



HYPERLEDGER

BLOCKCHAIN TECHNOLOGIES FOR BUSINESS

The Hyperledger Vision

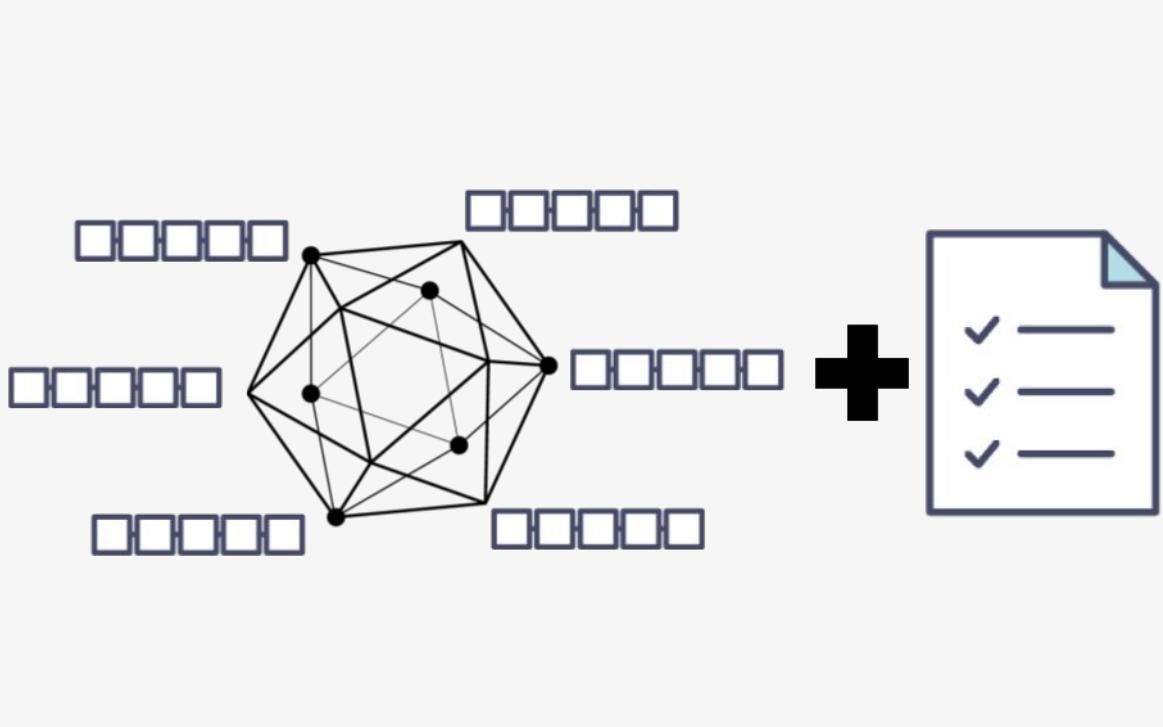
Blockchain 101, Introducing Hyperledger, Industry Use Cases

The background of the slide features a stylized Earth in shades of blue and white. Overlaid on the upper portion of the globe is a complex network of glowing blue lines and small dots, suggesting a global communication or blockchain network.

Blockchain 101

What are Blockchain Technologies?

Encompasses both
distributed ledgers
and smart contracts.



What is a Distributed Ledger?

An append-only
system of record
or log of
transactions.

Blockchains can be used to record promises, trades, transactions or simply items we never want to disappear. Mirrored exactly across all nodes in a given network, it allows everyone in an ecosystem to keep a copy of the common system of record. Nothing can ever be erased or edited.

A distributed ledger is a multi-party database with no central trusted authority. The differentiating nuance is that when transactions are processed in blocks according to the ordering of a blockchain, the result is a distributed ledger.

Cryptography for Integrity and Privacy

Software
standards keep
everyone in the
shared ecosystem
in sync.

A hash-based data structure is essential to know that each entry in the ledger is in a certain order and is cryptographically connected to the prior entries. The exact order of those entries is transparent and verifiable by all the participants, safeguarding the entries from manipulation or dispute.

Distributed Ledgers in Action

All business participating in a commercial ecosystem need a ledger to contain a record of transactions. It is vitally important to know that your copy of the ledger is identical to your business partners' and free from discrepancies.

Example scenario:

1. Everyone in a room has a book with the instructions to write down entries as they get called out.
2. Someone calls out item number one and everyone writes it down.
3. Then two people call out item number two at the same time, but the item number differs.
4. There needs to be a process for who wins, and the loser gets to try to call out item number three.
5. When all agree on the outcome of an entry, the next link in that ledger can be written.
6. Whether this happens in a small scale or the size of the internet, that is the spectrum for how a distributed ledger can work.

What is a Smart Contract?

The code or any complex program stored and executed on a blockchain.

Building one layer above distributed ledger technologies, you have smart contracts. Since distributed databases allow for multiparty, shared database use, distributed ledgers can be equipped with multi-party business logic, which is more commonly referred to as 'smart contracts'. These are a way to publish scripts and write programs in a language particular to a given chain, have them live on the shared network, and be able to execute on all those different nodes simultaneously.

Smart Contracts in Action

Imagine a farmer based in Sacramento, California buys an insurance agreement that protects them from extreme weather condition. If temperatures reach more than 100 degrees for 100 days, they get reimbursed 10,000 USD.

With human ledgers widely operated today, the insurer might find a way to back out of, procrastinate or dispute this agreement.

