The State of Illinois Blockchain Initiative

June 22, 2017

Sponsored by the NASCIO Enterprise Architecture & Governance Committee

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Host

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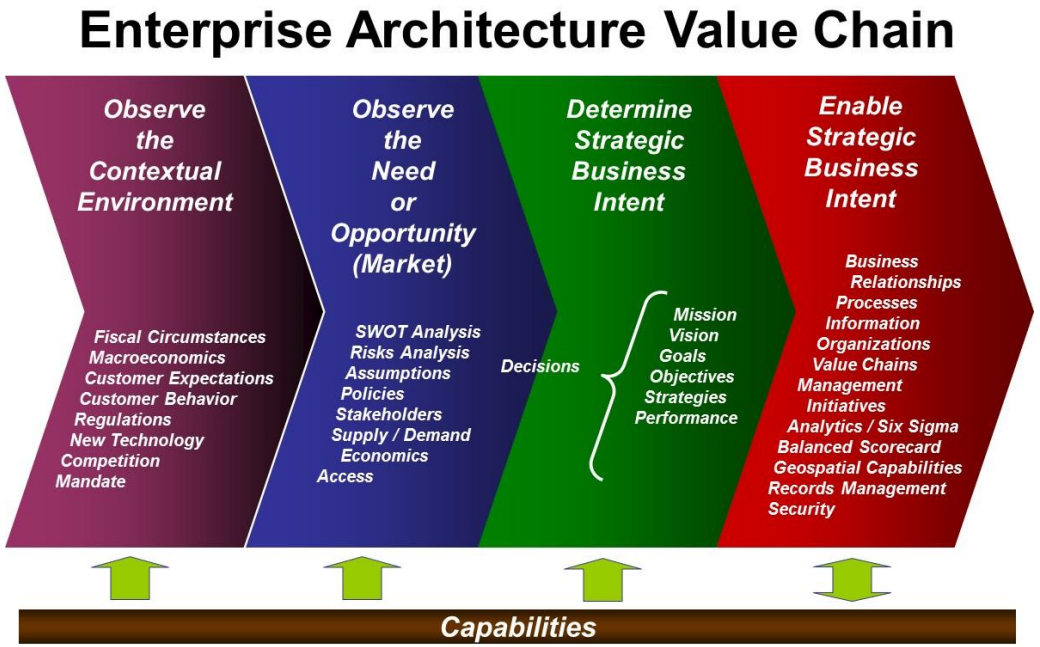
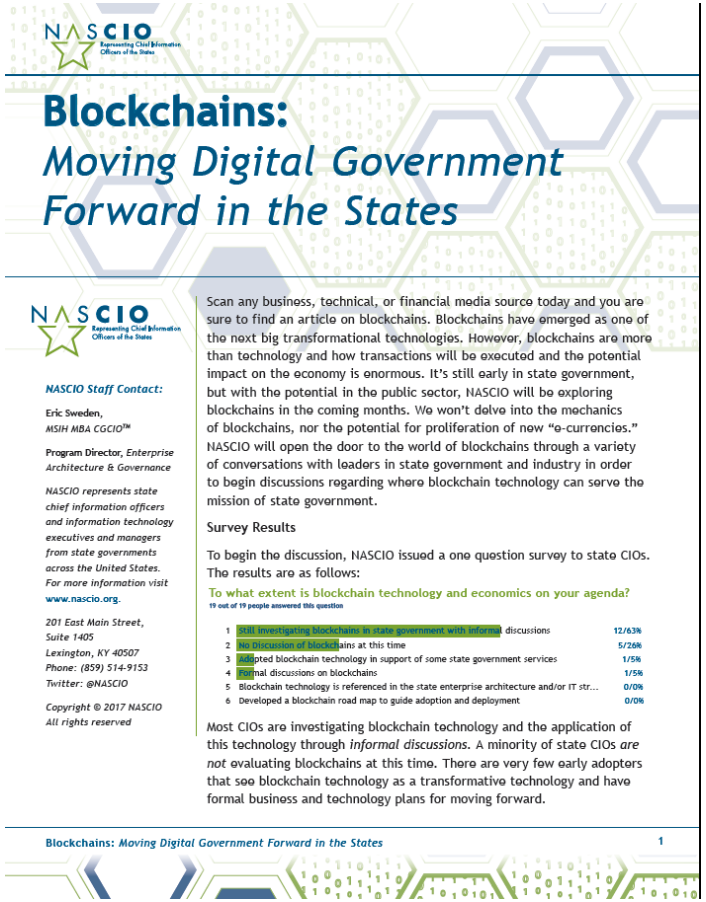


Enterprise Architecture - *the path to Government Transformation*



Blockchains:
Moving Digital Government Forward in the States

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NASCIO represents state chief information officers and information technology executives and managers from state governments across the United States. For more information visit www.nascio.org.

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Scan any business, technical, or financial media source today and you are sure to find an article on blockchains. Blockchains have emerged as one of the next big transformational technologies. However, blockchains are more than technology and how transactions will be executed and the potential impact on the economy is enormous. It's still early in state government, but with the potential in the public sector, NASCIO will be exploring blockchains in the coming months. We won't delve into the mechanics of blockchains, nor the potential for proliferation of new "e-currencies." NASCIO will open the door to the world of blockchains through a variety of conversations with leaders in state government and industry in order to begin discussions regarding where blockchain technology can serve the mission of state government.

Survey Results

To begin the discussion, NASCIO issued a one question survey to state CIOs. The results are as follows:

To what extent is blockchain technology and economics on your agenda?

