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Blockchain: Is it the future of business?

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by

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Contents

Introduction

In this day and age, businesses are learning now more than ever to take advantage of cutting-edge technologies that can give them an edge in finding more efficient processes and cost-savings. This is because of technology becoming more accessible, which is able to increase operating efficiencies. Disruptive technologies can radically change an industry, and firms that are unaware or unable to adapt to the disruptive technology are at risk. Blockchain is one of these new and disruptive technologies being developed; it is predicted to change the landscape of business in an extremely similar fashion as the Internet did. In lay terms, blockchain is a new technology designed to secure privacy (Collins, 2016), cut out unnecessary middleman costs (Eha, 2017), dramatically lower the cost of transactions (Iansiti & Lakhani, 2009), lower transaction time (Underwood, 2016), and assist in making assets become more liquid and appealing (like cash) because they are more easily transferable (Paech, 2016). Blockchain functions like a ledger; it is able to keep track of an asset's ownership by recording transactions made. Blockchain is different from traditional ledgers because it is designed as a distributed ledger- meaning that it is a single ledger that is shared between the parties on the blockchain. Blockchain is predicted to have an impact in every facet of business including finance, accounting, marketing, sales, human resources, logistics, and IT departments (Tapscott & Tapscott, 2017). Blockchain technology has a huge potential because it can change a variety of industries including governments, energy companies, financial services, and even in vehicle environments. Additionally, IoT devices are becoming much more prevalent in businesses (Drubin, 2017), and blockchain can assist in IoT frameworks.

Blockchain has become popular because it is the framework of Bitcoin, a popular and volatile cryptocurrency that has taken markets by storm. Bitcoin became very popular because there is no central authority required in transactions (Aron, 2015). Central authorities can be governments, third-party banks, financial institutions, or other middlemen that ensure security in transactions and have been necessary for businesses when dealing internationally with other businesses, or to meet regulatory laws from governments. These transactions can be costly and complex to maintain. Blockchain eliminates the need for these expensive third-parties and allows sellers to interact directly with buyers (Eha, 2017). Bitcoin has been struggling to recapture its growth because it is limited as a cryptocurrency, whereas other blockchains (like Ethereum) have allowed users to create "smart contracts", which allow transactions and functions to autonomously trigger under certain circumstances.

What is blockchain?

Blockchain is a disruptive technology that functions as a distributed ledger where transactions are secure and allow all parties in the transaction to have visibility to the transaction made (Gupta, 2017). Information stored on the blockchain is both transparent and private (Collins, 2016). Transparency and privacy are accomplished by separating identity verification from the transaction validation. Attributes of a person can be known without knowing his or her identity (Collins, 2016). This is done with a mix of cryptography and a hashing algorithm. A blockchain is built up from assets and entities. Assets are items of value, which can be anything including cash, tangible assets like a building, or even intangible things including intellectual properties. Entities are users, such as individuals (or businesses), that are able to trade ownership of these assets through transactions (Palfreyman, 2017). A block is created from a transaction

that shows a transfer of ownership of an asset, which is also timestamped. As more transactions are made, more blocks are created and linked together creating a chain, hence the name. Hyperledger is an open-sourced effort created by the Linux Foundation to develop blockchain technology. Figure 1 (below) is an example of Fabric code (which is one of the different blockchain codes employed by Hyperledger) that creates an entity or user.

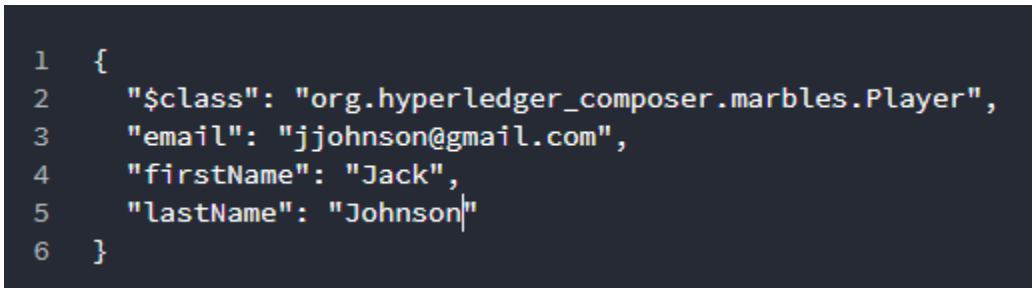


Figure 1- Entity Creation Code

This entity has an email of jjohnson@gmail.com, a first name of Jack, and a last name of Johnson. Another code, not shown, was used to create an asset of a red marble, similarly to the code above. To transfer the ownership of the red marble asset, a transaction is made which transfers the marble (with an identity of 0357) from another user to the user created previously (jjohnson@gmail.com). This transaction is shown below in Figure 2.

