But let's leave that debate for another day...

## "Deposits"

I once wrote a piece explaining how payment systems work (<http://gandal.me/2013/11/24/a-simple-explanation-of-how-money-moves-around-the-banking-system/>). I was blown away by the response: hundreds of thousands of hits, huge numbers of them from people at *banks*. Clearly: this stuff isn't as obvious as perhaps it should be.

One of the key points I made in that post was the one I was hinting at above: it makes no sense to say you've "paid money into the bank" or that you have "money at the bank". There's no jar in the back office containing your money, with your name on the front. Instead, when you "deposit" money with a bank, what you are actually doing is *lending it to the bank*. It *ceases to be yours* and that cash becomes an asset *of the bank*. It becomes *theirs*, to do with as they wish. In exchange, they make a promise to you: to give you cash in the future if you ask for it. You acquire a *claim* on the bank.

So let's see how that works. What happens if and when somebody finally *does* make a deposit?

Let's imagine Alice has just sold her house for £500k and needs somewhere to park the cash for a few days:

Assets		Liabilities	
Cash:	£1m	Alice's account	£500k
Equipment, etc	£500k	Loan from other bank:	£5m
Loan to Bob:	£100k	Bob's account:	£100k
Lots of loans:	£10m	Lots of "deposits"	£5m
		Shareholders funds:	£1m

(<https://gendal.files.wordpress.com/2015/07/balancesheet7.png>).

*We have an extra £500k on hand as a result of a £500k deposit from Alice.*

So this works as we'd expect: we record the fact that we owe £500k to Alice – our liability – and that we have an extra £500k in the vault (or with the Bank of England) – our asset.

**OK, OK, Enough! What does this have to do with distributed ledgers?!**

Well done for getting this far. Why have I written so many words and laboured so many points? Because, and as I argued recently, we could be moving to a world where agreements and obligations between firms are recorded on a shared ledger at the level of an industry or market (<http://gendal.me/2015/06/08/towards-a-unified-model-for-replicated-shared-ledgers/>), rather than on private systems maintained separately by each of the players.

And, if this is true, we're going to need to represent the idea that Alice has a £500k deposit at GendalBank or that Freddie has borrowed £500k from "OtherBank". And this is only going to work if everybody building this systems has a deep, intuitive sense that "deposits" should be modelled as "claims against an identifiable entity" and that £500k at GendalBank is fundamentally different to £500k at OtherBank and so on. I think we need to be thinking in terms of a "four-column model" of "issuer", "holder", "assetID" and "quantity":

## DistributedLedger

Issuer	Holder	Asset	Value
GendalBank	Charlie	GBP	2m
GendalBank	Debbie	GBP	3m
OtherBank	Elsbeth	GBP	1m
Freddie	OtherBank	GBP-1yr-Loan	500k

(<https://gendal.files.wordpress.com/2015/07/balancesheet11.png>).

*Will the "four-column" model be the core data structure of the shared ledger world? (This is not an original idea to me: the concept is at the heart of systems like Ripple, Stellar and Hyperledger, amongst others)*

Perhaps more importantly, once you start thinking about things in this way, it becomes possible to see the outlines of how the future state could work.

One can imagine a world where the bank still records that it *owes* some money to its customers but the shared ledger is the place that records precisely who those people are. This is fundamentally different to using the shared ledger as a mirror (or mirroring it to the bank's own ledger) – it's more akin to seeing the shared ledger as a partial *subledger*.

And it might perhaps be something that gets adopted to different degrees by different firms.

Perhaps GendalBank just uses the shared ledger to record *some* balances. So we update GendalBank's system to say that it owes £5m to *somebody* but that it's the distributed ledger that records to whom. And we see on the distributed ledger (above) that these people are Charlie and Debbie. So the total (£5m) is recorded in both places but only the shared ledger keeps track of the fine-grained detail. So it becomes a logical sub-ledger for some deposits ("DistLedger below) whilst the bank's own ledger is used to record other facts.

## GendalBank

Assets		Liabilities	
Cash:	£1m	Alice's account	£500k
Equipment, etc	£500k	Loan from other bank:	£5m
Loan to Bob:	£100k	Bob's account:	£100k
Lots of loans:	£9.5m	"DistLedger"	£5m
		Shareholders funds:	£500k

(<https://gendal.files.wordpress.com/2015/07/balancesheet12.png>).