If a Smart Contract is in place, the script in the ledger would rule that on that 100th day of 100+ degrees, the 10,000 USD would be automatically withdrawn. With an automated process, like it or not, the insurer cannot back out.



Myth Debunked: Blockchain ≠ Cryptocurrency

Cryptocurrency is
an application that
sits on top of
blockchain.

Not the other way
around.

Blockchain and cryptocurrencies are often discussed in similar contexts, but they are not one in the same.

Distributed ledgers do not require a cryptocurrency to work.

Cryptocurrency encompasses an anonymous record of who owns what tokens. Token exchanges create new entries on the ledger. Blockchains prevent the same token from being spent twice.

Many open source blockchain efforts implement cryptocurrency as a means to fund mining and participation in consensus. However, the most popular existing blockchains like Bitcoin [Nak08] and Ethereum [But13] utilize completely trustless networks and permissionless chains.

Permissionless networks present tremendous challenges and not all of them technical as debates rise over the roles these platforms should play in society and who should govern them.

Why Business Blockchain Technologies

All over the global market there are ledgers that organizations and individuals alike must trust.

Permissioned blockchains differ from what you'll find in Bitcoin or Ethereum.

Most enterprise blockchain applications rely upon real world trust relationships, wherein the goal is to set up a set of participants in an ecosystem with the needed insurance that the boundaries are flexible enough to bring in more participants in the future. Participants on a permissioned network are known to one another, and therefore have an intrinsic interest in participating in the consensus making process. This community of participants want to share data with a greater degree of security. Without needing to run proof of work mechanisms, they can resolve more immediate problems than on a public cryptocurrency blockchain.

This is why you're seeing every financial business looking to get involved in business blockchain technologies.

Business Blockchain Components Glossary

Consensus Layer	Responsible for generating an agreement on the order and confirming the correctness of the set of transactions that constitute a block.
Smart Contract Layer	Responsible for processing transaction requests and determining if transactions are valid by executing business logic.
Communication Layer	Responsible for peer-to-peer message transport between the nodes that participate in a shared ledger instance.
Data Store Abstraction	Allows different data-stores to be used by other modules.
Crypto Abstraction	Allows different crypto algorithms or modules to be swapped out without affecting other modules.
Identity Services	Enables the establishment of a root of trust during setup of a blockchain instance, the enrollment and registration of identities or system entities during network operation, and the management of changes like drops, adds, and revocations. Also, provides authentication and authorization.
Policy Services	Responsible for policy management of various policies specified in the system, such as the endorsement policy, consensus policy, or group management policy. It interfaces and depends on other modules to enforce the various policies.
APIs	Enables clients and applications to interact with blockchains.
Interoperation	Supports the interoperation between different blockchain instances.

Early Adopter Industries



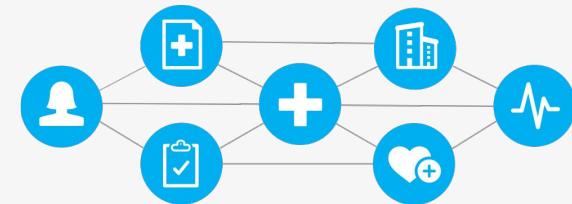
Financial Services

The most immediate business opportunities are to use business blockchains to track and trade stocks and bonds with reduced risk and time, and increased transparency.



Supply Chain

Blockchain technologies will lead to greater efficiency, as well as safer and more ethical standards through the ability to prove the veracity of transactions to all stakeholders.



Healthcare

Business blockchains are giving the healthcare industry a chance to reinvent what historically has been a thorny problem: sharing patient data records between organizations.



TRUST

THE DECIDING FACTOR IN WHETHER A SOCIETY CAN FUNCTION

The Need for Trust

The [2018 Edelman Trust Barometer](#), an annual survey of 33,000 people in 28 countries, reveals that the general population's trust in key institutions — business, government, NGOs, and media — has steadily declined the last two years.

20 of 28 markets surveyed now lie in distruster territory, up one from 2017. Yet dramatic shifts are taking place at the market level.

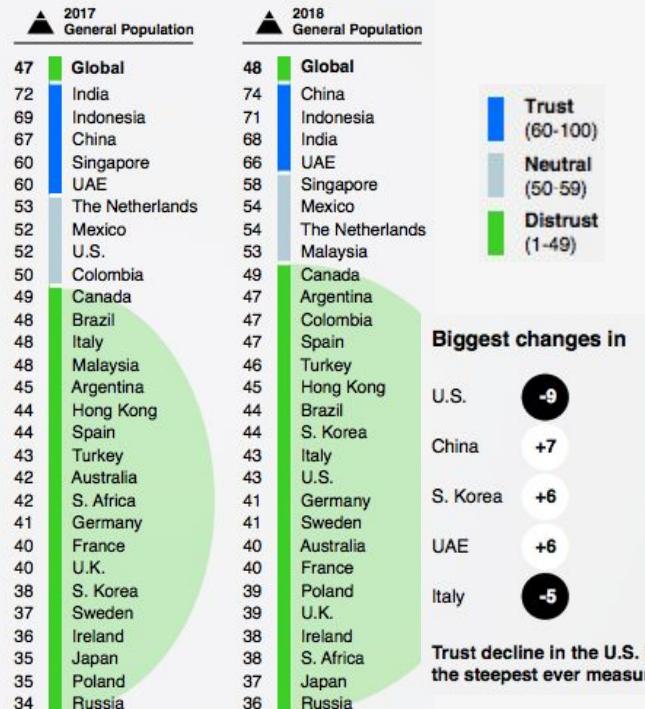
Without trust, the system fails. The onus is on businesses to prove that it is possible to act in the interest of shareholders and society alike and show that free markets can succeed for all if businesses work with the people.