19 out of 19 people answered this question

1	Still investigating blockchains in state government with informal discussions	12/63%
2	No Discussion of blockchains at this time	5/26%
3	Adopted blockchain technology in support of some state government services	1/5%
4	Formal discussions on blockchains	1/5%
5	Blockchain technology is referenced in the state enterprise architecture and/or IT str...	0/0%
6	Developed a blockchain road map to guide adoption and deployment	0/0%

Most CIOs are investigating blockchain technology and the application of this technology through *informal discussions*. A minority of state CIOs *are not* evaluating blockchains at this time. There are very few early adopters that see blockchain technology as a transformative technology and have formal business and technology plans for moving forward.

www.nascio.org/ResourceCenter

"Blockchain technology possesses potential to transform numerous services delivered by government agencies at all levels, offering enhanced security, transparency and reliability,"

Dr. Craig Orgeron,
CIO
State of Mississippi
Chair of the NASCIO Enterprise Architecture & Governance Committee

Insights, Progress & Horizon Scanning

Illinois Blockchain Initiative

NASCIO Webinar

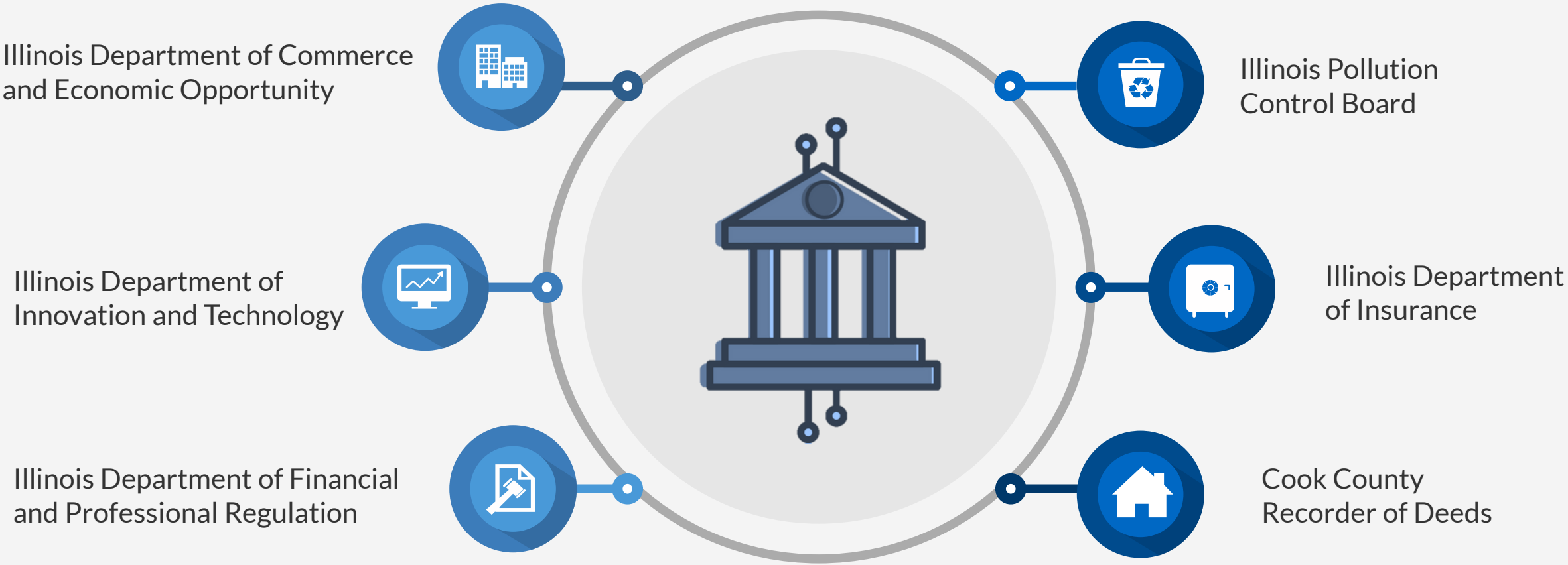
22 June, 2017

Governing Distributed Ledgers

Developing an Ecosystem

Integrating Government

Illinois Blockchain Initiative



What are blockchains & distributed ledgers?

An Internet of Value

Mainframe
1970s

Personal Computing
1980s

Internet
1990s

Mobile
2000s

Blockchains & DLT
2010s

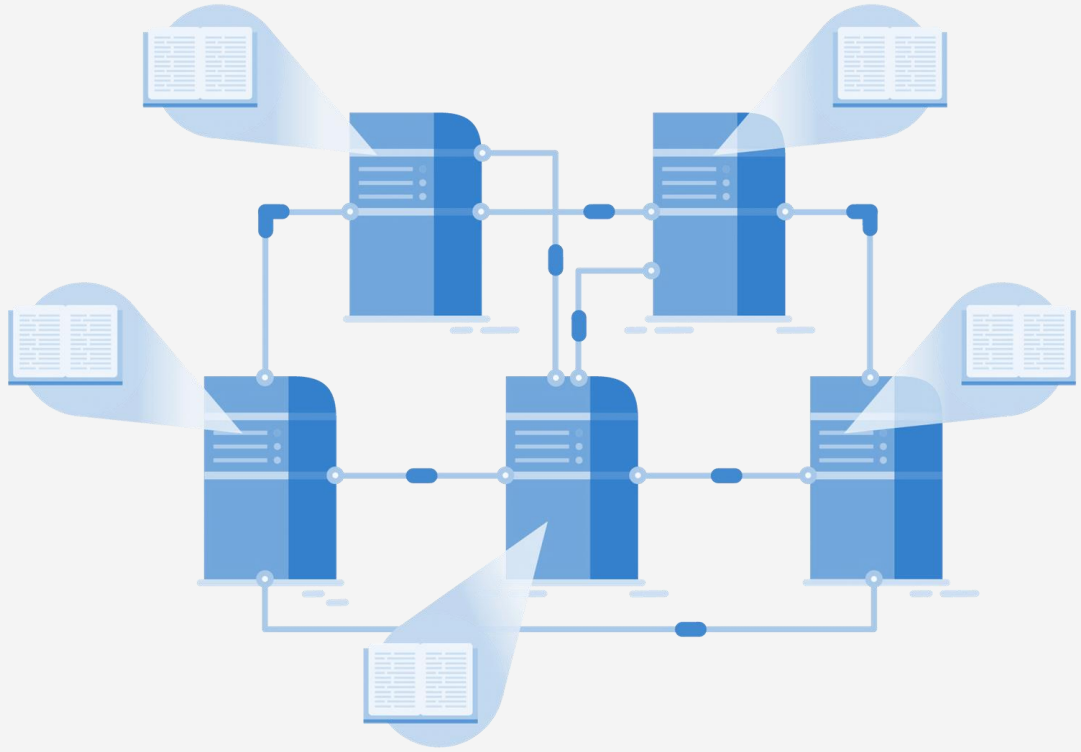
Trust is a foundational element of business. Yet maintaining it—particularly throughout a global economy that is becoming increasingly digital— is expensive, time-consuming, and, in many cases, inefficient. Some organizations are exploring how Blockchain, the backbone behind bitcoin, might provide a viable alternative to the current procedural, organizational, and technological infrastructure required to create institutionalized trust. Though these exploratory efforts are still nascent, the payoff could be profound. Like the Internet reinvented communication, Blockchain may similarly disrupt value transfer, contracts, and trust—the underpinnings of business, government, and society.

