CLOSING THE HALL OF MIRRORS
HOW BLOCKCHAIN WILL SIMPLIFY AND TRANSFORM THE SUPPLY CHAIN
Second only to finance, supply chain is arguably the fastest evolving area in business technology.

Managing inventory, shipping and trading, creating products and buying materials are some of the oldest known human activities. As such, they’ve evolved along with sophisticated technologies—especially information technology—to make them more efficient. Few people realize, for example, that ERP was launched in 1974, almost half a century ago. The first major eCommerce standards were released more than 35 years ago. They were followed by web browsers, offshoring work with high-bandwidth data connections in the 90s, robotic process automation and, today, blockchain.
There are problems, however, that technology has not yet solved. One of the more interesting, which blockchain addresses, is what could be called the ‘hall of mirrors’ effect. A buyer sends a purchase order. They receive a confirmation, schedule lines for delivery, and maybe prepare an advanced shipping notification with all the pallets, loads and serial numbers. There is also a transport order, bill of lading and perhaps some certifications. This creates inventory in the seller’s systems, receipts for the buyer, proof of delivery, invoices, payment and payment confirmations. No surprise that all this also becomes somewhat desynchronized.

Furthermore, all of these records need to reference one key thing—the contract governing all this activity. As these documents in electronic commerce flow more and more freely, we’re generating billions, if not trillions, of copies of documents. But, there is a fundamental problem: we can’t reconcile them, know which are the original versions, or control the veracity of the information we hold.
As high-volume shippers know, invoices coming from transportation providers can be a challenge. What were the freight rates at the time of the shipment, the mode, the service level and what extra charges were allowed? How do weights tie off to the original contract? Is the billing correct, were the service levels met, are there issues with the shipment which need remediation before billing goes out?
Now, let’s examine sales orders. A large big-box retailer is buying goods from a supplier. There’s likely to be a complex series of channel incentives – volume and timing discounts, cost offsets for marketing, quotas and pricing controls that are mandated between the parties. In order to get pricing conditions, meet quota and handle all the incentive structures, the retailer needs to see the supplier’s inventory, sales-out and pricing. They have to reconcile this with contracts and trading history, and of course, the supplier will also be sending invoices with all the volume, timing, and other discounts, marketing allowances offset. But these may all be rolled together. Imagine the volume of possible error and conflict, and the reconciliation that goes on between organizations to try to reach one accurate stream of information.

Now, multiply this by around 5,000—the approximate amount of companies that have $1,000,000,000+ in annual revenue worldwide that are transacting between $100,000 and $20,000,000 a minute. Then, the incredible complexity is obvious: tracking all of that inventory, and all of those purchases, invoices, shipments, serial numbers and receipts, which collectively, are endlessly reflected between all of the companies in the system. But, there is a solution.

A conservative estimate for a high-volume shipping company is that perhaps 10 percent of freight invoices are problematic and subject to an array of problems.

These include duplication, wrong freight mode charges and incorrect fees.

And because they are all consolidated across multiple transport orders, attribution is highly complex.

It is not unusual to see a company spend $10 per-invoice to manage billing. Many outside providers offer this service of course, and it’s so lucrative that they’re able to do so on a no-cure-no-pay basis.
Imagine in the first case that, instead of sending copies (of copies) of transactions, documents, purchase orders, transportation, inventory receipts, transfers and so on, all of the players in an industry could store transactions that they must share among parties in one place. The purchase order, the inventory receipt and more could go into a ‘master ledger’ that everyone could write to, but then only permitted members can read.

The ledger must be tamperproof. Parties must not be able to change a transaction or falsify transactions after they have been written. Only parties writing valid transactions to the ledger can be allowed to update it, and the system should be able to verify that the partners are who they say they are. Only parties that are allowed to read a record should be able to—the transactions must be protected with security such as dual-key public encryption. This ledger system with such attributes is, of course, what is known as blockchain.
With blockchain in place among trading parties, virtually all of the complexity fades away. In its place is a simple trail of (third-party-verified) transactions, which is maintained over the lifetime of a relationship between two parties in a supply chain. What happens with this simple reduction of copies of material? It is very similar to what happens with, for example, vendor managed inventory.