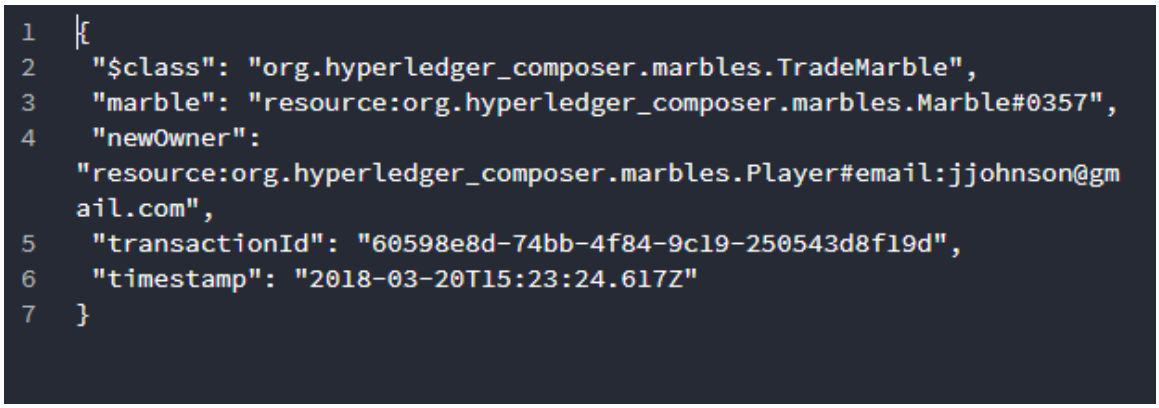


Figure 2- Transaction of a Marble asset to an entity created: jjohnson@gmail.com

As you can see, while the user (Jack Johnson) has an identity of 'jjohnson@gmail.com', the transaction made has a separate identity created which is the transactionid of "60598e8d-74bb-4f84-9c19-250543d8f19d". That transactionid is the unique indicator showing the transfer of ownership of an asset. This is also timestamped (timestamp shown is "2018-03-20T15:23:24.617Z") to show the order in which transactions occurred. This ID and timestamp are generated by the system and show that the most recent timestamped ID shows the current ownership of an asset. Figure 3 (below) demonstrates that a list can be used to show all transactions made on the blockchain, which is available to all permissioned users on a private blockchain (or all users on a public blockchain). This list also shows when a new user (participant) or asset is added to the blockchain.

Date, Time	Entry Type	Participant	
2018-03-20, 10:23:24	TradeMarble	admin (NetworkAdmin)	view record
2018-03-20, 10:22:02	UpdateAsset	admin (NetworkAdmin)	view record
2018-03-20, 10:20:27	AddParticipant	admin (NetworkAdmin)	view record
2018-03-20, 10:20:02	RemoveParticipant	admin (NetworkAdmin)	view record
2018-03-20, 10:18:39	AddAsset	admin (NetworkAdmin)	view record
2018-03-20, 10:18:04	AddParticipant	admin (NetworkAdmin)	view record
2018-03-20, 10:14:39	AddParticipant	admin (NetworkAdmin)	view record
2018-03-20, 10:10:06	ActivateCurrentIdentity	none	view record

Figure 3- List of transactions made

A blockchain must be created with characteristics of consensus, provenance, immutability, and finality (Gupta, 2017). Consensus allows all parties to agree on the validity of the transactions on the chain. The entities on the blockchain are permissioned to see the transaction that has taken place, which increases the security of the transaction. For someone to steal an asset, they must be able to change all of the records of the transaction because the files are no longer centralized (Collins, 2016). Normally, hackers that break into a system can access all files easily because of a traditional hierarchy structure, but this consensus dynamic creates a peer-to-peer system that does not give them the ability to do this anymore. Even if they are able to get into the system, they will be unable to gain control of a majority of the nodes (nodes are simply an owner of part of the blockchain. An entity would own a node) and change the transaction without any of the entities or the system noticing that it is being tampered with. Provenance allows participants to understand where the asset came from and how the asset's ownership changed over time (Gupta, 2017). Immutability means that the transaction cannot be tampered with; it can only be reversed through another transaction. This protects transactions and ownership from being stolen in the system; however the transaction made must be recorded correctly to start with to ensure its integrity. Finality is a concept that shows that ownership of an asset is determined by the transactions on the blockchain that determine the asset's most recent owner's acquisition, as all transactions are timestamped. This is the only place to determine the ownership made.

Blockchain and IoT

IoT (Internet of Things) devices are another example of a disruptive technology that is already changing business landscapes everywhere. IoT devices are changing how data is collected and information is being extracted from this data, however, IoT devices raise large issues of privacy and concern (Lee, 2017). Blockchain is predicted to solve these issues in IoT devices, which can radically change big data that corporations are using. The purpose of this thesis is to examine blockchain technology and how blockchain will affect the various facets of business and IoT environments, while also explaining the extent that these changes will have.

IoT devices can collect data through sensors or other means and are able to take the data collected and communicate or exchange this data with other devices, while still being able to connect to the Internet. The IoT market is becoming extremely competitive from the various technologies designed to create this interconnected environment. IoT is predicted to represent 15% of Wi-Fi, 27% of Bluetooth, and over 60% of 802.15.14 device shipments by 2022 (Drubin, 2017). According to Gartner, there will be over 20 billion IoT devices in use by 2020 (van der Muelen, 2016) (See below).