- Deloitte "Democratized Trust"

What are blockchains & distributed ledgers?

A blockchain is a type of distributed ledger. It is essentially an asset database that is shared across a network of sites, geographies or institutions.

- All participants within the network have their own identical copy of the ledger (often referred to as a node). Any addition or entry to the ledger is reflected in all ledgers instantaneously.
- The assets can be financial, legal, physical or electronic. The security and accuracy of the assets stored in the ledger are maintained cryptographically through the use of ‘keys’ and signatures to control who can do what within the shared ledger.
- Entries can also be updated by one, some or all of the participants, according to rules preconfigured and agreed upon by the network.



Characteristics of a Blockchain

Blockchains have certain characteristics that separate them from traditional ledgers and databases.

I Database and a Network

Blockchains are databases because they store a chronological list of validated entries. The entries on the ledger are called transactions, but can represent any data (land records, car titles, health records etc.). Blockchains are data agnostic, and value is just one data type.

- Think of an entry as a record, or receipt, of activity between two or more parties on the ledger. The entry may record the transfer of virtual currency between two parties, or it may record that a patient authorized his family practitioner to release his medical records to a specialist.

Blockchains are not only a database of time-ordered activity (ledger), they are also networks. Because the ledger is distributed across multiple parties/computers (nodes), these parties form a network.

II Continuous Synchronization

When a new entry is written to the ledger (in batches called “blocks”), the new version of the ledger is replicated in its entirety across all nodes. Thus, each copy of the ledger maintained by a node is said to be synchronized with every other copy.

Characteristics of a Blockchain

Blockchains have certain characteristics that separate them from traditional ledgers and databases.

III Immutability

Once an entry is committed to a block and added to the ledger, it cannot be undone. Each new block represents a new "state" of the entire ledger, and references information about the previous block. Entries on the ledger are not editable.

New entries are cryptographically appended to the old record. The first block (the genesis block) in the chain contains the oldest record. The latest block in the chain contains the current record.

IV Programmability

Static entries are not the only thing that can be written to the ledger. A small amount of computer code can be deployed on the ledger and autonomously executed.

- For example, imagine a distributed ledger used to manage car title records, each vehicle registered in the State of Illinois and the associated owner(s) is recorded on the ledger.
- A conditional statement is committed to the ledger that says "if $5,000 is sent to a specific blockchain address before December 31, 2017, the title record for Car XYZ will be updated to reflect the sender of the $5,000.

This statement, called a smart contract is a set of conditions that if satisfied, self-executes and performs the activity specified in the code.

Value Proposition

Reconciliation

Reconciliation is the process of ensuring that two sets of records are in agreement. The reconciliation of transaction records is critical to any accounting process. For example, Bank A engages in a transaction with Bank B, and each bank records an entry in its respective ledger. At some point in the future, the entries are reconciled to ensure accuracy.

The need for reconciliation extends beyond finance, and can include any data set or record that is maintained by more than one party. Blockchain technology addresses data reconciliation by requiring network participants to share data points.

- In the banking example above, instead of Bank A and Bank B maintaining separate entries for a single transaction, they would share a single entry maintained on a shared ledger, eliminating the need to reconcile entries later on.

Standards

Interoperability is the ability of computer systems or software to exchange and make use of information. Improving interoperability is one of the most important IT goals in every industry. These systems do not always communicate well with each other, often requiring a translation layer to send messages or data back and forth.

A subtle, but powerful impact of blockchain technology is the standardization of data and transactions formats.

- When users join a blockchain network, they (and their computers) agree to a protocol – a format for transmitting data between nodes on a network.
- By virtue of their participation, users are bound by the data and transaction formats of the network. Not only are the parties communicating in the same “language”, they are sharing a place of record.

Value Proposition

Transparency

In a time when accountability is paramount, government transparency, particularly on a state and local level, is often lacking. The public (and shared) nature of distributed ledgers could offer greater transparency into government workings and create an objective record that holds governments and officials accountable.

- Distributed ledgers are inherently transparent to the nodes on the network. Transactions are not only processed by the network, they are permanently recorded on a shared ledger.
- Public government ledgers for expenditures, legislative actions, grants, and government contracts would impose a greater level of accountability.

Permissions

In serving the interests of the public, governments are often tasked with regulating industries in the name of consumer protection. State departments regulate everything from professional services (e.g. doctors, attorneys) to the sale and solicitation of securities (e.g. company stock). And with regulation comes some level of compliance for industry operators.

Using a blockchains' built-in cryptographic identity system, permissions can be assigned to network participants, and granted to agencies or departments at the most granular level.

- For example, a state pharmacy regulator could be granted read-only permission to view of all Schedule II prescriptions that are filled across the state. These permissions can be stored on chain, ensuring to network participants that the data entered to the ledger is only accessible those with permission.

Insights

What is government's role in a distributed economy?

Design Principles for Government [1]

Trust & Integrity

Trust is intrinsic in a distributed ledger system, encoded in every process and not vested in a single member. Its Blockchain's immutable design properties make data uniquely authoritative and nearly impossible to alter after entries are added. This increases confidence in integrity and reduces the need for federal, state and local governments to separately reconcile individual registries.

Shared Value Creation

Blockchains systematically align incentives so that value is generated through collaborative coordination. Systems that reward shared-value creation have the opportunity to more granularly and accurately link policy-making efforts to the needs of tax payers and voters.

Distributed Power

Blockchains can distribute power to citizens by decentralizing administrative control and providing unparalleled personal information ownership. Decentralized control strengthens the resiliency of democratic checks and balances. When information is equally distributed, data sovereignty empowers the citizen that creates it not the agency that stores it.

Embedded Security

With strong cryptography and distributed computing forming the basis for the underlying protocol, governments can ensure services are highly reliable and available. Securing citizen data is not a choice or investment to be made by leadership managing government; confidence, security and authenticity are hard coded into the system.

Privacy & Rights Preserved

The cryptographic nature of the protocol allows governments to balance transparency and privacy. Blockchains can help manage and cryptographically link owners with assets so that ownership is clear and rights are enforceable. By decentralizing data control, governments can vest privacy rights in the hands of the citizens that create it.

Inclusion & Participation

Not one participant controls a blockchain and everyone has consistent, equal access to all records added to the ledger. An integrated government mechanized and automated by distributed ledgers allows leadership to focus its policy and administrative efforts on a governing process that is inclusive of all citizens and tailors services specifically their needs.