For blockchain, “2018 needs to be the year of scale done well. Projects that demonstrate blockchain technology can emerge from the relatively sterile confines of a pilot project into true, transformative, production-class environments.” Read more in the [Trust Barometer blog, Faint Signals On Trust in Blockchain Companies](#)

Trust Index

A World of Distrust

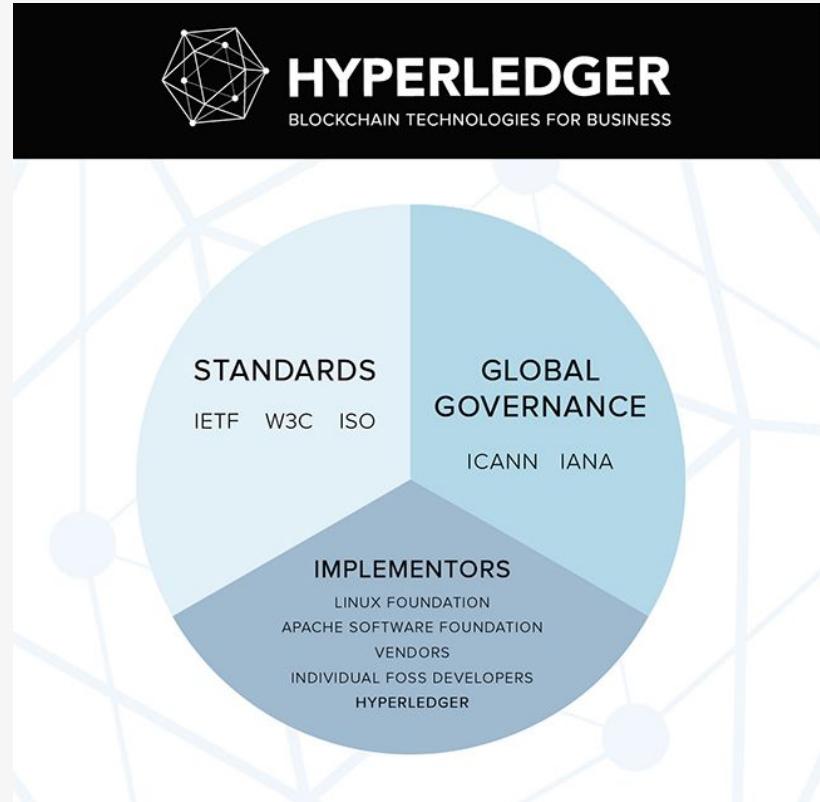
Average trust in institutions, general population, 2017 vs. 2018.



The Trust Protocol

The way internet technologies tend to get developed is a partnership between three organizations: standards, global governance and implementers, like Hyperledger.

If Hyperledger could help not only forge common ground between different software development efforts, but also encourage a gradual detachment between standards, implementations, and global governance (whether that's around currencies or other use cases), then we will also accelerate adoption of blockchain technologies widely and further reduce needlessly duplicated engineering and hardening efforts.





HYPERLEDGER

BLOCKCHAIN TECHNOLOGIES FOR BUSINESS

Introducing Hyperledger

A global,
cross-industry
community of
communities
advancing business
blockchain
technologies.

Hyperledger is incubating and promoting enterprise grade, open source business blockchain technologies, including distributed ledgers, smart contract engines, client libraries, graphical interfaces, utility libraries, and sample applications.

Hyperledger provides the underlying open source software, on top of which anyone can set up apps to meet business needs.

Built under technical governance and open collaboration, individual developers, service and solution providers, government associations, corporate members and end users are all invited to participate in the development and promotion of these game-changing technologies.

Hosted By The Linux Foundation



For the last 16 years, The Linux Foundation® has provided unparalleled support for open source communities through financial and intellectual resources, governance structure, IT infrastructure, services, events, and training.

Dedicated to building sustainable ecosystems around open source projects, The Linux Foundation is working with the global technology community to solve the world's hardest problems through open source and **creating the largest shared technology investment in history**.

The Linux Foundation is the umbrella organization for **more than 60 open source projects** accelerating open technology development and commercial adoption. Some of the game-changing initiatives hosted by The Linux Foundation include:



The Hyperledger Genesis

This technology is young.
It is still early days.

Hyperledger was initially seeded with various blockchain-supporting commercial members, some of whom had interesting internal or nascent open source efforts that needed the kind of home that The Linux Foundation could provide. They saw a need within the enterprise market for a flat, distributed, multi-party database ledger and Smart Contract system separate from cryptocurrencies, and through open source collaboration began building blockchain technology building blocks to enable these types of systems.