Perhaps GendalBank only uses a shared ledger to record details of some accounts ("DistLedger") and continues to maintain others locally.

OtherBank, by contrast, might go further and move pretty much *everything* to the distributed ledger – both records of its liabilities *and* assets. So OtherBank's internal ledger is extraordinarily simple: it just records the value of assets and liabilities managed externally on the shared ledger:

## OtherBank

Assets		Liabilities	
Cash:	£1.5m	"DistLedger"	£1m
"DistLedger"	£500k		
		Shareholders funds:	£1m

(<https://gendal.files.wordpress.com/2015/07/balancesheet13.png>).



OtherBank has “outsourced” or moved all processing to the shared ledger

So what?

Let’s look at the shared ledger again:

## DistributedLedger

Issuer	Holder	Asset	Value
GendalBank	Charlie	GBP	2m
GendalBank	Debbie	GBP	3m
OtherBank	Elsbeth	GBP	1m
Freddie	OtherBank	GBP-1yr-Loan	500k

(<https://gendal.files.wordpress.com/2015/07/balancesheet11.png>).

Imagine you’re Charlie. If you have the ability to read / write to this shared ledger, you could pay away your claim against GendalBank to any other user of that ledger without having to go through any of GendalBank’s systems. We’d have decoupled the deposit-taking and lending functions from the record-keeping, accounting, payment and trading systems.

If you were OtherBank, you could sell your loan to Freddie to somebody else and the business logic might move with the loan (the “smart contract idea): previously illiquid assets might become tradeable under this model. As I keep saying, this space is about more than just payments, after all.

Now, obviously: there is a *lot* of detail here that I’ve not even touched on. The reality is going to be *so much* more complex than this.

But hopefully this sketch shows some possibilities for where this could be going. And, like I said earlier, none of this will happen unless we get everybody to the same page with the right mental model for how banking works...

### Appendix: Aside on Regulation... what stops us going completely mad with this?

I can’t write a piece on bank balance sheets without talking about risk. And a legitimate question is: if my analysis above about how loans are made and deposits are created is correct, what’s to stop us going completely mad and taking in huge amounts of deposits or making huge numbers of loans? Don’t irresponsible banks tend to get into trouble and need to be bailed out? Well, yes they do. And there are (at least) two *very different* things that can go wrong.

*Illiquidity*

The first problem banks can face is one of liquidity. Imagine lots of customers want their money back at once and the bank doesn't actually have enough cash on hand. What happens?

As discussed above, the bank *might* be able temporarily to borrow the cash from somebody else. But what if nobody wants to lend it to the bank? They'd be suffering from *illiquidity*: the value of their assets exceeds their liabilities, so they're not bust... but they can't meet their obligations to repay people. *Oops!*

In most countries, the central bank will step in in such scenarios and temporarily lend the money to the banks. Indeed, we might say that the ECB's "Emergency Liquidity Assistance (<http://www.bloomberg.com/news/articles/2015-02-04/emergency-liquidity-assistance-for-greek-banks-an-explainer>)" programme for Greek Banks was an example of this: on the assumption (pretence?) that the Greek banks weren't bust, the ECB lent increasing amounts of Euros to the Greek banks to support deposit outflows.

From a regulatory perspective, rules such as the Basel Accord's "Liquidity Coverage Ratio (<http://www.investopedia.com/terms/l/liquidity-coverage-ratio.asp>)" is an attempt to force banks to hold enough cash (or cash-like instruments) on their balance sheet for foreseeable withdrawals.

### *Insolvency*

Another problem banks can run into is *insolvency* – being bust. It's easy to see how this could happen:

Imagine that some of the people to whom you've lent money lose their jobs or their companies go bust and you suddenly realize there is no way they will ever be able to repay their debts to you.

Let's say £2m of the loans you've written become unrecoverable. So you "write down" the loan book from £10m to £8m... since you now know you'll only ever recover £8m.

Now your assets are worth £9.6m. But your *liabilities haven't changed*. You still *owe* £10.6m to your customers and the banks you've borrowed money from.

You *owe* more than you *own*. Game over. Good bye. You're insolvent.

