Five Things Regulators Should Know about Blockchain (and Three Myths to Forget)

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August 16, 2018

Abstract

With all the excitement about blockchain, it is important that utility regulators separate truth from myth. What should they know? The basic benefits of blockchain technology, its potential regulatory applications, the roles of smart contracts, and the implications for artificial intelligence. What are the myths? That blockchain removes the need for trust, that it uses too much electricity, and that smart contracts are actually smart and contracts.

I. Introduction

Blockchain technology is grabbing headlines and people's imaginations. Hacker Noon – a technology news site – listed 24 significant conferences focused on blockchain for the last half of 2018, covering North America, Europe, Asia, and the Middle East.[2] Energy Web lists 10 blockchain events focused on energy in the first eight months of 2018.[3] Several tech startups are developing blockchain applications for the energy sector, including promoting green energy and improving energy trading.

Supporters of transactive energy are looking to blockchain as a technology solution. This was a central topic of a panel at the National Association of Regulatory Utility Commissioners 2018 summer meetings in Phoenix. During the panel, a state commissioner asked a key question to the panelists: "Should I care about blockchain?" The speakers answered a resounding, "Yes!" But they were vaguer in their answers to the natural follow-up question: "What should a regulator know?"

In this article, we suggest five things that every regulator should know about blockchain, and three myths that they should forget. We begin with what regulators should know.

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[2] Hacker Noon, "Top Blockchain Events and Conferences, 2018," https://hackernoon.com/top-blockchain-events-conferences-95ad281a00c1, accessed August 7, 2018.

[3] Energy Web, "Past Events," https://energyweb.org/events/, accessed August 7, 2018.

II. Five Things to Know

1. Know what blockchain is, but at a strategic rather than technical level

Blockchain is a technology for validating information and protecting it from tampering. But such technologies have been around for a long time. What's different with blockchain is that it decentralizes governance, which means that people that rely upon the information don't have to trust a single individual or organization to honestly and reliably validate and protect the information. Instead, people trust the software.

This has the potential for changing how businesses, customers, and regulators operate. We discuss this in more detail below. Here we recommend that regulators look for situations where it is hard to maintain and share information that people need to trust. For example, in some instances market monitoring information has been controversial. If blockchain is used to collect the information, it can be made instantly available to persons who are authorized to access it and can be protected from loss and tampering.

What do regulators need to know about how blockchain works? Basically, that it organizes information into blocks chronologically. Each block is encrypted to protect its information. To ensure that information is valid – for example, ensuring if someone is sending money that the sender really has the money to send – the blocks are assembled in a chain that makes everything trackable. The blocks in the chain are linked to each other by having each block's encryption code (called a hash) tied to the previous block's hash. In this way money, for example, can be traced back to the first moment that it entered the blockchain and each transfer inspected to ensure that ownership is clear.

A slightly more technical description of blockchain

Here we describe how blockchain could work to address a particular problem. We do not mean to imply that it is the only technology solution.

Consider how to solve this problem: Suppose that a utility contracts with an entrepreneur to own and operate an energy storage facility connected to the utility's grid. According to the contract, the entrepreneur pays to receive energy off the grid at off peak times and then is paid by the utility to send energy back into the grid during peak times. The two companies want to ensure that the transaction records are shared, valid and secure.

How can they do that? For a single transaction, one technology fix is to create something called a hash. What is a hash? It is simply a string of digits and letters, typically 32 characters long, generated by a computer program that encrypts the transaction record and when it occurred (called a timestamp). The record, timestamp, and hash comprise a block. (A block may contain more than one transaction, but we assume there is just one for illustrative purposes.)

Hashing makes the data effectively tamperproof[4] because any attempt to change the record triggers a change in the hash, which is detected by the blockchain software. We explain this next.

The utility wants a system that ensures that the entrepreneur isn't cheating by putting energy onto the grid that it gets from say solar panels. How can the utility and entrepreneur do that? They can chain the blocks together, creating a blockchain.