Hyperledger Momentum

2

years since launch

47K+

Commits

5

Tools

5

Frameworks

2

1.0 Production
Releases

190+

Members
(30+ in China)

10

Active Community
Working Groups

112

Meetups
Worldwide

30K

Meetup
Participants

1,500+

Media Clips Per
Month in 2017



THE HYPERLEDGER VISION

Parallels With The Early Web

----- INTERNET -----

Your Internet ID: monopoly@host.yab.com

Getting Files		Finding Information	
[A] Find Files on the Net (Archie)	[G]	Search for Information (Gopher)	
[F] Get Files from the Net (FTP)	[W]	Hypertext Search (WWW)	
[Y] File Transfers for Net Account	[Q]	Query About Someone (Finger)	
Entertainment			
[M] MUDs (Games)	[E]	Internet E-Mail	
[I] Internet Teleconference (IRC)	[U]	Internet Message Areas (Usenet)	
[J] Tintin Interface for MUDs		Help	
Miscellaneous			
[B] Unix Shell Access (BASH)	[D]	Detailed Reference Text	
[T] Connect to Other Sites (Telnet)	[H]	Help Using Internet Functions	
	[K]	If You're Stuck at "Password"	
		SLIP Access (Mosaic, NetScape, etc)	
[S] SLIP - Graphical Interface	[C]	How To Configure SLIP Access	
[P] PPP - Point-to-Point Protocol			

Your Choice (A,B,C,D,E,F,G,H,I,J,K,M,P,Q,S,T,U,W,Y or X) :
(N)onstop, (Q)uit, or (C)ontinue? Menu: <Ctrl R-Shift>

2400 8N1

VT100 Online

Blockchain technologies are in the early stages of a 20-year, if not a 50-year, adoption and maturation cycle. Many compare blockchain today with 1995 and the Web. Internet at the time was much more decentralized than it is today, and built primarily with open source. The technology was young and ripe with promise.

Today, there are clear examples of blockchain efforts that have seen widespread adoption and scale. There are commercial blockchain stacks running in production, clear momentum around Hyperledger frameworks. Yet, by no means is this a mature industry – we seek better consensus mechanisms for both permissioned and permissionless chains, a better range of choices for smart contract platforms and the right identity models.

The Hyperledger Vision

Blockchain promises to change the way business is conducted and transactions are executed across industries. Precisely how, and the pace at which, each of these industries adopts blockchain will surely vary.

There will never be one global chain-of-all chains that all industries convert to.

Ultimately, there will be many public chains and millions of private chain distributed ledger systems designed for specific marketplaces. They will interoperate over standards and ideally each use a common base of technology, much like how the Linux community uses the common Kernel operating system. Potentially, each will have a different consensus mechanism, preferred smart contract language, and other unique characteristics.

In this environment, the most valuable role that Hyperledger can play is to serve as a trusted source of innovative, quality-driven open source software development community, creating modular, open source components and platforms. The optimal focus of Hyperledger is to advance industry goals of distributed ledger and smart contracts.

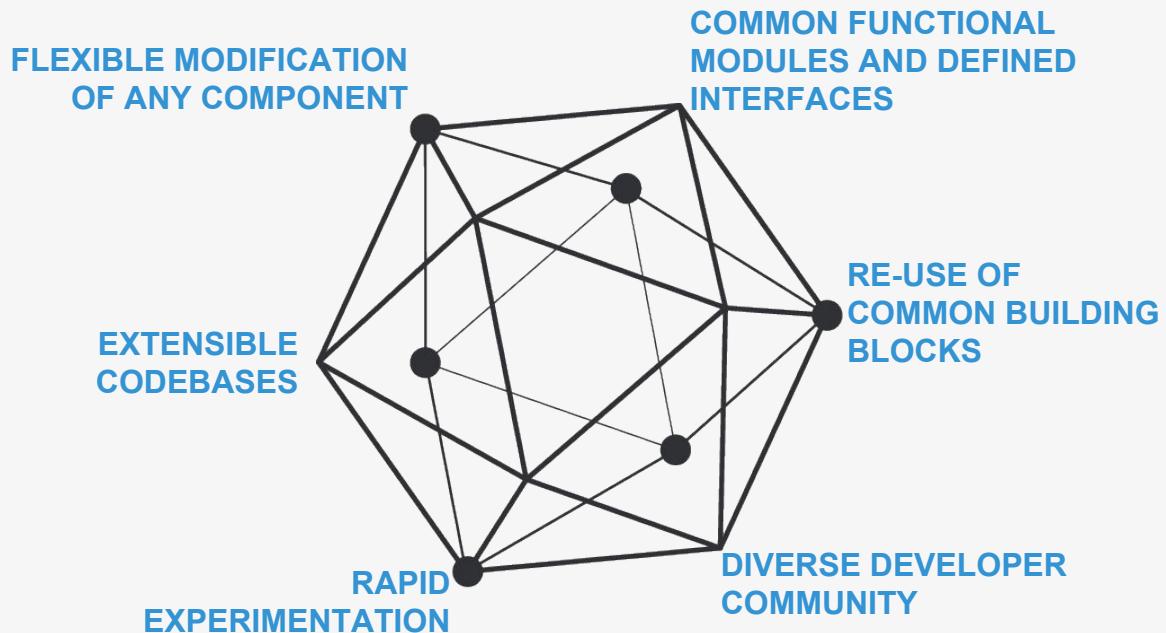
Hyperledger is forging a brand to be seen widely as the accepted default, “safe” deployment platform for enterprise teams, and as a great home for active collaboration around new technologies.

Hyperledger Modular Approach Benefits

Similar to The Linux Foundation, Hyperledger also has a modular umbrella approach. At the top level, The Linux Foundation and Hyperledger provide the infrastructure for open development to occur. This includes technical, legal, marketing, and organizational aspects.

Under Hyperledger's umbrella are frameworks and tools that take different approaches to creating blockchains for business.

There are many benefits to this modular approach.