Assets		Liabilities	
Cash:	£1m	Alice's account	£500k
Equipment, etc	£500k	Loan from other bank:	£5m
Loan to Bob:	£100k	Bob's account:	£100k
Lots of loans:	£8m	Lots of "deposits"	£5m
		Shareholders funds:	£-1m

(<https://gendal.files.wordpress.com/2015/07/balancesheet8.png>).

*Your losses on loans mean your assets are now smaller than your liabilities. You're bust*

But notice something really interesting.... If you'd only lost £500k on your loans, you'd have been OK because your assets (£11.1m) would have still been greater than your liabilities (£10.6m):

Assets		Liabilities	
Cash:	£1m	Alice's account	£500k
Equipment, etc	£500k	Loan from other bank:	£5m
Loan to Bob:	£100k	Bob's account:	£100k
Lots of loans:	£9.5m	Lots of "deposits"	£5m
		Shareholders funds:	£500k

(<https://gendal.files.wordpress.com/2015/07/balancesheet9.png>).

*... but if you only lost £500k on the loans you'd have been OK*

So you can lose *some* money on your assets and be OK. But if you lose too much, you're in trouble. What determines how much you can afford to lose? The answer is *capital* – shareholders' funds.

You got away with the £500k loss but not the £2m loss because of your *capital*. Your shareholders took the hit. Before the bad debts came along, their residual claim on the company was worth £1m. A £500k loss takes their claim down to £500k. But in the £2m bad case above, the loss was greater than the "loss-absorbing" cushion of £1m provided by the capital and that's why you went bust.

And so this is why regulators are so fixated on capital: the more the bank is *funded* by capital rather than deposits or debt, the more resilient the bank is when they make losses on their assets. Capital can be written down to absorb losses on assets in a way that debt can't. It's why you hear so much talk about "capital ratios" and the like: what percentage of your assets should be financed by capital rather than debt?

But notice: the bank is *in no sense* "holding" capital. You hold *assets* and capital is not an asset... Instead, think in terms of capital being a mechanism through which the bank is funded.

And these phenomena can interact: if you are illiquid, you might need to sell lots of assets at "firesale" prices, turning a liquidity problem into a solvency problem.

[Update 2015-07-05 My description of insolvency is \*very\* simplified, as Ken Tindell has noted here... <https://twitter.com/kentindell/status/617719608875872256> (<https://twitter.com/kentindell/status/617719608875872256>)]

POSTED BY

GENDAL

POSTED ON

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BITCOIN

COMMENTS

24 COMMENTS

## Decentralised Digital Asset Registers – Concepts

I am hugely optimistic about the role cryptocurrencies (such as bitcoin) will play in the future – and one of the reasons is that they enable us to build decentralised digital asset registers. I've written about this concept [here](http://gendal.wordpress.com/2013/10/26/bitcoin-more-than-a-currency/) (<http://gendal.wordpress.com/2013/10/26/bitcoin-more-than-a-currency/>).

In this post, I'll explore some of the current thinking on how to *build* such a system.

The simplest way to think about this subject is to imagine you own one hundred twitter shares that you would like to sell and, because you're one of these early-adopting trailblazers, you want to sell the shares for Bitcoins and want to do so using only the bitcoin system. Here's how it could work:

As I write, Twitter shares trade for just over \$40, so your one hundred shares would be worth about \$4000. So you could announce to the world that a particular Bitcoin you own (strictly, a transaction output) is for sale and that you will give whoever buys it all the rights associated with the twitter