How do they chain the blocks? Through their hashes. Each newly created block contains the hash of the previous block. So, the new block's hash effectively includes the previous block's information (through its hash), which includes its previous block's information (through its hash), etc. Through this mechanism the software ensures that the power put onto the grid can be traced back to a corresponding amount that was taken off the grid.

So, the transactions are validated and protected by software that everyone involved has had the opportunity to inspect and authenticate, and the chain ensures that the entrepreneur sells into the grid only amounts that it has taken.

2. Blockchain can be used regulators as well as by industry

How can regulators use blockchain? In many ways, according to Skeeta Carasco, a regulatory economist with the National Utilities Regulatory Commission of St. Lucia. She posted the following to the Academy of Regulatory Professionals Facebook page in June 2018:

> My thoughts are that blockchain could improve the efficiency of transactions among bureaucratic government departments and agencies. For instance, the processing of simple licences may require approval or input from different agencies, each with its own system or ledger. Using a blockchain in such an instance could reduce the time spent for processing licences. It would eliminate the need for verification of information by each department which receives information from another. Furthermore, it would reduce the need to convert data from one form to another to meet the system requirements for each entity.
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> In the regulatory context, this may work between a utility regulator and a regulated entity in instances where they both provide input into transaction approvals. For instance, our regulator currently issued permits to distributed generators after some input from the electric utility. This permit is later considered by the electrical licensing department and utility in approving the solar photovoltaic system for interconnection. The use of a blockchain would make the process a lot more efficient since a customer

[4] Technically, someone with massive computing power can hack the encryption, but doing so is prohibitively expensive.

would be able to initiate a permit transaction which could be traced at each stage of the process. This would also decrease the information asymmetry between the regulator and regulated entity on which customers have already been interconnected and the exact moment of interconnection. Whereas such an application seems logical and feasible, currently, paper based (sic) transactions are seemingly more trusted and consequently preferred. The financial implications of implementing such a system could also potentially be a limiting factor.

Blockchain can streamline government processes that involve multiple agencies, clean up permitting, and automate information sharing between regulators and utilities. Utilities using blockchain for service provisioning and financial management could automate the regulator receiving its required information.

As a first step in applying blockchain, a regulator could use it for docket management. Each order, filing, evidence record, etc. could be placed in the blockchain, making it properly time stamped and immutably archived. Smart contracts (see item 3 below) could manage permissions, issue notices automatically, and archive in the blockchain any accessing of the information. Such a blockchain would be centralized rather than decentralized, but the technology still works.

3. Smart contracts can automate transactions once certain conditions are met

There is a lot of buzz about smart contracts, which are software that execute transfers of money or other actions based on triggers. A typical example is a vending machine that automatically dispenses the requested food product when the right buttons are pressed, and a credit card approved. Broadband providers could use smart contracts to subsidize rural hospitals, for example, by having the activation of a broadband connection to a rural hospital trigger a payment from an association of broadband providers to the supplier that is providing the subsidized service.[5]

How might smart contracts be used in utility regulation? A smart contract in water could be written so that when specified lab reports find that water quality indicators have dropped below (or risen above) a specified level, penalties (or rewards) would be automatically implemented. A smart contract in energy could deliver a reward to a utility for achieving a specified level of renewable energy production.

In utility applications, smart contracts could be used to facilitate the real-time coordination of energy data. Suppose that one utility wants to provide power to another, and wheels the energy through a transmission provider. In some current arrangements, the transmission provider has a legal obligation to both facilitate the financial transaction and wheel the power. Blockchain technology's can address the financial aspect, removing the need to place a financial

[5] Mark A. Jamison, "Can blockchain save broadband for rural healthcare?" *AEIdeas*, June 6, 2018, https://www.aei.org/publication/can-blockchain-save-broadband-for-rural-healthcare/.

obligation on the transmission company. For example, blockchain could draw data from the meters that measure the power flows between the two utilities and the transmission provider. When agreed-upon conditions are met, such as a week has passed or an amount of power has been transferred, a smart contract could execute the financial transaction from the receiving utility to the producer utility and the transmission provider. Blockchain's relatively low costs could increase the commercial viability of such arrangements, which would improve economic efficiency.

