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Blockchain Center of Excellence

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An overview of the 'Internet of Value', powered by blockchain technologies

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by Mary Lacity, Director of the Blockchain Center of Excellence

An overview of the 'Internet of Value', powered by blockchain technologies

Abstract: *Many executives and business professionals are still perplexed—and rightly question—the hype surrounding blockchain-based solutions. Part of the problem is that too many technologists focus on the technologies. The technologies, however, are just the enablers of a much larger idea, namely, to create the Internet of Value. The Blockchain Center of Excellence (BCoE) at the University of Arkansas wrote this briefing to explain the Internet of Value and the blockchain foundations needed to build it. We provide a realistic impression of the state of enterprise blockchain solutions and what executives need to consider now.*

The vision for the 'Internet of Value'

Since the 1990s, we have had an 'Internet of Information' that allows us to seamlessly share *information*—such as documents, images, and videos—over the Internet. Beginning with Bitcoin in 2009, we are moving towards an 'Internet of Value' that allows us to seamlessly transact *value*—money, goods, services, and other assets—over the Internet without relying on trusted third parties.

So, what is different between the 'Internet of Information' and the 'Internet of Value'? With the Internet of Information, we share *copies* of information over the Internet. If you send someone an email, you have a copy of the email and the recipient has a copy of the email. The Internet of Value needs to work differently. If you send someone a dollar over the Internet, you cannot send a *copy* of it. Instead, the law requires that after the transaction is complete, you no longer have the dollar, the recipient does. A reliable record of the transaction upon which you and the recipient agree, now and in perpetuity, is also needed.

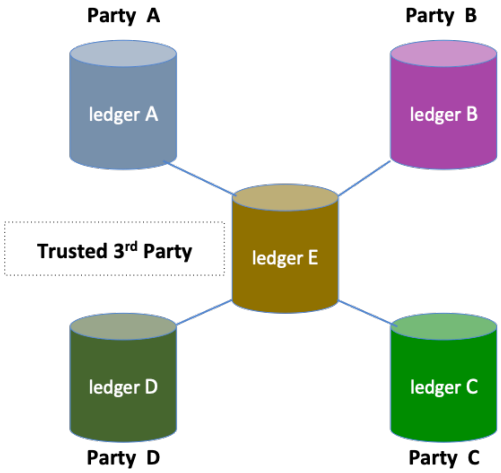
From an enterprise perspective, ***the Internet of Value most assuredly will improve the way value is transacted outside the boundaries of the enterprise, but it also could disrupt the enterprise's business model, or even disintermediate industries, in unforeseen ways.*** Now is the time to learn more.

Enterprise transactions before the Internet of Value

The best way to understand the potential business value created by an Internet of Value is to compare it to the way enterprises most frequently transact today (see Figure 1). We focus on two key attributes:

1. **Trusted Third Parties.** Before a blockchain solution, parties rely on trusted third parties (TTPs) to establish trust and to mitigate counter-party risks in trading relationships. TTPs provide independent 'truth attestations' such as notarizing signatures; verifying identity; verifying ownership; authenticating assets; preventing double spending; and attesting that agreements have been properly executed. TTPs provide these, and many other, vital services to facilitate inter-organizational transactions.

2. **Enterprise-level record keeping.** Before a blockchain, every party maintains its own systems of record. Specifically, each party maintains its own accounting system to post transactions on its own ledgers. Each enterprise can swiftly and unilaterally execute decisions about accounting rules; transaction reversals; software upgrades, etc., within the boundaries of the firm.



Each party maintains its own systems of record and its own ledger. Parties rely on a trusted third party to provide truth attestations, such as notarizing signatures; verifying identity; verifying ownership; authenticating assets; preventing double spending, etc.

Figure 1: Before a Blockchain

Despite the benefits of (1) TTPs and (2) enterprise-level record keeping, there are negative consequences, including ***high transaction fees*** paid to TTPs and ***low transparency*** (because enterprises typically only see the transactions entering or exiting its own systems of record). In turn, low transaction visibility makes locating assets or ascertaining the status of transactions difficult. With enterprise-level record keeping, every party has its own version of the truth that needs to be reconciled with trading partners. This ***slows settlement times***. Once reconciled, there is nothing to prevent trading partners from ***modifying records*** after the fact; partners cannot be confident they are dealing with the same historical record of transactions through time. The threat of '***vendor opportunism***'—the idea that vendors may pursue their self-interests with guile[1]; may withhold information; or may not comply with the terms and conditions of the agreement—always exists. Therefore, trading partners spend a lot of resources monitoring agreements to make sure that trading partners are behaving as promised.

Moreover, ***cybersecurity risks and costs are escalating*** because each party has to protect its own IT perimeter. Large enterprises successfully fend off thousands of cybersecurity threats each day. However, a single security breach can cost an organization billions of dollars to remedy. A blockchain solution aims to solve these problems.