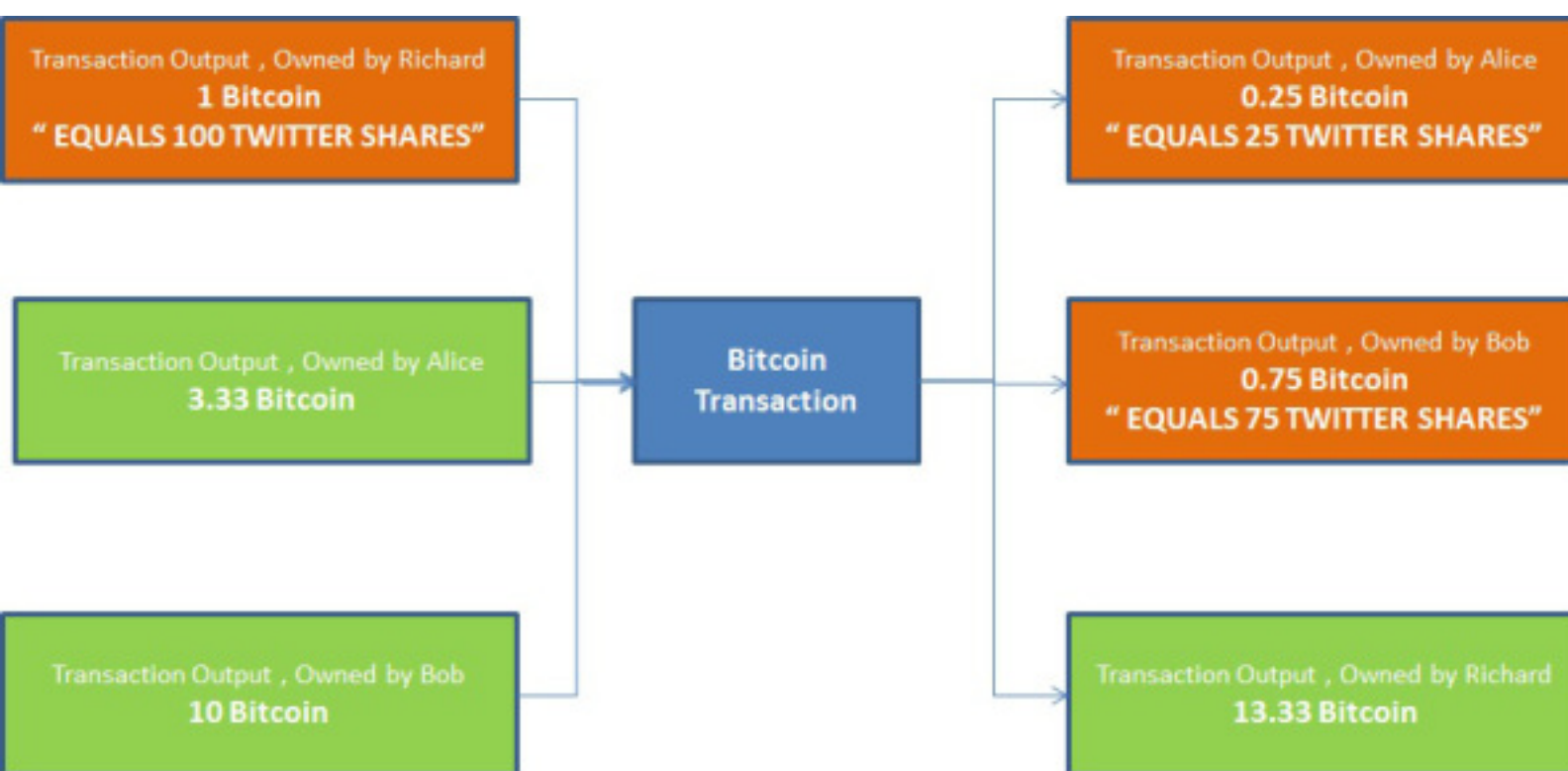


shares... e.g. dividends, votes, etc. You don't plan to transfer the share through the regular equity settlement systems in your country, though; you'll remain the registered owner there... but provided you are trustworthy, the recipient will trust you to *pass on* the benefits you receive to them.

A Bitcoin today trades for about \$300. So if you could find somebody who trusts you, they might be willing to pay you about \$4300 for your special bitcoin (\$300 for the Bitcoin plus \$4000 for the rights to the shares). Perhaps they'd demand a discount to account for the ongoing counterparty risk they have to you. So let's imagine they offer to pay you \$4000 to keep the maths simple.

To make it interesting, let's imagine that Alice is willing to buy 25% of your holding (\$1000, or 3.33 XBT) and Bob wants 75% (\$3000 or 10 XBT). What we want is for them to transfer these coins to you and for you to transfer your "special" (or, colored) coin to them so that, once you're done, you have 13.33 XBT and they have a share of the colored coin.