Category	2016	2017	2018	2020
Consumer	3,963.0	5,244.3	7,036.3	12,863.0
Business: Cross-Industry	1,102.1	1,501.0	2,132.6	4,381.4
Business: Vertical-Specific	1,316.6	1,635.4	2,027.7	3,171.0
Grand Total	**6,381.8**	**8,380.6**	**11,196.6**	**20,415.4**

Table 1- Gartner's chart of predicted IoT growth by 2020, (van der Muelen, 2016)

These autonomous devices will be performing business functions while collecting valuable and possibly private information. Because of the IoT market diversity, there is no technology solution that solves every problem. However, blockchain is a solution that is fundamental to the evolution of the technology landscape (Drubin, 2017). Security and privacy are amongst the biggest challenges that IoT devices are currently facing (Quaddah, Elkalam, & Ouahman, 2017). IoT devices that are communicating with each other will need to be protected from cyber-attacks that can disrupt their operations or steal valuable information (Lee). It is possible that a proposed firmware update using a blockchain can check the firmware version, validate correctness, and download the update if the versions are correct. The device can download this firmware from blockchain nodes on a peer-to-peer firmware network. Integrity of the firmware is checked by the nodes, which guarantees the correctness and timeliness of the update.

"Since there is a third party in the traditional E-Business model, IoT cannot give full play to its advantages." (Zhang, 2017) Blockchain removes the third party requirements in this E-Business model, which allows IoT devices the independence needed to create autonomous decisions to make transactions without the need of third party verification. Once IoT devices are making purchasing decisions without the need of human authentication, the sheer number of transactions will explode in the market. Verification of these transactions can be expensive, and blockchain promises to verify and secure these transactions at a much cheaper and more efficient manner than using a third party.

Why should blockchain be considered in a business?

Blockchain can be used in nearly any industry and change how businesses operate in nearly every capacity. It is a shared and secure way to record the ownership of assets. The World Wide Web standardized the way documents are linked, and blockchain allows us to link ledgers. Taxes can be calculated quickly. Inaccuracies can be eliminated and fraud harder to commit. Expenses like title insurance could become a thing of the past because ownership is shown on the blockchain within a transaction (Brody, 2017). Financial services are impacted because a blockchain can provide a trust element that allows parties to make a transaction that is normally provided by a financial institution, which essentially severs the need for the centralized agent (Fanning & Centers, 2016). Blockchain is viable for many industries such as auditing, gambling, and authentication for events or luxury goods (Fanning & Centers, 2016). It can even reach solar energy companies (Rutkin, 2017), vehicle environments (Sharma, 2017), and other industries that use IoT devices. It is a transforming technology that all CFOs should know about. Blockchains give firms visibility, trust, digital, and no single point of failure.

There have been estimates that blockchain could save financial institutes at least $20 billion annually in costs (Fanning & Centers, 2016). Blockchains could improve loyalty-points programs. The health industry can be completely revolutionized by storing patient data safely and securely. The lower costs of verification and the cost of exchanging without an intermediary can save firms thousands of dollars. A distributed ledger will make audits and truth assessing redundant and they can be eliminated. Settlement and reconciliation will complete change the financial side of business. Banks are intrigued by distributed ledgers, but are afraid of cryptocurrencies because of philosophical implications it may have on how worth and value are judged in currencies which could hurt current bank models and structures (Michelman, 2017). The cost of networking is another cost that is reduced greatly. Labor and capital intensive costs are also reduced from using a blockchain. The CEO, CTO, chief economist, and any key employees should be included in developing a blockchain for a firm if the firm wishes to create a blockchain (Michelman, 2017).

The Internet shaped businesses by allowing firms to move information; a blockchain allows firms to move value. Intermediaries that work on confirming identities and security are subject to crashes, fraud, hacks, leaks, etc… and additionally charge fees and collect customer behavior and data. Human resources departments are impacted by lower costs from holding information about prospective employees and contractors (Tapscott & Tapscott, 2017). Finance and accounting can be improved because the value is sequential from timestamping. It can also uncover off-book transactions and hidden accounts. Sales and marketing are improved because it can provide a way to obtain information about possible customers. Sellers don't need to establish trust. IT departments can reduce cost because warehousing data may not be necessary. Smart contracts being used can also assist in legal affairs. Supply chain analysts and can track an asset's location from transactions and can determine when value is being lost in a good. Blockchain has roots from being a cryptocurrency; employees can be paid with it. Valuable insights can be made from this new ability tracking each and every product in a supply chain. Blockchain also reduces transaction time (Underwood, 2016). As transaction times are reduced, businesses can make many more secure transactions from otherwise unavailable markets.

What does this mean for companies?

Blockchain is something that large corporations everywhere should be investigating and possibly looking at implementing into their business strategy. It is a disruptive technology with

extreme cost-savings that are crucial to existing businesses. Businesses that fail to adopt blockchain technology could face a disadvantage from higher costs of networking, transactions, reconciliation, settlements, and other business operations. Over time, these disadvantaged firms may lose out to competitors because they are unable to improve other areas because of time and money spent on these unnecessary costs. Blockchain based sources may be emerging and controlling the economy as the Internet did (Iansiti & Lakhani, 2009). As assets become more liquid (Paech, 2016), transferability of assets may cause businesses to be more willing to sell and move assets in ways that they were unable to before. Blockchain allows a company to become more secure, transparent, and mobile while retaining aspects of security. As previously stated, current problems in business such as the high cost of transactions and need for better security can be solved with blockchain technology.