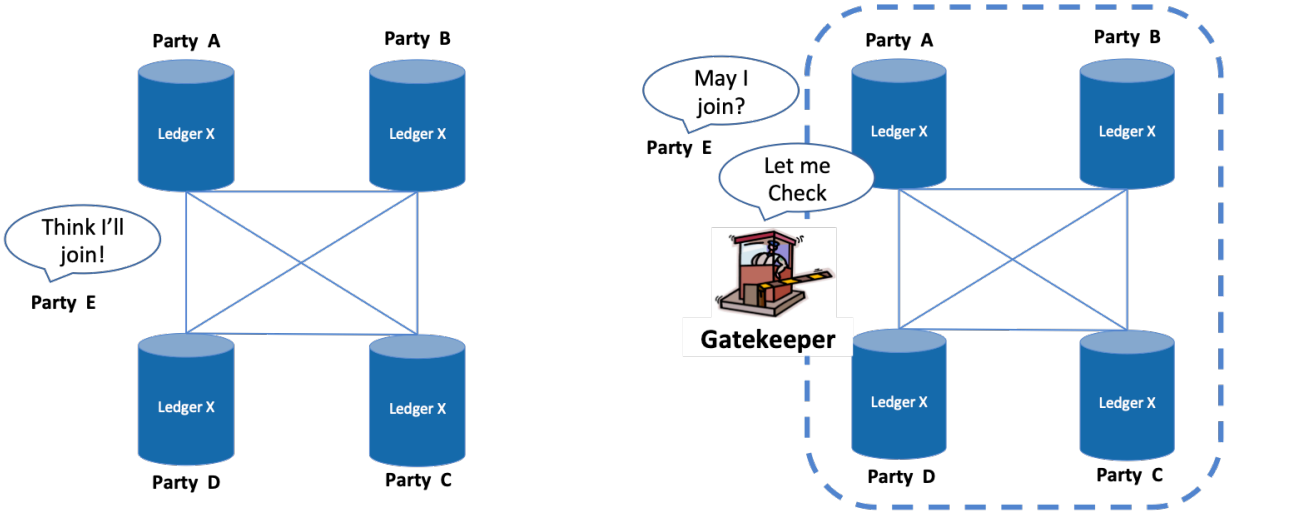
Enterprise transactions after the Internet of Value

A blockchain solution is software that is *shared* among ecosystem partners. Authorized parties run the same software and maintain an identical copy of the ***digital ledger.*** The digital ledger is ***distributed*** to all authorized parties in the network. Because parties rely on one version of the truth, so there is no need for reconciliations. Instead of relying on TTPs, a blockchain solution uses ***cryptography***—*"a method of protecting information and communications through the use of codes so that only those for whom the information is intended can read and process it"*—and ***computer algorithms***—well-defined procedures so that a computer can execute a process—to perform truth attestations.[2] For example, many blockchain solutions rely on cryptographic private-public key pairs to verify asset ownership; whoever is in possession of the private key is assumed to be the legitimate owner of the asset. Computer algorithms that codify agreements, known as ***smart contracts,*** can automatically execute agreed upon terms. Assets are represented inside the applications as either fungible ***tokens*** (like money or loyalty rewards) or non-fungible tokens (like property or machine parts).

Parties transact using the software. The software examines all the newly submitted transactions using the rules of the network. Unverified transactions are rejected; verified transactions are time-stamped, sequenced, secured with unique cryptographic identifiers and added to the ledger. The first copy to update the ledger distributes the update to all authorized copies. Once enough independent copies recheck the verifications and accept the update, the network reaches ***consensus***; they all agree: *"this*

is the record of truth". The transactions are forever locked in all the copies of the ledger, a property known as ***immutability***. The copies constantly chatter with each other to make sure no party tampers with the records after-the-fact. If anyone cheats, the other parties automatically ignore it.

Blockchain solutions may be ***permissionless***, meaning that anyone can join the network (see Scenario A in Figure 2) or ***permissioned*** where joining the network is by invitation-only, and where only authorized members validate transactions (see Scenario B in Figure 2).



Scenario A:
A permissionless blockchain

The four trading partners share a blockchain solution, run the same software, and maintain independent copies of a single ledger. Rather than rely on a TTP, parties rely on software to provide truth attestations. Additional parties may join the network without permission.

Scenario B:
A permissioned blockchain

The four trading partners share a blockchain solution. Additional parties need permission (represented by the 'Gatekeeper' guarding the perimeter), to join the network.

Figure 2: After a Blockchain

Although Figure 2 is overly-simplistic, it nonetheless clearly warns TTPs about the *potential* for disintermediation. In reality, few TTPs disappear from ecosystems—at least not yet. TTPs more commonly become peer members of a blockchain solution and continue to provide services that are not automatable.