Greentech Media predicts that blockchain and smart contracts will be used for renewable energy credits (RECs): "For RECs, blockchain can replace legacy platforms and reduce the possibility of double-counting. Developers can design these REC trading platforms to conform to existing regulations."[6]

4. Blockchain opens more opportunities for artificial intelligence

Utilities are increasing their use of artificial intelligence (AI). What is AI? It is where a computer learns from its experience, the experiences of others, and massive amounts of data to improve decision making.

For example, Nest thermostats use AI to predict consumers' preferences for room temperatures. AI is also being used to also predict hot water usage and other customer choices. Some utilities are beginning to use AI to anticipate grid demand, equipment failures, and outages.

How does this relate to blockchain? The key to great AI performance is massive amounts of data, and blockchains are excellent sources of clean, well-organized data. To illustrate, suppose there were a battle between an okay AI system using massive amounts of data and an amazing AI system relying on limited data. Which would win? The one with the massive data. Why? Just as is often the case with humans, an AI system with extensive, relevant experiences outperforms systems with limited experiences even if the latter systems have better programming.

But a major barrier to using massive data is the challenge of making sure it is clean, i.e., free of consequential errors, consistent in its format, and properly defined. Blockchains provide clean data in potentially large volumes. And blockchains can combine utility and customer data, enabling the use of AI in jointly managing a customer's and utility's equipment.

5. Blockchain can change the shape of the utility business and of regulation in ways we cannot anticipate

[6] Colleen Metelitsa, "4 Predictions for Blockchain in Energy in 2018," *Greentech Media*, March 5, 2018, https://www.greentechmedia.com/articles/read/four-predictions-for-blockchain-in-energy-in-2018#gs.xCOeAjk (accessed August 11, 2018).

The examples we describe above illustrate that blockchain can change the nature of relationships between utilities and customers, between utilities and suppliers, between government agencies, and between regulators and utilities. Blockchain with AI changes how decisions are made and who makes them. Together they also alter the economics of obtaining and managing data and increase the value of data. These changing economics will likely redraw the boundaries of business and government.

How will the boundaries be redrawn? That is unclear. The new economic realities have conflicting effects. On the one hand, some blockchain applications can be shared by utilities and customers, which could strengthen ties between supplier and customer. Smart contracts could also tighten this tie by intertwining supplier and customer operations and finances. But in contrast, blockchain and smart contracts can lower contracting costs, which would create opportunities for utility rivals.

How should regulators respond? Be adaptable. A lesson from telecommunications deregulation is that regulators and industry alike are unable to reasonably predict how changing technologies and economics will shape an industry. So, an imperative for utility regulators is to remain flexible and keep options open. In particular remain open on which types of vertical integration or breakup are optimal, which types of horizontal integration or breakup are best, how prices might be changed, and how performance can be monitored and rewarded.

Those are our five things to know. What are the myths to forget?

III. Three Myths to Forget

Myth 1. Blockchain is trustless

Blockchain changes the loci of trust, not the need for trust. Why? Blockchains are not readily understandable by the general public. Consider this computer code from a proposed change in bitcoin's blockchain:[7]

```
before_install:
  - export PATH=$(echo $PATH | tr ':' "\n" | sed '/\/opt\/python/d' | tr "\n" ":" | sed
    "s|::|:|g")
  - BEGIN_FOLD () { echo ""; CURRENT_FOLD_NAME=$1; echo
    "travis_fold:start:${CURRENT_FOLD_NAME}"; }
  - END_FOLD () { RET=$?; echo "travis_fold:end:${CURRENT_FOLD_NAME}"; return
    $RET; }
```

[7] GitHub, "bitcoin", https://github.com/bitcoin/bitcoin/commit/566f826902cf1a1df18dba83d5302cf173b64e1d, accessed August 7, 2018.

The general public cannot interpret this, so most of us are left with either trusting the coders or distrusting the blockchain.