The buyer does not need to send a purchase order of materials if they know three things:

- **01** How much inventory the supplier has
- **02** What service level is needed
- **03** The rate at which they will consume the material

The buyer could either send a purchase order, and go through a complex back-and-forth of confirmation, shipment, receipts, and so forth. Or, they could simply send the supplier their actual level of inventory consumption to be set against a pre-agreed service level. The supplier ships inventory and sends invoices, and the buyer simply pays and periodically carries out inventory counts to reconcile. There is really only one set of data moving (one distributed ledger). The efficiency of materials management increases because there is no need to match all of the back-to-back transactions.
The Paperwork is Gone. But, What About Bad Transactions?

That first step in this blockchain apparatus got rid of the incredible amount of paperwork. Now, let’s consider the other problems in the current state of the market:

Having a single public journal does not necessarily mean the end of all bad transactions. However, this is where blockchain comes into play again—this time, with ‘smart contracts.’ Imagine a contract with terms and conditions that are not just statements.

For example, consider this scenario: Service Level A is price $X, Service Level B is price $Y, invoicing is 30-days after proof of delivery, issues must be registered within 15 days of delivery, and after 1,000 units, the unit price goes down 3 percent, and so on. Now, imagine instead that each one of these variables was a line of code, stored in a master system-of-record. When a new record is written, the public record-keeping system automatically checks to determine if there was an out-of-balance condition. If that occurs, the system would prevent the record being entered. That is what is called a ‘smart contract.’
A company tries to invoice, and it matches the contract conditions, prior orders, shipments, and proof of delivery without fail. The blockchain contract runs its code when a party tries to enter a new record. If this transaction passes the ‘smart conditions,’ then it is written, and the invoice has to be paid. If the invoice is duplicate, however, the smart contract and blockchain will ‘add up’ all of the elements of the contract—open purchase orders, contract terms, existing invoices and payments—and, if it doesn’t balance, the block is not ‘verified,’ and cannot be written.

So, instead of trying to correct the bad invoice on the side of the buyer, the bad invoice must be corrected on the side of the seller in order to be written. The reason it is incorrect is a public record between the two parties, and the verification happens ‘automatically’ within the blockchain ‘network.’ It is not something that the buyer nor the seller can control. In effect, there is a third-party audit every time a record is written, so long as both parties agreed to the contract. Under this blockchain scenario, there will no longer be dubious invoices, or any room for claiming ‘misplaced’ or ‘lost’ invoices.

With today’s current technology, while having a third-party verifier and system of record between two players (or many-to-many) players is possible, it is also both technically complex and expensive. Every pair of interactions—every buyer / seller—would have to have a secure channel, with a third-party intermediary, who adjudicates impartially and provides open access. These have not, to date, been successful. That is because no company really wants to have 10,000 suppliers requiring possibly 10,000 unique connections. By the same token, no supplier wants to have 10,000 customers requiring 10,000 unique connections.

Now, consider a hypothetical ‘Contract A,’ in which terms and conditions X, Y, Z, are all written into a blockchain.
Blockchain with smart contracts is a good technical solution for reducing data redundancy across trading partners in a supply chain.

- Enables an impartial enforcement of contract terms to create and consume the data (‘consistent data’).
- Provides security as good as or better than existing approaches (‘EDI VAN’).
- Reduces the complexity of linking-in, as there is only one point to which players can read and write.
- The technology automatically maintains consistency across participating nodes, thereby eradicating the 10,000 x 10,000 problem for managing trading relationships.

**IN OTHER WORDS, IT ALLOWS ENTERPRISES TO CLOSE DOWN THE HALL OF MIRRORS**
Even basic applications of blockchain technology in supply chain—particularly, where contracts occur—can yield substantial cost reductions and efficiency benefits to supply chain operations. This can be done both from the ‘connecting with’ suppliers and customers phase through read/write, and to one point for millions of participants, and the ‘ongoing communication’ phase by enormously reducing transaction volumes and irregularities. The shift to a common blockchain journal of data for all parties—which will avoid unnecessary reconciliation, miscommunication, and poor enforcement of joint contract standards—will create an order-of-magnitude opportunity for those who adopt.

You should be asking your Supply Chain Strategy Team and Supply Chain IT team: how can we lean into this shift, take advantage of early adopter opportunities, and drive true change, instead of playing catch-up. The impact on your enterprise will potentially be as substantial as the Internet, itself, and who would want to be late to an opportunity as significant as that.
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