Current Limitations of Blockchain

Blockchain seems to be a necessary technology in response to problems in the growing IoT market, and to solve for unnecessary expenses that businesses have had to deal with for a long time. However, while blockchain is touted as a universal and fundamental technology that will change the business landscape, blockchain does have many limitations that affect its usefulness. Scalability remains a very large issue for blockchain. "All blockchain-based networks have not properly addressed the issue of scalability; which causes the original decentralized nature of the blockchain to become more centralized, with only the highest resourced users being able to participate in the network. It remains to be seen whether it is possible to reduce the size of the blockchain in a secure and distributed manner, and if so, how this can be successfully implemented in all blockchain-based networks." (Dennis & Owenson, 2016) Blockchain will have a difficult time adapting to increasing the amount of transactions that it can make. Bitcoin is only capable of handling 7 transactions per second because of the block size limit, whereas VISA handles almost 20,000 transactions per second (Dennis & Owenson, 2016). This transaction rate needs to be improved if blockchain is to be used on a large scale, especially considering the data collection rates that IoT devices may be operating at.

Blockchain may also face regulatory issues. Bitcoin has had many associations with money laundering activities because of its anonymous userbase and capabilities. The Financial Action Task Force reported that hundreds of millions of US dollars have been laundered for criminal organizations (Yeoh, 2017). Blockchain has also helped allow the now infamous Silk Road website operate, which has been shut down from its illustrious activities. It is unsure how future regulation could affect the impact blockchain can have on businesses and the economy.

Blockchain is not suitable for every application or company

While blockchain can solve many problems in modern business, it is not helpful to all companies. Blockchain technology consumes large amounts of energy to power it. The blockchain technology that is used to power bitcoin could use more energy than Argentina this year (Zhao, 2018). Smaller firms that wish to adopt blockchain technology may not get enough savings to make up for the cost of energy used to justify using the technology. As stated earlier, scalability remains a big issue for much larger corporations. Blockchain's transaction rate must be significantly improved before it can achieve widespread use within a firm, otherwise it will not be able to support the functions necessary for the firm to survive. However, it may be useful

to use a blockchain for smart contracts or other smaller uses before implementing it on a wide scale.

Is the use of blockchain the future of business?

It is likely that this is the direction the businesses are heading towards. Blockchain's many applications across nearly every industry is simply too good of an opportunity to pass over. Governments can become more efficient in holding information, taxes, and property rights, while also reducing fraud (Brody, 2017). The financial services sector will be completely transformed and has already been successful in a few firms (Fanning & Centers, 2016). It has been used in a solar energy company (Rutkin, 2017), has been shown that it can assist in self-driving vehicle environments (Sharma, 2017), and will be able to solve many problems in the IoT landscape as a fundamental technology (Drubin, 2017). As technology progresses, there will be more solutions created to solve for the issues blockchain has in scalability and power consumption.

Works Cited

Aron, J. (2015). New kid on the blockchain. *New Scientist*, 1-1.

Bitcoin and blockchain consume an exorbitant amount of energy. These engineers are trying to change that. (2018, February 23). Retrieved March 23, 2017, from cnbc.com: https://www.cnbc.com/2018/02/23/bitcoin-blockchain-consumes-a-lot-of-energy-engineers-changing-that.html

Brody, L. (2017). E Pluribus Unum And The Blockchain. *Forbes*, 78-79.

Christidis, K., & Devetsikiotis, M. (2016). Blockchains and Smart Contracts for the Internet of Things. *IEEE Access*, 2292-2301.

Collins, R. (2016). Blockchain: A New Architecture for Digital Content. *EContent100*, 22-23.

Dennis, R., & Owenson, G. (2016). Rep on the Roll: A Peer to Peer Reputation System Based on a Rolling Blockchain. *International Journal of Digital Society*, 1123-1134.

Drubin, C. (2017). Cellular, LPWAN Challenge Short-Range Wireless Solutions in IoT Markets. *Microwave Journal*, 49-50.

Eha, B. (2017). Can Bitcoin's first felon help make a cryptocurrency a trillion-dollar market? *Fortune*, 78-88.

Fanning, K., & Centers, D. (2016, October 10). Blockchain and Its Coming Impact on Financial Services. *Wiley Periodicals, Inc.* , pp. 53-57.

Gupta, M. (2017). *Blockchain for Dummies.* Hoboken: John Wiley & Sons, Inc.

Hurlburt, G. (2016). Might the Blockchain Outlive Bitcoin? *IT Pro*, 12-16.

Iansiti, M., & Lakhani, K. (2009). The Truth About Blockchain. *Harvard Business Review Notice of Use Restrictions*, 119-127.

Lee, B. (2017). Blockchain-based secure firmware update for embedded devices in an Internet of Things environment. *Journal of Supercomputing*, 1152-1167.

Michelman, P. (2017). Seeing Beyond the Blockchain Hype. *MIT Sloan Management Review*, 17-19.

Paech, P. (2016). *Securities, intermediation and the blockchain: an inevitable choice between liquidity and legal certainty?* Oxford University Press.

Palfreyman, J. (2017, May 2). *Ten things blockchain is NOT*. Retrieved March 23, 2018, from idm.com: https://www.ibm.com/blogs/insights-on-business/government/ten-things-blockchain-not/

Quaddah, A., Elkalam, A., & Ouahman, A. (2017). FairAccess: a new Blockchain-based access control framework for the Internet of Things. *Security Communications Networks*.