Is there evidence that blockchains sometimes do not do what they claim? Yes. A recent study of the fifty top-grossing initial coin offerings (ICOs) found problems.[8] ICO is the name for launching a new coin or token on a blockchain.[9] The researchers compared each blockchain's computer code with what the creators promised the code would do. In numerous instances the actual code fell short of what the ICO founders promised.

For example, the research found that many ICOs failed to protect investors from insider self-dealing. More specifically, for vesting requirements — which are intended to protect investors from the threat of founders deserting the new enterprise — of the 30 ICOs that made promises about vesting, only 7 actually effected the promises in the computer code.

Myth 2. Blockchain uses too much electricity

There has been much hand-wringing over bitcoin's consumption of electricity.[10] Newsweek even went so far as to claim in a headline that bitcoin is on track to consume all the world's energy by 2020![11] Power Compare believes that bitcoin miners[12] consume more electricity on an annual basis than do Alaska, Hawaii, Idaho, Maine, Montana, New Hampshire, New Mexico, North Dakota, Rhode Island, South Dakota, Vermont, and Wyoming together.[13]

The estimates of energy consumption might accurately represent the current state of bitcoin, but they do not say much about blockchain in general nor about the future. Why not? These estimates are specifically about bitcoin, not blockchain per se. Created in 2009, bitcoin's blockchain was designed specifically to consume lots of electricity to make it expensive for someone to tamper with the system. And there are other, less energy intensive ways to make blockchains effectively tamperproof and more recent blockchains are applying these approaches.

Myth 3. Smart contracts replace traditional contracts

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[8] Shaanan Cohney, David A. Hoffman, Jeremy Sklaroff, and David A. Wishnick, "Coin-Operated Capitalism," (July 17, 2018). Available at SSRN: https://ssrn.com/abstract=3215345 or http://dx.doi.org/10.2139/ssrn.3215345

[9] This terminology is changing. People are starting to refer to initial offerings of tokens as initial token offerings or ITOs. The basic difference between coin and token is that a cryptoasset is a coin if its sole purpose is for payments. A cryptoasset is a token if it has other functions, such as providing rights to be part of a network, such as a group of energy producers and energy users.

[10] Mark A. Jamison, "Is bitcoin an energy hog?" *AEIdeas*, January 12, 2018, http://www.aei.org/publication/is-bitcoin-an-energy-hog/.

[11] Anthony Cuthbertson, "Bitcoin Mining on Track to Consume All of the World's Energy by 2020," *Newsweek*, December 11, 2017, https://www.newsweek.com/bitcoin-mining-track-consume-worlds-energy-2020-744036.

[12] A bitcoin miner is an entity that validates and memorializes bitcoin transactions. Bitcoin is designed to support many miners to ensure that control of the bitcoin blockchain is distributed and not centralized.

[13] "Bitcoin Mining Now Consuming More Electricity Than 159 Countries Including Ireland & Most Countries In Africa," *Power Compare* (undated), https://powercompare.co.uk/bitcoin/.

Smart contracts won't replace traditional contracts for two reasons. First, smart contracts aren't smart: There is no learning or thinking going on, only automated processes that otherwise require human intervention.

But the primary reason is that smart contracts aren't contracts in the common use of the term. We are not lawyers, but our understanding is that agreements generally have to include the following elements to be considered contracts: Offer, acceptance, a legally binding agreement to do something that is legal to do, an exchange of things of value, and parties of legal capacity (e.g., not minor children). A smart contract may not be legally enforceable if one of the affected parties decides to object after the smart contract has been executed. There may be no exchange of value in a smart contract. For example, the water quality smart contract we described above executes without any exchange of value, without an offer, and without acceptance of an offer. And there is nothing to stop a minor child from executing a smart contract.

IV. Conclusion

What should regulators do with these five things to know and three things to forget? Some will find it beneficial to be proactive and encourage their agency and sister agencies to begin developing blockchain applications. Others will find it better to simply be well informed so that they are not caught unaware when blockchain applications become regulatory issues. All regulators should stay in a learning mode because it is unknown how blockchain will change the worlds of utilities and their regulators.