[1] Adapted from: Tapscott, Don, and Alex Tapscott. *Blockchain Revolution: How the Technology Behind Bitcoin Is Changing Money, Business, and the World*. 2016.

Government's Role

Developing an Ecosystem For Growth and Collaboration

Although, the long-term benefits of blockchain for industries, the economy and society are clear, blockchains and DLTs are still very much nascent technology. Governments can play an role in catalyzing its maturity as a technology by supporting grassroots developer innovation.

Modernizing Governance for a Distributed Economy

Effective governance in a distributed economy will require legislative agility beyond what rules and regulations can provide. Modern governance will need to carefully balance a combination of broad policy principles, technology standards and "code".

Integrating Services for a Highly Efficient Government

A "hyperconnected" government enables unprecedented transparency, and efficiency, where services are tailored to individual's needs. Blockchain and DLT will be used to connect disparate entities within and across regional, municipal, and state entities around citizens, businesses and assets.

Developing an Ecosystem

Fostering a Talent Pipeline

Partnering with educational institutions to incorporate curriculum into schools and colleges to support workforce development.

Supporting Entrepreneurship

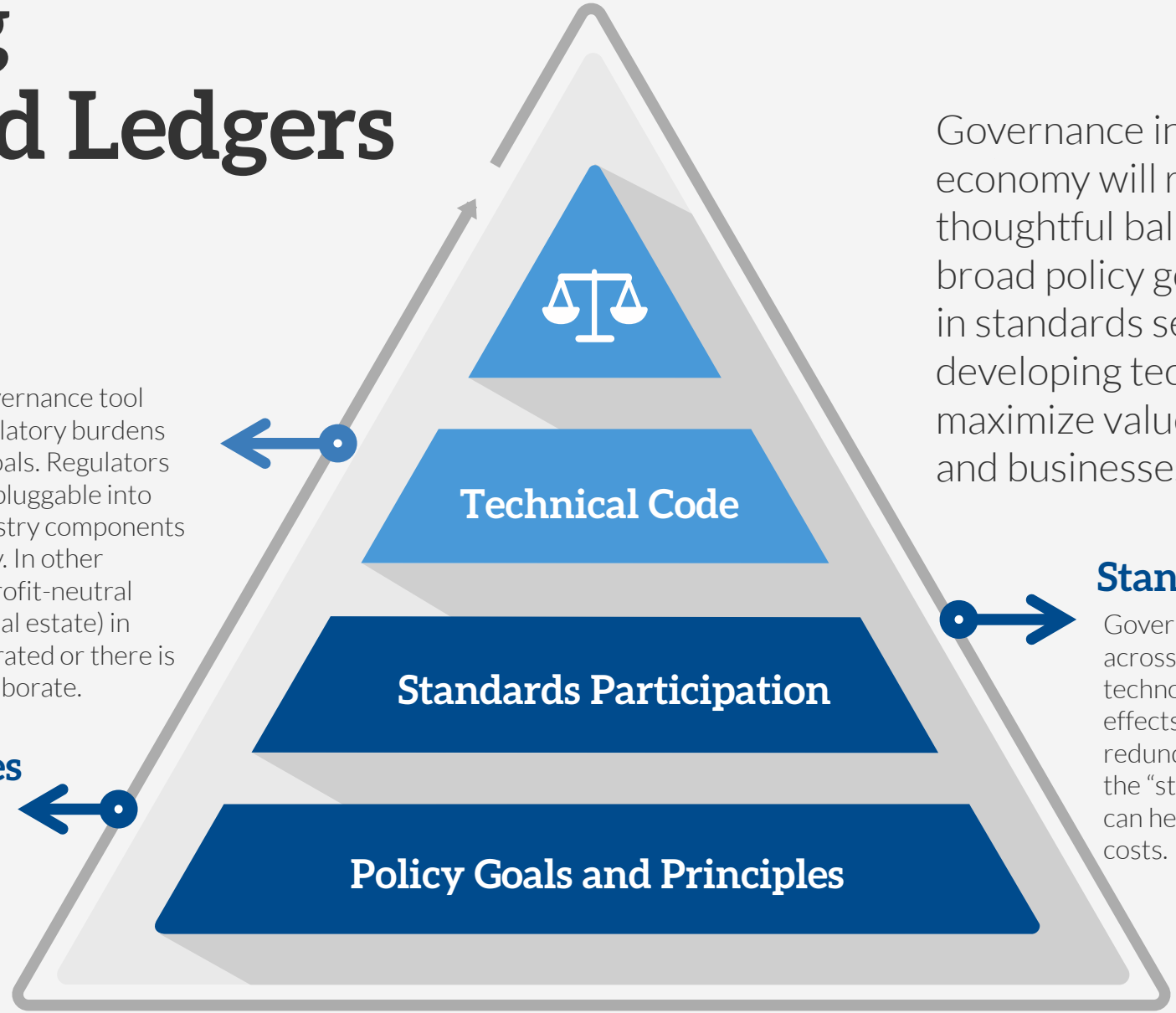
Build relationships with entrepreneurs and leaders to foster a supportive environment for startups and investment.

Collaborating with Enterprises

Encourage startup/enterprise collaboration. Help enterprises partner with promising startups in the ecosystem.

Governing Distributed Ledgers

Governance in a distributed economy will require a thoughtful balance of providing broad policy goals, participation in standards setting, and developing technical code to maximize value for both citizens and businesses.



Technical Code

Technical code can be an effective governance tool when it reduces market frictions/regulatory burdens and also achieves its broader policy goals. Regulators can provide "utility services" that are pluggable into blockchains, standardizing cross-industry components such as identity or fiat digital currency. In other instances governments can provide profit-neutral services (i.e. escrow as a service for real estate) in areas where economic risk is concentrated or there is little incentive for participants to collaborate.

Policy Goals & Principles

By participating in the formative days of the technology, governments can ensure broad policy goals such as transparency and public engagement are incorporated into the core design of the system and so that the benefits of "decentralized coordination" are illuminated.

Standards Participation

Governments have the unique ability to work across industries and protocols to ensure technology standards harness network effects, promote interoperability and minimize redundancy. By acting as neutral arbiters in the "standard setting" process governments can help minimize risks such as coordination costs.

