Blockchains for supply chains

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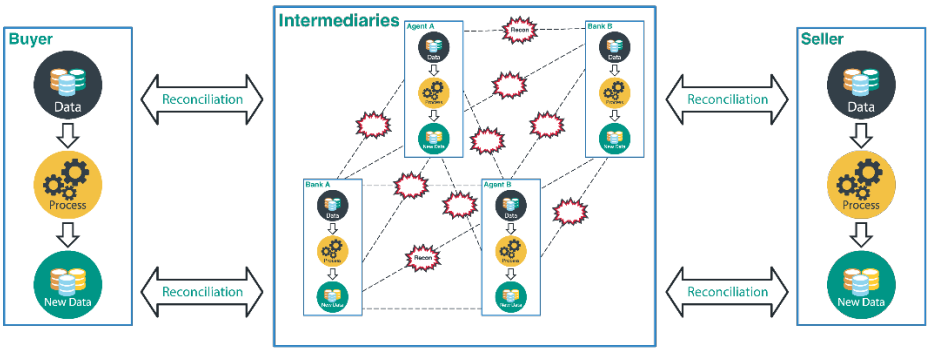
This is a two-part series examining the impact of blockchain technology on supply chains.

Blockchain is widely known for its most famous application, Bitcoin, and other virtual currencies. However, it is the conviction of many that in the fullness of time blockchain will make its biggest mark as a game changer for supply chains.

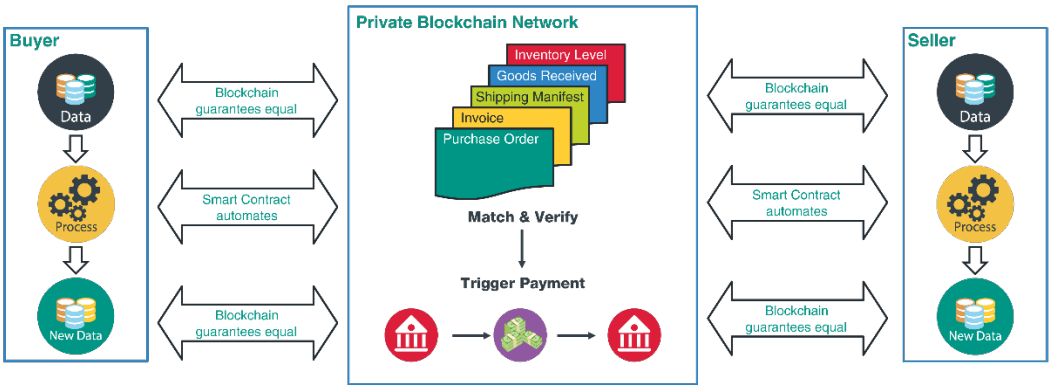
Blockchain's most basic promise for the supply chain is that it removes the need for third parties otherwise required to ensure trust within buyer-seller relationships, or for that matter any source-destination relationship served by a supply chain. These third parties include banks, customs clearing agents, inspection and verification agents, and legal advisors, who all process and verify transactions as they pass between buyers and sellers before authorising the transfer of value, whether physical goods, services or money.

In an environment enabled by blockchain technology, transactions become peer-to-peer with little need for intermediaries.

Traditional Transactional Model:



Blockchain model with smart contracts and automation:



How does blockchain do it?

Blockchain is a type of decentralised database that keeps encrypted records of digital transactions in a distributed ledger. Rather than having a central administrator like a traditional database – think banks or customs and logistics agents – a blockchain has a distributed network of replicated databases, synchronised via the internet and visible to anyone with access to the network. Networks can be permissionless/public, like Bitcoin, or permissioned/private in the case of a blockchain network between retailers and suppliers.

When a digital transaction is carried out (for example a purchase order), it is grouped together in an encrypted 'block' with other transactions and replicated across the permissioned/private network. Certain members of the network validate the block of transactions, which is then timestamped and added to a 'chain' of transactions in a linear, chronological order – hence the name 'blockchain'.

New blocks of validated transactions are linked to older blocks, making a chain of blocks that show every transaction made in the history of that blockchain. The entire chain is continually updated so that every database in the network is the same, giving each member the ability to prove who owns what, or who gave which instruction, at any given time. Access to the network and to specific information contained in the blocks are restricted through unique cryptographic 'keys', allowing members to only access information they are allowed to access.

Blockchain's decentralised and cryptographic nature allows people to trust each other and transact peer-to-peer without the need for third parties. This brings unparalleled security and business continuation benefits for members of the network. If they want access to information in a blockchain, or to alter information already in the blockchain, hackers would not only need to hack into that specific block, but all of the preceding blocks going back through the entire history of that blockchain across every ledger in the network, simultaneously. Because a network of participants shares a blockchain, it has no single point of failure and is designed to be resilient in the face of outages or attacks. If any node in a network of participants fails, the others will continue to operate, maintaining the information's availability and reliability.