Hyperledger Modular Umbrella Approach

Infrastructure

Technical, Legal,
Marketing, Organizational

Ecosystems that accelerate
open development and
commercial adoption

Cloud Foundry

Node.js



Hyperledger

Open Container
Initiative

Frameworks

Meaningfully differentiated approaches
to business blockchain frameworks
developed by a growing community of
communities

Hyperledger
Indy

Hyperledger
Fabric

Hyperledger
Iroha

Hyperledger
Sawtooth

Hyperledger
Burrow

Tools

Typically built for one framework and
ported to other frameworks through
common license and community approach

Hyperledger
Quilt

Hyperledger
Composer

Hyperledger
Explorer

Hyperledger
Cello

Hyperledger
Caliper

Hyperledger Blockchain Frameworks

Hyperledger Fabric

Intended as a foundation for developing applications or solutions with a modular architecture, Hyperledger Fabric allows components, such as consensus and membership services, to be plug-and-play.

Hyperledger Iroha

A business blockchain framework designed to be simple and easy to incorporate into infrastructural projects requiring distributed ledger technology.

Hyperledger Sawtooth

A modular platform for building, deploying, and running distributed ledgers. Hyperledger Sawtooth includes a novel consensus algorithm, Proof of Elapsed Time (PoET), which targets large distributed validator populations with minimal resource consumption.

Hyperledger Burrow

A permissionable smart contract machine. The first of its kind when released in December, 2014, Burrow provides a modular blockchain client with a permissioned smart contract interpreter built in part to the specification of the Ethereum Virtual Machine (EVM).

Hyperledger Indy

Tools, libraries, and reusable components for providing digital identities rooted on blockchains or other distributed ledgers so that they are interoperable across administrative domains, applications, and any other silo.

Architecture of Hyperledger Projects

Available Tools

- Common software license: Apache v2
- Common IP framework: the Developer Certificate of Origin
- Collaboration tools (Gerrit, Jira, Rocket.Chat, Slack, email)
- Promotion and branding
- Security processes and practices for bugs

A Team of Developer Volunteers

- Build code in the open
- Manage individual roadmaps and release schedules
- Responsible for following Hyperledger policies and requirements
- Align modular code with other projects

Infrastructure from The Linux Foundation

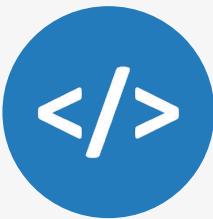
- Executive Director
- Business Operations
- Technical Staff for Security, Ecosystem and Community Development
- Communications Staff for Marketing, PR and Events
- Legal Counsel
- Membership Sales

Hyperledger Goals

Where open source teams build diverse approaches
for business blockchain technology systems



Create enterprise grade, open source, distributed ledger frameworks & code bases to support business transactions



Provide neutral, open, & community-driven infrastructures supported by technical and business governance



Build technical communities to develop blockchain and shared ledger POCs, use cases, field trials and deployments



Educate the public about the market opportunity for blockchain technology



Promote our community of communities taking a toolkit approach with many platforms and frameworks



INDUSTRY USE CASES

Distributed ledgers for different use cases can have vastly different requirements. Hyperledger embraces the full spectrum of industry use cases, especially enterprise scenarios with widely varied requirements for decentralization, trust, continuity and confirmation times. Each represents a potentially unique optimization point for the technology.

Here you will find industry-specific use cases to illustrate how blockchain technologies can and are being implemented to bring more trust across industries and the world today.

Cross-Border Payments

Transferring money across international borders is still complicated, time consuming and expensive. Payments routed abroad can take several days to get settled.

Existing money transfer systems suffer furthermore from long lines, exchange rate losses, counter-party risks, bureaucracy and extensive paperwork. Cross-border payments have become a critical part of millions of lives as we moved towards a more globalized world and multicultural societies.

After months of work, a global team of developers have completed a cross-border POC built with Hyperledger Fabric. Designed to test whether moving member bank accounts to a distributed ledger could help the inter-bank payments platform Swift reconcile in real time, the blockchain trial is now ready for its next phase of testing with General members ANZ, BNP Paribas, BNY Mellon and Wells Fargo.

Hyperledger Fabric enables real-time visibility on the liquidity of Nostro accounts, easing reconciliation and allowing liquidity savings while meeting key industry requirements such as governance, data privacy, standardisation, and identity.



BNY MELLON



BNP PARIBAS

Read about the POC in [Coindesk](#).

Hear about the collaboration in the [ANZ Community Spotlight video](#).

Healthcare Records

Blockchain may offer a way to get the healthcare industry to commit to an information sharing platform in which pointers to personal health data could be stored on a secure, permissioned chain and shared back and forth quickly like email.

Hyperledger Composer offers a set of APIs, a modeling language and a programming model to quickly define and deploy business networks and applications that allow participants to send transactions that exchange assets.

Say, for example, a patient's x-ray sits on a cloud site and insurers can request the password to access it. Password requests get stored on a chain, and a set of smart contracts allow the doctor to share the pointers to the x-ray with the insurance company. The patient has a wallet noting which chains their records are stored on. When those pointers are shared, they're recorded as auditable events in the healthcare system, allowing patients to have complete visibility into their data and ultimately the ability to mediate and approve who their records are shared with.



Join the Hyperledger Healthcare Working Group (HLHC) to help bring commercial blockchain adoption to the healthcare industry.



[Learn more here.](#)

Interstate Medical Licensing

Associate Hyperledger Member State of Illinois has implemented a pilot program in collaboration with General member Hashed Health using Hyperledger Fabric to reduce complexity of interstate medical licensing, as well as to improve the veracity of provider directories and claims adjudication processes.

