Gennaro (Jerry) Cuomo

IBM Fellow

Vice President, Blockchain Technologies

House Energy and Commerce

Subcommittee on Commerce, Manufacturing & Trade

How to Capitalize on Blockchain

March 16, 2016

Good Morning Chairman Upton, Ranking Member Pallone, Chairman Burgess, Ranking Member Schakowsky, and members of the subcommittee. My name is Jerry Cuomo and I am IBM's Vice President for Blockchain Technologies. Thank you very much for the opportunity to testify this morning.

Technology and business leaders at IBM believe that blockchain is a revolutionary technology. It's a foundation for building a new generation of applications that establish trust and transparency while streamlining a wide variety of transactional processes. You are wise to include blockchain in your study of "disruptive" technologies because blockchain has the potential to vastly reduce the cost and complexity of getting things done—across industries, government agencies and social institutions.

I also want to tell you what blockchain is not, It's not Bitcoin, the cryptocurrency. While blockchain is the core technology that enables Bitcoin to operate, it can be used for entirely different purposes. Whereas Bitcoin is an anonymous network, blockchain can be used to set up trusted networks to handle interactions between known parties.

In this paper I'll explain what blockchain is, how it works, how it can best be built and used—for the benefit of business, the economy and society.

Key points:

Blockchain creates trustworthy and efficient interactions. It's a distributed ledger shared via a peer-to-peer network that maintains an ever-expanding list of data records. Each participant has an exact copy of the ledger's data, and additions to the chain are propagated throughout the network. Therefore, all participants in an interaction have an up-to-date ledger that reflects the most recent transactions or changes. (The "block" is the record and the "chain" is the collection of blocks that populate the ledger.) In this way, Blockchain reduces the need for establishing trust using traditional methods.

Blockchain technologies must be enhanced to meet the needs of businesses. The core technology must be adapted to further address security and privacy concerns—creating an enterprise-ready blockchain. In addition, computer systems and networks must be architected so they can scale up to handle an immense volume of transactions and industries and governments begin using the technology to handle their core organizational processes—and complete their tasks in seconds rather than minutes.

Blockchains must be open and interoperable. For blockchain to fulfill its full potential, it must be based on non-proprietary technology standards to assure the compatibility and interoperability of systems. Furthermore, the various blockchain versions should be built using open source software, with a combination of liberal licensing terms and strict governance, rather than proprietary software--which could be used to suppress competition. Only with openness will blockchain be widely adopted and will innovation flourish.

Blockchain will greatly benefit from government participation. It's critical from a national competiveness point of view for US companies and government agencies to lead the world in understanding the potential of blockchain and putting it to use. Because of the transparency made possible by blockchain, government agencies will be able to understand better what's going on within financial and commercial systems—and spot potential problems before they become critical. Blockchain

will also enable more efficient interactions between government and businesses—regarding everything from taxes to land use.

Part 1: How Blockchain Can Be Used

Over the past two decades, the Internet, cloud computing and related technologies have revolutionized many aspects of business and society. These advances have made individuals and organizations more productive, and they have enriched many people's lives.

Yet the basic mechanics of how people and organizations forge agreements with one another and execute them have not been updated for the 21st century. In fact, with each passing generation we've added more middlemen, more processes, more bureaucratic checks and balances, and more layers of complexity to our formal interactions–especially financial transactions. We're pushing old procedures through new pipes.

This apparatus–the red tape of modern society–extracts a "tax" of many billions of dollars per year on the global economy and businesses.

What can be done? Businesses, governments and other institutions can use blockchains to build and govern business networks..

Blockchain-based systems could help radically improve whole industries, beginning with banking and insurance. But its impact could be much broader. It could make a difference whenever valuable assets are transferred from one party to another and whenever you need to know for certain that a piece of digital information — anything from electronic artwork to the terms of a business agreement — is unique and unchangeable by any party without the agreement of all parties.

I want to add a note of caution, however. Blockchain isn't the answer to every process- or transaction-related problem. There will be situations where it will improve efficiencies and provide other benefits,

but there will be others where it's not a good fit. Furthermore, don't underestimate the technical and organizational challenges of building and adopting blockchain-based systems.

Here's where blockchain fits well—managing a business agreement between two or more companies. They can record the terms of that agreement on a blockchain, knowing it will execute and be enforced autonomously (e.g., "if you pay me in under 15 days, then I will give you a discount."). Nobody is in private control of the ledger and nobody can secretly change the terms of the agreement. It's like every guest at a B&B writing in the guest book with an indelible Sharpie. So, with blockchain, facts and agreements are recorded certifiably and indelibly, increasing trust, reducing risk, and thus reducing friction in business.