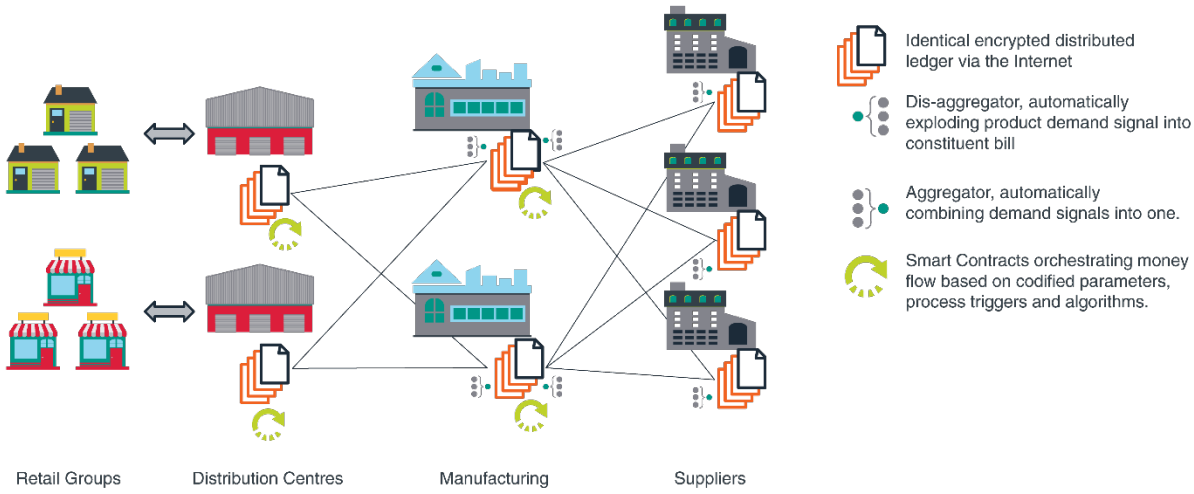
How smart can a contract get?

Apart from providing the means to transact peer-to-peer, blockchain can be used to create 'smart contracts' that execute the terms of any agreement when specified conditions are met. Essentially, a smart contract is a piece of computer code that predefines a set of rules under which the parties to that smart contract agree to interact with each other. The code facilitates, verifies, and enforces the negotiation or performance of a contract. This is the simplest form of decentralised automation.

These smart contracts can represent a contract or an ownership title. It can also represent physical goods, via a barcode or RFID tag.

In an example of the retailer-supplier relationship, the ability exists for cascading purchase orders, invoices, receipts, shipping notifications, inventory data and other trade related documents to not only be automatically matched and verified, but to also trigger payments, replenishment orders, aggregation and disaggregation events automatically based on the codified rules within a smart contract.

Private retail/consumer goods blockchain network:



An operating system for supply networks?

What could the future supply chain look like as the current blockchain hype matures into industrial strength applications? Supply Chain 4.0 is one such concept – where entire supply networks are digitised, and communications between nodes use blockchain networks as 'industry protocol', to facilitate and automate all transactions, similar to what Internet Protocol (IP) did for the Internet.

Adrian Gonzalez neatly summed it up in the January 2015 edition of Talking Logistics:

Much like the Internet triggered the evolution away from client/server applications toward Web-based apps, software-as-a-service, and today's cloud solutions, the peer-to-peer, decentralized architecture of blockchain has the potential to trigger a new wave of innovation in how supply chain applications are developed, deployed, and used.

The blockchain, in essence, could become the new operating system for Supply Chain Operating Networks – like Descartes, Elemica, GT Nexus, One Network, and others that combine B2B connectivity with software applications – and also help federate those networks.

Thinking more broadly, the evolution of blockchain apps will ultimately intersect with what's happening in the Internet of Things (IoT) world, where the ledger entries will be made automatically by the inventory and assets themselves as they move across the supply chain.

Key takeaways

Blockchain technology for supply chains is young and the vendor ecosystem is immature, but the speed of its maturation and adoption is accelerating as its potential impact on supply chains is better understood by more people.

Paradoxically, the highest levels of interest are shown by large international banks, who – although they perhaps stand the most to lose from their traditional transactional models in a blockchain-enabled supply chain of the future – are working with major financial institutions to develop blockchain applications. Over 50 major financial institutions are already involved with collaborative blockchain start-ups, like R3 CEV or Chain.

Blockchain technology allows us to more securely and transparently track all types of supply chain transactions. Every time value changes hands, whether physical products, services or money, the transaction could be documented, creating a permanent history of the product or transaction, from source to ultimate destination. This could dramatically reduce time delays and added costs from third parties in supply chains today.

In the second part of this article, we will look at a few real-world examples of blockchain-enabled supply chains – how they operate and the benefits they create.