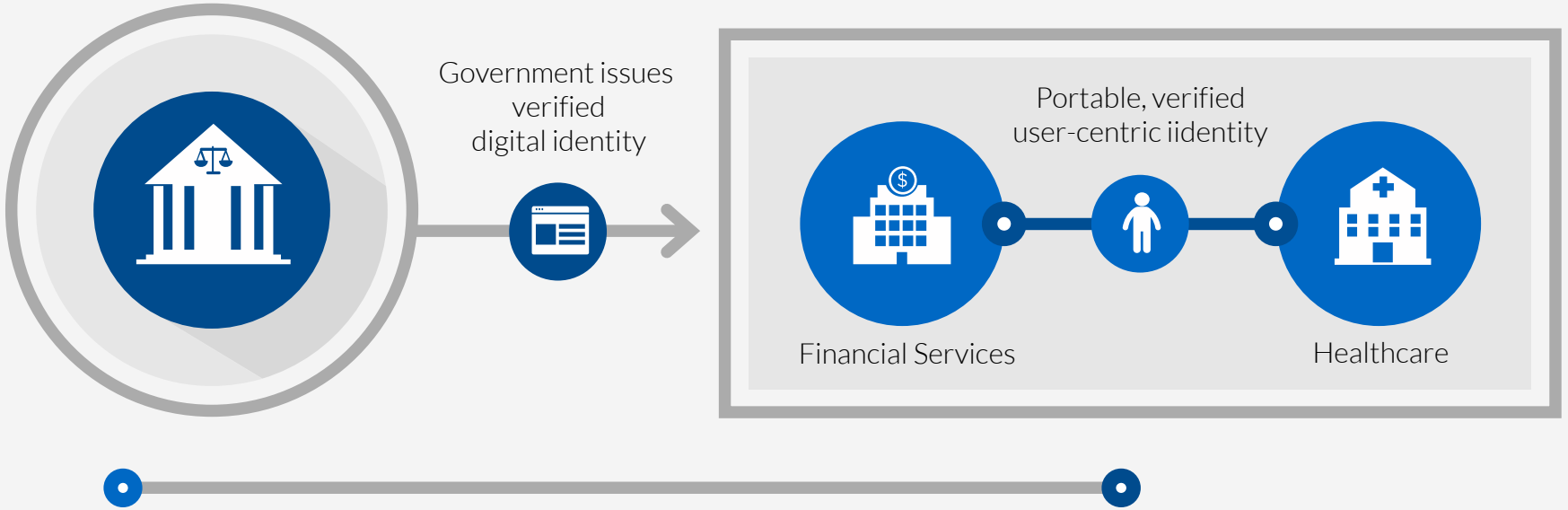
Governing Distributed Ledgers:

"Utility Services:" Government Issued Digital Identity

Example Policy Goals

Financial Services: Know your customer (KYC) regulations ensure money flowing through FIs are not used for illegal activities.

Healthcare: HIPAA regulations protect medical records and medical history to ensure patient confidentiality and privacy.



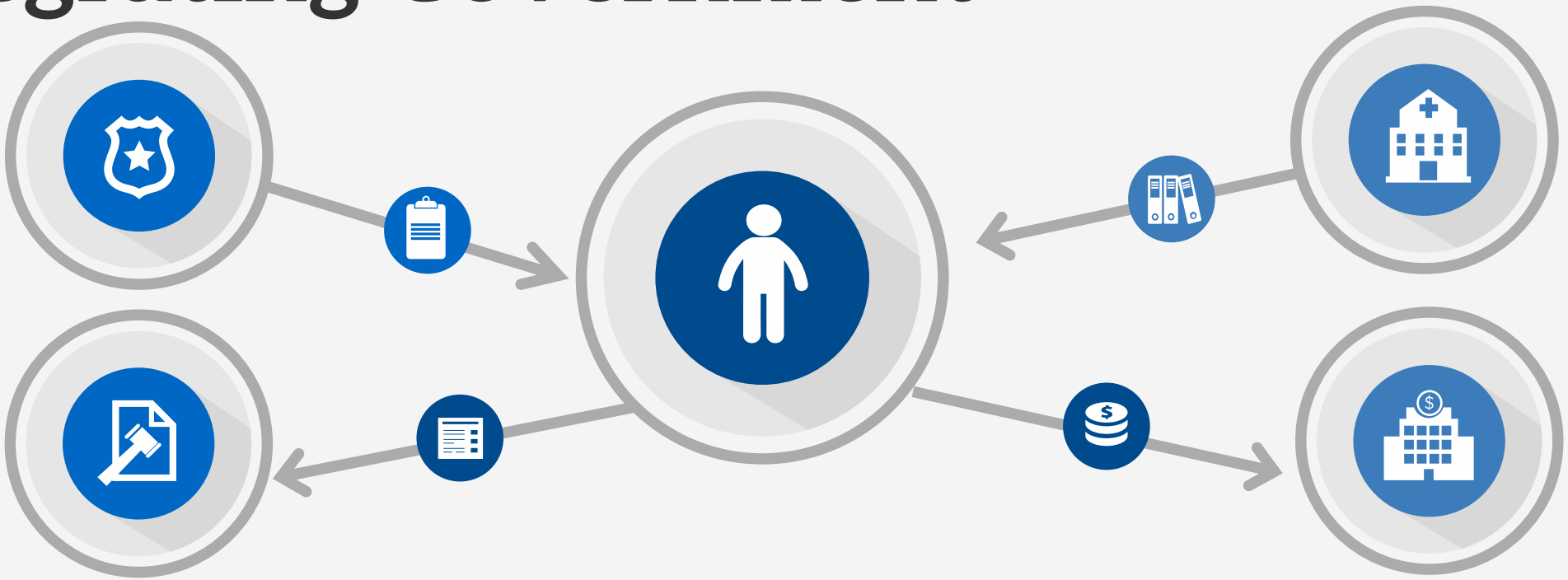
Government develops software "utility service"

- By providing utility-type services (directly "as a service", or indirectly as a data asset), state departments and agencies can facilitate and support smarter and more efficient insurance, banking, energy, real estate, and transportation industries.

Achieves policy goal & enables market efficiencies

- Industries such as financial services or insurance are relieved from the burden of KYC compliance. A portable identity can also be utilized in healthcare for both providers and patients as well. Overall reduces market friction in regulated industries.

Integrating Government



Singular, Citizen-Centric Identity

Public addresses on a blockchain can be used to form the basis of a unified citizen ID across multiple departments and systems. A fit-for-purpose distributed ledger could be used as a new type of master data management system, maintaining a single source of truth for all government recordkeeping.