There's a broad range of potential business solutions. On one hand, enterprises will be able to re-imagine well known business processes and areas like supply chain, securities trading and logistics. At the same time, blockchain is poised to enable enterprises and whole industries to invent new digital business processes that include connected devices (Internet of Things) like cars, smartphones, appliances, solar energy panels, and drones. This capability could be critical, for instance, in enabling the insurance industry to design liability insurance policies to cover autonomous vehicles.

IBM is already begun deploying a blockchain-based system internally—for managing our commercial financing business.

The financial services industry is in the forefront of blockchain adoption. Almost every transaction in financial services involves multiple parties and many steps, largely because of the checks and balances that are required to assure that what has been promised has been done. Consider how the technology might be used in a critical financial services process, the settlement in securities trading. People in the industry are talking about a concept they call T+0, which means same day settlement. The hope is that they'll be able to use blockchain to strip out the inefficiencies and handoffs that are required to settle a

trade so that settlement occurs on the same day as opposed to 2 or 3 days later as it is today, depending on the market.

Now, imagine supply chains where blockchain is put to work. An aircraft manufacturer, for example, might create a blockchain-based system for holistically managing all of its relationships with suppliers of parts and components. All of the suppliers will share the exact same information about a new aircraft model–every step in the process of planning, designing, assembling, delivering and maintaining it. At the same time, the manufacturer will use other blockchain-based systems for managing the financial relationships and transactions connected to each step. Thanks to blockchain, trust and accountability are built into supply chains. So are compliance with government regulations and internal rules and processes.

Blockchain fundamentally changes the game across three dimensions: time, cost, and risk. It reduces the time required to settle a multi-party contract from days to seconds, potentially. It reduces costs by stripping out intermediary organizations and processes. And, by enabling permissioned networks to share a transparent and non-changeable ledger, you reduce the risk of tampering, fraud and collusion.

Part 2: How Blockchain Works

Blockchain is both a software technology and a mechanism for groups working together.

At the heart of the blockchain network is a shared ledger, which describes assets, identifies their owners, lays out the steps in a process and records when each step is completed. Only at that point is the exchange of things of value consummated. The ledger has three important properties: replication, which synchronizes all of the copies of the ledger in the network; consensus, which assures that all ledgers are exact copies; and permissions, which ensure that members of a network can only see items in ledger that involve them.

When an entry is agreed to and committed to the blockchain's shared ledger, it cannot be changed. This is a critical feature, which differentiates blockchain's ledger from most database technologies--where entries can be updated and deleted. This makes blockchain resistant to tampering and provides clear audit trails for parties in transactions and government investigators to follow.

Another critical element of blockchain technology is the "smart contract." These are terms of agreement that are captured in software and stored and executed within the blockchain. The smart contracts automatically fulfill the obligations that members have agreed to. A blockchain is an ideal place to store and run such contracts because of its immutability and cryptographic security.

In our view, however, most blockchain implementations, and the tools surrounding them, aren't yet ready for many serious business uses. The concept and architecture are taking form, but some key capabilities and standards are missing or only now emerging. For instance, many enterprise applications require more extensive security capabilities than most of today's blockchain implementations offer. Within healthcare, more extensive privacy protections are needed.

So IBM and others in the industry are augmenting the core blockchain technologies with additional features. One goal is to ensure that institutions and individuals (whether participants or not) can only access information they're supposed to see. A key element is "entitled access," which is achieved by using modern cryptography so access to private data requires presentation of encryption keys/certificates held by authorized participants.

We're also taking steps to ensure that participants cannot commit fraud or collude in ways that jeopardize the integrity of the blockchain. Fraud and collusion resistance is achieved by ensuring that every transaction is validated by all the members of the blockchain networks, which might include regulatory and clearinghouse institutions.

Lastly, we're enabling regulators , with permission, to check for regulatory compliance, and for law enforcement with proper judicial authority, to access details of transactions in the course of criminal investigations.

These additional features will be essential in healthcare scenarios, where the privacy of individuals is both a legal and moral imperative. Blockchain can prevent against accidental or malicious privacy breaches by requiring both encryption and multiple signatures to approve access to sensitive information. There might be a mechanism, for instance, that for a patient record to be seen, a doctor, a nurse and the patient must approve within the blockchain.

Part 3: Why it's Critical for Blockchains to be Open and Interoperable

It's essential for blockchain technology to be developed following the open source model so a critical mass of organizations will coalesce around it—and reap its full benefits. Because of open source rules, participants can trust that the technology will fulfill their needs and conform with industry standards–assuring interoperability between blockchain applications. Also, by sharing the foundational layer, the participants can focus their individual efforts on industry-specific applications, platforms, and hardware systems to support transactions.