Rutkin, A. (2017, August 31). *Blockchain aids solar sales*. Retrieved March 23, 2018, from ebsco: https://library.uark.edu/wamvalidate?url=http%3A%2F%2F0-web.a.ebscohost.com.library.uark.edu%3A80%2Fehost%2Fdetail%2Fdetail%3Fvid%3D3%26sid%3D02a9b9fc-3bfc-4a1a-b71f-871618d9f22b%2540sessionmgr4008%26bdata%3DJnN...

Sharma, P. (2017). Block-VN: A Distributed Blockchain Based Vehicular Network Architecture in Smart City. *Journal of Information Processing Systems*, 184-195.

Tapscott, D., & Tapscott, A. (2017). How Blockchain Will Change Organizations. *MIT Sloan Management Review*, 10-13.

Underwood, S. (2016). Blockchain Beyond Bitcoin. *Communications of the ACM*, 15-17.

van der Muelen, R. (2016, February 7). *Gartner Says 8.4 Billion Connected "Things" Will Be in Use in 2017, Up 31 Percent from 2016*. Retrieved March 23, 2018, from Gartner: https://www.gartner.com/newsroom/id/3598917

Xia, Q., Sifah, E., Smahi, A., Amofa, S., & Zhang, X. (2017). BBDS: Blockchain-Based Data Sharing for Electronic Medical Records in Cloud Environments. *Multidisciplinary Digital Publishing Institute*, 2-3.

Yeoh, P. (2017). Regulatory issues in blockchain technology. *Journal of Financial Regulation and Compliance*, 197-204.

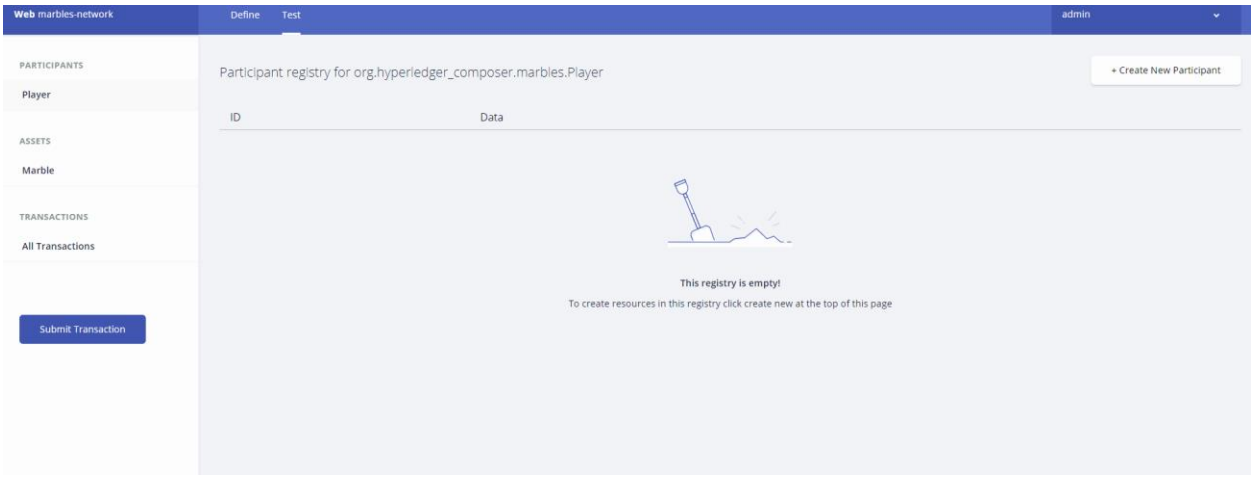
Zhang, Y. (2017). The IoT electric business model: Using blockchain technology for the Internet of Things. *Peer-To-Peer Networking and Applications*, 983-994.

Zhao, H. (2018, February 23). *cnbc*. Retrieved March 23, 2018, from Bitcoin and blockchain consume an exorbitant amount of energy. These engineers are trying to change that.: https://www.cnbc.com/2018/02/23/bitcoin-blockchain-consumes-a-lot-of-energy-engineers-changing-that.html

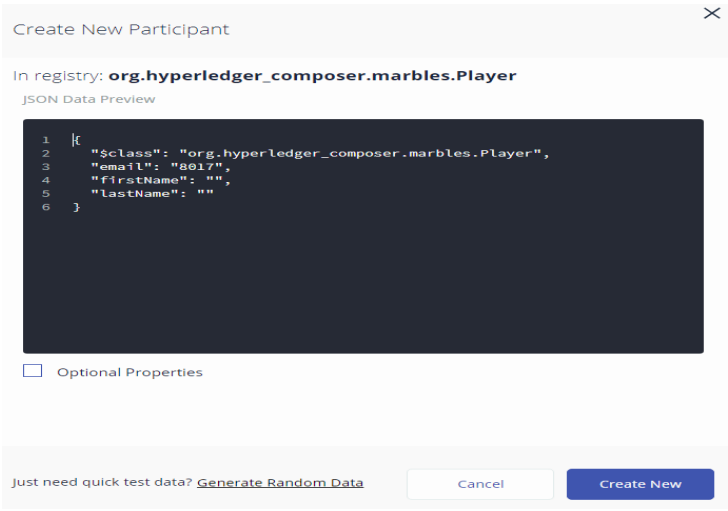
Appendix

Here is a short ‘how-to’ guide to help you understand the transaction in an example of Hyperledger blockchain that you can do on your own. This can be found at: https://composer-playground.mybluemix.net/editor. This guide is using the “marbles network”.