Identity Attributes & Attestations

Identity attributes (credentials or attribute claims) can be issued and cryptographically linked to a citizen's unique ID. Each department can append attributes to a citizen's credential or claim repository that is managed on a government distributed ledger, but owned by and sovereign to a citizen or business entity.

Assets & Ownership Registries

Under this "networked" system asset and property can also be issue unique IDs. Ownerships such as real property, vehicle, fire arm or even intangible assets can be cryptographically tied to a citizen's unique ID. Blockchains and smart contracts can efficiently keep record of asset ownerships and their tradeable value.

Integrating Government: Use Case Snapshots

Sharing Economy: Public Transit

An interesting application of distributed applications would be an Uber-like public transit service provided by the State of Illinois. With self-driving vehicles on the horizon, it is entirely possible to have a state-operated on-demand vehicle service that is hosted on a distributed ledger. In fact, private companies such as Arcade City are already providing rides to consumers by using a distributed ledger.

Tokenizing Tax Credits

Tax credits could be categorically defined and “tokenized” on a blockchain, similar to the way other assets (i.e. property or bonds) are being tokenized to improve market visibility and ensure asset provenance. The government could also open an exchange, where “tax tokens” could be traded, improving the liquidity of the credits and ensuring they are deducted properly.

Distribution of Emergency Aid Grants

Many government grants are based on eligibility criteria, a grant is either approved or denied to an individual or entity based on the meeting of certain requirements. Rolling up all systems into one distributed ledger could simplifies the eligibility process. Upon eligibility, a smart-contract can trigger a grant payment instantly. For complex disaster recovery grants , IoT devices can add sensor data to the eligibility process as trusted ”oracle” service.

Demand-Based Service Marketplaces

By combining Blockchain, the Internet of Things, and Big Data, cities and counties can create a demand-based marketplace for waste management and snow removal. Sensors can determine demand autonomously; that data can be fed into a blockchain system, where it interacts with a smart contract. Price is determined and a service provider is sourced automatically based on agreed upon conditions in the smart contract.

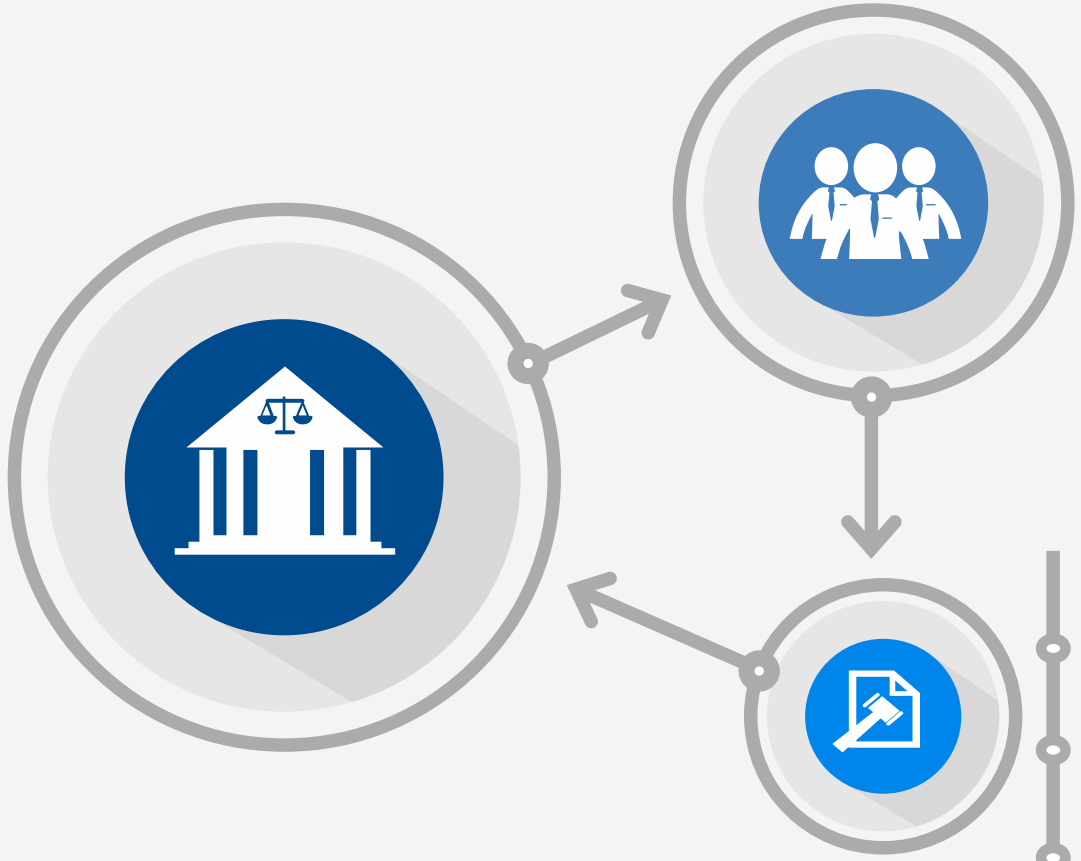
Progress & Horizon Scanning

What have we accomplished and where do we plan to go?

The Illinois Approach

Integrating Government

- Stand up “sandbox” and proof-of-concepts that demonstrate value and solve pain points.
- Work with industries to develop utility services supporting smarter, efficient markets.
- Use success of pilots to lay groundwork for solid foundation and long-term roadmap.