Business value of blockchain-based solutions

For enterprises, benefits of the Internet of Value include:

- **Lower transaction costs:** Fees are typically quite small, just enough to finance the blockchain application.
- **Faster settlement times:** Parties rely on one version of the truth, so there is no need for reconciliations; it's a confirm-before-commit process instead of post-then-confirm-later process. The transactions can settle in sub-second to sixty minutes, depending on which consensus algorithm is used in the blockchain solution.

- **Better transaction visibility:** Parties of an exchange can instantly determine the status of a transaction by reading the ledger.
- **Immutability of records**: Every party can be confident they are always dealing with the same historical data, guaranteeing consistent data provenance across parties.
- **Lower vendor opportunism**: Rather than rely exclusively on paper contracts, verbal agreements or handshakes, parties can rely—at least in part—on computer algorithms that automatically execute the terms of agreements without oversight. For example, a supplier may get automatically paid once delivery is confirmed on the ledger.
- **Better cybersecurity:** Blockchain solutions function properly even if a high percentage of the host computers that operate the blockchain software, and maintain a copy of the ledger, are faulty—or even malicious—enabling fault tolerance, resiliency and 100 percent availability. In theory, the only way to break a blockchain application is to commandeer more than 50 percent of the host computers.[3]

Additionally, many organizations have worthwhile social missions like using blockchain technologies to bring financial services to the 1.7 billion people who lack access; protect the property rights of people with low economic status; protect the integrity of political elections; and enable self-sovereignty over one's identity and personal data.

The evolutionary path to the Internet of Value

In the 1990s, when enterprises were first pondering how the Internet of Information would affect their businesses, they tended to build hard-wired private networks (called Intranets) within the boundaries of the enterprise; the Internet technology, standards, and regulations had not yet matured enough to be considered safe, private, or scalable. Fast forward to today, most enterprises rely on Virtual Private Networks (VPNs) that run on top of the Internet to connect to trading partners, or to the public Internet to connect with millions or even billions of consumers.

In a similar evolutionary pattern, most enterprises are building private Internet of Value resolutions, using permissioned blockchain solutions. Example of permissioned solutions include: TradeLens tracks shipping containers; MediLedger verifies the authenticity of pharmaceutical returns in the US supply chain; the IBM Food Trust traces food from farm and fishery to retail stores; WineChain tracks and authenticates wine bottles; Microsoft uses a blockchain application to track royalty payments owed to Xbox application owners; JP Morgan uses its own digital token, called JPM Coin, to facilitate financial transactions for its largest clients;[4] Walmart Canada tracks freight with its truck carriers.[5] While none of these applications are fully scaled yet, they demonstrate the possibilities of getting business value, such as lower administrative costs per shipping container (TradeLens); lower transaction costs per royalty payment and fewer disputes (Microsoft); faster traceability in the case of a food recall, reduction of food waste, and improved verifiability of food quality (IBM Food Trust); fewer counterfeit drugs (MediLedger); fewer counterfeit wines and enhanced branding (WineChain).[6]

Some enterprises have already moved to the next evolutionary phase, namely, sending private transactions on public, permissionless blockchain networks in a way that protects confidentiality. For example, Santander issued an end-to-end bond on a public blockchain. WineChain stores the unique bottle ID on a public blockchain. During the final evolutionary phase, we will not longer talk about blockchains; they will become the boring, interoperable platforms supporting the Internet of Value.

Enterprise choices

Every enterprise needs to consider when and how to participate in building the Internet of Value. There are three strategic options:

1. Lead blockchain development as a founder or benevolent dictator. The fasted way to deploy production-ready blockchain solution is to lead the effort. Leaders include EY; IBM; MediLedger; McKesson; Microsoft; and Walmart. A leader's main challenge is incentivizing other ecosystem partners to join the leader's platform, which might require sacrificing returns and sharing governance—thus losing some control.

2. Collaborate with ecosystem partners to design open solutions. Many enterprises join consortia to develop standards, build code bases, and/or develop applications. Consortia are more like marathons than sprints. While it takes more time to deliver solutions than a founder model, consortia members hope that the solutions will become widely adopted. There are nearly 103 blockchain consortia of significance.[7]

3. Wait until others develop the solutions and join later. Particularly for smaller firms, this strategy means the enterprise will not influence the future and they will have to live with the options created by others, but they will not squander limited resources.

The bottom line

The Internet of Value, powered by blockchains, is here for leaders and is coming for fast-followers. ***Each enterprise will either help architect the future or risk being victimized by it.***

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About the Blockchain Center of Excellence (BCoE)

The BCoE is housed in the Information Systems Department of the Sam M. Walton College of Business at the University of Arkansas. The BCoE was the officially launched by US State Governor of Arkansas, the Honorable Asa Hutchinson, on August 1, 2018. The center's vision is to make the Sam M. Walton College of Business a premier academic leader of blockchain application research and education. The BCoE's research briefing series is one activity towards achieving that vision.

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Endnotes

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