# Blockchain Technology: The Missing Link in Services Management? Part I

**In this two part article, Dr George Downie and Dr David Parker describe blockchain and how it works, analysing its potential, and attempting to de-mystify some of the reported facts, as well as dispelling some of the misconceptions.**

In October 2008, an unknown person or persons going by the nom de plume Satoshi Nakamoto, published a paper titled Bitcoin: A Peer-to-Peer Electronic Cash System[1]. On 3 January 2009, bitcoin came into existence. At the same time, blockchain, the technology underpinning the crypto currency, made its public debut[2]. It has been an impressive decade of development for blockchain; moving from concept to reality and from single-use platform to a potential springboard for market disruption – especially in the services sector.

Despite a decade of history, a very long time in the digital firmament, many, indeed most, do not really understand what blockchain is or how it may affect their business. In this article, we aim to explain in simple, accessible terms what blockchain is, how it works, where it is already making its presence felt in service industries and how it may develop in the future.

## What is blockchain?

First of all, let's deal with a common misconception: Bitcoin IS NOT Blockchain! Blockchain is the technology behind Bitcoin, but it has the potential to be so much more than just a cryptocurrency enabling platform.

You probably already know, and a cursory look at articles or on the web will confirm that blockchain is a 'disintermediated' or 'peer-to-peer' platform. In other words, it cuts out the middleman; making operations efficient, transparent, safe and secure.

Blockchain is often referred to as a digital eco-system. It allows digital information to be distributed, viewed and confirmed as accurate, but not copied, so each individual piece of data can only have one owner. The platform is an incorruptible digital ledger 'that can be programmed to record not just financial transactions but virtually anything of value'[3].

Simply put, blockchain is a time-stamped series of immutable records, managed by the software via a cluster of computers. The data is not owned by any single individual or company. Each of these records or 'blocks' are secured and bound to each other in 'the chain' using secure encryption. The blockchain network has no central authority, so no middleman or intermediary, eg a bank. The information carried by it is open for anyone in the system to see.

In explaining blockchain to our clients, we start by saying, imagine a spreadsheet that is duplicated thousands of times across a network of computers. Then imagine that same spreadsheet is regularly and automatically updated, reconciled and time-stamped. That is essentially the idea behind blockchain.

As with any software, there has to be a basic 'architecture' or structure. Figure 2 shows a basic blockchain.