The Hyperledger Fabric pilot program will identify opportunities to improve the efficiency and accuracy of the medical credentialing process in the state of Illinois. The concept will utilize a blockchain-based registry to streamline the sharing of smart contracts and medical credential data to automate workflow associated with interstate and multistate licensure.

In the short-term they anticipate this pilot will show how distributed ledger technology can help reduce the complexity of interstate licensing processes in Illinois. In the long-term, they see this as a secure, privacy-enhancing way in which state licensure boards can efficiently manage credentialing at national scale, while also presenting health payers and provider networks a ‘single source-of-truth’ to improve the veracity of provider directories and claims adjudication processes.



HEALTHCARE BLOCKCHAIN INNOVATION



The Illinois
BLOCKCHAIN
Initiative

[Read the full announcement.](#)

Seafood Supply Chain Traceability

Blockchain technologies are being used in the fishing industry to drive fish catch towards more ethical practices, obstructing pirate fisherman and fish that are caught outside of legal fishing areas from being sold.

Hyperledger Premier member Intel is collaborating with the Hyperledger community to implement a modern approach to seafood traceability. Leveraging the Hyperledger Sawtooth framework, the seafood journey can now be recorded from ocean to table.

IoT sensors can be attached to any object (like fish) that is entrusted to someone else for transport, with trackable ownership, possession, and telemetry parameters such as location, temperature, humidity, motion, shock and title. The final buyer can access a complete record of information and trust that the information is accurate and complete. Revolutionizing the seafood supply chain is just one example of the many ways Hyperledger Sawtooth can have real world benefits.



Intel has revealed a public demo that finds it showcasing how a seafood supply chain can be built using Hyperledger Sawtooth.

[Watch the explainer video and read the full case study on the Hyperledger Sawtooth project page.](#)

[Read about the demo.](#)

Diamond Supply Chain

In 2003, the Kimberley Process Certification Scheme (KPCS) was established to prevent conflict diamonds. Purchased diamonds now come with a certificate to prove the distributor did not obtain the diamond from rebels, that the mine has been audited, etc. The idea is that paperwork can confirm provenance; however, the process is lengthy and there is a history of fraud from missing paperwork.

To keep blood diamonds from entering the supply chain Hyperledger Premier members SAP Ariba and IBM are collaborating with Everledger to pilot a distributed ledger diamond track and trace system using Hyperledger Fabric v1.0 that everyone in the industry can write to from miners, to distributors, to retailers.

Holding a diamond to light creates a unique pattern that may be used to create an ID. When a bag of diamonds changes hands in the supply chain, it forms two entries in the chain: the diamond IDs present upon sending and receipt. Once a diamond ID number is inside the system it provides integrity as any stakeholder can then query and instantaneously verify a diamond's provenance.



This system is empowering organizations to get specific on tracking where conflict diamonds are entering the supply chain and preventing them from entering the market.

[Read about the Hyperledger Fabric pilot in International Business Times.](#)

Digital Identity

As of 2017, only 44% of Filipinos were utilizing bank accounts, a metric that is quickly increasing thanks to rapid economic growth in the Philippines, but is still hampered by inefficient mechanisms for checking the identity and history of new account applicants. “Know Your Customer” laws require asking for the same data over and over, much of which is not available in digital or verifiable form.

To solve this, the Bankers Association of the Philippines (BAP) in partnership with Hyperledger member and technology consulting company Amihan, and a coalition of major banks undertook a proof-of-concept exercise to build a prototype that implements self-sovereign identity using Hyperledger Indy.

The platform streamlines onboarding of new accounts, by allowing consumers to enter information once in a privacy-preserving way, and re-use that data for new account opening. The bank can trust that the history of that data is solid. If successful, this could serve as a test for a nation-wide self-sovereign ID system.



*Read more about the Amihan use case for the Hyperledger Indy framework in *The Manila Times*.

Verifiable IDs for Refugees

Blockchain could bring tremendous positive impact to those who live in communities without a strong state actor issuing verifiable identification. The World Bank reports 2 billion people internationally do not have access to financial services. Moreover, the UN reported in 2015 that more than 95 million people have been forcibly displaced, stateless or refugees.

Consider the more than 245,000 refugees living in one of five camps that comprise the Dadaab UNHCR base in northern Kenya, the second-largest such complex in the world. Established 17 years ago, Dadaab is no longer a temporary camp, this is a city struggling to develop.

These refugees are underserved not only by the state, but also by the NGOs who are trying to understand the refugees' histories, both medical and financial. If someone requests a new business loan, for example, what is their financial history? Have they taken out a loan before? A common system of record to track items and actions of a given identity in that network could help the people of Dadaab build something from the ground up that they wouldn't otherwise be able to build.



Identity Management is a core focus of Hyperledger's Blockchain for Good initiatives. If interested in helping write the world using blockchain, [join the open Identity WG](#), which meets every other Wednesday at 9am PST.

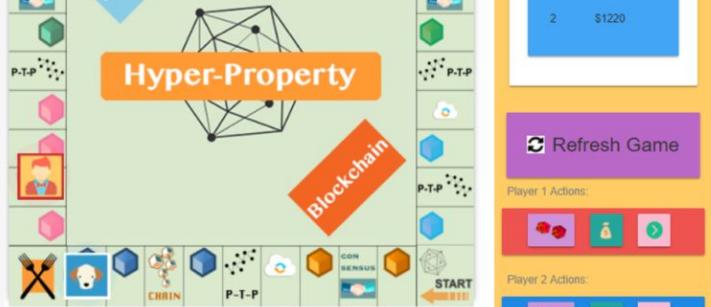
Read more about the impact of blockchain on refugees in [Quartz](#).