An open source blockchain with liberal licensing terms and strict governance will enable the broadest adoption of blockchain by regulated industries. The liberal licensing terms will accelerate innovation, and the strict governance will hasten adoption and regulatory acceptance.

Given the nature of a blockchain network, industry users and regulators of blockchain are going to want visibility right down to the source code to verify its source, accuracy and security.

We believe that the best path forward for blockchain is for the tech industry, government, and the business community to consolidate their efforts around a single open source blockchain foundation

that's developed and governed in an environment of transparency and cooperation. We also believe that organizations will be best served if they use industry-specific or function-specific extensions of that technology, which are created and governed following the same principles. An example of this might be a banking framework that deals with loans, lenders and borrowers.

There are several open source blockchain projects, but only the project managed and sanctioned by the Linux Foundation, called Linux Hyperledger, offers industry friendly terms and multi-company governance. That's why we're participating in the Linux Hyperledger project and urging others to do so as well.

The Linux Foundation announced the project last December. Founding members of the initiative represent a diverse group of stakeholders, including ABN AMRO, Accenture, ANZ Bank, BNY Mellon, Cisco, The Depository Trust & Clearing Corporation (DTCC), Deutsche Börse Group, Digital Asset Holdings, Fujitsu Limited, IBM, Intel, J.P. Morgan, R3, Red Hat, SWIFT, VMware and Wells Fargo. Already, several companies, including IBM, have contributed high-quality software code, technology, and intellectual property rights. The transparency, collaboration and shared governance of this project makes it attractive to participants—whether they're technology companies or enterprises who want to deploy the technology. The reaction to the announcement was overwhelming. More than 2300 organizations or individuals have asked to participate, the highest such tally in the Linux Foundation's history.

Part 4: Government's Stake in Blockchain

Blockchain is a true technology phenomenon. Less than a year ago, it was little known outside a small group of technologists. Now, it's making headlines everywhere and businesses and governments are scrambling to come to terms with it.

The good news for government leaders is that Blockchain has the potential to transform governmental processes as fundamentally as is does those of the businesses—providing superior levels of transparency, accuracy and efficiency. It could help governments do everything from collect taxes and deliver social services benefits, to manage land registries and assure the integrity of government records.

Take the US Social Security system, for instance. It involves the federal government, millions of employers, their payroll service providers, and more than 200 million beneficiaries and working individuals who are paying into the system. This is a model scenario for blockchain. There are many parties, many rules, many steps in the process of administering the system, and a critical need for very high levels of privacy protection and security from breaches.

Other potential uses of the technology are quite intriguing. What if the US government began issuing regulations and monitoring compliance via blockchain technology? And what if the government implemented the taxation system with blockchain. Individuals and businesses might never have to file an income tax return. Instead, a blockchain network noting their tax obligations and recording their financial transactions would continuously invoke the tax code, assess taxes and transfer money. No need to file a tax return.

The possibilities are endless, yet most governments around the world have not yet begun to come to terms with blockchain.

In my view, there's a clear role for government—cribbed liberally from a position paper issued recently by the UK government. It should:

Use blockchain technology. Government should act as an early adopter and start deploying the technology for projects like voting, recording land registries, managing immigration, and the like

Invest in research. Just as the National Institute of Standards and Technology works with industry to develop and apply technology, measurements, and standards, the government should investigate to make sure blockchain technology is robust, secure and scalable, while understanding the ethical and social implications of potential uses and the costs and benefits of adoption.

Create a regulation framework. The government needs to make sure that blockchains are being used in accordance with US laws while avoiding the stifling of innovation through excessive or rigid regulations.

Set standards to ensure security and privacy. The government needs to work with academia and industry to ensure that standards are set for the integrity, security and privacy of distributed ledgers and their contents. These standards need to be reflected in both regulatory and software code.

Conclusion

Blockchain is a classic emergent technology. It appears to have a broad set of uses and benefits, but it's so strikingly different from what people are used to that many business and government leaders alike are adopting a wait-and-see attitude. We applaud judicious caution, but, at the same time, we believe that organizations and institutions that don't quickly assess the potential of blockchain and begin experimenting with it risk falling behind as the world undergoes what we see as a tectonic shift.

Therefore, we urge Congress and the Obama administration to study and discover the best uses of blockchain for the US government and the best regulatory approaches to maximizing its potential while protecting the interests of citizens. Blockchain may have begun its existence in the shadows of the crypto currency realm, but it now stands in the open—a powerful tool ready to serve business and society.