To start, you need to select the ‘Test’ tab at the top of your screen. Your screen should look similar to the screen below.

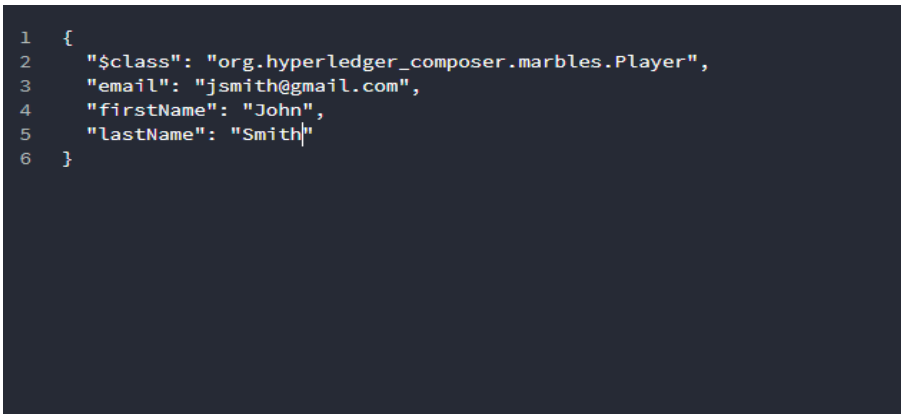


From there, select ‘Play’ from the left side of your screen. ‘Player’ is a participant in this blockchain. This means that any person on this blockchain network can own assets listed within the network and may trade those assets on the network. Click ‘+Create New Participant on the upper right side of your screen. It will open up a smaller screen that looks like the one shown below.

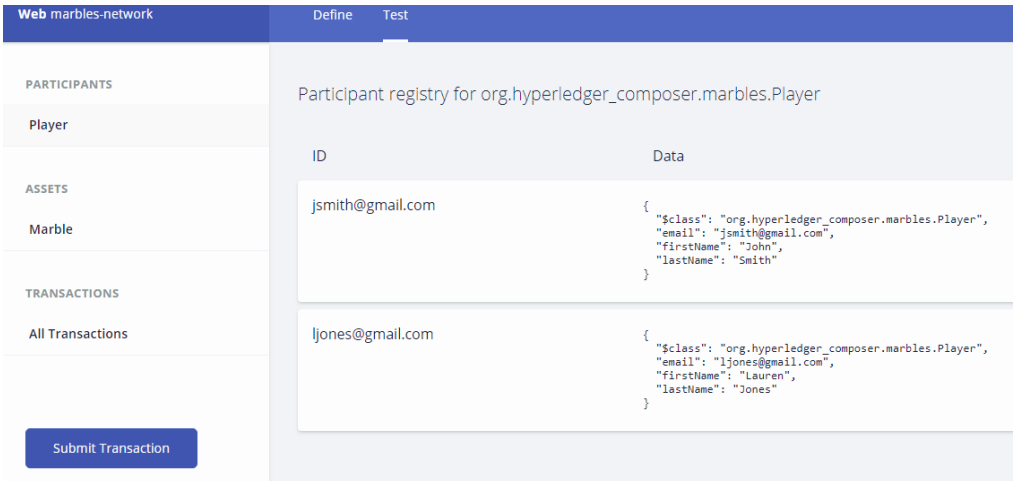


From here, you are able to create a participant on the network by defining the participant’s unique ID, and attributes that describe them which are their first and last name. The email used here can not be used for any other participant on the network. This is to ensure that each participant is different from each other, even if the participant may have the same name as another. To do this, add the correct information between the quotation marks next to each