It sounds simplistic, but a Blockchain is a chain of data entries or


*Figure 1: How blockchain works.*

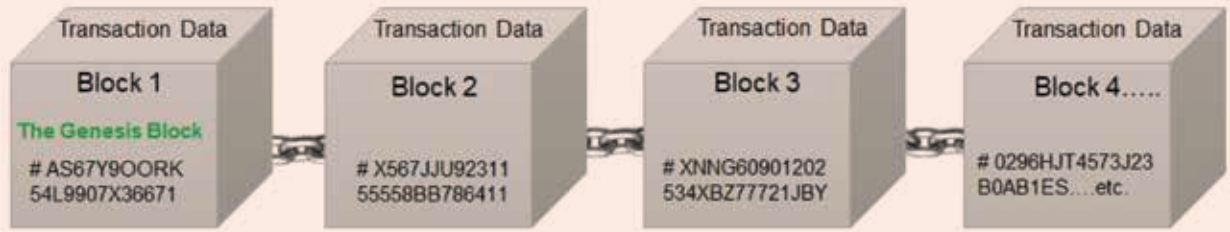


*Figure 2: Basic Blockchain Architecture.*

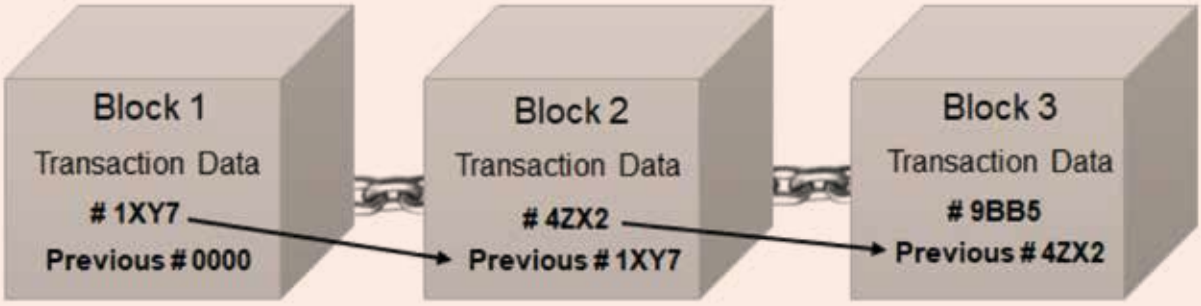


*Figure 3: Application of the SHA.*

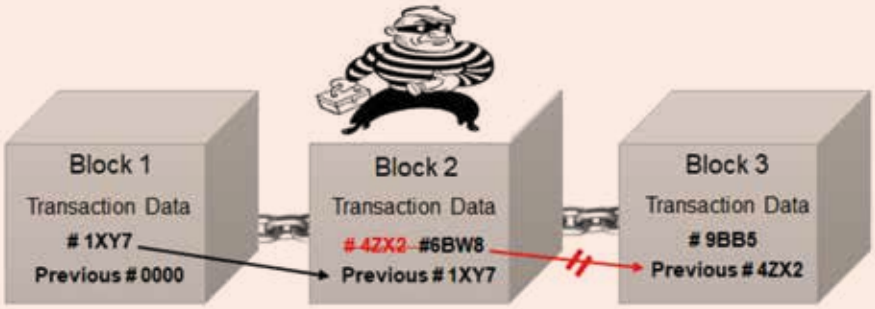


*Figure 4: Why hacking a single block invalidates the chain.*

'blocks' which contain information. You may hear the first block referred to as 'The Genesis Block' The data which is stored inside a block depends on the type of blockchain. Typically, it will include sender and recipient (purchaser and vendor) details, contractual information etc but could be a CV, a recipe or anything else relevant to the transaction.

A block also has a hash (#). The SHA (Secure Hash Algorithm) is like a signature, or as many prefer to think of it, a finger print, for a text or a data file. SHA-256 algorithm generates an almost-unique, fixed size 256-bit (32-byte) hash. Hash is a one-way function – it cannot be decrypted back.

All blocks contain the hash of their preceding blocks. Each time data is added, the SHA generates a change to that block's hash. This makes a blockchain very secure as, even if a hacker could change the data within one block, the hashes would not reconcile going forward.

However, assume that a hacker is able to change the data present in the Block 2.

Correspondingly, the Hash of the Block also changes. But, Block 3 still contains the old Hash of the Block 2. This makes Block 3, and all succeeding blocks invalid as they do not have the correct hash from the previous block.

If this seems complicated, again, think of it as a spreadsheet that is being audited at each point of data entry. If a change has been made that has not been agreed through the protocol, the data will not have been transmitted to the next copies in the chain and so the transaction is irreconcilable. Blockchain uses a mechanism called 'proof of work' to facilitate the process.

The peer-to-peer nature of the chain is also used to enhance security. In other words, everyone involved in the system has a full copy of the blockchain. Each computer is called a node. All these nodes in this network create a consensus. They agree about what blocks are valid and which are not. Nodes in the network will reject blocks that are tampered with.

So, to successfully hack a blockchain, an attacker would need to:

1. Tamper with all blocks on the chain
2. Redo the proof-of-work for each block
3. Take control of greater than 50% of the peer-to-peer network.

The basic logic underpinning blockchain is a pretty straightforward process, as the graphics above demonstrate. One final thing to mention on the basic framework is the issue of access: who can be involved in/be a node in the chain.