Graphically, this is what it might look like:



(<http://gendal.files.wordpress.com/2013/11/colored-coin-diagram.jpg>).

In this picture, we see that a Bitcoin transaction has been constructed that has the following interesting properties (in reality, it may be done as a sequence of transactions and I'm not 100% sure you could actually do it this way for real on the current Bitcoin network but the concepts remain the same so we'll stick with this for the purposes of this post)

1. Alice and Bob pay their agreed amounts of Bitcoins into the transaction (i.e. their 25% and 75% share of the costs) – colored green in the diagram
2. I pay in the coin I have previously asserted to be "equivalent" to 100 twitter shares – colored orange in the diagram
3. Alice and Bob receive 25% and 75%, respectively, of the special (colored) coin so that everybody can now see that they are the owner of the coin, and hence entitled to their shares of any benefits associated with the shares – shown in orange on the right-hand side
4. I receive Alice and Bob's payments – shown in green on the right.

Easy, right? Well.... not quite.

The problem is step 3. If you are an independent third party arbitrating a future dispute, how do you *know* that the 0.25 XBT and 0.75 XBT received by Alice and Bob relate to the ‘colored’ 1XBT I paid in? What would have happened if I had also paid somebody else 0.75 XBT in that transaction? How would we know one of these payments was the special colored coin and one was just a regular bitcoin?

Worse, what would happen if Alice or Bob somehow temporarily *forgot* their coins were special and spent them as if they were normal coins? They could lose a fortune! It would be helpful if their wallet software warned them. Which means the wallet would need to be able to tell automatically. Worse, what if Bob used his colored coin as *part-payment* for a larger expense, with regular coins making up the difference? How on earth would the recipient interpret their receipt of a transaction output that was formed from combining colored and non-colored coins?!

The answer is that there is nothing in the core bitcoin system that allows you to tell. So various conventions have been proposed. The simplest is one that just relies on ordering, but there are others, none of them particularly satisfactory. But it’s being worked on. I think one piece of work in particular has helped in this space by generalising this problem by introducing the idea of a “color kernel ([https://github.com/bitcoinx/colored-coin-tools/wiki/colored\\_coins\\_intro](https://github.com/bitcoinx/colored-coin-tools/wiki/colored_coins_intro))”, whose job it is to decide which outputs are related to which types of coin. Projects such as bitcoinx (<http://coloredcoins.org/>) are working on implementing a system based on these concepts.

In a future post, I’ll discuss a very different model, that of mastercoin.

POSTED BY

GENDAL

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POSTED UNDER

UNCATEGORIZED

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1 COMMENT

## Watched the video, bought the t-shirt

My interview with Elizabeth Lumley (<https://twitter.com/LizLum>) of Finextra has been posted to YouTube (<http://www.youtube.com/watch?v=VDO7TDMlxsY>). One of the commenters there, Nicholas Klunder, decided he liked one of my quotes... and has turned it into a t-shirt at teespring

(<http://teespring.com/nobodyknows>). I've ordered a couple, but there is still some way to go before teespring will manufacture it. Go on... you know you want one.



(<http://teespring.com/nobodyknows>).

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LEAVE A COMMENT

“A remarkable conceptual and technical achievement”

The Federal Reserve Bank of Chicago has published a rather impressive four-page briefing on Bitcoin ([http://www.chicagofed.org/digital\\_assets/publications/chicago\\_fed\\_letter/2013/cfldecember2013\\_317.pdf](http://www.chicagofed.org/digital_assets/publications/chicago_fed_letter/2013/cfldecember2013_317.pdf)).

It does a good job of explaining how the system works and I think is fair in its assessments of the weaknesses. Worth a read.

If I have one criticism, it is in their use of the word “recursive”. I don’t think that’s hugely helpful as it immediately puts the reader in a “programming” frame of mind and can obscure what’s actually going on. I prefer to explain it by appealing to listeners’ recollections (usually vague!) of *inductive* reasoning: “bear with me for a moment and let’s assume the system already works and everybody knows who owns what... right, now let’s work from there and figure out how to spend some coins in a way that allows everybody still to agree afterwards”. That’s pretty much what they did but I think saying “induction” rather than “recursion” helps the explanatory process.