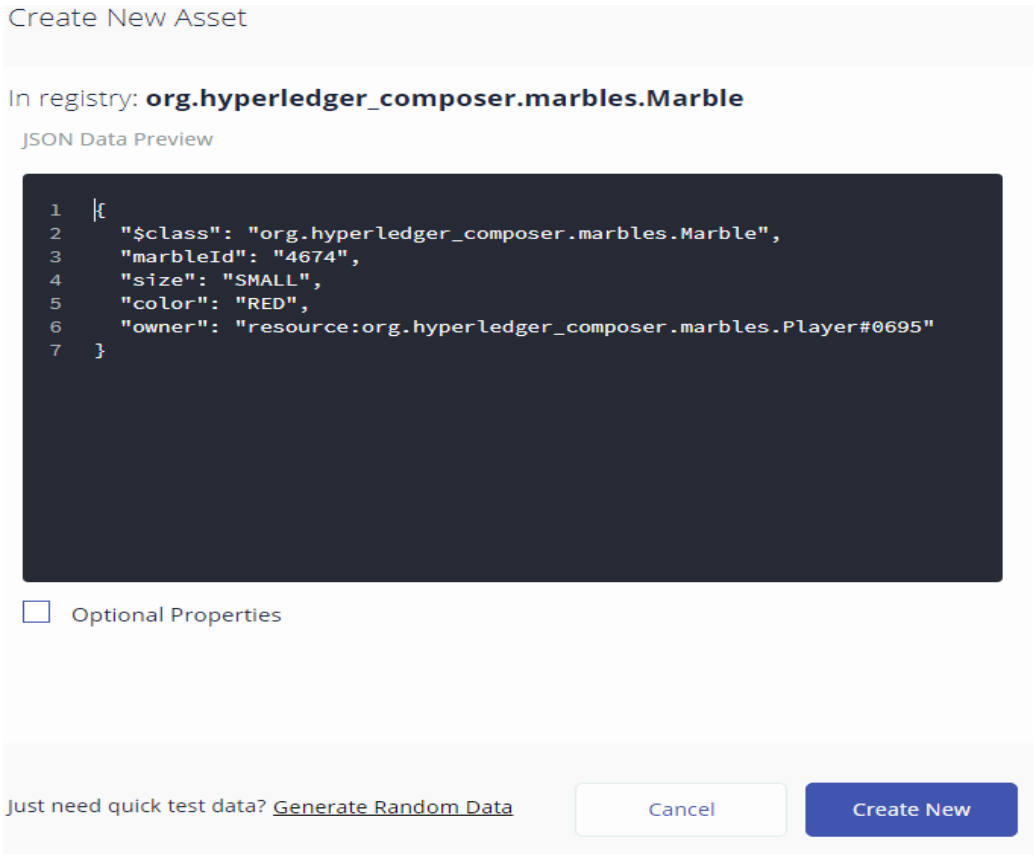
attribute. For example, I've created a participant with an email of jsmith@gmail.com, a first name of John, and a last name of Smith shown below.



Click 'Create New' to add the participant to the network. This step can be repeated to add as many participants that are needed to be on the network. For this example, one more is needed with an email defined. Once you are finished, there should be a list of the participants made on display when 'Player' is selected. The screen below is an example of the listing of the participants created in this example.



After the participants are made, it is necessary to create assets for them to trade on the network. Click 'Marble' on the left side of the screen to display the assets created. It should be blank, much like the person list before we created them. From there, select 'Create New Asset' from the top right corner of your screen. A new screen will appear that allows us to create the assets, though it is a little different from when we created participants. The asset must begin with a participant owning it. The screen should look like the screen below.

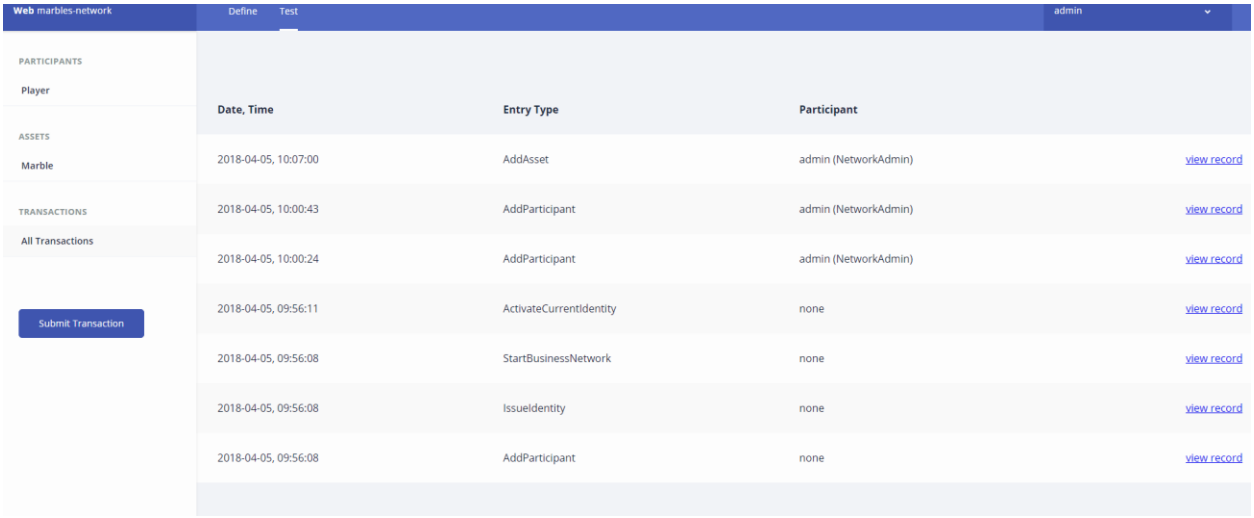


From here, the ‘marbleId’ is the unique identifier for this asset. The ‘owner’ is the owner of the asset. This is changed by changing the Player# at the end of the code to the ID number of the participant that will own the asset. The ‘size’ and ‘color’ attributes are descriptions of the asset owned. For this example, a marble created below will have a title ID of 1234, be owned by John Smith (the participant created earlier with an email of jsmith@gmail.com), and will be described as a small and green marble. This will look like the screen below.

```
{
  "$class": "org.hyperledger_composer.marbles.Marble",
  "marbleId": "1234",
  "size": "SMALL",
  "color": "GREEN",
  "owner":
"resource:org.hyperledger_composer.marbles.Player#jsmith@gmail.com"
}
```

