Blockchain 101

June 23, 2017

An introductory webinar to Blockchain presented by:

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Blockchains serve as a foundation for decentralized agreement on what those balances are.
It is the shared, collective history of transactions on the network.
A copy of the blockchain is stored on each user’s computer.
The blockchain and its transactions are fully public and may be seen by anyone.
Distributed grid solutions that bring people, technology and energy together
Utility Scale Programs

- Applying tested models for emerging tech adoption and market transformation

Company background:
- Energy Program Design
- Community Engagement
- Codes and Standards
- REC Markets
- Blockchain
- Advanced Meters
- System Architecture
- Computation
More than half of the estimated additional solar generation will be distributed, not utility scale.
New Energy Resources - Predictably Intermittent

Source: EIA, Nov 2016

New energy resources are predictably intermittent, as shown in the graph for a typical spring day. The graph indicates that actual 3-hour ramp to 10,692 MW on February 1, 2016, requiring over generation risk of 13,000 MW in three hours. Net load of 11,663 MW on May 15, 2016.

Source: CAISO

Market Background

California Independent System Operator average hourly real-time price dollars per megawatthour:

- January: 100
- February: 100
- March: 100

Source: U.S. Energy Information Administration, based on LCG consulting

Source: WattClarity, Jan 2017
Consumers Demand New Choice and Services

69% of consumers are interested in having an energy trading marketplace.

33% of consumers who say reading positive reviews on social media platforms/networks would increase their interest in energy-related products or services.

47% of consumers plan to sign up for a community solar program managed by a third party and one that allows them to benefit from solar power even if they do not have solar panels on their property within the next five years.

Source: Accenture’s New Energy Consumer research program 2016
Utility Grid Faces Structural Issues

- Grid unidirectional and brittle - future calls for fast-acting, resilient, adaptive platform
- Current utility business models do not encourage Distributed Energy Resources
- Regulatory barriers limit consumer participation in energy
- Major market changes underway, unprecedented shifts by utilities and market actors
- “Prosumer” movement creating pressure on existing business models
- Broad, coordinated control of small scale DERs is uneconomic
Blockchains Enable Transactions

Node A
- Block 1
- Block 2
- Block...
- Block n

Node B
- Block1
- Block 2
- Block...
- Block n

Node C
- Block1
- Block 2
- Block...
- Block n

Block Contains:
- Time stamp
- Ownership status
- Reference previous block
- List of transactions

Blockchain Transactions:
- Secure
- Efficient
- Frictionless
- Flexible
- Transparent
Blockchain-based Microgrid Intelligence System

- Transactive, distributed intelligence system to control microgrids
- Based on open-source, cryptographically-secure protocol layer delivering military-grade cybersecurity and real-time data
- Auditable, immutable, secure device control
Tokenization of energy production, storage and consumption creates efficient local markets.

Efficient Local Markets attract investment, increase impacts and create local value for energy, environment and community.

Rise of the Prosumers neighbor-to-neighbor, neighbor-to-business community transactions reward local markets and return community value.

Reward efficiency and resiliency allowing participants to optimize existing energy spend according to individual values, priorities and outcomes.

Community Energy – Sharing Economy
Current Status & Next Steps

- First peer-to-peer energy transactions executed
- Demonstration projects underway
- Testing business models
- Brooklyn Microgrid in development
  - Over 50 sites metered and over 300 interested
- Partners
  - Strategic Partners - Siemens, KIT, AEMO
Next – Targeted Demonstrations

- **Deploy** – Technology
- **Develop** – Business Models
- **Demonstrate** – Market Adoption
They are your electrons, right? Don’t forget that.
Insights, Progress & Horizon Scanning

Illinois Blockchain Initiative

NARUC Webinar
23 June, 2017
Insights

What is government’s role in a distributed economy?
**Design Principles for Government**

**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.

**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.

**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.

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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.

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.
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.

**Governing Distributed Ledgers**

- **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.

- **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.

- **Policy Goals and 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.
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. Ownership 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 Govt: 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.

**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 simplify 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

- **2016**
  - Illinois Blockchain Initiative Launched
  - Digital Currency Guidance Issued
  - RFI for Blockchain Applications Released

- **2017**
  - Proof-of-Concepts in Development
  - Chicago Blockchain Center Opens
  - R3, Hyperledger & EEA Partnerships

- **2018**
  - Blockchain Hackathon Underway
  - Advisory Committee Formed
  - White Paper Released
Developing an Ecosystem: Partnerships

- Hyperledger
- r3
- Chicago Blockchain Center
- Enterprise Ethereum Alliance
- Chamber of Commerce
- Ben
Developing an Ecosystem

Quarterly Seminar Series
Local Meetups
Blockchain Legislative Task Force
Student Hackathons
University of Illinois Partnership
Chicago Blockchain Center

Illinois Blockchain Initiative ©
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 the University of Illinois 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.

**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 issue a digital identity 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.
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Questions?