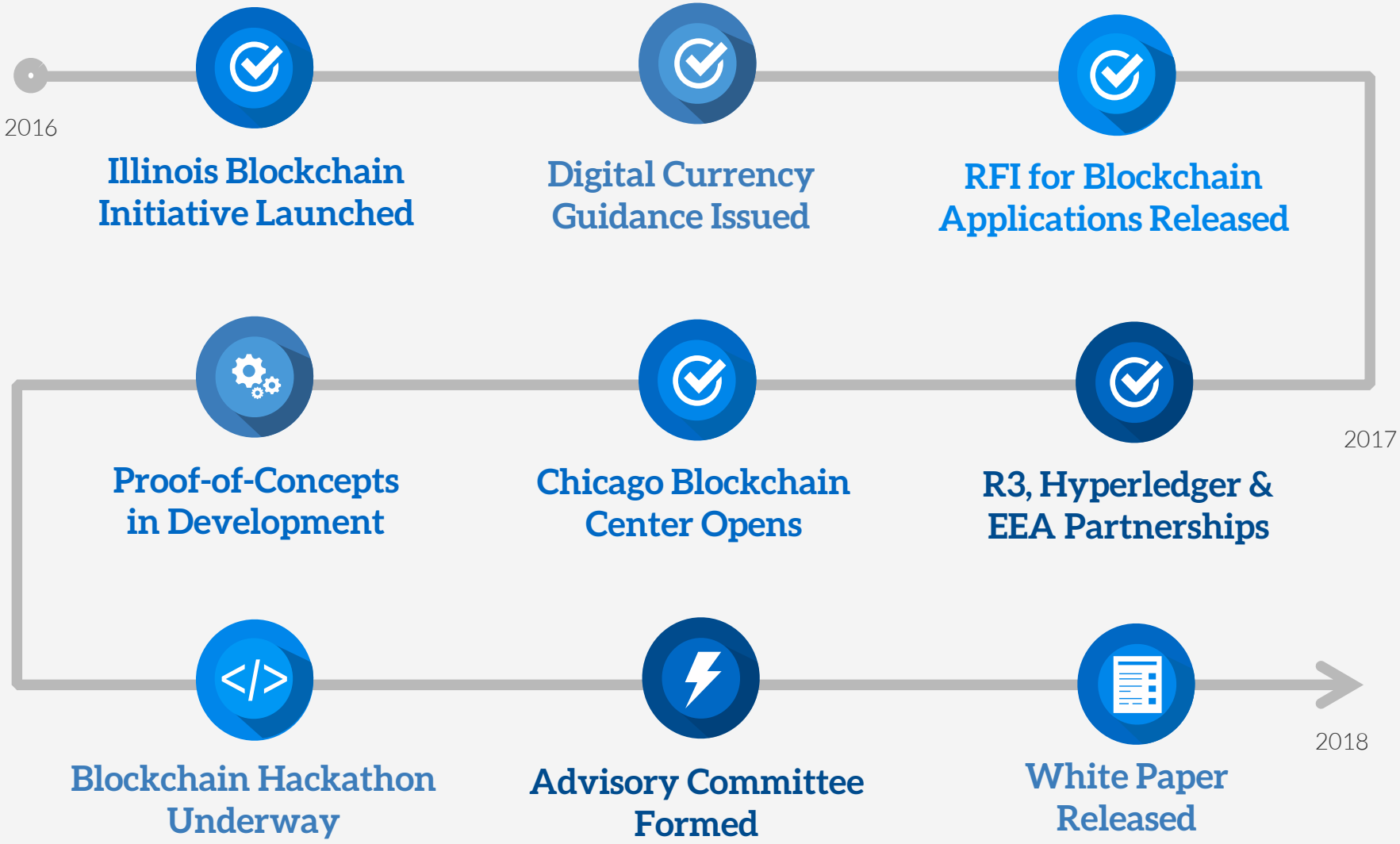
Developing an Ecosystem

- Seed long-term innovation through centers of excellence, incubators and code-a-thons.
- Host educational workshops and conferences to develop continuous knowledge-sharing.
- Develop environment where enterprises, startups and academia are encouraged to collaborate.

Governing Distributed Ledgers

- Dedicate early resources to formulating supportive regulatory environment.
- Facilitate industry standards and interoperability to harness network effects, minimizing duplication.
- Participate in industry solution development to leverage DLT’s benefits for efficient compliance.

Progress to Date



Developing an Ecosystem: Partnerships

HYPERLEDGER

r3.

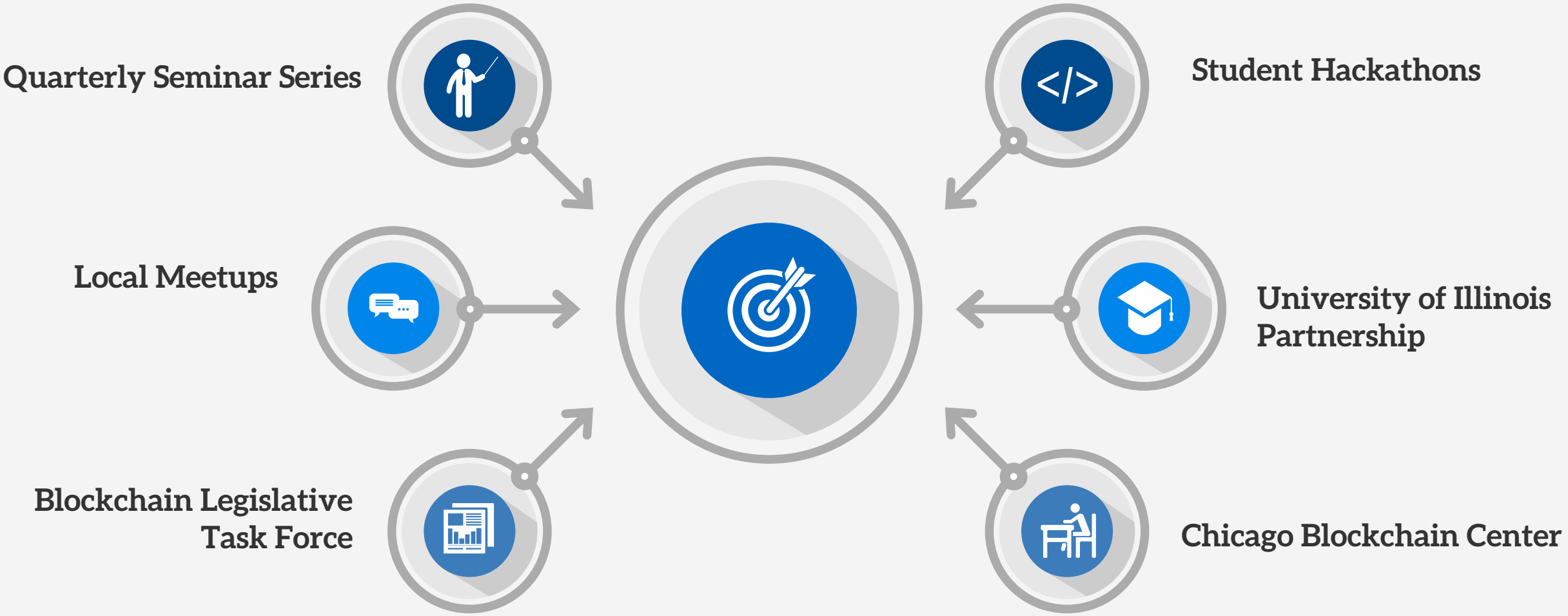
CHICAGO BLOCKCHAIN CENTER
A State of Illinois Innovation

ENTERPRISE ETHEREUM ALLIANCE

CHAMBER OF DIGITAL COMMERCE

ben
BLOCKCHAIN EDUCATION NETWORK

Developing an Ecosystem



Governing Distributed Ledgers

Digital Currency Regulatory Guidance

Department of Financial and Professional Regulation (IDFPR) released guidance, taking light-touch regulatory approach to digital currencies while also providing certainty for businesses operating in the space.