Real Estate Transactions

In the 1990s and 2000s, many international organizations put pressure on emerging countries to digitize land titles to guarantee citizens' legal rights to their properties. In some cases of corruption, the move to government-owned centralized databases backfired, and digital histories of land titles were eradicated, properties seized and handed over to oil companies.

Decentralizing databases and turning to distributed ledger technologies to keep track of land titles could keep governments accountable and create a more trustworthy system, even in instances where the individual actors may not be trusted.

Every transaction such as when a property is sold from one party to another or when a loan is taken out against a property, would be recorded on the public ledger. Financial firms would reference the distributed ledger to decide whether or not to extend the loan to someone looking to buy a property. This permissioned-based, shared system of record will increase trust overall and protect homeowners.



The winning team at the Consensus 2017: Building Blocks Hackathon, built an online property banking and acquisition game utilizing Hyperledger Fabric with IBM Bluemix.

HyperProperty shows that Hyperledger Fabric can be used to guarantee who owns what properties. Lessons from *HyperProperty* can be applied to any tokenized economy where assets are represented by tokens on a blockchain.

When assets need to be traded, trade participants can exchange value for the token and make transactions without a middleman. This has the potential to facilitate more efficient and less costly real estate transactions.

[Play HyperProperty.](#)

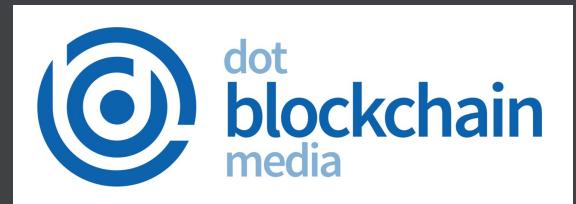
Music and Media Rights

Dot Blockchain Media (dotBC) is building a music content rights registry that will help musicians express their rights and wishes for commercializing their art in an interoperable file format. Data is maintained across a distributed network that utilizes Hyperledger Sawtooth.

dotBC's blockchain implementation is a foundation for music and media rights expression into the works themselves. It creates a fair and transparent method for music composers, artists, publishers and rights holders to express their rights and wishes for commercializing their art into a modern and interoperable file format. dotBC maintains partnerships and connections in the music and wider media industries to enable seamless data exchanges between more than 63 million globally recorded works from independent and major label artists and the dotBC ecosystem.

"Hyperledger Sawtooth will enable us to scale rapidly and customize transaction processors specifically for ingesting rights data. We look forward to delivering a strong and lasting solution, anchored on a sophisticated and secure blockchain foundation, for the music and media industries with Intel."

– Benji Rogers, dotBC CEO



Although not a member of Hyperledger, dotBC is able to leverage the open source Hyperledger Sawtooth platform for recording its content rights registry for the media industries.

Read the full story in [Crypto Ninjas](#).

Green Assets Management

General Hyperledger member Energy Blockchain Labs partnered with Premier member IBM on the world's first blockchain-based green assets management platform based on Hyperledger Fabric. In production use by the carbon asset market in China, it allows enterprises to generate carbon assets more efficiently, helping to build a green, low-carbon and environmentally-friendly future in China.

Blockchain technology is expected to become an important means for effective control of carbon emissions, which is of great significance to China, the world's largest source of carbon emissions. Carbon asset development, also known as CER (Carbon Emission Reduction) quota issuing, is one of the most popular ways of encouraging enterprises to decrease emissions and use low carbon emission technology.

The platform is estimated to significantly shorten the carbon assets development cycle and reduce the cost of carbon assets development by 20-30 percent just in the pilot stage of the platform, enabling cost-effective development of a large number of carbon assets.



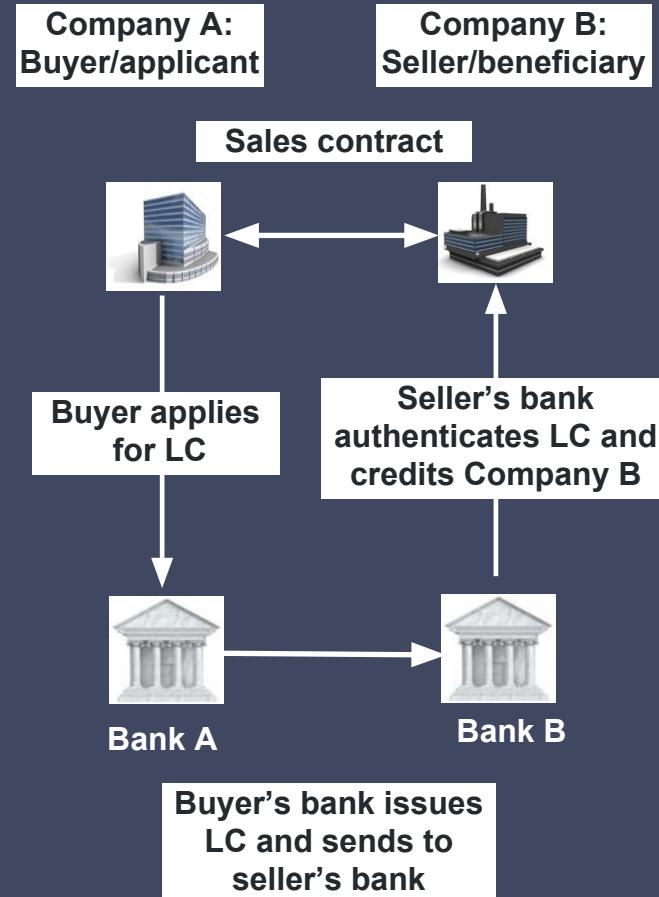
Learn more about Energy Blockchain Labs in their [Hyperledger Community Spotlight video](#).