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BANKING, PAYMENTS

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1 COMMENT

## Where is the power in the mobile payments ecosystem?

I am a member of the UK and Ireland affiliate to the IBM Academy of Technology (<http://www-03.ibm.com/ibm/academy/index.html>). We held our Autumn symposium in Birmingham a few weeks ago and I had the pleasure of hearing about Droplet (<https://dropletpay.com/>) and meeting one of their management team, David Roberts (<https://twitter.com/daviddrprojects>).

Droplet is a mobile payment system that allows individual to pay merchants using a very simple app, with their unique selling point appearing to be that no other infrastructure is required (no POS terminals, no card readers, ...) and that neither the payer nor the recipient is charged for the service. I’ll leave this aspect of their business model to one side for now as I’m not sure if the details have been publicly disclosed (and it’s not what motivated me to write this post in any case). What interested me was that it ticks my “push rather than pull” button. I discussed why I like this model here (<http://gendal.wordpress.com/2013/10/21/lessons-from-bitcoin-push-versus-pull/>) and so I’m always interested in those who are implementing it for real.

Right now, they seem to be targetting local retailers (such as my favourite pizza delivery joint) but it made me wonder: what would it take for a system such as this to be adopted by a major retailer? What are the incentives and game-theoretic chains of logic that help us make sense of this question?

Imagine you're a major retailer. What are your options?

- You could build your own system – perhaps licensing technology from a startup such as Droplet – maybe integrating it with your loyalty card system. But you immediately run into a problem: what incentive does any *other* retailer have to accept it? They'd surely be extremely wary of ceding control to a competitor. So we have to assume this approach would lead to an arms race, with *all* major retailers launching their own mobile payment systems. The costs would surely be prohibitive and consumers would surely rebel: would you really want to have to load (and configure and remember the PIN) for tens or hundreds of different apps? In the ensuing shakeout, perhaps a couple of retailers gain dominance... but if you were CEO of a retailer, how much would you be willing to risk on a bet that you'd be one of the winners? The odds are against you.
- Alternatively, the retailer could make a bold statement and adopt a system provided by a neutral third party. Perhaps a major grocer would simply announce that they will start accepting payments over Droplet or Zapp or in partnership with one of the card networks. The problem here is: why would you gift an endorsement so valuable to an independent company? You'd surely be tempted to negotiate a sweetheart deal, which would surely leak and you'd be back to square one: nobody else would want to support it.
- A different approach might be simply to announce acceptance of *multiple* systems: let a thousands flowers bloom. But now you have the problem of consumer confusion and staff training. And staff training will be bad enough with only *one* option. Indeed, I consider it the most significant inhibitor of a move from “pull” to “push” payments.

For these reasons, I'm increasingly convinced that the optimal response for most major retailers is simply to *do nothing*! Wait. See how the market plays out. Then be a fast follower. But I'd love to hear somebody make an argument that says I'm wrong...

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GENDAL

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# Bitcoin: more than a currency

Bitcoin, and the other cryptocurrencies it spawned, are often described as forms of “digital cash”. This is a useful analogy but also obscures an exceedingly important point: all transactions are visible to everybody and in a form that allows the bitcoin units associated with every payment to be tracked for ever more\*. This means that *Bitcoins are not fungible*. This is **huge**.

It is huge because it means that Bitcoin isn’t just a currency and payment system; *it is a globally distributed asset register*.

Consider this scenario:

Imagine I own some shares in Facebook. I could publicly announce that a particular Bitcoin (strictly, a transaction output) that I owned actually represented those shares. Thus, somebody who wanted to own these shares could pay me the market price (less a discount, perhaps, to reflect their ongoing counterparty exposure to me) and I would transfer the Bitcoin to them. This transaction would be visible to everybody and anybody aware of my public announcement would know which Bitcoin address now owned those shares.

If Facebook issued a dividend, I would pay it to the Bitcoin address that owned the coin on the relevant date.

The owner could sell it on – and would have no ongoing participation in the scheme – I would be the only entity whose honesty and solvency would need to be relied on.

One could extend this further to encompass other corporate actions and to allow merging and splitting of claims.

Call me a “registrar” or a “custodian” and it’s not a stretch to imagine the Bitcoin architecture forming the basis of a next-generation securities servicing system for the world: is there a whole layer of cost that could be taken out of that industry?