R3 and Enterprise Ethereum Partnership

IDFPR signs partnership agreement with R3 CEV and Enterprise Ethereum Alliance (EEA) financial services consortiums As a member of R3 the IDFPR will be participating in the firm's RegNet and banking/ regulatory working group. As a member of EEA the State is actively participating in identity and pharma/ supply chain working group, defining use cases and technical standards

Integrating Government: Pilots

Property Deed Recording

Cook County Recorder of Deeds will be the first land titling office in the US to record property transfer on the blockchain. The goal is to expand the scope of the program, the extensibility of the solution while also providing the solution to other Illinois county recorders.

Academic Credentialing

Partnering with Illinois Universities to issue academic credentials/transcripts on a blockchain. MVP focuses on credential verifications, with the goal of recording transcripts of all Illinois institutions on a distributed ledger for students, employers or professional credential verifiers.

Health Provider Registries

Healthcare payers spend over $2.1b a year reconciling a few discrete health provider data fields issued by CMS, DEA and state boards. Provider data, starting with the state licensing board would be entered onto a distributed ledger acting as a single source of truth dataset for providers and payers.

Energy Credit Marketplace

Energy producers are issued tax credits when producing “green” energy. Program would include standing up a marketplace where REC could be traded. Credits would be granularly divisible. Potential to improve traceability and liquidity, providing better “green” energy policy outcomes.

Vital Records

Vital records such as birth events to be placed on a distributed ledger. Birth records allow the state to attest to verifiable digital identity claims tied to a person’s birth that could be managed on a distributed ledger, adding attributes to it as the citizen interacts with different agencies throughout his/her lifetime.

Illinois Blockchain Initiative (IBI) Contacts

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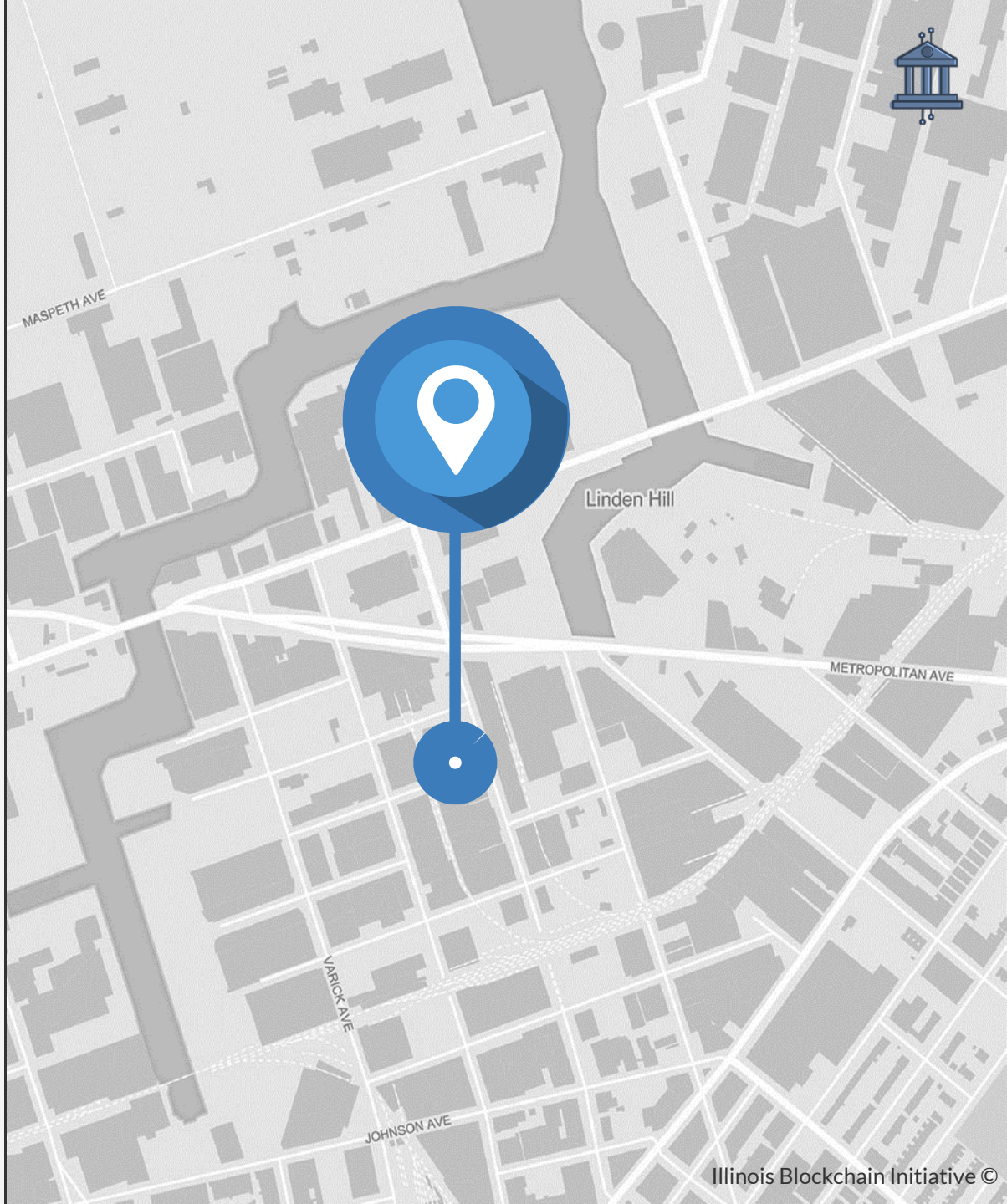

Reading Resources

- United Kingdom:
  Distributed ledger technology beyond block chain
- Cook County Recorder of Deeds:
  Blockchain Pilot Program Final Report
- World Government Summit:
  Building a Hyperconnected Future on Blockchains
- Australia CSIRO: Data 61
  What does the future hold for blockchain in Australia?

Questions


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