Letters of Credit

Letters of credit (LOC) is a centuries old process (actually started in medieval times with the Knights Templar who required a way to allow pilgrims to travel to Jerusalem without the danger of carrying money around). The LOC process is a difficult one to automate due to the sheer number of network participants involved. In this example, Bank A and Bank B are used to represent a complicated network.

This use case also allows for innovative methods of payment using IoT devices. Smart contracts could implement rules that prevent/allow/increase/reduce payment if certain conditions hold (e.g., if it gets too hot/cold/humid/dry, or if the goods are a certain percentage of the way to the destination).

Example) Bank handling LOC wants to offer them to a wider range of clients. Currently constrained by costs and time to execute. Blockchain provides a common ledger for LOC. Blockchain presents a modernized opportunity; the LOC is stored on the blockchain, and once spent, is marked as such so that the value of the letter cannot be spent again. Blockchain allows all counter-parties to have the same validated record of transaction and fulfillment, with increased execution speed and significantly reduced costs.

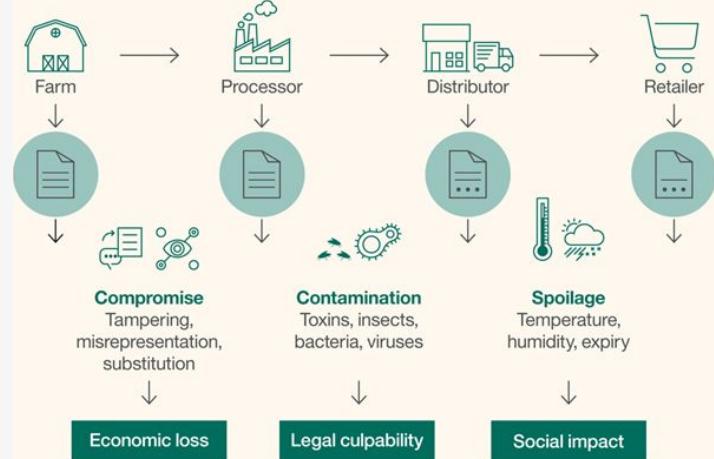


Food Trust

Blockchain technologies can provide a trusted source of information and traceability across the food network, a complex distribution and processing ecosystem involving farms, distributors, retailers and consumers, which make it difficult to assure food provenance.

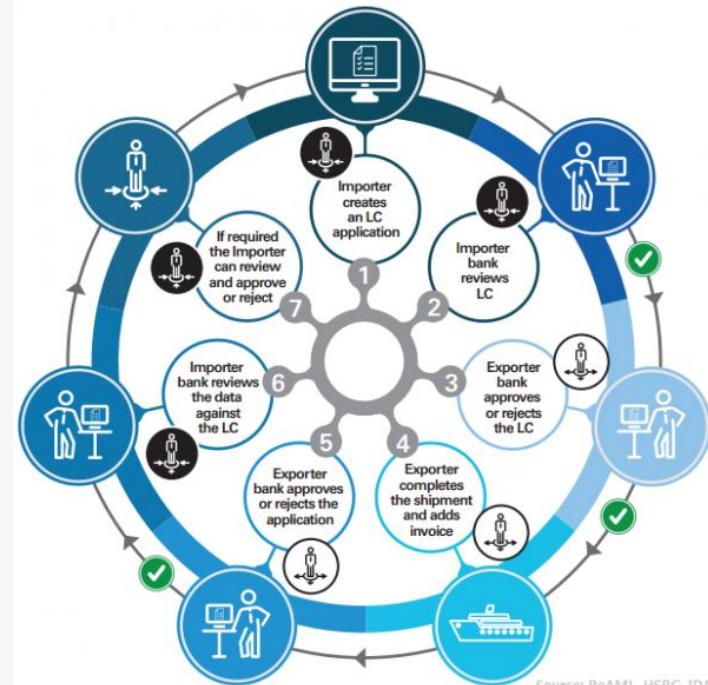
By making a shared ledger accessible to each party in the supply chain, all food processing steps can be recorded and stored on the blockchain, including digital compliance documentation, test results and audit certificates to improve transparency and efficiency across the food network.

The result is a reduced impact of food recalls through instant access to end-to-end traceability data to verify history in the food network and supply chain, which can help address the 1 in 10 people sickened every year from food-born illness.



Digital Trade Chain

- we.trade is a blockchain-based international trading system for a consortium of major world banks including:
Deutsche Bank, HSBC, KBC, Natixis, Rabobank, Société Générale, Santander, UniCredit and Nordea
- Enables accurate trading posture information, order to settlement control, risk coverage, track and trace options
- Near-real time exchange of information on a secure platform that digitizes transactional financing and other complex processes
- Continual business and compliance readiness in any regulatory environment
- Scalability that allows for rapid international expansion as business, regulatory, and security opportunities converge



Source: BoAML, HSBC, IDA

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