## **You can go further**

Why does the asset have to be a security? Imagine it is a parcel of land or piece of property: now you have a land registry.

This idea of “tagging” Bitcoins so that they have value independent of their currency value is known as colored coins (<http://www.coindesk.com/colored-coins-paint-sophisticated-future-for-bitcoin/>).

The core Bitcoin development team are working on updates to Bitcoin’s design to make this idea easier to implement but, even at a theoretical level, the power is clear.

[Coindesk \(http://www.coindesk.com/downside-miner-problem-robot-overlords-ahoy/\)](http://www.coindesk.com/downside-miner-problem-robot-overlords-ahoy/) has a nice précis of [my interview with Finextra \(http://www.finextra.com/Video/Video.aspx?videoid=513\)](http://www.finextra.com/Video/Video.aspx?videoid=513) on this topic (scroll down to the third section of the article).

\* various mechanisms exist to obscure transactions but they are not relevant to this discussion.

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[GENDAL](#)

POSTED ON

[OCTOBER 23, 2013](#)

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[UNCATEGORIZED](#)

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[11 COMMENTS](#)

## On the blockchain, nobody knows you're a fridge

I recorded an [interview about Bitcoin \(http://www.finextra.com/Video/Video.aspx?videoid=513\)](http://www.finextra.com/Video/Video.aspx?videoid=513) with [Elizabeth Lumley \(https://twitter.com/LizLum\)](https://twitter.com/LizLum) of [Finextra \(http://finextra.com/\)](http://finextra.com/) last week and it has just gone live.



<http://gendal.files.wordpress.com/2013/10/richard-bitcoin.png>

I made the point that Bitcoin is clearly going to be *huge*. But not for the reasons people commonly suppose.

My take is that, even if it only enjoys modest success as a currency and payment system, that will be sufficient to kickstart a whole other world of innovation. In particular, ideas such as [Colored Coins \(http://www.coindesk.com/colored-coins-paint-sophisticated-future-for-bitcoin/\)](http://www.coindesk.com/colored-coins-paint-sophisticated-future-for-bitcoin/) could enable the



emergence of truly secure and tradeable property rights over digital assets and the core insights underpinning Bitcoin's design have implications for how we build systems for our clients.

I also discussed how the takedown of Silk Road (<http://www.bbc.co.uk/news/technology-24526677>) and how it is likely to legitimise Bitcoin in the eyes of mainstream firms and the possibility that autonomous agents in the "Internet of Things" could become *economic agents*.

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BANKING, BITCOIN

COMMENTS

10 COMMENTS

## Lessons from Bitcoin: Push versus Pull

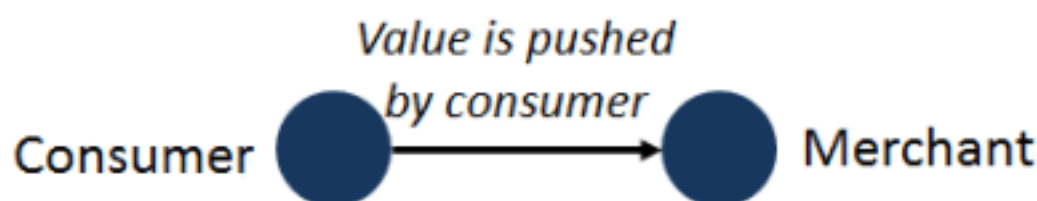
Bitcoin is going to change the world – but not for the reasons we commonly assume. One subtle way in which it will change the world is through its influence on other players in the payment ecosystem.

At the heart of the Bitcoin system is the idea of a *transaction*: at its simplest, this is a transfer of value from one Bitcoin user to another – a *credit transfer*, if you like.

Consider what this *isn't*. This isn't a direct debit. It isn't a credit card authorisation. Nor is it the creation of a debt or a precursor to a subsequent billing cycle. It is the closest thing we have in the digital world to a person-to-person cash payment.

In this way, we can think of a Bitcoin payment as analagous to a SEPA Credit Transfer, a UK Faster Payments transaction or, more generally, a wire transfer. Push, not pull.