There are effectively two options, public and private:

- In a public blockchain, by definition, anyone can join or leave, read, write and audit the ongoing activities on the public blockchain network, which helps a public blockchain maintain its self-governed nature. The most obvious example of these are cryptocurrencies like Bitcoin.
- Private blockchains allow only selected entry of verified, invited participants, like those for a private business or membership organisation, and can be joined only through an authentic and verified invitation, with formal validation either by the network operator(s) or by a clearly defined set protocol implemented by the network.

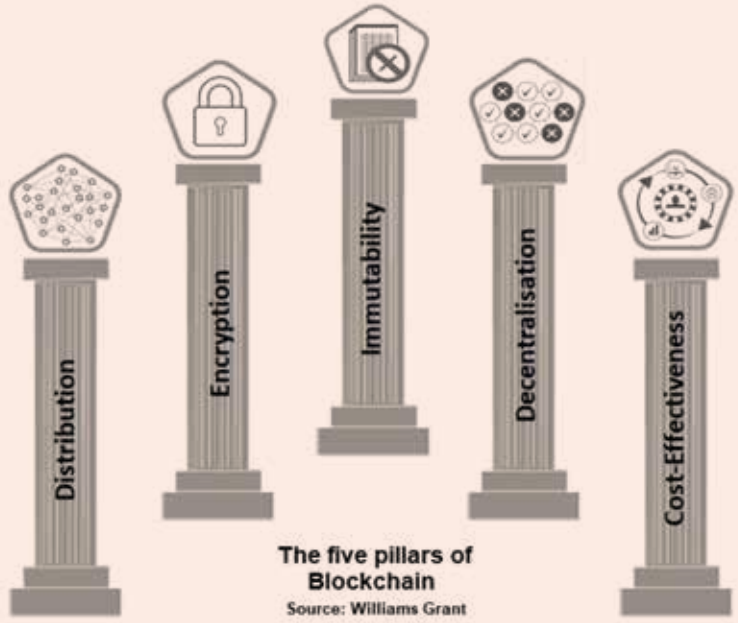


*Figure 5: The five pillars of blockchain.*

The primary distinction between the public and private blockchains is that private blockchains control who is allowed to participate in the network and maintain the shared ledger. The owner or operator has the right to override, edit or delete the necessary entries on the blockchain as required. In true sense, a private blockchain is not decentralised. Rather it is a distributed ledger that operates as a closed, secure database based on cryptography concepts.

You may hear about a 'third category' of blockchains: the permissioned blockchain. This is really just a hybrid that allows a mixed bag between the public and private blockchains with options to customise the protocols, eg allowing anyone to join the permissioned network after suitable verification of their identity, and allocation of select and designated permissions to perform only certain activities on the network. The 'consortium blockchain' is another sub category where only a group of organisations can verify and add transactions. Here, the ledger can be open or restricted to select groups. Consortium blockchain can be used cross-organisation where it is typically controlled by pre-authorised nodes.

## Why are service companies starting to use blockchains?

The operational arena for all businesses is increasingly dynamic and, arguably especially so for services-based businesses. The last decade has transformed the industry in so many ways, from using mobile devices, to having real-time data, to being connected to your customer 24/7. Embracing change is the only way to stay competitive.

The whole notion of blockchain is predicated on security, reliability of data, efficiency and transparency. This has led to what we term the five pillars of blockchain as shown in Figure 5. The most relevant features for services-based operations that blockchain offers as a result are:

- Blockchains are resilient. The blocks are regularly replicated and reconciled. Even in the event of a large scale hack the chain is still operated by most nodes and the integrity of data is verifiable through the on-going audit trail.
- Blockchain can play a vital role by allowing quicker settlement of transactions and trades as it removes the need for lengthy process of verification, settlement, and clearance. Blockchain certifies and verifies the identities of the interested parties. This removes double records, reducing rates and accelerates transactions
- Immutability is achieved by registering transactions in chronological order, certifying the inalterability of all operations: when any new block has been added to the chain of ledgers, it cannot be removed or modified, providing a water-tight audit trail.
- Nakamoto was initially focused on payments systems and stated that, 'While the (banking) system works well enough for most transactions, it still suffers from the inherent weaknesses of the trust-based model'[2]. These weaknesses incur additional costs for business users, including mediation and fraud. The shared nature of the data/information in the blocks and node consensus, massively reduce possible losses due to fraud or embezzlement. In logistics-based businesses, blockchain as a monitoring mechanism is both cost effective and cost efficient.
- Decentralisation, allowing parties to transact directly with each other without the need for mediating third parties, also increases efficiency and reduces costs. The standards rules on how every node exchanges the blockchain information. This method ensures that all transactions are validated, and all valid transactions are added one by one.

## Who are the early adopters?

Once you start to research the application of blockchain, it is truly amazing how it has developed since Nakamoto[2] promulgated the idea in 2008. Indeed, very swiftly the notion of 'blockchain 1.0'

evolved into new and novel applications of the technology and the philosophy behind it; embraced initially by Fintech upstarts and increasingly by increasing numbers of industry players: services and services management being significant amongst them. So, who is doing what?

This is by no means a comprehensive list, but should give you a flavour of some of the ways in which the technology is being applied.

## Show me the money!

Whilst the genesis of blockchain was Bitcoin and Fintech, financial services is just the beginning. Traditionally, banks have served as the storehouses and clearing houses of value. As a digitised, secure, and tamper-proof ledger, blockchain has already disrupted the financial services industry by seeking to serve the same functions in a more cost-efficient manner, whilst providing enhanced accuracy and information-sharing into the financial services ecosystem.

Barclays, UBS, HSBC and others are experimenting with blockchain as a way to expedite back office functions and settlement, which some in the banking industry say could cut up to £16 Billion in central counterparty costs. In May 2019, Barclays invested £4.5 million in Crowdz, a blockchain-based B2B payments start-up that helps companies collect payments and automate digital invoices[4].

Blockchain is also growing as a solution aimed at reducing the cost of cross-border transactions, which accounted for 27% of global transaction revenue in 2017, according to McKinsey[5]. Blockchain company Ripple, has partnered with financial institutions including Santander[6], with the goal of improving the efficiency of cross-border transactions.

Bitcoin and other cryptocurrencies continue to be in vogue with both Facebook and China planning their own digital currency projects. Bank of England governor Mark Carney, who has previously poured scorn on bitcoin and its crypto peers, now feels that a global digital currency, could replace the US dollar as the world's reserve currency[7]. Lenders minimise the risk posed by loans or lines of credit to small businesses by evaluating their histories using business credit reports. These third-party reports, issued companies such as Dun & Bradstreet, are generally inaccessible smaller business owners.

This can make business owners feel like credit bureaus have all the power over loan terms, even though the credit bureau may be assessing outdated or inaccurate information to determine their reports. Blockchain offers a potential solution to this, although a corporate network architecture and clear protocols would need to be employed to avoid over transparency on potentially commercially sensitive data to other nodes in the network.

As the banking industry continues to adapt to cryptocurrencies and blockchain technology, accountants are beginning to follow suit. Accountants work with a range of documents, from tax forms to bank statements to spreadsheets, containing extensive personal or organisational information. Employing blockchain technology could make it easier to keep track of this sensitive data as it is processed by accounting firms, large and small.

Data tracking enabled by blockchain technology may also help to automate certain accounting services using AI, which could reduce human error and instances of fraud. Indeed, we already seen this with the roll out of cloud-based applications such as Xero, CountingUp, Quick Books and others.

The Big Four accounting firms are already investigating the options: KPMG has invested in programs and projects to research and share information about blockchain; Deloitte has developed blockchain-based software; while PwC has created a blockchain-based auditing service; and Ernst & Young integrate information and processes within and across enterprise boundaries.

In part II of the article, which will be published within the Spring issue of Management Services Journal, the authors continue to describe how companies are using blockchain and offer some real life examples in the business world.

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