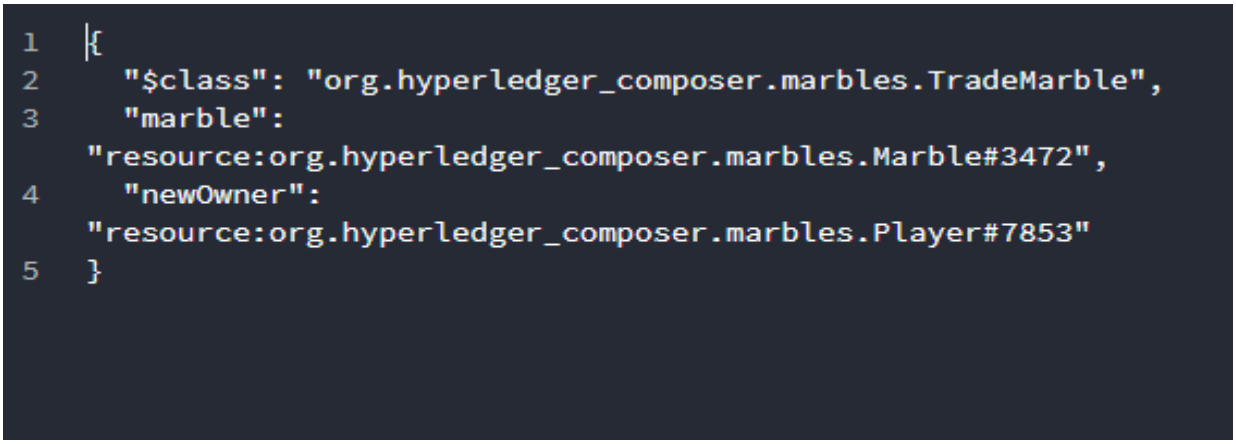
After filling the information in the quotation marks correctly, click ‘Create Asset’ at the lower right corner of the screen. It should be listed much like the assets were previously.

Finally, we can make a transaction. For this transaction, John Smith will trade the small green marble we created to the other player on this example network (Lauren Jones, with an email of ljones@gmail.com). Click the ‘All Transactions’ tab on the left side of your screen to display the transactions on the network. It should look similar to the screen below.



From here, we can see all of the transactions on the network and what type of transaction it was. All of our current transactions have been adding participants and assets to the network, which have been all timestamped to show the order in which the events have occurred. This allows us to see the history of assets and participants on the network.

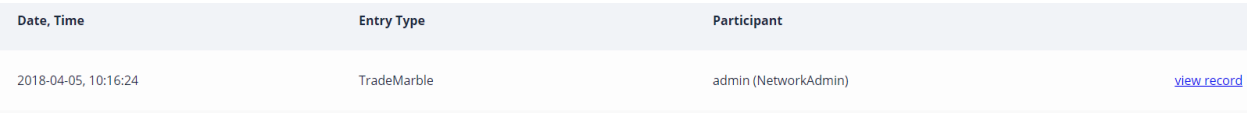
To trade the marble, click ‘Submit Transaction’ on the left side of the screen. You will have code displayed like the screen below.



From here, we can change the Marble# to the ID number of the marble that is being traded. Because our green marble has an ID of 1234, we will change the number to that. The Player# should be changed to the unique identifier we have for our player that will be the new owner of the asset. In this example, John Smith is trading the marble to Lauren Jones, so we will replace the Player#7853 to Player#ljones@gmail.com. It should look like the screen below.

```
{
 "$class": "org.hyperledger_composer.marbles.TradeMarble",
 "marble": "resource:org.hyperledger_composer.marbles.Marble#1234",
 "newOwner":
"resource:org.hyperledger_composer.marbles.Player#ljones@gmail.com"
,
```


From the transaction list, we will see that a new transaction has been made. A marble has been traded on the network shown below.



Click the ‘view record’ button to the right side of the screen. Code will pop up similar to the example below.


```
{
 "$class": "org.hyperledger_composer.marbles.TradeMarble",
 "marble": "resource:org.hyperledger_composer.marbles.Marble#1234",
 "newOwner":
"resource:org.hyperledger_composer.marbles.Player#ljones@gmail.com"
,
 "transactionId": "a6ead7ea-ca12-4b63-898a-58678bf3bd05",
 "timestamp": "2018-04-05T15:16:24.912Z"
}
```


This transaction is created with a unique transaction ID of ‘a6ead7ea-ca12-4b63-898a-58678bf3bd05’. This is the unique identifier for this transaction on the network. These are created with a hashing algorithm to ensure that the transaction is not only secure, but that the particpant’s information is safe. We can see that the player with the id of ‘ljones@gmail.com’ received the marble, but we do not know the other attributes such as her name. Using a number as an identifier would be much more secure than the email that we used above, but for the purpose of the exercise an email was provided.

To check if the transaction was successful, you can click ‘Marble’ under assets and review the data of the marble traded. The ‘owner’ has changed from jsmith@gmail.com to ljones@gmail.com (shown below).

From this example, a blockchain network was made with players being able to trade assets (marbles) on a network safely and securely.