Graphically, we could depict this as the consumer *pushing* value directly to the merchant, just like with cash:



(<http://gendal.files.wordpress.com/2013/10/push-payment.png>)



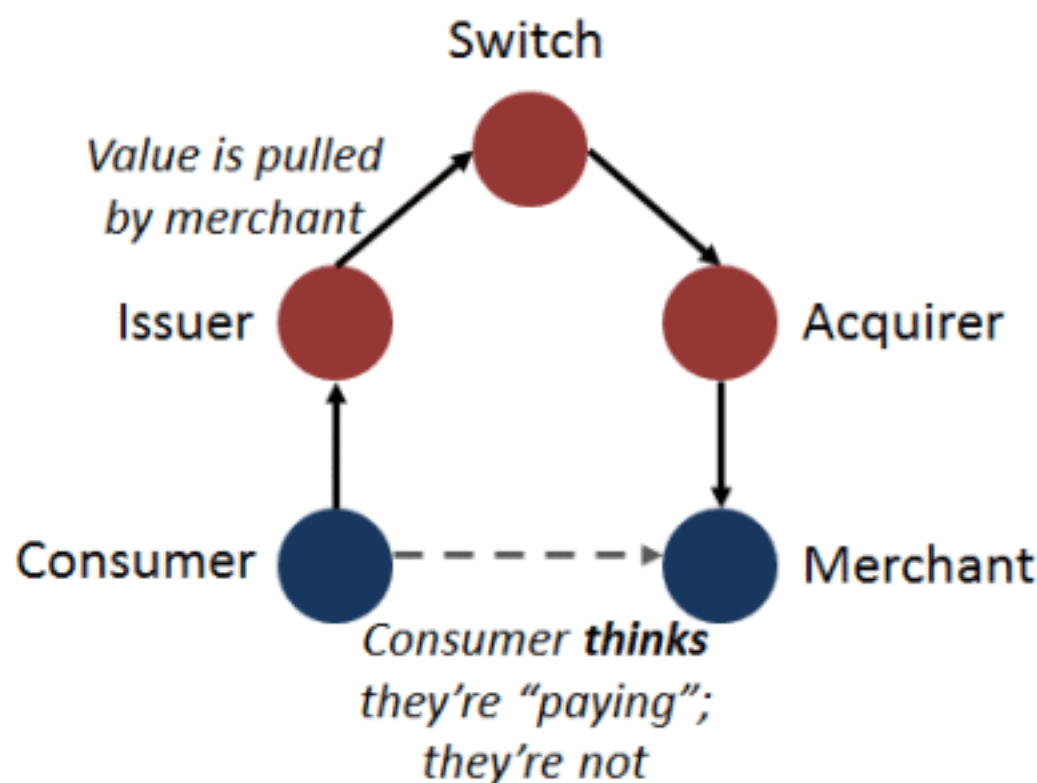
Now, consider how that differs to most other forms of electronic payments in the retail space. They are, almost invariably, achieved through the use of one or more card schemes.

But think about how they work...

The customer *thinks* they're paying. But, really, they're not. Instead, when they sign the chitty or enter their PIN, they are initiating a supremely sophisticated choreography of immense complexity.

They are, in reality, *authorising* the merchant to *pull* the payment from their account, with the request being routed through several intermediaries.

Graphically, it looks something like this:



(<http://gendal.files.wordpress.com/2013/10/pull-payment.png>)

This model has its advantages but it also suffers from severe problems: the most obvious of which is that if you're moving payment authorisations around, you need to be maniacally focussed on security: there's a reason why PCI-DSS

([http://en.wikipedia.org/wiki/Payment\\_Card\\_Industry\\_Data\\_Security\\_Standard](http://en.wikipedia.org/wiki/Payment_Card_Industry_Data_Security_Standard)) exists.

It's easy to understand why the system was built the way: what else would you have done with 1960s technology? The pull model employed by the card processors is a wonder of the world. But it's also an artefact of its time. Would you design it that way if you were starting from scratch today? I would contend that a system that doesn't need PCI-DSS, doesn't need acquirers, doesn't need issuers, doesn't need switches and doesn't require you to trust any third parties has much to commend it.

For this reason, I use this "Push versus Pull" metaphor as a quick heuristic for evaluating payments startups I come across in my day job...

